Международная конференция Российского общества цвета

Сборник материалов

1-5 декабря

Смоленск 2020

Смоленский государственный университет
Научно-образовательный центр «Лаборатория цвета»
Рабочая группа по изучению цветового дизайна среды
Международной ассоциации цвета
ИНИОН РАН

МЕЖДУНАРОДНАЯ НАУЧНАЯ КОНФЕРЕНЦИЯ РОССИЙСКОГО ОБЩЕСТВА ЦВЕТА

Сборник статей

Смоленск, 1–5 декабря 2020 года

Смоленск
Издательство Смоленского государственного университета
2021

УДК 316.4
ББК 60.5
М 43

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М 43 **Международная научная конференция Российского общества цвета:** сборник статей / под ред. Ю. А. Грибер, В. М. Шиндлер. Смоленск: Изд-во СмолГУ, 2021. – 332 с.

ISBN 978-5-88018-660-0

В книге представлены статьи участников Международной научной конференции Российского общества цвета, посвященной обсуждению широкого круга вопросов, связанных с теорией цвета и его практическим использованием в различных социокультурных практиках. Рассматриваются соответствующие психологические, социологические, лингвистические, философские, педагогические, искусствоведческие аспекты.

Книга издана при поддержке гранта Президента Российской Федерации, предоставленного Фондом президентских грантов (проект № 20-2-000280).

УДК 316.4
ББК 60.5

ISBN 978-5-88018-660-0

Smolensk State University
Research and Education Center «Color Lab»
AIC Study Group on Environmental Color Design
Institute of Scientific Information for Social Sciences
of the Russian Academy of Sciences

THE INTERNATIONAL SCIENTIFIC CONFERENCE OF THE COLOR SOCIETY OF RUSSIA

Selected Papers

Smolensk, December 1–5, 2020

Smolensk
Smolensk State University Press
2021

УДК 316.4
ББК 60.5
М 43

Editors: Yulia A. Griber (Russia)**,** Verena M. Schindler (Switzerland)

Reviewrs:
Juliet Albany (Australia), Vadim Andreev (Russia), Kine Angelo (Norway), Ulrich Bachmann (Switzerland), Doreen Balabanoff (Canada), Janet Best (United Kingdom), Sabina Bračko (Slovenia), Michael H. Brill (USA), Yuriy Burykin (Russia), Ingrid Calvo Ivanovic (Chile), Vien Cheung (United Kingdom), Elisa Cordero-Jahr (Chile), Paula Csillag (Brazil), Osvaldo Da Pos (Italy), Maria João Durão (Portugal), Vassilyj Dvoynev (Russia), Alexander Egorov (Russia), Brian Funt (Canada), Yacine Gouaich (Algeria), Paul Green-Armytage (Australia), Kyoko Hidaka (Japan), Robert Hirschler (Hungary), John Hutchings (United Kingdom), Domicele Jonauskaite (Switzerland), Robin Kingsburgh (Canada), Faina Kremen (Russia), Agata Kwiatkowska-Lubańska (Poland), Jean-Philippe Lenclos (France), Maggie Maggio (USA), Banu Manav (Turkey), Fiona McLachlan (United Kingdom), Manuel Melgosa (Spain), Alexandra Pankratova (Russia), Galina Paramei (United Kingdom), Laurence Pauliac (France), Lubov Puzyrova (Russia), Saara Pyykkö (Finland), Maurizio Rossi (Italy), Jada Schumacher (USA), Elena Sukhova (Russia), Elza Tantcheva-Burdge (United Kingdom), Justyna Tarajko-Kowalska (Poland), Yulia Ustimenko (Russia), Jinghong Wang (China), Ralf Weber (Germany), Mark Wentworth (United Kingdom)

М 43 **The International Scientific Conference of the Color Society of Russia:** Selected papers / ed. by Yulia A. Griber, Verena M. Schindler. Smolensk: Smolensk State University Press, 2021. – 332 p.

ISBN 978-5-88018-660-0

This book presents the selected full papers by participants of the International Scientific Conference of the Color Society of Russia. They discuss a wide range of issues related to colour theory and its application in various socio-cultural contexts. The relevant psychological, sociological, linguistic, philosophical, pedagogical, art historian, technical and scientific aspects are considered.

The book is published with the support of the Presidential Grant Foundation (Project No. 20-2-000280).

УДК 316.4
ББК 60.5

ISBN 978-5-88018-660-0

СОДЕРЖАНИЕ

Грибер Юлия (Смоленск, Россия) **Шиндлер Верена М.** (Цолликон, Швейцария)
Предисловие 13

Асебо Ибаньес Энрике дель (Буэнос-Айрес, Аргентина)
Антарктика, или Белый континент: цвет, ценности и магия
(*перевод с английского В. Двойнева*) 17

Вентворт Марк (Норвич, Великобритания)
Цветовое профилирование: визуальный архетипический план процесса индивидуации по Юнгу (*перевод с английского В. Двойнева*) 28

Кайвано Хосе Луис (Буэнос-Айрес, Аргентина)
Системы цветового порядка, смешение цветов и роль cesia
(*перевод с английского В. Двойнева*) 34

Карташова Татьяна Викторовна (Саратов, Россия)
Цветовая символика в южноиндийском театре катхакали 47

Красиков Михаил Михайлович (Харьков, Украина)
Цвет в традиционной народной культуре украинцев:
символика и прагматика (некоторые наблюдения) 52

Красильников Игорь Борисович (Смоленск, Россия)
Цвет как образ революции 57

Кремень Фаина Маратовна, Кремень Сергей Анатольевич (Смоленск, Россия)
Особенности цветовых репрезентаций
различных профессий среди молодежи 62

Ланкло Жан-Филипп (Париж, Франция)
География цвета (*перевод с французского А. Нанкевич*) 68

Мантет Джеймс (Арройо Секо, Калифорния, США)
Цветовые решения в двух портретах Дмитрия Шостаковича 84

Панова Наталья Геннадьевна (Москва, Россия)
Колористика в архитектурной школе
(опыт Московского архитектурного института) 90

Сивова Татьяна Викторовна (Гродно, Беларусь)
Концептосфера цвета флористического пространства прозы К.Г. Паустовского 97

Соловьева Елена Анатольевна (Санкт-Петербург, Россия)
Ассоциативный потенциал цветовых символов 102

Фаткуллина Римма Рафгатовна, Абуталипова Людмила Николаевна, Мухамадиева Диляра Дамировна (Казань, Россия)
Экологические мотивы при проектировании сценической одежды 108

Шалаев Владислав Вадимович, Маринина Юлия Анатольевна (Нижний Новгород, Россия)
Роль символики цвета в драме Оскара Уайльда «Саломея» 114

Бривио Арианна, Плутино Элис, Рицци Алессандро (Милан, Италия)
Цвета киноленты «Всю ночь»: исследование по реставрации цвета 119

Кальво Иванович Ингрид, Маттиоли Франческа (Милан, Италия)
Цвет стоит тысячи слов! Развитие коммуникации в многокультурных командах с помощью цвета 125

Карвальо Жизель (Лиссабон, Португалия), **Круз Камила** (Ресифи, Бразилия)
Цветовая палитра социального жилья в Ресифи, Бразилия 131

Каваллини Джойс, Ксиллаг Паула (Сан-Паулу, Бразилия)
Визуальная группировка: исследование преобладания цвета или формы в играх «три в ряд» 136

Дантас Итало Хосе де Медейрос (Кампина-Гранди, Бразилия)**,**
Алвес Элоиза Мирелли Феррейра (Кайко, Бразилия),
Насименто Мариана (Кайко, Бразилия), **Фрейре Алина Габриэль** (Кайко, Бразилия),
Солино Ливия Джулиана Силва (Кайко, Бразилия)
Построение хроматических знаков в бразильской политической и социальной среде 143

Дантас Итало Хосе де Медейрос (Кампина-Гранди, Бразилия)**,**
Кордейро Рамон Бастос (Рио-де-Жанейро, Бразилия)**,**
Сильва Камила Ассис Перес (Кампина-Гранди, Бразилия)
Цвет как инструмент повествования в сказке Шарлотты Перкинс Гилман «Желтые обои»: дискурсивно-семиотический анализ 149

Дайверс Эллен (Роли, Северная Каролина, США)
За пределами тона: эмоциональные реакции на светлоту и насыщенность 154

Ефимов Андрей Владимирович (Москва, Россия)
Концепция формирования колористической среды города 160

Эвайс Ашраф Юсеф (Каир, Египет)
Аналитическое исследование пигментов (цветов) сцены «Живая природа» в погребальной камере Рашепсеса (Саккара-Египет) 167

Фуэнтес Вия Тания Эрандени, Фуэнтес Вия Клаудиа Айари (Мехико, Мексика)
Влияние испанской колонизации на цветовую семиотику и мировоззрение в доиспанской Мексике 173

Глогар Мартини Ира, **Сутлович Ана**, **Беритич Иван**, **Беслич Сильвия**, **Печек Ведрана** (Загреб, Хорватия)
Анализ цветовых характеристик натуральных красителей – субъективное vs. объективное 179

Гразина Руи, Морейра да Сильва Фернандо (Лиссабон, Португалия)
Цвет: экстенсивный и интенсивный подходы 185

Григораш Алёна (Москва, Россия)**, Босси Давид** (Милан, Италия)
Феноменология белого в современном искусстве и дизайне 190

Гуарини Джанлука, Росси Маурицио (Милан, Италия)
Практическое использование реальных цветовых материалов в системах CAD 196

Джафария Разие, Гаранджиг Камаладин (Тегеран, Иран)
Влияние ультрафиолетового излучения на колориметрические характеристики экологически чистых окрашенных шерстяных нитей 202

Коорошния Марьян, Тепе Ян (Бурос, Швеция)
Использование цветного освещения в качестве материала для дизайна в физической и виртуальной средах 207

Кумар Пуджа, Лобо Карла (Лейрия, Португалия)
Депрессия к выражению: цвет как визуальный язык для передачи сложных эмоций 213

Кушниренко Елизавета (Милан, Италия)**:**
Цвет как визуальный язык: хроматическая палитра в анимации Сюзан Питт 219

Лопес Анаи, Ди Сарли Алехандро Р. (Ла-Плата, Аргентина)
Оценка качества поверхности при использовании цементных смесей: серый цвет строительных растворов и бетона с качественной и количественной точки зрения 224

Манав Бану (Стамбул, Турция)
Цвет как способ коммуникации при обучении дизайну 230

Мариконде Мария Марта, Инкатасьято Адриана, Треттель Паола (Кордова, Аргентина)
Технология в движении: опыт чтения цвета городского ландшафта 236

Мариконде Мария Марта, Видаль Евгения, Виотти Октавио, Аисама Лукас, Эченике Микаэла (Кордова, Аргентина)
Дополненная реальность в интерактивном цветовом опыте: в память о Баухаусе 100 242

МакЛеллан Галина (Брисбен, Австралия)
Переосмысление роли технологий в обучении цветовому дизайну 247

Мельгоса Мануэль (Гранада, Испания), **Васкез Давиэль** (Мадрид, Испания), **Гарсия Урена Лурдес** (Мадрид, Испания), **Ли Чанцзюнь** (Аньшань, Китай), **Вик Михал** (Либерец, Чехия)
Количественный анализ цвета традиционных академических мантий в Испании 253

Мина Гален (Вашингтон, США)
Тектоника цвета: усиление и модификация формы и пространства при помощи цвета 259

Оллие Ксавьер, Ландрин Хелен, Ленер Ванесса (Тулуза, Франция)
Роль цветового образования в промышленности 265

Пепа Лорена, Родригес Сильвио, дос Сантос Феррейра Кристина, Буэра Мария дель Пилар (Буэнос-Айрес, Аргентина)
Характеристика полного спектра степеней потемнения в моделях жидких пищевых продуктов 271

Пиньейро Ана Паула, Дуарте Руи (Лиссабон, Португалия)
Синий цвет в регионе Алентежу: аутентичность и устойчивость 277

Праузе Карлос Эстебан (Санта-Фе, Аргентина)
Цвет как свойство визуальной идентичности: анализ доминирующего цвета бренда и его восприятия реципиентом 283

Прокопавичюте Эгле (Вильнюс, Литва)
Потенциал цветного света по сравнению с другими сенсорными стимулами в создании атмосферы 289

Квотрер Милена (Рио-де-Жанейро, Бразилия)**,** **Силва Гувея Анна Паула** (Кампинас, Бразилия)
Основные параметры цветового образования: концепция теории цвета для бразильских начальных и средних школ 295

Райзингер Маркус (Байройт, Германия)
Уникальные преимущества многоспектрального освещения 301

Сафи Махди, Ансари Кейван, Хоссейни Шекараби Сейедех Фарох (Тегеран, Иран)
Сравнительные цветовые характеристики ЭЛТ и ЖК-мониторов: смещение чёрного, точки белого и линейности 305

Шиндлер Верена М. (Цолликон, Швейцария), **Грибер Юлия** (Смоленск, Россия)
Французский период цветового дизайна среды: философия цвета 310

Тарайко-Ковальска Юстина (Краков, Польша)
Желтый цвет в европейской архитектуре и антропогенной среде: традиции и современное применение 319

Васильски Драгана (Белград, Сербия)
Цвет как знак в минималистской архитектуре 325

TABLE OF CONTENTS

Schindler Verena M. (Zollikon, Switzerland), **Griber Yulia A.** (Smolensk, Russia)
Introduction 13

Acebo Ibáñez Enrique del (Buenos Aires, Argentina)
Antarctica as the white continent: color, values and magic 17

Wentworth Mark (Norwich, United Kingdom)
Color profiling: a visual archetypal blueprint for the process of Jungian individuation 28

Caivano José Luis (Buenos Aires, Argentina)
Color order systems, color mixtures and the role of cesia 34

Kartashova Tatyana V. (Saratov, Russia)
Color symbolism in the South Indian Kathakali Theater 47

Krasikov Mikhail M. (Kharkiv, Ukraine)
Color in the traditional Ukrainian folk culture: symbolism and pragmatics
(some observations) 52

Krasilnikov Igor B. (Smolensk, Russia)
Colors of the revolution 57

Kremen Faina M., Kremen Sergey A. (Smolensk, Russia)
Color representations of different professions by young people 62

Lenclos Jean-Philippe (Paris, France)
The Geography of Color 68

Mantet James W. (Arroyo Seco, California, USA)
Color solutions in two portraits of Dmitri Shostakovich 84

Panova Natalya G. (Moscow, Russia)
Colouristics in an architectural school
(experience of the Moscow Architectural Institute) 90

Sivova Tatyana V. (Grodno, Belarus)
Color concept in the floristic space of Konstantin G. Paustovsky's prose 97

Solovyova Elena A. (Saint Petersburg, Russia)
The associative potential of color symbols 102

Fatkullina Rimma R., Abutalipova Lyudmila N., Mukhamadiyeva Dilyara D.
(Kazan, Russia)
Environmental motifs in the stage clothing design 108

Shalaev Vladislav V., Marinina Yulia A. (Nizhny Novgorod, Russia)
The role of color symbolism in Oscar Wilde's Drama "Salomé" 114

Brivio Arianna, Plutino Alice, Rizzi Alessandro (Milan, Italy)
The colors of "Toute Une Nuit": a study of color restoration in film 119

Calvo Ivanovic Ingrid (Milan, Italy; Santiago de Chile, Chile),
Mattioli Francesca (Milan, Italy)
A color is worth a thousand words! A color-based tool to foster communication
in culturally-plural teams 125

Carvalho Gisele (Lisbon, Portugal), **Cruz Camila** (Recife, Brazil)
The use of color in spaces central to social life in contemporary residential
housing in Recife, Brazil 131

Cavallini Joyce C., Csillag Paula (São Paulo, Brazil)
Visual grouping: a study on preponderances of color or shape in match-three games 136

Dantas Ítalo José de Medeiros (Campina Grande, Brazil), **Alves Heloisa Mirelly Ferreira** (Caicó, Brazil), **Nascimento Mariana Nunes do** (Caicó, Brazil), **Freire Aline Gabriel** (Caicó, Brazil), **Solino Lívia Juliana Silva** (Caicó, Brazil)
The construction of the chromatic sign in the Brazilian political
and social environments 143

Dantas Ítalo José de Medeiros (Campina Grande, Brazil), **Cordeiro Ramon Bastos** (Rio de Janeiro, Brazil), **Silva Camila Assis Peres** (Campina Grande, Brazil)
Color as a narrative tool in the tale *The Yellow Wallpaper* by Charlotte
Perkins Gilman: a discursive semiotic analysis 149

Divers Ellen (Raleigh NC, USA)
Beyond hue: the affective response to value and chroma 154

Efimov Andrey (Moscow, Russia)
The theory of urban color environment 160

Ewais Ashraf Youssef (Cairo, Egypt)
Analytical study of pigments (colors) of the Wildlife Scene
at Ra-shepses Burial Chamber (Saqqara, Egypt) 167

Fuentes Villa Tania Erándeni, Fuentes Villa Claudia Ayari (Mexico City, Mexico)
The impact of Spanish colonization on color semiotics and worldview
in Prehispanic Mexico 173

Glogar Martinia Ira, Sutlović Ana, Beritić Ivan, Bešlić Silvija, Peček Vedrana (Zagreb, Croatia)
Analysis of natural dyes color characteristics – subjective vs. objective 179

Grazina Rui, Moreira da Silva Fernando (Lisbon, Portugal)
Color, extensive and intensive approaches 185

Grigorash Alena (Moscow, Russia), **Bossi Davide** (Milan, Italy)
Phenomenology of white in contemporary art and design 190

Guarini Gianluca, Rossi Maurizio (Milan, Italy)
A practical procedure for obtaining calibrated material colors for CAD Systems 196

Jafari Razieh, Gharanjig Kamaladin (Tehran, Iran)
Effect of illuminant UV component on colorimetric attributes
of eco-friendly dyed wool yarns 202

Kooroshnia Marjan, Tepe Jan (Borås, Sweden)
Using coloured lights in physical and immersive VR environments
as material for design 207

Kumar Puja, Lobo Carla (Leiria, Portugal)
Depression to expression: color as visual language to communicate complex emotions 213

Kushnirenko Elizaveta (Milan, Italy)
Color as a visual language: exploring the chromatic palette in Suzan Pitt's animation 219

López Anahí, Di Sarli Alejandro R. (La Plata, Argentina)
Surface quality evaluation in cementitious mixtures: the gray color of mortars
and concrete from a qualitative-quantitative point of view 224

Manav Banu (Istanbul, Turkey)
Color as a way of communication in design education 230

Mariconde María Marta, Incatasciato Adriana, Trettel Paola (Córdoba, Argentina)
Technology in the walk: experiential reading of color of urban landscape 236

Mariconde María Marta, Vidal Eugenia, Viotti Octavio, Aisama Lucas,
Echenique Micaela (Córdoba, Argentina)
Augmented reality in interactive color experience: commemorating Bauhaus 100 242

McLellan Galyna (Brisbane, Australia)
Rethinking the role of technologies in teaching colour design 247

Melgosa Manuel (Granada, Spain), **Vázquez Daniel** (Madrid, Spain),
García Ureña Lourdes (Madrid, Spain), **Li Changjun** (Anshan, China),
Vik Michal (Liberec, Czech Republic)
Quantifying colors of traditional academic gowns in Spain 253

Minah Galen (Seattle, WA, USA)
Color tectonics: enhancing and modifying form and space with color 259

Ollier Xavière, **Landrin Helene, Lehner Vanessa** (Toulouse, France)
The role of the color training in industrial environments 265

Pepa Lorena Sofía, Rodríguez Silvio David, dos Santos Ferreira Cristina Isabel, Buera María del Pilar (Buenos Aires, Argentina)
Characterization of the full-scale of browning degrees in liquid food models 271

Pinheiro Ana Paula, Duarte Rui (Lisbon, Portugal)
Blue in *Alentejo*: authenticity and sustainability 277

Prause Carlos Esteban (Santa Fe, Argentina)
Color as a distinctive quality in visual identity: analysis of dominant color in brand identity in relation to the perception of the recipient 283

Prokopavičiūtė Eglė (Vilnius, Lithuania)
Unveiling the potentials of colored light in relation to other sensory stimuli for atmosphere design 289

Quattrer Milena (Rio de Janeiro, Brazil), **Silva Gouveia Anna Paula** (Campinas, Brazil)
Basic parameters for color education: a proposition of concepts on color theory for Brazilian elementary and middle schools 295

Reisinger Markus (Bayreuth, Germany)
Unique experiential benefits that multispectral lighting may provide 301

Safi Mahdi, Ansari Keivan, Hosseini Shekarabi Seyedeh Farokh (Tehran, Iran)
A color performance comparison of LCD and CRT monitors: considering black offset, white point and linearity 305

Schindler Verena M. (Zollikon, Switzerland), **Griber Yulia A.** (Smolensk, Russia)
The philosophy of colour in the French period of environmental colour design 310

Tarajko-Kowalska Justyna (Cracow, Poland)
Yellow color in European architecture and built environment: traditions and contemporary application 319

Vasilski Dragana (Belgrade, Serbia)
Color as a sign in minimalist architecture 325

Предисловие

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Международной научной конференции
Российского общества цвета

В сборнике представлены 50 статей, подготовленных участниками Международной научной конференции Российского общества цвета, которая состоялась в онлайн-формате 1–5 декабря 2020 года.

Соорганизаторами конференции выступили Смоленский государственный университет, научно-образовательный центр «Лаборатория цвета», ИНИОН РАН, Рабочая группа по изучению цветового дизайна среды Международной ассоциации цвета (AIC), Российское общество цвета и Издательство «Согласие».

В конференции приняли участие 182 исследователя из 27 различных стран мира и 17 регионов Российской Федерации. К участию были приглашены российские и зарубежные специалисты, молодые ученые, профессорско-преподавательский состав образовательных учреждений, магистранты, аспиранты, докторанты, а также все лица, заинтересованные в обсуждении вопросов психологии и социологии цвета, городской колористики, лингвистики и философии цвета.

Принципиальной особенностью мероприятия стал перенос фокуса внимания со связи между цветом и индивидуальным сознанием, которая традиционно изучается в рамках гуманитарных наук, на отношения между цветом и обществом, анализ социальной дифференциации цветовых кодов культуры, выявление взаимосвязи между структурой цветового пространства и социальными структурами.

Работа конференции проходила в пяти секциях:

(1) Психология цвета;

(2) Социология цвета;

(3) Лингвистика цвета;

(4) Цвет в искусстве и дизайне;

(5) Цвет в науке и технологиях.

Заявки на участие в конференции оценивали 52 члена программного комитета – известные ученые из 22 стран мира.

Ежедневный график работы конференции включил выступления приглашенных лекторов, доклады в рамках тематических секций, презентации рабочих групп Международной ассоциации цвета, выступления участников рабочей группы по цветовому дизайну среды и даже виртуальную экскурсию по Смоленску. В рамках конференции состоялось обсуждение изданных в последние годы участниками конференции книг о цвете, аннотации которых представлены в электронной версии издания.

Проведение конференции стало возможным благодаря поддержке Фонда президентских грантов, которая помогла создать площадку для обсуждения результатов исследования.

Работа конференции была организована в Смоленске, в Информационном центре по атомной энергии, и непрерывно транслировалась в режиме живого видео на канале YouTube, где за происходящим наблюдали зрители из 49 различных стран.

Работой секций управляли модераторы – Василий Двойнев и Анастасия Ларченко.

Техническую поддержку конференции и ее трансляцию в режиме живого видео организовывали Павел Деревянко, Алексей Делов и Карина Цыганкова.

Видеозаписи всех дней работы конференции размещены на YouTube:

1-й день: https://youtu.be/yi0-1vYr9BI

2-й день: https://youtu.be/0gxwjJ7XXA4

3-й день: https://youtu.be/qExuyvBX1mU

4-й день: https://youtu.be/dBiuuMaRtR8

5-й день: https://youtu.be/l55XTaV-UGw.

Мы сердечно благодарим всех участников, которые внесли свой вклад в успех Международной научной конференции Российского общества цвета!

Introduction

Verena M. Schindler
Art and Architectural Historian, Zollikon, Switzerland
Chair of the AIC Study Group on Environmental Colour Design

Co-chair of the Organizing Committee of the International Scientific Conference of the Color Society of Russia

This book contains fifty selected papers in Russian and English presented at The International Scientific Conference of the Color Society of Russia (RUcolor2020, The Second Russian Congress on Color) that took place online on December 1–5, 2020.

The conference was co-organized by Smolensk State University; the Research and Education Center “Color Lab”; the Institute of Scientific Information for Social Sciences of the Russian Academy of Sciences; the AIC Study Group on Environmental Color Design; and, the publishing house “Soglasiye” in Moscow.

The conference was attended by 182 color researchers from twenty-seven different countries and seventeen regions of the Russian Federation. It brought together a wealth of topics that reflected the scope of work being undertaken within color theory and color research. RUcolor2020 provided a unique opportunity for researchers, educators, designers, and industrialists from all over the world to meet each other, cooperate, exchange experience, and learn about advanced technologies.

A key feature of the event became the shift of its focus from the relationship between color and individual perception and experience, which is traditionally studied within the framework of the humanities, to the relationship between color and society, the analysis of the social differentiation of color codes in culture, and the identification of the relationship between the structure of color space and social structures.

The work of the conference took place in five sections:

(1) Psychology of Color;

(2) Sociology of Color;

(3) Color in Communication;

(4) Color in Art and Design;

(5) Color in Science and Technology.

Submissions were evaluated by fifty-two members of the Scientific Committee, who were renowned researchers from twenty-two countries.

The daily schedule of the conference included invited talks, oral presentations within the thematic sessions, presentations of the study groups of the International Color Association (AIC), Meeting of the AIC Study Group on Environmental Colour Design, and also a virtual tour around Smolensk. The conference also included a discussion of the books on color published during the past five years by the conference participants. Abstracts of these publications are presented in the electronic version of this book.

The Conference was funded by the Presidential Grant Foundation, which helped to create an amazing platform for sharing and discussing color research findings from around the world.

The conference was held at the Smolensk Nuclear Energy Information Center, and was streamed live on YouTube where viewers from forty-nine countries could view the talks.

The sections were moderated by Dr. Vassily Dvoinnev and M.A. Anastasia Larchenko.

Technical support and live video streaming of the conference were provided by Pavel Derevyanko, Alexey Delov and Karina Tsygankova.

Videos of all five days of the conference are available on YouTube:

Day 1: https://youtu.be/yi0-1vYr9BI

Day 2: https://youtu.be/0gxwjJ7XXA4

Day 3: https://youtu.be/qExuyvBX1mU

Day 4: https://youtu.be/dBiuuMaRtR8

Day 5: https://youtu.be/l55XTaV-UGw

We warmly thank all participants who contributed to the success of The International Scientific Conference of the Color Society of Russia!

Антарктика, или Белый континент: цвет, ценности и магия

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ABSTRACT
Color is a central feature of social life although in Sociological theory its value represents sometimes ambiguity, reflected in terms of color perception and color symbolism. Antarctica as an (almost) empty space is a representation of the confluence of national statements on sovereignty and the globalization processes. It can be seen as a paradigm of a natural realm, a patrimony for humankind, a confluence of aesthetic and ethics, reality and poetry, immaculate purity facing potential exploiters. This is explicitly marked in article 3 of the 1991 Protocol of Environmental Protection to the Antarctic Treaty, when the Consultative Parties (ATCPs) committed themselves to “the protection of the Antarctic environment and the intrinsic value of Antarctica, including its wilderness and aesthetic values”. Several studies we have followed up during the last years showed us that people in general referred to it symbolically (symbol of world peace and cooperation, virginity, wilderness, beauty, purity) or using metaphors (White Continent, Terra Incognita, interiorized milieu, the last shelter, magic, a mystery). We developed comparative studies of the individual representations of Antarctica with a survey of participants aged 15–30 in Argentina (Buenos Aires, Bariloche) and comparing samples with Northern countries (Iceland, Finland) to analyze how the Antarctica is perceived. In all cases a questionnaire with both open and closed questions was applied to subjects on the base of age, gender and socioeconomic level (SEL) quotas. We have used additional explanatory variables such as “level of rootedness”, “level of individual anomie” and “grade of participation”.

Keywords: *Antarctica, white continent, sociological theory, rootedness, anomie*

ВВЕДЕНИЕ

Цвет является одной из основных характеристик жизни общества, выражающейся в терминах социальных репрезентаций цвета, символизма цвета, восприятия цвета, искусства и практики украшения тела, а также моды. Фактически цвет является незаменимым измерением как субъективного жизненного мира, так и социокультурного пространства.

Тем не менее, для нас связь между белым цветом и Антарктидой оказалась значимым открытием. Действительно, изучая индивидуальные представления молодых горожан из Аргентины, Исландии и Финляндии об Антарктике и ее экологических проблемах, мы пришли к выводу: тот, кто сильнее привязан к своему обществу и городу, демонстрирует более высокий уровень социальной активности, как правило, осведомлен об экологических проблемах Антарктики, позитивнее и с энтузиазмом относится к ним и их возможным решениям. Более того, среди таких «укорененных» молодых горожан те, что придерживались утопического и/или лирического представления о реальности, называли Антарктиду «Белым континентом», при этом белый цвет выступал скорее как символ (чистоты, нетронутости, последнего убежища), чем как простое описание ландшафта.

Во многих наших исследованиях мы отталкивались от теории укорененности (Acebo Ibáñez and Costa 2010, 1996), которая включает три измерения: пространственную, социальную и культурную укорененность, а также ее главную черту – тотальность феномена (Mauss 1970–1972). Она также связана с экологией человека (Hawley 1950), неоэкологической школой (Erpicum 1976), экологической социологией (Boff 1997, Di Pace 1992, 2007, Järvelä and Wilenius 1996, Leff 1994, Redclift and Benton 1994, Redclift and Woodgate 2002) и экологической психологией (Aragonés and Amérigo 2000, Lévy-Leboyer 1985). Также следует отметить вклад формальной социологии (Simmel 1977) и социологии экзистенциализма как нового прочтения философского экзистенциализма (Heidegger 1954, Weil 1954, Bollnow 1962, 1969, Tiryakian 1969) в познание жизненного мира индивида и социокультурное пространство.

В то же время мы опирались на положения социологии повседневной жизни – подход, предлагающий наилучшее понимание установок, поведения и индивидуальных репрезентаций городского населения (Remy et al. 1978–1980), на работы Агнеш Хеллер, выдающейся представительницы Будапештской школы, основанной под влиянием Д. Лукача, а также на концепцию жизненного мира (Lebenswelt) Э. Гуссерля.

Повседневная жизнь подразумевает тотальное территориальное, психосоциокультурное и историческое пространство, где знаки и символы представляют собой единое семантическое поле, образуя «социальный текст» с большим количеством смыслов, главным образом в больших городах, согласно серьезным критическим замечаниям Мануэля Кастельса (Castells 1975, 1976, 1978, 1998).

Окружающая среда – это также тотальный феномен, природный, но созданный искусственно мир, требующий меж- и трансдисциплинарного подхода (Mauss 1972, Simmel, 1977, Park 1925, 1935, 1952, Hawley 1950). Самокритика человеческой экологической мысли породила особое сознание, которое позволило нам рассматривать окружающую среду как интериоризованную; эта самокритика связана с упомянутым выше подходом экзистенциалистской социологии (Acebo Ibáñez 2010) к пространству и территории как к «царствам смысла».

Антарктида стала одним из главных феноменов, обсуждаемых в мире, по причине ее необычных особенностей – уникальной экосистемы с множеством скрытых свойств, международного статуса и социокультурной специфики. Кроме того, это континент, наименее загрязненный и измененный в результате деятельности человека (возможно, вследствие таких ограничений, как географическая изоляция, труднодоступность и экстремальность) – самый высокий, самый холодный и самый ветреный континент на планете.

В Антарктике живут в основном мужчины в возрасте 25–40 лет, однако растет и число женщин – они составляют примерно 20 % всего населения (на некоторых станциях есть семьи и дети). Это ученые и исследователи, а также военнослужащие из разных стран (следует помнить, что некоторые страны заявляют о своих правах на отдельные территории материка). Они живут в поселениях, которые можно разделить на а) постоянные поселения, б) поселения, в которых живут только летом, в) временные поселения и г) опустевшие поселения. Численность населения зимой в среднем составляет приблизительно 1 тыс. чел., летом – в среднем 4–5 тыс. чел. Численность населения средних по размеру антарктических станций летом в среднем составляет 40–80 чел. (например, аргентинская станция Марамбио, австралийская станция Кейси и др.).

На некоторых других станциях проживает намного больше людей. Так, самой большой является американская станция Мак-Мердо, население которой обычно составляет 1 тыс. чел.

Все станции и базы представляют собой небольшие автономные сообщества, сообщающиеся с большой землей посредством спутниковой связи.

СОЦИОКУЛЬТУРНОЕ ПРОСТРАНСТВО КАК ТОТАЛЬНЫЙ ФЕНОМЕН		
УРОВНИ / ПОДСИСТЕМЫ	**ЯВНЫЕ ПРИЗНАКИ**	**СКРЫТЫЕ ПРИЗНАКИ**
I / КУЛЬТУРНАЯ ПОДСИСТЕМА	ИСКУССТВЕННАЯ СРЕДА ИСКУССТВО ТЕХНОЛОГИЯ ЯЗЫК АРТЕФАКТЫ	*МИРОВОЗЗРЕНИЕ* ВЕРОВАНИЯ И МИФЫ ПОЗНАНИЕ ЦЕННОСТИ И НОРМЫ СОЦИАЛЬНЫЕ ИНСТИТУТЫ **СОЦИАЛЬНЫЕ РЕПРЕЗЕНТАЦИИ (ВОЗРАСТ, ГЕНДЕР, КРАСОТА, ЦВЕТА)** ОБЫЧАИ И РИТУАЛЫ
II / СОЦИАЛЬНАЯ ПОДСИСТЕМА	НАСЕЛЕНИЕ СОЦИАЛЬНЫЕ АКТОРЫ СОЦИАЛЬНЫЕ ГРУППЫ АГЕНТЫ СОЦИАЛИЗАЦИИ СОЦИАЛЬНОЕ ВЗАИМОДЕЙСТВИЕ СОЦИАЛЬНЫЕ СЕТИ	СОЦИАЛЬНАЯ СТРУКТУРА ПРОЦЕССЫ СОЦИАЛИЗАЦИИ ОТНОШЕНИЯ ВЛАСТИ СКРЫТЫЕ КОНФЛИКТЫ
III / ИНДИВИДУАЛЬНАЯ ПОДСИСТЕМА	ЖИЛИЩЕ СОЦИАЛЬНОЕ ДЕЙСТВИЕ ПОВЕДЕНИЕ СТРАТЕГИИ АДАПТАЦИИ СТАТУСНО-РОЛЕВОЙ НАБОР ИНДИВИДУАЛЬНЫЕ СЕТИ	УСТАНОВКИ ОЖИДАНИЯ СОЦИАЛЬНО-ПСИХОЛОГИЧЕСКИЕ И ЭКЗИСТЕНЦИАЛЬНЫЕ ПОТРЕБНОСТИ
IV / ОРГАНИЧЕСКАЯ / ЭКОЛОГИЧЕСКАЯ ПОДСИСТЕМА	ЧЕЛОВЕЧЕСКОЕ ТЕЛО КАК ОРГАНИЗМ И ЕГО СТРОЕНИЕ БИОЛОГИЧЕСКИЕ ПОТРЕБНОСТИ ЧЕЛОВЕКА ЗДОРОВЬЕ И БОЛЕЗНИ ЕСТЕСТВЕННАЯ ОКРУЖАЮЩАЯ СРЕДА КЛИМАТ ЛАНДШАФТ ГЕОГРАФИЧЕСКИЕ УСЛОВИЯ	**СОЦИАЛЬНЫЕ ПРЕДСТАВЛЕНИЯ О ПРИРОДЕ И КЛИМАТЕ** **СОЦИАЛЬНЫЕ ПРЕДСТАВЛЕНИЯ ОБ АНТАРКТИКЕ** **АНТАРКТИКА КАК БЕЛЫЙ КОНТИНЕНТ**

Таблица 1. Социокультурное пространство как тотальный феномен (Acebo Ibañez 2019)

СОЦИОКУЛЬТУРНОЕ ПРОСТРАНСТВО И ИНДИВИД

Социальные науки и антропология подчеркивают, что любое социокультурное пространство следует анализировать как целостный феномен, который состоит из нескольких взаимосвязанных уровней. Следовательно, для такого анализа необходимо применять междисциплинарный и трансдисциплинарный подходы.

Любое социокультурное пространство имеет различные измерения, неразрывно связанные друг с другом, а также интегрирующиеся в любую концепцию, касающуюся социальной жизни, окружающей среды, территории и времени. Данными измерениями (или подсистемами) являются культура, общество, индивид и окружающая среда. Все они обладают явными (очевидными, непосредственно воспринимаемыми) и скрытыми (неочевидными, неявными, не воспринимаемыми непосредственно) признаками. Эти признаки настолько сильно зависят друг от друга, что любое изменение одного из них (прямо или косвенно, явно или неявно, в краткосрочной или долгосрочной перспективе) сказывается на других, как это показано в Таблице 1 (Acebo Ibáñez 2019: 361). При этом время и территория представляют собой систему координат, в которой находится данное пространство.

Для лучшего понимания нашего исследования следует обратить внимание на следующие скрытые переменные, представленные в Таблице 1:

a) социальные представления о цвете и об Антарктике, которые следует включить в группу скрытых признаков культурной подсистемы;

b) потребность в чистоте, убежище, волшебстве и прочие утопические желания/потребности, которые отметила существенная доля респондентов;

c) скрытые признаки биоэкологической подсистемы.

УКОРЕНЕННОСТЬ И ПРИВЯЗАННОСТЬ К СООБЩЕСТВУ: ТЕОРЕТИЧЕСКИЙ ПОДХОД

Индивид стремится сохранить или создать для себя ту или иную форму укорененности, в противном случае он оказывается изолированным, не испытывает чувства солидарности, попадает под сильное влияние потребительства и превращается в хищника. На самом деле коренные жители готовы воспринимать свое социокультурное пространство и местное сообщество родного города или села не только как населенный пункт, но и как ценность, поскольку и пространство, и люди этого места в той или иной мере определяют их собственную индивидуальность (Simmel 1977, Lefebvre 1974, Lewis and Lyon 1986). Данный тип жителей имеет четкую установку на социальную активность и поиск своего призвания, а в отношении окружающей среды их можно определить как активных или воинственных, то есть тех, кто обеспокоен экологическими проблемами, например, изменением климата или загрязнением. Как правило, человек склонен испытывать привязанность к своему местному сообществу и чувствовать причастность к его социокультурному пространству, в результате чего он в той или иной степени объединяет в себе различные формы укорененности:

а) пространственную укорененность: территориальный императив, когда пространство или место становятся сферой «коллективных смыслов»;

б) социальную укорененность: принадлежность к группам и организациям, а также активное участие в социальной и/или политической жизни;

в) культурную укорененность: восприятие индивидом себя как интегрированного/вовлеченного в данную ценностно-нормативную систему с коллективными смыслами. Отсутствие укорененности порождает аномию. Мы заявляли ранее (Acebo Ibáñez 2019, 2010), что если аномия носит структурный характер, то она создает отношения и поведение, дисфункциональные для всего социокультурного пространства. Кроме того, аномия является причиной возникновения той или иной степени индивидуализма, слабости или риска, которые, в свою очередь, ведут к тому, что в Антарктиде можно увидеть (или мечтать об этом; в любом случае, мечтать – это способ увидеть) «последнее убежище», «континент с магией и тайнами», а также «Белый континент».

Допуская, что чувство причастности к сообществу непрерывно воспроизводится в процессах повседневной жизни и социальных образах, данные переменные необходимо учитывать в анализе социальных представлений о цвете и Антарктиде. Например, существуют связи между восприятием места, поведением и рассуждениями об окружающей среде и изменении климата или об антарктических проблемах в локальном контексте, с одной стороны, и глобальными концепциями – с другой. Мы уже писали (Acebo Ibáñez 2019: 367), что, по утверждениям исследователей (Karjalainen et al. 2008), относительно Республики Коми даже если и можно говорить об экологической глобализации, то на местном уровне она лишь отчасти гомогенизировала общественное восприятие, мнения и поведение в отношении окружающей среды. Ведь взаимодействие человека и природы подразумевает как раз местные условия и локальную социально-экономическую и политическую ситуацию. При этом именно они формируют восприятие климатических условий или проблем Заполярья. И вновь диалектика локального и глобального («глокальный» контекст) встает как неизбежная проблема того, как наилучшим образом постичь реальность, избегая этно- и/или хроноцентризма.

Мы заметили, что люди с высоким уровнем укорененности и низким уровнем аномии, как правило, отмечают экологические проблемы, непосредственно связанные с человеческой деятельностью, например, истребление видов и/или загрязнение. Это можно трактовать как открытое признание индивидуальной ответственности за этиологию современных экологических проблем. В то же время данный тип социального актора (укорененный и не проявляющий признаков аномии) имеет тенденцию отдавать приоритет в решении экологических проблем и проблем Заполярья процессам социализации и передачи информации. Это означает, что респонденты апеллируют к возможностям и ответственности индивидов, предполагая, что люди, вероятно, изменят свое поведение в результате адекватного процесса социализации и получения адекватной информации. Это также подразумевает некоторую надежду на возможность изменения хищнического поведения человека. Как мы уже писали ранее (Acebo Ibáñez 2007: 142), возможно, четкая визуализация ценностно-нормативной системы конкретного общества и наглядный опыт ее интернализации могли бы сформировать личность, способную не только лучше распознавать социальные и экологические проблемы, а также проблемы приполярных территорий, но и предполагать причины их возникновения и возможности их решения.

АНТАРКТИДА КАК «БЕЛЫЙ КОНТИНЕНТ»: ЦВЕТ, ЦЕННОСТИ И МАГИЯ

Антарктида как (почти) пустое пространство является отражением слияния заявлений национальных государств о своем суверенитете и процессов глобализации, скрытого интеграционного процесса и возможных конфликтов, поскольку на обладание некоторыми антарктическими территориям претендуют одновременно несколько стран. Вопреки этому факту, Антарктиду можно рассматривать как парадигму царства дикой природы, которую люди должны защищать, которая является достоянием человечества, слиянием этики и эстетики, реальности и поэзии, безупречной чистотой, с которой сталкиваются потенциальные эксплуататоры. Важно отметить, что об этом прямо говорится в статье 3 Протокола об охране окружающей среды 1991 года к Договору об

Антарктике (British Antarctic Survey 1991), в котором консультативные стороны взяли на себя обязательство «защищать окружающую среду Антарктики и ее внутреннюю ценность, в том числе ее дикую природу и эстетические ценности».

Несколько исследования последних лет рассматривали отношение к экологическим проблемам Антарктиды и социальные представления об этом континенте. Результаты исследований показали, что люди, независимо от контекста, говорят об Антарктике в символическом ключе, чтобы лучше передать ее сущность (символ мира и сотрудничества, первозданности, дикой природы, красоты, чистоты), или используют метафоры (белый континент, терра инкогнито, интериоризированная среда, последний приют, магия, тайна). Употребление выражения «Белый континент» в качестве синонима Антарктиды не кажется нам ни очевидным, ни случайным.

	Безраз-личие, скептицизм	Прагма-тизм, конфликт-ность	Террито-рия своей страны	Уникаль-ная среда обитания	Эстетико-лирическое видение, утопическое видение	ЗО/НО	%
Буэнос-Айрес	33,0	9,8	29.5	0,0	20,5	7,2	100
Сан-Карлос-ди-Барилоче	29,2	26,9	25,1	10,5	8,3	0,0	100

Таблица 2. Индивидуальные представления об Антарктике молодых жителей аргентинских городов Буэнос-Айрес и Сан-Карлос–ди-Барилоче, (%) (Acebo Ibáñez and Costa 2010)

Молодежь Буэнос-Айреса и Сан-Карлос-ди-Барилоче в Патагонии

Мы осуществили сравнительное исследование по выявлению индивидуальных представлений об Антарктике у молодежи в возрасте 15–25 лет, проживающей в городах Буэнос-Айресе и в Сан-Карлос-ди-Барилоче в Патагонии (Acebo Ibáñez and Costa 2010).

В то время как население Буэнос-Айреса (столицы Аргентины) составляет почти 3 млн. чел., в туристическом городе Барилоче в горах проживает почти 120 тыс. чел. (рис. 1). В каждом городе мы отобрали с применением квотной выборки по полу, возрасту и социально-экономическому положению по 500 респондентов, которым предложили ответить на открытые и закрытые вопросы.

В каждой выборочной совокупности примерно треть респондентов продемонстрировала в некотором роде безразличное и/или скептическое отношение к Антарктиде. Остальные варианты индивидуальных представлений об Антарктике с распределением ответов приведены в таблице 2.

Представления об Антарктиде как плод эстетического, лирического и утопического видения присутствуют у 20,5 % респондентов из Буэнос-Айреса и только у 8,3 % опрошенных из Барилоче (однако эту небольшую долю ответивших можно объединить с 10,5 % участников исследования, которые считают Антарктиду «оригинальной и уникальной средой обитания»). Такая воображаемая Антарктида преимущественно присутствует в представлениях молодых людей, а) менее ориентированных на потребление, б) демонстрирующих низкий уровень аномии и в) высоким уровнем потенциальной социальной активности. Это люди, наделенные достаточной энергией, чтобы действовать и продвигаться в тех областях, где Антарктида предстает как «белая» метафора красоты, таинственности, чистоты, нетронутости или последнего прибежища. Более прагматичное и конфликтное видение Антарктиды (почти 10,0 % респондентов из Буэнос-Айреса, но почти 30 % опрошенных из Барилоче) обычно встречается среди молодежи с а) высоким социально-экономическим статусом, б) более высоким уровнем аномии и в) более ориентированной на потребление.

Рисунок 1: Карта, демонстрирующая географическое положение городов Буэнос-Айреса и Сан-Карлос-де-Барилоче относительно Антарктиды (Acebo Ibañez and Costa 2013)

Студенты университетов Буэнос-Айреса, Исландии и Йювяскюли (Финляндия)

Еще одно сравнительное исследование было организовано в Аргентине, Исландии и Финляндии. Отбор респондентов производился среди студентов в возрасте 18–28 лет, обучающихся в университетах Исландии (N=105), г. Йюваскюля в Финляндии (N=69) и Буэнос-Айреса (N=110). Цель исследования заключалась в выявлении восприятия Антарктики с точки зрения ценностей и ожиданий. Во всех вузах был использован инструментарий, содержащий как открытые, так и закрытые вопросы, и применялась квотная выборка по полу, возрасту и социально-экономическому положению. Помимо переменных гендера, возраста и социально-экономического положения мы вновь использовали независимые переменные: уровень укорененности, уровень индивидуальной аномии и уровень социальной активности. В Университете Исландии

(УИ) и Университете Йюваскюли (УЙ) исследование проводилось в онлайн-формате. Полностью с результатами исследования, включающего также изучение проблем арктического региона в контексте повседневной городской жизни, восприятия экологических проблем и путей их решения, можно ознакомиться в ранее изданной публикации (Acebo Ibañez et al. 2014).

Университет	Чистота	Природные ресурсы	Далекая страна	Террито-рия своей страны	Научная значимость	Ничего	%
Буэнос-Айреса	14,4	31,0	28,2	14,4	4,0	8,0	100
Исландии	25,0	11,0	36,3	4,5	0,5	22,7	100
Йюваскюли	60,0	5,0	0,0	10,0	25,0	0,0	100

Таблица 3. Индивидуальные представления об Антарктике студентов университетов Буэнос-Айреса, Исландии и Йюваскюли (%) (Acebo Ibáñez et al. 2014)

Из таблицы 3 следует, что опрошенные студенты обладают различными индивидуальными представлениями об Антарктиде.

а) Антарктида символизирует чистоту для 60 % респондентов из УЙ (в основном для студентов в возрасте 21–25 лет (82 %) и для 100 % мужчин), для 25 % ответивших из УИ (в основном это студенты 18–20 лет) и для почти 15 % опрошенных из Университета Буэнос-Айреса (УБА) (рост наблюдается у студентов с низким социально-экономическим статусом, а также у женщин).

б) Антарктида является «далекой страной» для 36,3 % респондентов из выборки УИ (рост наблюдается у студентов с низким социально-экономическим статусом (80 %)) и для 28,2 % ответивших из УБА (в основном это студенты с низким социально-экономическим статусом (75 %) и с уровнем укорененности ниже среднего).

в) Антарктика ассоциируется с природными ресурсами у 31 % респондентов из УБА (у 42 % студентов 18–20 лет, социально активных студентов и студентов с высоким уровнем укорененности), у 11 % опрошенных из УИ (рост наблюдается среди мужчин (19 %)) и только у 5 % участников исследования из УЙ (в основном у студентов старше 25 лет с низким социально-экономическим статусом (25 %)).

г) Антарктика представляется значимым местом для ученых четверти респондентов из УЙ (в основном студентам с высоким социально-экономическим статусом (43 %) и женщинам (45 %)) и только 4 % опрошенных из УБА и 2,5 % ответивших из УИ.

д) Антарктиду считают частью территории своей страны почти 15 % респондентов из УБА (рост наблюдается у студентов с высоким социально-экономическим статусом), 10 % ответивших из УЙ (в основном студенты 18–20 лет) и 4,5 % опрошенных из УИ (только студенты с низким социально-экономическим статусом).

е) Антарктида ничего не значит почти для четверти респондентов из УИ (22,7 %) (в основном это студенты с высоким социально-экономическим статусом (45 %)) и только для 8 % опрошенных из УБА. У респондентов из УЙ такой ответ зафиксирован не был.

ЗАКЛЮЧЕНИЕ

Результаты проведенных сравнительных исследований позволяют утверждать, что даже при условии недостатка у некоторых респондентов знаний об Антарктиде или безразличного отношения к ней большого числа молодых людей, участвовавших в исследованиях, Белый континент осознается как:

• практически пустое место;
• слияние национальных заявлений о суверенитете и процессах глобализации;
• парадигма царства природы, которую люди должны защищать;
• достояние человечества;
• конвергенция эстетики и этики, реальности и поэзии;
• диалектика безупречной чистоты и эксплуатации.

В то же время результаты исследования свидетельствуют о том, что в целом люди, независимо от происхождения или национальности, склонны относиться к Антарктиде как к символу – символу мира во всем мире, сотрудничества, нетронутости, дикой природы, красоты и чистоты.

Также примечательно, что с целью лучше передать суть Антарктики респонденты многократно использовали метафоры – например, «Белый континент», «терра инкогнита», «интериоризованная среда», «последнее убежище», «магия» и «тайна».

Наконец, принимая во внимание теоретические подходы, которые легли в основу исследований (в первую очередь концепцию укорененности), необходимо подчеркнуть следующее:

• Исследования подтвердили, что люди с высоким уровнем укорененности и низким уровнем аномии склонны отождествлять экологические проблемы с проблемами, связанными с «непосредственной деятельностью человека», например, с «истреблением видов и/или загрязнением». Это можно рассматривать как открытое признание индивидуальной ответственности за этиологию современных экологических проблем.

• Данный тип социальных акторов (укорененный и не проявляющий признаков аномии) имеет тенденцию отдавать приоритет в решении экологических проблем и проблем приполярных территорий процессам социализации и передачи информации. Это подразумевает определенную надежду на возможность изменения человеческого поведения в целях решения этих проблем.

• Мы предполагаем, что четкая визуализация ценностно-нормативной системы конкретного общества и наглядный опыт ее интернализации могли бы сформировать личность, способную не только лучше распознавать социальные и экологические проблемы и проблемы приполярных территорий, но и предполагать причины их возникновения и возможности их решения. В проведенном нами исследовании приняли участие молодые люди с более развитым внутренним миром, что побудило подавляющее большинство из них отдать предпочтение эстетическому, лирическому и утопическому образу Антарктиды как Белого континента.

Обозначенные особенности позволяют сделать вывод о значимости укорененности, привязанности к своему сообществу, социальной активности и социальных действий, ориентирующихся на ценности, принятые в месте проживания. Жилище представляет собой не только потребность человека, но и необходимое условие его бытия в мире. Хайдеггер в некотором роде выводит физическое пространство из пространства экзистенциального. Философ-экзистенциалист понимает, что «жить» означает «поселиться», «проживать где-то», но помимо этого он подразумевает под этим понятием удовлетворение, ощущение свободы и безопасности, защищенности от любых бед и угроз. Именно для немецкого философа-экзистенциалиста основной чертой обитания является «забота о земле смертных». Следовательно, любое расточительство, любое действие, способствующее экологическому кризису, демонстрирует, что люди отказались от своего экзистенциального призвания. Совершенно очевидно, что жить – значит спасать землю.

Антарктиду следует рассматривать не только как область научных исследований (рис. 2), но и как лучшее место для медитации о планете (и вселенной). Возможно, благодаря его чистоте и «глубокой белизне» можно достичь того, что так дорого достается современному человеку – обратить свое сердце к Антарктиде. Научные исследования и, главным образом, заселение должны дать больше знаний об Антарктиде и внести вклад в создание «антарктической идентичности». В конце концов, цвета, как и континенты, тоже открывают и заселяют.

Белая Антарктида – громкий крик, который заглушает и услаждает, потому что его нельзя услышать. Здесь нет ни зелени, ни радуги – только белизна и ветра, которые встречаются послушать тишину.

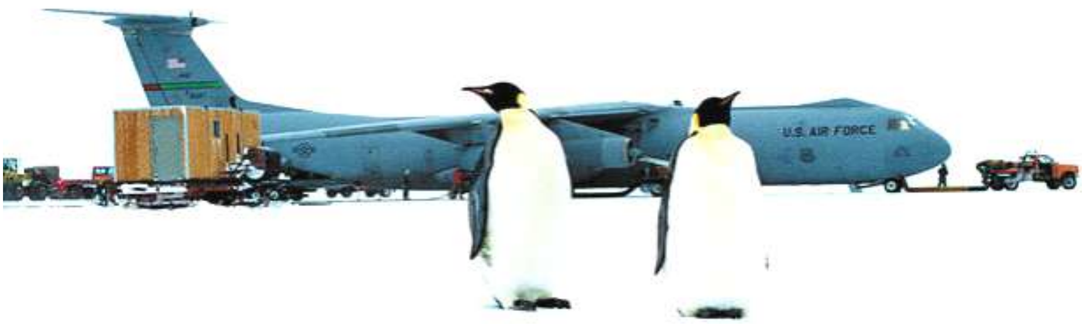

Рисунок 2: Антарктида, Белый континент и простор для исследований в поисках собственной идентичности

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Цветовое профилирование: визуальный архетипический план процесса индивидуации по Юнгу

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ABSTRACT

Colour Profiling is the ability to create through the medium of colour, an archetypal personality profile for an individual, with the intention of aligning a person to their greatest potential on the path to becoming whole. Becoming "whole", relating to what Carl Jung referred to as the continuing emotional and psychological life-long process towards the state of Individuation. Individuation being the ability to hold the tension between two opposing energetic forces within one's own psyche. Using and adhering to the three core principles of Colour Profiling combined with the information gleaned from the personal colour profile it is then theoretically possible to assess and evaluate through colour, the unique blueprint of archetypal behavioural patterns at play within the individual, thus being able to coach and empower the individual to live a fulfilled life with a good sense of overall wellbeing. In this paper I will demonstrate how, through the use of colour profiling protocols it is possible to highlight archetypal character strengths and life potential using colour as a language to express inherent behavioural tendencies. I will explain the core principles and protocols used to create a Colour Profile and use a case subject to explain and demonstrate and highlight a visual archetypal blueprint. Colour Profiling shows potential to be providing a visual language and a visual tool, using the medium of colour, to make visible and identify Hillman's "Acorn Theory" and Jung's "invisible lattice work of archetypal energy" for the process of Individuation.

Keywords: *archetypes, colour, Jung, soul*

ВВЕДЕНИЕ

Цветовое профилирование – это способность создавать с помощью цвета индивидуальный профиль личности с целью раскрытия ее потенциала. Этот процесс схож с тем, что Карл Густав Юнг назвал процессом индивидуации, или путешествием к Самости, где Самость является интегрированным целостным Я человека или, согласно другим системам взглядов, его Сверх-Я.

Юнг говорил: «Индивидуация – это процесс трансформации, когда индивидуальное и коллективное бессознательное превращаются в сознание (например, посредством снов, активного воображения или свободных ассоциаций) для слияния с полноценной личностью. Это абсолютно естественный процесс, необходимый для интеграции психики. Индивидуация оказывает на человека абсолютный исцеляющий эффект как духовно, так и физически» (Jung 1962).

Согласно Юнгу, цвет принадлежит к миру архетипов и является основой человеческого коллективного опыта. Цвет можно охарактеризовать как представление другой стороны архетипа «Самость». Следовательно, имея возможность переводить посредством языка цвета эти изначальные формы поведения, существующие в каждом из нас и окрашенные в различные тона и оттенки, мы способны обеспечить человеку ориентиры для саморазвития и помочь ему стать тем, кем он стремится стать, используя все его способности, а следовательно осуществить процесс индивидуации.

Цветовой профиль можно сравнить с планом; план функционирует как руководство по сотворению или созданию чего-либо. По мере нашего развития основы нашей личности начинают постепенно проявляться. С каждым шагом, который мы совершаем в жизни, первоначальный план раскрывается все больше и больше. Этот план, этот уникальный эскиз личности, как говорят, скрыт глубоко внутри бессознательного, и только через встречи с бессознательным, будь то во снах или посредством символов, мы можем надеяться узнать о нем больше и осмыслить его. Цвет рассматривался Юнгом как один из символов и языков бессознательного.

Когда мы хорошо знаем фундамент, на который опираемся, у нас появляется больше возможностей жить именно той жизнью, для которой мы были рождены, и следовать своему призванию по рождению, с осознанием того, что мы вносим свой собственный уникальный вклад в эволюцию коллективного сознания.

ТЕОРИЯ

Теория цветового профилирования базируется главным образом на трех основных принципах; это своего рода линза, сквозь которую можно увидеть любой профиль. Первый принцип заключается в том, что внутри каждого человека есть предсуществующая Самость, которая уже является целостной, здоровой и реализованной. Эту самость можно соотнести с теорией психолога Карла Роджерса и его гипотезой Я-идеального, в котором то, к чему мы всегда движемся и стремимся, это скорее состояние и ощущение бытия, чем реальный пункт назначения, то есть процветающая и полноценно развитая личность. Второй принцип, выдвинутый основателем движения архетипической психологии Джеймсом Хиллманом, состоит в том, что каждый рожден с определенной целью и имеет уникальный план. Хиллман назвал этот план «кодексом души» и «теорией желудя». Обладание знанием об этом плане и доступ к нему имеют единственную цель – способствовать эволюции человеческого сознания.

Исследователь творчества Юнга Роберт Джонсон повторяет его мысль: «Внутри бессознательного каждого человека находится первичная схема, “план”, если хотите, в соответствии с которым формируются сознательный разум и целостная функциональная личность – от рождения и на протяжении долгих лет психологического роста к подлинной внутренней зрелости. Эта схема, эта невидимая решетчатая конструкция энергии, содержит все черты, все сильные стороны, недостатки, базовую структуру и части, которые составляют целостное психологическое существо» (Джонсон 1986: 7).

Третий принцип цветового профилирования следующий: все мы являемся частью имманентно здоровой семьи и социальной системы, поддерживаем с ними связь и получаем от них содействие. В этом смысле семья выходит за рамки обыкновенной, с точки зрения биологии – нуклеарной семьи и включает в себя физиологическую, эмоциональную и психологическую наследственность, полученную от предшествующих поколений, о которой может быть известно или не известно ее членам. Это ощущение связи не ограничивается пределами семьи по крови, оно относится к группам, профессиональным и социальным, к которым принадлежит индивид. В этой невидимой сети поддержки мы также усматриваем систему духовной поддержки, которую принимает человек и из которой он черпает силу.

Данные принципы дают нам основание и емкость, в которую мы теперь можем добавлять ингредиенты для создания цветового профиля.

Первым ингредиентом является представление Пифагора о числах и его теория чисел, в частности нумерология – учение, которое представляет собой эзотерическую манеру перевода и постижения сущности человека с помощью чисел и букв. Хотя некоторые относят нумерологию к псевдонаукам, историю ее применения можно проследить на протяжении многих эпох и обнаружить ее следы в формировании атеистических убеждений.

С ростом влияния христианства и церкви многие эзотерические исследования Пифагора были сочтены еретическими. Пифагор мало писал, большая часть его учения передавалась устно, что в его время было обычным делом. Сегодня Пифагора больше знают благодаря его математическим формулам, тогда как его исследования и поиски были связаны скорее с изучением путешествия души после смерти человека. При этом математические формулы были, по сути, второстепенными и, возможно, использовались как средство для поиска ответа на этот извечный вопрос, и нам не суждено узнать, нашел Пифагор на него ответ.

Нумерология исходит из того, что каждое число обладает определенной вибрацией и что эта вибрация может быть отнесена к определенным архетипам человеческого поведения. Система Пифагора сводит все числа к однозначным цифрам от 1 до 9. Любые большие числа складываются до тех пор, пока они не уменьшатся до числа от 1 до 9. Кроме того, в этой системе каждой букве алфавита присваивается числовое значение, также относящееся к диапазону от 1 до 9, соответственно: A = 1, B = 2 и I = 9, затем J = 1, а R = 9; каждый раз, когда достигается число 9, следующее кодирование вновь начинается с цифры 1.

В какой-то момент истории, в котором отсутствовало конкретное событие, дата или человек, числа и цвета начали ассоциироваться друг с другом и между ними возникла связь. Вместе с этой связью зародилась гармония числа и цвета в индуизме (в чакрах и кундалини).

Основой взаимосвязи здесь является комбинация вибрации, состояний бытия и поведения. Обсуждение этой взаимосвязи представляет большой интерес, однако оно не соответствует предмету данной статьи.

Комбинации числа и цвета выглядят так: 1 = красный, 2 = оранжевый, 3 = желтый, 4 = зеленый, 5 = синий, 6 = индиго, 7 = фиолетовый, 8 = розовый, 9 = золотой. Буквы алфавита также имеют свои цветовые коды A, J, S = 1 = красный и т. д.

Теория цветового профилирования заключается в том, что дата рождения и имя человека сначала преобразовываются согласно системе Пифагора в числа, которые затем переводятся в девять цветов. Используя основные принципы цветового профилирования в сочетании с информацией, полученной из личного цветового профиля, с помощью цвета можно теоретически оценить уникальный план архетипических образцов поведения, функционирующих во внутреннем мире человека. Это позволяет подготовить индивида к полноценной жизни с ощущением совершенного благополучия.

ЭКСПЕРИМЕНТ

Участник эксперимента будет подвергнут поэтапному изучению, при этом его личность будет раскрыта после получения результатов. Это необходимо для того, чтобы наглядно продемонстрировать, как при взгляде на визуальный цветовой образ индивида пробуждается первобытный язык знания и понимания, уводящий нас за пределы произнесенного слова.

Участник эксперимента родился 29 января 1954 года, что в нумерологии можно представить числом 4. Расчет производится следующим образом: 2 + 9 + 1 + 1 + 9 + 5 + 4 = 31 = 3 + 1 = 4.

Согласно методу цифрового профилирования, число 4 соответствует зеленому цвету (рис. 1).

Цвет даты рождения считается цветом жизненного пути и фундаментом, на который опирается человек. Цвет жизненного пути считается ключевым для возвращения человека к полноценной гармонии на всех уровнях бытия (Wentworth 2012).

Зеленый цвет считается цветом сердечной чакры, на санскрите эта чакра известна как чакра Анахата, что в переводе означает «не пораженный» (Anodea 2004: 224). Следовательно, можно было бы считать, что «человек зеленого цвета» будет действовать и относиться к миру от всего сердца. Взаимосвязанные положительные черты зеленого – это сострадание, любовь, понимание, гармония, природа и возрождение. Взаимосвязанными отрицательными чертами зеленого являются зависть, ревность, горечь, негодование и хладнокровие. В «человеке зеленого цвета» сочетаются положительные и отрицательные свойства зеленого, при этом одни будут преобладать над другими в зависимости от пережитого опыта.

Ожидается, что благодаря накопленному индивидом опыту могут возникнуть ситуации, позволяющие удерживать напряжение между двумя противоположными сторонами «зеленого» поведения. Например: «Я завидую этому человеку, но могу признать и сострадать ему и той части меня, которая испытывает зависть».

Следующий шаг – преобразование имени в цвет – можно представить следующим образом: A = 1 = красный, B = 2 = оранжевый и т. д. Результат преобразования представлен на рис. 2.

Цвета имени записываются в так называемый цветовой глиф, который используется для того, чтобы показать, сколько раз тот или иной цвет встречается в имени. Например, у участника нашего эксперимента мы видим, что есть один красный цвет, три синих, два индиго, два фиолетовых, один розовый и три золотых. Количество повторений одного и того же цвета отображает силу влияния данного цвета. Цветовой глиф можно сравнить со штрих-кодом, который при сканировании позволяет распознать товар и зачастую дает о нем полную информацию. Если говорить о поведении человека, то в цветовом глифе мы можем распознать то, что делает индивида уникальным, ту самую «первичную схему» Юнга, а также отношение индивида к миру. Более того, цветовой глиф позволит понять, как мир видит этого индивида и относится к нему.

Теперь, когда на жизненный путь зеленого цвета был наложен цветовой глиф, мы получили цветовую карту участника эксперимента. Я советую читателю не пожалеть своего времени и еще раз взглянуть на нее (рис. 2), прежде чем продолжить чтение и узнать, кто оказался нашим испытуемым. Отражает ли цветовая карта того человека, о котором идет речь?

Рисунок 1: Зеленый цвет

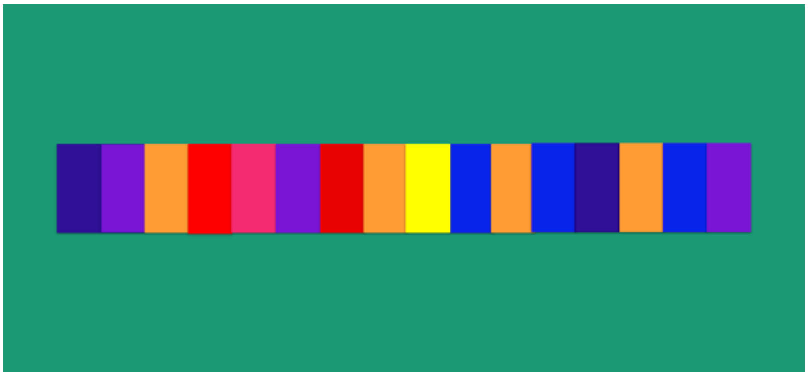

Рисунок 2: Цвет жизненного пути и цвета имени

Рисунок 3: Опра Гейл Уинфри

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ

Цвета, выявленные у участника эксперимента, находятся ближе к холодному краю спектра – восемь из двенадцати букв относятся к сине-фиолетовой части радуги. В цветовой духовно-психической системе они в большей степени ассоциируются и демонстрируют связь с группой, а не с эго, в фокусе оказывается скорее коллективное «мы», а не эгоистичное «ты» и «я». С учетом того, что золотой цвет встречается в имени испытуемого три раза и что этот цвет часто ассоциируется с божественной мудростью и исцелением, можно предположить, что участник эксперимента стремится делиться мудростью и знанием, независимо от того, насколько они велики или малы.

Результаты эксперимента свидетельствует о том, что испытуемый обладает всеми возможностями Самости, необходимыми для познания эмоциональных потребностей других и соприкосновения с ними; для него, независимо от призвания, жизненно важно чувствовать, что это имеет смысл лишь тогда, когда это делается искренне, от всего сердца.

Известная американская телеведущая Опра Гейл Уинфри (рис. 3) произвела революцию в телевизионных ток-шоу: открыто рассказывая о своих собственных проблемах, она тем самым дала другим возможность почувствовать себя настолько комфортно, чтобы они смогли поделиться историями из их личной жизни. Девизом и мантрой Опры Уинфри всегда был лозунг «Изменения происходят благодаря образованию».

Пример Опры Уинфри является прекрасной иллюстрацией превращения личных невзгод в возможность исцеления и служения другим. Цветовой профиль ведущей представляет собой наглядный пример того, как цветовая карта индивида, первоначальный план, постепенно проявляется в его поступках, а в последнее время – в ее благотворительной деятельности. В определенный момент она сама стала олицетворением своего цветового профиля и, если смотреть через призму процесса индивидуации по Юнгу, она, насколько нам известно, до сих пор сохраняет напряжение между противоположными полюсами своей души.

ЗАКЛЮЧЕНИЕ

Если говорить кратко, то вывод, к которому я пришел после тридцати трех лет изучения и разработки цветовых профилей психодинамики, заключается в том, что они дают возможность разработать визуальный язык и визуальный инструмент для того, чтобы, используя цвет, продемонстрировать значимость «теории желудя» Дж. Хиллмана (Hillman 1996) и «невидимой решетчатой конструкции архетипической энергии» К.Г. Юнга для процесса индивидуации.

Следующим этапом станет сбор данных для анализа с целью продолжения данного исследования. Заключительный вопрос и потенциальные дальнейшие шаги на протяжении нескольких лет будут связаны с влиянием использования представленной здесь информации в качестве руководства для помощи детям с раннего возраста, а также как способа развития и раскрытия их первоначального плана. Как он мог бы повлиять на общество, если бы стал составной частью системы образования?

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Системы цветового порядка, смешение цветов и роль cesia

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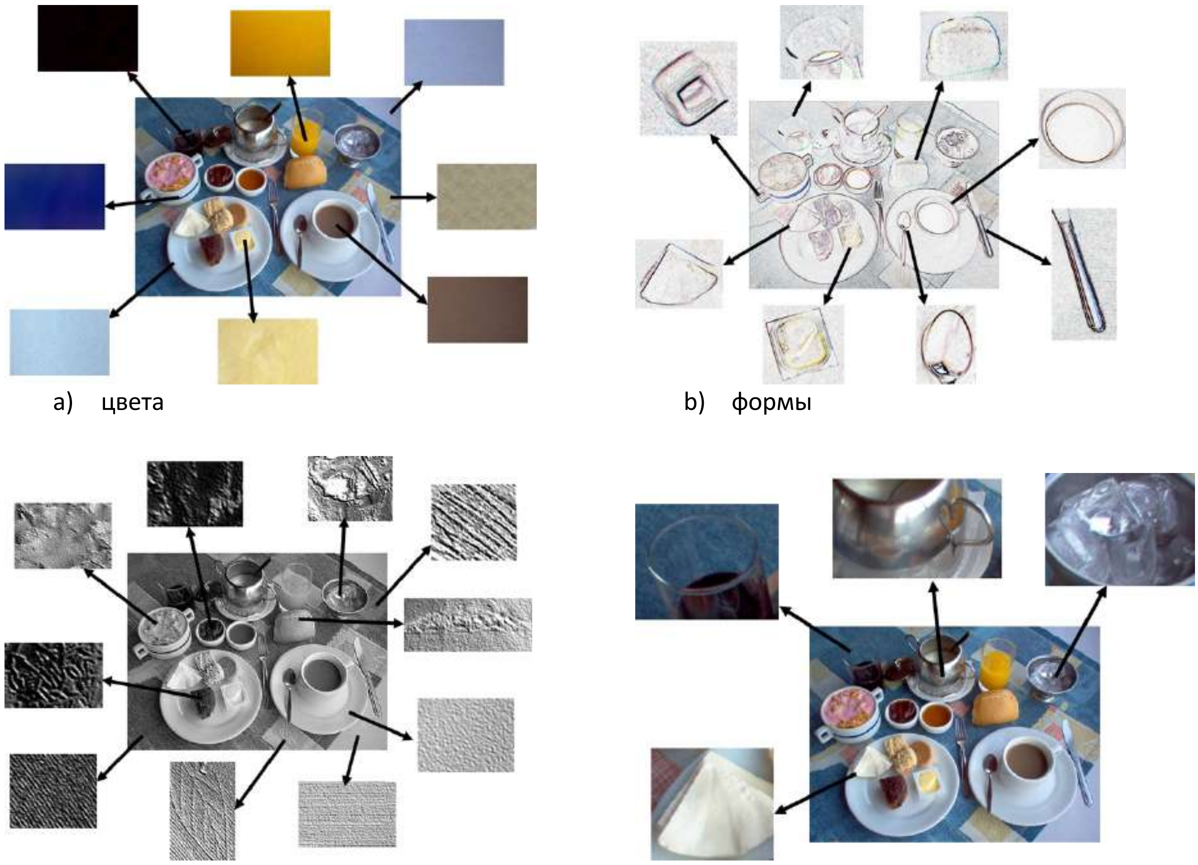
ABSTRACT
The aim of this paper is to offer an overview and delineate interrelationships between the following two questions: 1) how the shape of color order systems is related to different types of chromatic mixtures, and 2) how the degree of opacity or transparency (an aspect of cesia) of the coloring media involved in the mixtures define the results, beyond the established categories of additive, partitive and subtractive mixtures. The underlying idea is that these processes are of a gradualist nature, and that a continuous sequence can be traced between two poles: additive mixture of overlapping lights, on one side, and subtractive mixture of transparent pigmentary layers, on the other one. The hypothesis is that the degree of transparency or translucency of the material used, as well as the degree of gloss or matte finish of the surfaces, will have a great influence on these processes and in the results obtained. Thus, instead of just three separate or unconnected types of color mixtures, we can postulate a model based upon a gradual sequence between additive and subtractive mixture, with partitive mixture as one of the steps in between. A schematic 3D model of gradual transformation is proposed to encompass different color systems that represent any possible mixture between additive and subtractive.

Keywords: *color order systems, color mixtures, cesia, gradualism, transparency and opacity*

ВВЕДЕНИЕ: ИДЕЯ CESIA

В данной статье представлен обзор того, как форма той или иной системы цветового порядка связана с различными типами смешения цветов, а также как степень матовости или прозрачности красителей, применяемых в процессе смешения, воздействует на результаты без учета таких традиционных категорий, как аддитивное смешение цветов, партитивное цветообразование и субтрактивный синтез цвета. В основу исследования легла идея о том, что данные процессы носят градуальный характер и их следует понимать скорее как некий континуум, нежели классифицировать как отдельные категории.

Начнем с определения некоторых базовых аспектов. Рис. 1 позволяет назвать характеристики изображенных прямоугольников, и никто не станет отрицать, что все они разного цвета. Если свести изображение к набору линий или границ изменения цвета, мы будем говорить о формах, то есть определять предметы по их контурам или месту, занимаемому ими в пространстве (рис. 1b). Также, отбирая другие свойства предметов, можно заметить, что на рисунке представлена их разная текстура (рис. 1c). Наконец, мы можем говорить о таких качествах, как прозрачность, блеск, светопроницаемость, матовый эффект непрозрачных вещей и т. д. Для обозначения всех этих качеств, так или иначе связанных друг с другом, Сесар Джаннелло предложил термин «cesia» (рис. 1d).



a) цвета b) формы

c) текстуры d) cesias

Рисунок 1: Четыре варианта визуального представления одного изображения

«Cesia» следует понимать как визуальный эффект внешнего вида предметов, передающий изменение ощущений вдоль трех осей: прозрачное – непрозрачное, глянцевое – матовое и светлое – темное (Caivano 1991, 1994). Объекты могут по-разному влиять на распространение света в пространстве, и это их свойство становится стимулом для восприятия cesia. Диффузное отражение света от непрозрачного объекта обычно создает матовый эффект. Регулярное или зеркальное отражение придает поверхности вид зеркала. Способность объектов пропускать направленный свет позволяет нам видеть их прозрачность. В то же время объекты, пропускающие рассеянный свет, мы видим как полупрозрачные. Наконец, если объект поглощает весь получаемый свет, он визуально воспринимается как темный или черный (рис. 2).

Поскольку существуют атласы физических образцов цвета, это дает нам возможность создать атлас образцов cesia (см.: Caivano and Doria 1997). Атлас, представленный на рис. 3, составлен из кусочков стекла. На первой пластине атласа у непрозрачных образцов с изменением коэффициента диффузии зеркальный эффект переходит в глянцевый, а глянцевый – в матовый, и они приобретают темные оттенки вплоть до черного. На последней пластине коэффициент диффузии прозрачных образцов изменяется от полной прозрачности к абсолютной непрозрачности через промежуточные стадии полупрозрачности, и они тоже становятся темными или черными. Остальные пластины атласа (каждая демонстрирует изменения коэффициента диффузии и степени темноты) в свою очередь отображают изменения вдоль оси прозрачное – непрозрачное (рис. 3а). На рис. 3b приводится пластина атласа с прозрачными и полупрозрачными образцами cesia, у которых также изменяются оттенки темного, ее можно использовать для установления визуального совпадения образца с объектом путем сравнения.

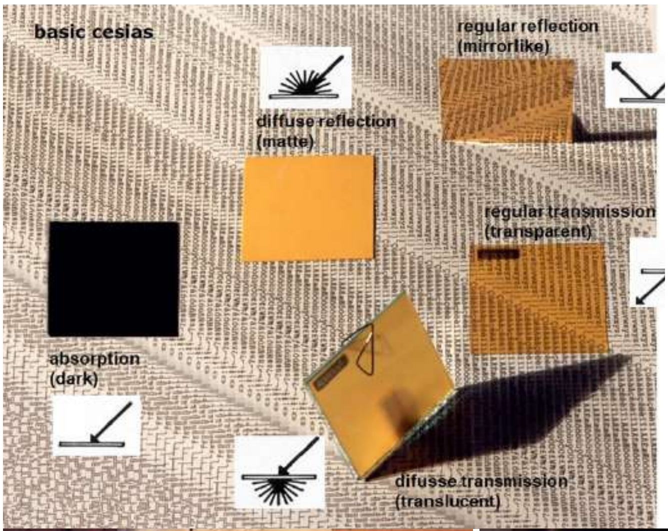
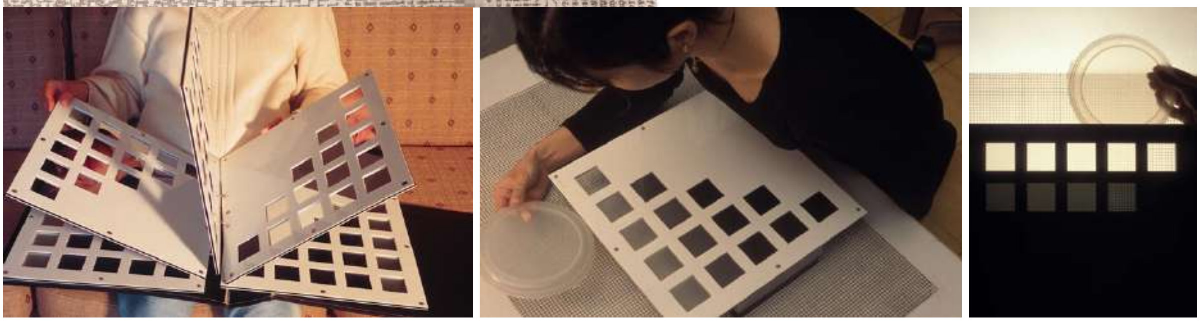


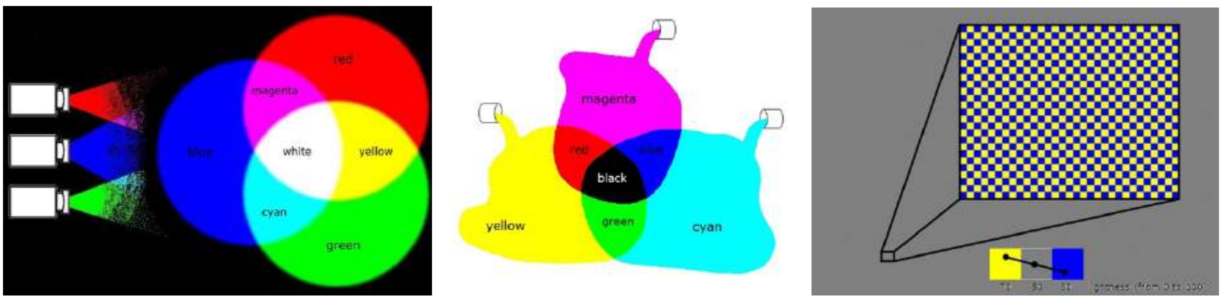
Рисунок 2: Пять базовых ощущений cesia (характеристики восприятия) и пять типов распределения света в пространстве (физические характеристики)



a) b)

Рисунок 3: a) Прототип атласа образцов cesia из кусочков стекла; b) применение прозрачной/полупрозрачной пластины атласа для визуальной оценки объекта по параметрам проницаемости, диффузии и темноты (три переменных cesia)

Какова связь цвета и cesia? Визуально любой цвет может представать в совокупности со всеми свойствами cesia. Например, желтый воспринимается как матовый, прозрачный, отражающий или полупрозрачный. А каждое свойство cesia способно проявляться в любом цвете. К примеру, прозрачность можно заметить в синем, зеленом, желтом, красном и любом другом цвете. Cesia взаимодействует с цветом во многих процессах, в том числе и в процессе смешения цветов.



a) b) c)

Рисунок 4: a) Аддитивное смешение цветов (лучей света): конечные цвета получаются светлее; b) субтрактивный синтез цвета (чернила): конечные цвета получаются темнее; c) партитивное, или оптическое, цветообразование: светлота конечных цветов является средней относительно светлоты исходных цветов

ТРАДИЦИОННЫЕ КАТЕГОРИИ СМЕШЕНИЯ ЦВЕТОВ

Что касается смешения цветов, мы обычно считаем само собой разумеющимся, что существует три категории.

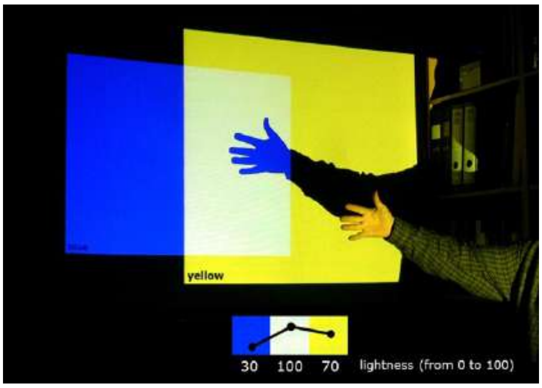
1. Аддитивное смешение цветов (сумма цветных лучей света, проецируемая на поверхность) дает цвета более светлые, чем исходные. Например, при аддитивном смешении красного, зеленого и синего пурпурный получается светлее, чем синий и красный, желтый – светлее, чем красный и зеленый, голубой – светлее, чем зеленый и синий, наконец, белый – светлее всех этих цветов вместе взятых (рис. 4a).
2. Субтрактивный синтез дает цвета более темные, чем исходные. Например, при типичном субтрактивном смешении желтого, пурпурного и голубого, красный получается темнее желтого и пурпурного, синий – темнее пурпурного и голубого, зеленый – темнее голубого и желтого, наконец, черный – темнее всех этих цветов вместе взятых (рис. 4b). Данный тип смешения можно выполнить чернилами, красками или наложением слоев пленки, которые действуют как фильтры и выборочно поглощают некоторые спектральные компоненты света, отражающегося или направленного в сторону наблюдателя.
3. Случай, представленный на рис. 4c, отличается от предыдущих. Мы воспринимаем однородный фон рисунка как серый, однако если увеличить его небольшой участок, мы понимаем, что он состоит из желтых и синих ячеек, которые слишком малы для восприятия по отдельности. Это напоминает технику пуантилизма или дивизионизма в живописи. Глаз объединяет небольшие точки, в результате происходит партитивное, или оптическое, цветообразование, создающее цвет, чья светлота является средней относительно светлоты исходных цветов. Например, оптическое смешение желтых и синих точек на рис. 4c образует серый цвет, который является более светлым по отношению к синему и более темным по отношению к желтому. Такое смешение цветов также можно выполнить с помощью вращающихся дисков. Синий и желтый сегменты на диске создадут сероватый цвет, если скорость вращения диска будет очень высокой (см. рис. 5b).

АНАЛИЗ ТРАДИЦИОННЫХ КАТЕГОРИЙ СМЕШЕНИЯ ЦВЕТОВ И ИХ ОБСУЖДЕНИЕ

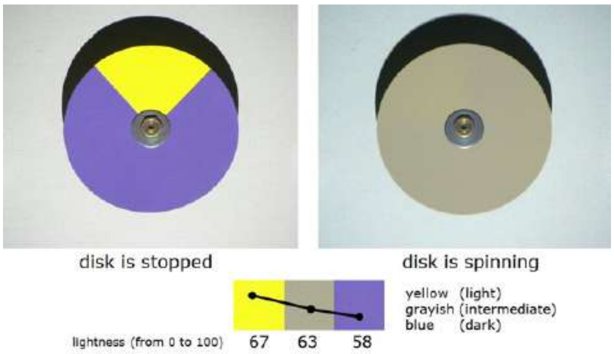
Помимо приведенных примеров аддитивного смешения цветов, субтрактивного синтеза цвета и партитивного цветообразования, все может быть иначе, если рассматривать конкретные случаи, тем или иным образом отклоняющиеся от типичных ситуаций. Принцип, действующий в аддитивном смешении цветов, подтверждается, по-видимому, во всех случаях, поскольку смешение происходит за счет добавления света, и в результате всегда получается более высокий уровень светлоты. Желтый цвет со светлотой 70 % и синий цвет со светлотой 30 % дают белый цвет с идеальным значением светлоты, равным 100 % (рис. 5a). Однако возможны некоторые различия – например, между наложенными друг на друга лучами света и расположенными по соседству небольшими световыми точками (как на экранах компьютеров или телевизоров).

На рис. 5b представлено оптическое цветообразование при помощи вращающихся дисков с матовой цветной бумагой. Светлота желтого цвета составляет 67 %, синего – 58 %, а полученный сероватый цвет имеет промежуточную светлоту в 63 %, что является средним показателем. В контексте этого утверждения о партитивном цветообразовании можно попытаться выяснить, что произойдет, если вместо дисков с матовой поверхностью использовать диски с глянцевой поверхностью или полупрозрачные и прозрачные диски.

Еще один случай – это трихромный процесс печати прозрачными чернилами (желтыми, пурпурными и голубыми), создающий тип смешения цветов, являющийся чем-то средним между аддитивным смешением и субтрактивным синтезом. Там, где отпечатанные точки накладываются друг на друга, получается более темный цвет (субтрактивный синтез цвета), но если точки расположены рядом или разделены, они дают промежуточный цвет (партитивное цветообразование), если смотреть на них с большого расстояния.



a)



b)

Рисунок 5: a) Наложенные друг на друга лучи света создают аддитивное смешение: синий + желтый (красный + зеленый) = белый; конечный цвет более светлый; b) вращающийся диск с цветными наклейками создает партитивное, или оптическое, цветообразование: синий + желтый = серый; конечный цвет имеет светлоту, являющуюся средней между светлотой исходных цветов

В смешивании пигментов бывают случаи, когда правило субтрактивного синтеза цвета не работает. На рис. 6 непрозрачные пигменты желтого и синего цвета разбавлены водой. В емкости в центре эти пигменты смешаны с зеленым. Но полученный цвет не темнее исходных. Вместо этого он имеет светлоту, среднюю между светлотой желтого и светлотой синего, что можно увидеть ниже на диаграмме с числовыми значениями. Таким образом, этот цвет следует рассматривать как результат партитивного цветообразования, а не субтрактивного синтеза цвета. Данная проблема была выявлена и подробно описана Дэвидом Бриггсом (2012): «Физическое смешение красок часто описывается просто как субтрактивное, но на самом деле в нем обычно задействован и компонент аддитивного смешения цветов с эффектом усреднения светлоты».

Рисунок 6: Смесь непрозрачных пигментов с водой. Это результат партитивного цветообразования. Полученный зеленый цвет имеет среднюю светлоту относительно светлоты исходных цветов

Матовость как одно из свойств cesia здесь является ключевым аспектом. Степень матовости красок измеряется нанесением тонких слоев на черно-белый контрастный рисунок. Шкала на рис. 7 демонстрирует изменение переменной вдоль оси прозрачное – непрозрачное. В левой части шкалы прозрачный слой лака позволяет очень четко видеть контрастный черно-белый узор фона. При постепенном смешивании лака с матовой черной краской темнота цвета на шкале увеличивается, а прозрачность уменьшается. Таким образом, контрастный черно-белый рисунок фона постепенно исчезает под слоем краски. Еще одна возможность – это постепенное смешивание прозрачного лака с матовой белой краской (рис. 7b). В этом случае матовость возрастает в правой части шкалы, проходя промежуточные стадии полупрозрачности, но сохраняя максимальную светлоту (иными словами, темнота стремится к нулю). Черно-белый контрастный рисунок фона снова постепенно исчезает, теперь уже под слоем белой краски (см.: Caivano et al. 2004). Такая же шкала изменения от прозрачного до матового белого изображена на рис. 7c, где прозрачная вода постепенно смешивается с непрозрачным молоком.

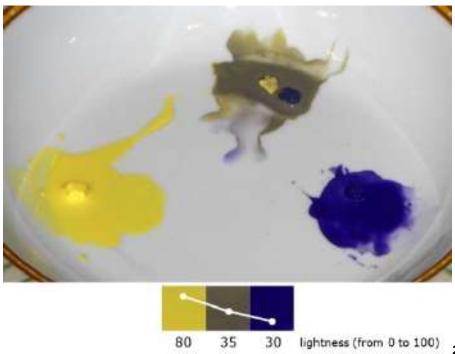
a)

b)

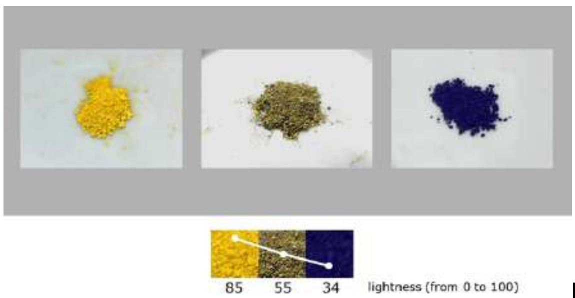
c)

Рисунок 7: Переменная прозрачности – непрозрачности: a) смешение прозрачного лака с черной краской – прозрачные образцы становятся темнее; b) смешение прозрачного лака с белой краской – образцы теряют прозрачность и становятся непрозрачными (и более светлыми); c) шкала прозрачности – непрозрачности, созданная с помощью смешивания воды и молока

На рис. 8a изображены те же пигменты синего и желтого цвета, что и на рис. 6, но здесь они не разбавлены водой, а смешаны в пасту с очень небольшим ее содержанием. Полученный зеленый цвет также является промежуточным по светлоте, подтверждая правило партитивного цветообразования. Таким образом, смешивание пигментов не следует рассматривать как синоним субтрактивного смешения цветов. Правильность этого вывода подтверждается еще больше, если смешать эти же пигменты в форме порошка, вообще не используя воду (рис. 8b). В этом случае становится очевидным, что зеленый цвет является результатом партитивного цветообразования, когда отдельные мелкие синие и желтые крупинки порошка не смешиваются, но располагаются близко друг к другу, соединяясь только в визуальном восприятии смотрящего.



a)



b)

Рисунок 8: Смешивание пигментов как результат партитивного цветообразования; конечный зеленый цвет является промежуточным по светлоте. a) Смешивание пигментов в пасту (с небольшим содержанием воды); b) смешивание пигментов в форме порошка

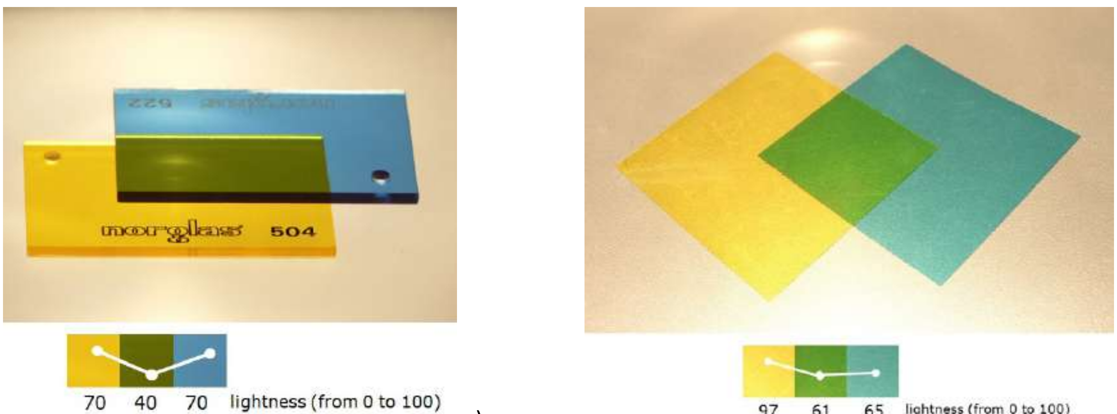
Если прозрачные слои наложить друг на друга, результатом станет субтрактивное смешение цветов: полученный зеленый будет темнее желтого и голубого, как видно из диаграммы с числовыми данными светлоты (рис. 9a). Но если накладывать друг на друга слои не идеально прозрачной цветной пленки, а более или менее полупрозрачной, то в результате получится смешение, близкое к партитивному цветообразованию. Стоит заметить, что зеленый в центре рис. 9b остается немного темнее, но по светлоте он уже ближе к голубому слою. По мере увеличения прозрачности получается более светлый зеленый цвет, занимающий промежуточное положение между желтым и голубым, становясь, таким образом, продуктом партитивного цветообразования.

Гельмгольц (1952) подробно описывает результаты применения разных процедур смешения цветов. Одной из них является смешение спектральных лучей света. Гельмгольц берет красный, зеленый и фиолетовый и, смешивая их, получает белый. Далее он описывает, что происходит с различными материалами: прозрачными красителями, менее прозрачными красками и порошковыми формами. Наконец, он говорит о вращающихся дисках с секторами из бумаги разных цветов, а также комбинации из стекла и бумаги двух цветов, один из которых виден при отражении света, а второй – при его пропускании сквозь объект.

Харальд Кюпперс учел данные аспекты при разработке законов синтеза цвета:

- аддитивный синтез (например, цветное телевидение);
- субтрактивный синтез (например, цветная фотография);
- слои прозрачного и непрозрачного цвета (слои краски разного цвета, наложенные друг на друга);
- интегрированное смешение (непрозрачные краски, смешанные друг с другом и нанесенные одним слоем);
- оптическое смешение (объединение в один цвет небольших точек разного цвета, которые не воспринимаются по отдельности);
- быстрое смешение (передача цветовых стимулов через очень короткие промежутки времени) (Küppers 1978 (1980): 145–182).

Кюпперс утверждает, что «существует, по меньшей мере, одиннадцать законов смешения цветов» (Küppers 1978 (1980): 177).



a) b)

Рисунок 9: a) Наложение прозрачных акриловых пластин создает субтрактивный синтез цвета: голубой (абсорбирующий красный) /желтый (абсорбирующий синий) = зеленый; конечный цвет получается темнее. b) Наложенные друг на друга слои полиэстера не являются идеально прозрачными и, обладая определенной степенью полупрозрачности, создают субтрактивную смесь, однако светлота полученного зеленого цвета приближается к пределу, за которым полученная смесь стала бы результатом партитивного цветообразования

СИСТЕМЫ ЦВЕТОВОГО ПОРЯДКА И СМЕШЕНИЕ ЦВЕТОВ

Что в данном контексте происходит с системами цветового порядка? В большинстве случаев форма той или иной системы связана с типом смешения цветов, который она представляет. Разница между аддитивным и субтрактивным смешением стала проясняться лишь в XIX столетии, благодаря работам Гельмгольца, Грассманна, Максвелла и др. В 1852 году Гельмгольц описал свои опыты по смешению цветов с применением излучений или пигментов и подчеркнул, что в обоих случаях он получал разные результаты. В «Справочнике по психологической оптике» Гельмгольц (Гельмгольц 1867: 276) продолжил разработку этой темы и использовал там уже термины «аддитивный» и «субтрактивный» для различения процессов смешения цветов.

Как только это различие стало очевидным, системы, представляющие смешение световых излучений, и системы, которые описывают смешение пигментов, стали изображать при помощи разных форм. Первые – в форме конусов (обычно с одной вершиной, где расположен черный цвет), вторые – в форме двойных конусов или сфер (с двумя полюсами, для белого и черного) (рис. 10).

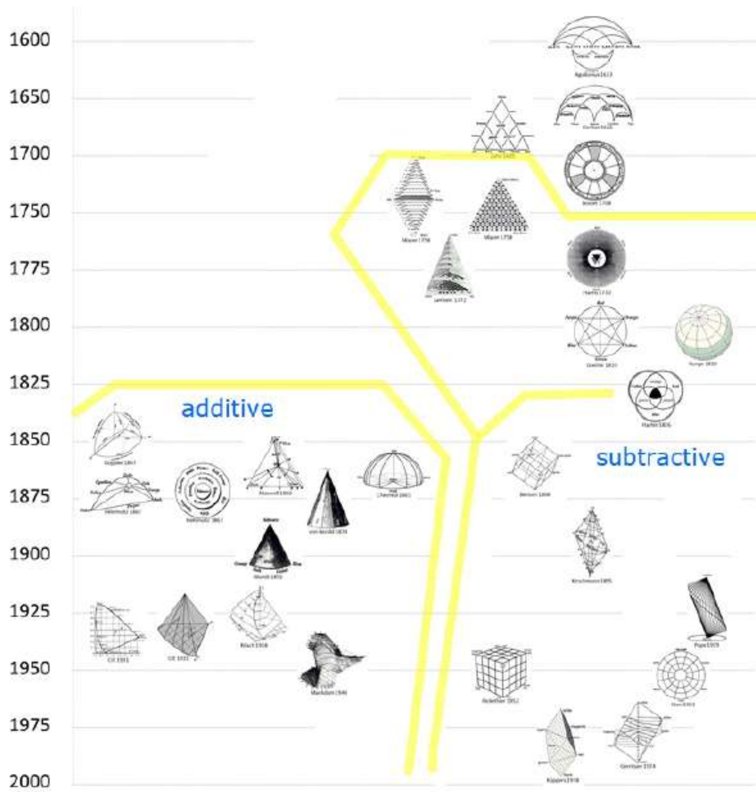


Рисунок 10: В середине XIX века различие между аддитивным смешением цветов и субтрактивным синтезом цвета позволило изображать системы цветового порядка при помощи различных форм

Однако существуют трудно классифицируемые случаи – например, двойной конус Оствальда. Здесь стоит ненадолго вернуться к Максвеллу и Гельмгольцу. Одним из методов смешения цветов, который применяли Максвелл и Гельмгольц (последний – наряду с другими методами), было вращение дисков с сегментами из бумаги разного цвета на поверхности (Maxwell 1855, Peruzzi and Roberti 2019). Данный метод был рассмотрен выше как пример партитивного цветообразования.

Оствальд также применял этот метод: на вращающихся дисках было по три сегмента – один черного цвета, один белого цвета и один с разными оттенками или цветами. Таким путем и с опорой на данные психофизических шкал он произвел расчеты и получил промежуточные цвета в каждом одноцветном сегменте круга оттенков (см.: Jacobson et al. 1948). В то время этот метод рассматривался как способ аддитивного смешения цветов. Категория партитивного цветообразования тогда еще не существовала. Позднее, в XX веке, стали утверждать, что данный метод пригоден именно для партитивного цветообразования, называвшегося также оптическим, а не для аддитивного смешения цветов.

ГРАДУАЛЬНАЯ МОДЕЛЬ СИСТЕМ УПОРЯДОЧЕНИЯ ЦВЕТОВ В СООТНОШЕНИИ С ТИПАМИ СМЕШЕНИЯ ЦВЕТОВ

Системы цветового порядка изменялись на протяжении более двух тысяч лет: от одномерных линейных шкал, которые постепенно перешли в двухмерные схемы в форме кругов, квадратов и треугольников, до современных моделей в трех измерениях (см.: Kuehni 2003, Kuehni and Schwarz 2008, Spillmann 2009, Baumann et al.2011). Трехмерные системы стали появляться в XVIII – XIX веке в форме пирамид, конусов, сфер и кубов, а в XX веке были созданы и другие, более сложные и замысловатые формы. Эволюция этих систем цветового порядка происходила параллельно с изменениями теоретических концепций о цвете и была связана с практическими потребностями в создании различных цветов при помощи смешения пигментов, световых излучений или других веществ.

К 2004 году я начал изображать этот широкий спектр систем цветового порядка в виде этапов эволюции или дерева, ветви которого разделены в соответствии с теориями цвета и практиками смешения цветов. Идея заключалась в том, что форма, в которой изображается та или иная система цветового порядка, связана с приписываемой этой системе теорией цвета, а также типом смешения цветов, который она иллюстрирует (рис. 11).

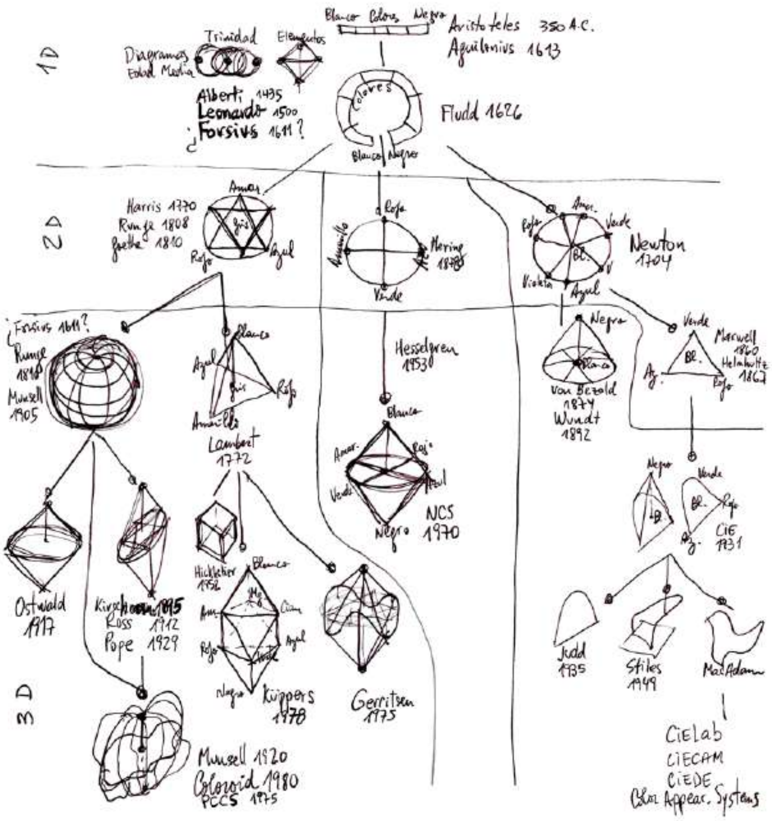


Рисунок 11: Этапы эволюции систем цветового порядка (эскиз выполнен в 2004 г.)

Существуют системы, основанные на трехкомпонентной теории цветового зрения и законе аддитивности и разработанные для предсказания результатов смешения цветных излучений. Они используются в колориметрии, для цветопередачи на телевизорах и экранах и в осветительной технике в целом. Другие системы предназначены для объяснения процесса смешения пигментов. Они в основном базируются на принципах субтрактивности и используются в живописи, полиграфии, дизайне, архитектуре и т. д. Однако некоторые модели демонстрируют определенную двусмысленность. Их можно рассматривать как в некотором роде гибридные системы или промежуточные этапы, представляющие другие случаи смешения цветов, поскольку иногда трудно провести четкое разделение между аддитивным смешением цветов, партитивным цветообразованием и субтрактивным синтезом цвета (рис. 12).

Отдельного упоминания заслуживает система NCS (Natural Color System), основанная на теории противоположных цветов Э. Геринга, который не ставил перед собой цели описать все виды смешения цветов. Эта система трактует цвет как визуальное ощущение независимо от того, как он был создан или какого рода смешение цветов было для этого необходимо (SIS 1979, Hård and Sivik 1981).

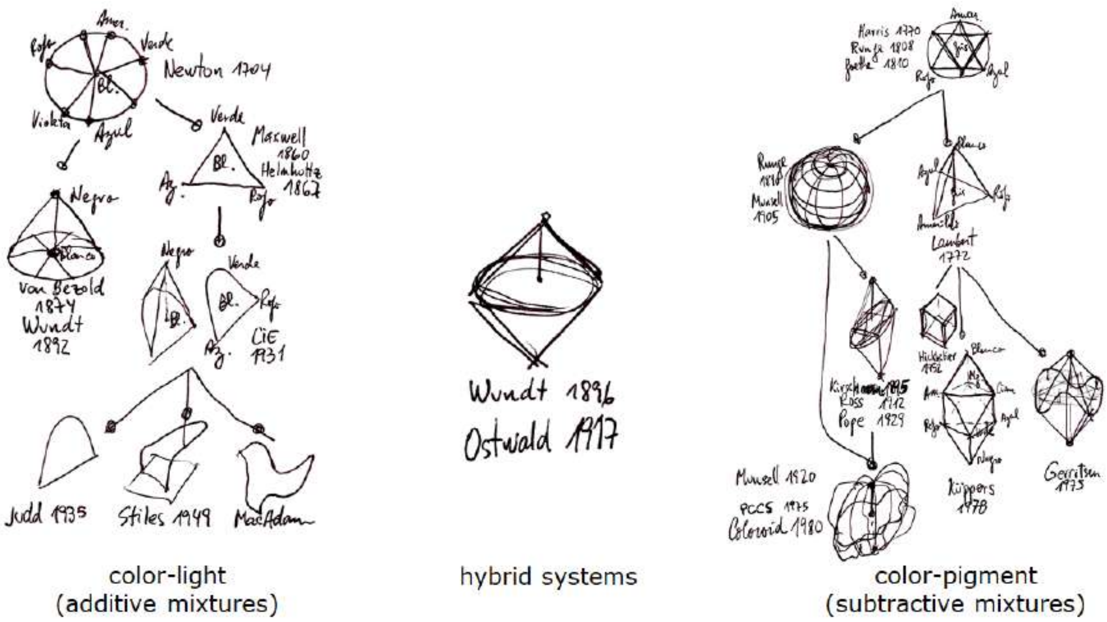


Рисунок 12: Типичные формы систем упорядочения цветов, представляющие аддитивное смешение световых излучений (слева), субтрактивного смешения пигментов (справа) и гибридные, или промежуточные, системы (в центре).

В целом, если сосредоточиться исключительно на взаимосвязи между системами цветового порядка и смешением цветов, можно говорить о трех основных случаях (рис. 13):

1. Трихроматические красное, зеленое и синее исходные световые излучения смешиваются при помощи аддитивного синтеза в белый у основания конуса; светлота уменьшается в сторону черного, который размещен у вершины конуса.

2. Непрозрачные пигменты, отображаемые вокруг наклонной сферы оттенков (желтый ближе к белому, а фиолетовый ближе к черному), смешиваются в средний серый цвет в середине ахроматической оси ближе к центру сферы (как правило, неправильной формы).

3. Трихроматические исходные пигменты голубого, пурпурного и желтого цвета, действующие как идеально прозрачные субтрактивные фильтры, смешиваются в черный в центре треугольника, в то время как белый находится за пределами этой поверхности, где субтрактивные пигменты не имеют никакого влияния.

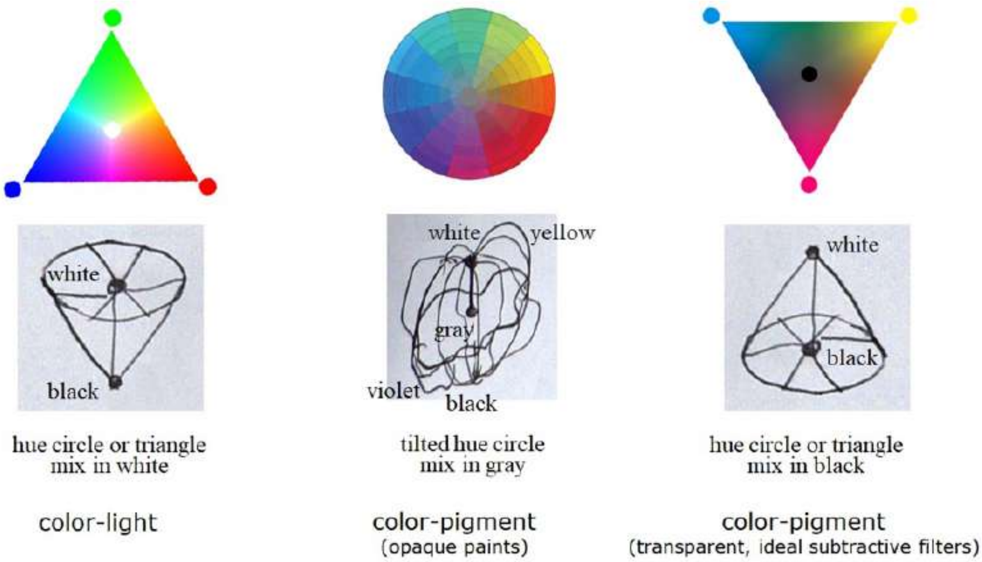


Рисунок 13: Три типичные формы систем цветового порядка, представляющие смешение световых лучей (слева), непрозрачных пигментов (в центре) и идеально прозрачных фильтров (справа)

Таким образом, существуют различные случаи смешения цветов, которые можно изучать, рассматривая поэтапные изменения между аддитивным смешением (на одном полюсе) и субтрактивным синтезом (на противоположном). Основываясь на критериях, разработанных Кюпперсом, представляется возможным предложить следующую модель градуальных чередований:

Световые излучения:	• наложенные друг на друга • находящиеся рядом друг с другом и имеющие небольшой размер (без наложения) • быстро чередующиеся прерывистые
Небольшие цветные точки:	• наложенные друг на друга • находящиеся рядом друг с другом • отделенные друг от друга (на белом фоне)
Цветные поверхности, вращающиеся или движущиеся на большой скорости:	• с матовым покрытием • с глянцевым покрытием
Непрозрачные пигменты:	• смешанные в порошок • смешанные в пасту (с постепенным изменением содержания воды) • разбавленные водой
Полупрозрачные пигменты:	• с увеличением прозрачности (от почти непрозрачных до почти прозрачных)
Прозрачные чернила:	• предварительно смешанные и нанесенные одним слоем • слои наносятся поочередно, после высыхания предыдущего

Данные случаи нуждаются в экспериментальной проверке, при которой следует учитывать, что степень прозрачности – полупрозрачности – непрозрачности вещества, а также глянцевое или матовое покрытие поверхностей будут существенно влиять на процесс и результат смешения цветов. Именно поэтому cesia играет важную роль. Вместо трех отдельных или несвязанных типов смешения цветов мы можем создать модель, основанную на наличии градуальной смены этапов между аддитивным смешением цветов и субтрактивным синтезом цвета, в которой партитивное цветообразование является промежуточным этапом.

Таким образом, представляется возможным предложить трехмерную модель-схему градуального преобразования, включающую в себя различные цветовые системы, которые позволяют создавать любую смесь цветов между полюсами аддитивного смешения и субтрактивного синтеза. На одном полюсе смешение трех цветных световых излучений (как правило, красного, зеленого и синего) в результате дает белый цвет. Между полюсами оптическое смешение основных цветов дает средний серый цвет. На другом полюсе субтрактивное смешение прозрачных чернил, играющих роль поглощающих свет слоев (например, при цветной печати), в результате дает очень темный серый, почти черный цвет. Нижняя или средняя части данных моделей могут состоять из треугольников или хроматических кругов, разделенных на части по количеству рассматриваемых основных цветов. Эта поверхность постепенно движется вниз (от белого к черному) по ахроматической шкале (рис. 14).

Данное предложение, или схема, или гипотеза, нуждается в дальнейшей разработке и проведении испытаний. Однако я убежден, что такой градуалистский подход может стать способом расширения наших знаний не только о системах упорядочения цветов, но и в области теории цвета в целом, если эту идею применить к различным аспектам исследования цвета.

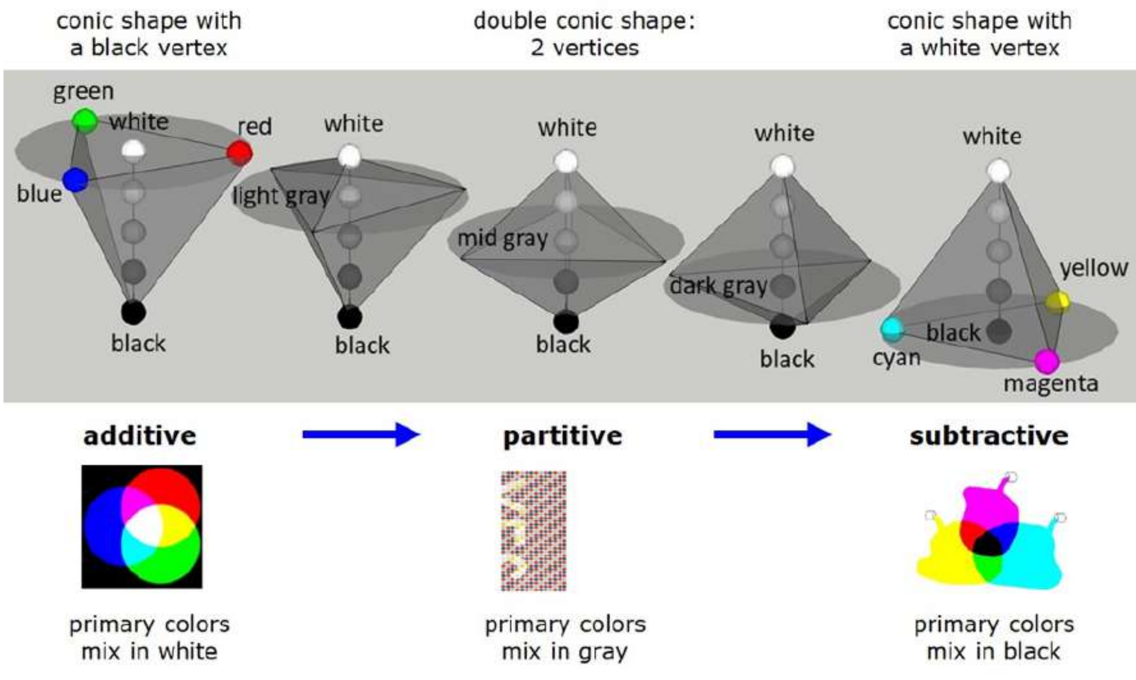


Рисунок 14: Трехмерная модель-схема градуального преобразования систем упорядочения цветов от совершенного аддитивного синтеза к идеальному субтрактивному смешению

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Цветовая символика в южноиндийском театре катхакали

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ABSTRACT
The article is devoted to the identification of color symbolism in Kathakali dance dramas, which have become a cultural symbol of the South Indian state of Kerala. It provides information about the history of the Kathakali dance drama, the specifics of the performance of the troupe, and also examines the musical accompaniment of performances. The article focuses on the identification of color symbolism in Kathakali dance dramas. The specifics of the actors' makeup, which directly depends on their role, are analyzed in detail; the characteristic features of the complex symbolism of lines, drawings, as well as the color scheme of each category of heroes are revealed. For sattvik (gods and noble heroes) characteristic green colour (pachha). Rajasik (anti-heroes) – a green base of makeup (katthi) with bright identifying red lines on the cheeks, nose and forehead. Also, distinctive features of the appearance of rajasikas are chuttippo – white balls of plants, attached to the forehead and the tip of the nose. Tamasik (demons, villains) are the third group of kathakali characters called thadi ("bearded"). A distinctive feature of their makeup is the dominance of black, on which specific red signs appear, outlined with white lines. The semantics of color are also inherent in the minor characters of minakku (women, sages): their makeup is orange-yellow, closer to the body, which emphasizes the naturalness of the face. The aim of the work is a multidimensional characterization of Indian kathakali theater; performances are considered as a syncretic art form that combines music, dance, martial arts and stage action. The author also characterizes the semantics of color that has developed in the art of kathakali. The methodology of the study is based on the principles of a comprehensive approach that considers the performances of kathakali from historical and theatrical-aesthetic positions; the result is a multidimensional consideration of the phenomenon of kathakali. In the process of working on the article, a key role was played by the experience of studying Indian musical culture, obtained by the author during research internships at the Shriram Bharatiya Kala Kendra Institute (New Delhi) in the period 2004-2006 and in 2009.

Keywords: *Kathakali, Kerala, sattvik, rajasik, tamasik*

Танцевальное искусство Южной Азии, равно как и театральное, своим происхождением связаны с храмовой культурой, поскольку были составной частью различных богослужений. По традиции во внутренних дворах храмов разыгрывались драматические представления на мифологические темы, рассказывавшие о жизни богов. В каждом штате возникли свои танцевальные драмы, которые стали своеобразным культурным символом многосоставной индийской художественной культуры.

Во второй половине XVII века на Малабарском побережье в южном штате Керала приобрёл популярность новый жанр танцевальных представлений *катхакали* – божественная мистерия, в которой причудливым образом переплелись музыка, танец, драматическое действие, *абхиная* (пантомима), акробатические элементы, пение и поэзия. По мнению исследователей, рождению *катхакали* благоприятствовала история, произошедшая в Коттараккаре (букв. «земля дворцов»). Его военачальник Балавир Кералан попросил местного *раджу*, носившего титул *заморина*, Манадеву из Каликута (ныне город Кожикоде, штат Керала), прислать на празднество труппу придворных актёров, исполнявших *кришнаттам*[1], чтобы они продемонстрировали своё искусство. Однако он получил отказ в оскорбительной форме: изысканное искусство *кришнаттам* недостойно быть представленным в других государствах. И тогда Балавир Кералан решил создать свой храмовый театр: он придумал спектакли, апеллирующие к сказаниям о подвигах божественного Рамы, которые разыгрывались в течение восьми ночей. Эти постановки коттараккарского раджи стали называться *раманаттам*, или «танец Рамы». Дальнейшее развитие этих божественных действ и расширение их тематических направлений привело к возникновению искусства, получившего название *катхакали* (букв. «повествование для разыгрывания пьесы») – «танцевальной драмы, где предания из *пуран* и эпические рассказы (*катха*) воплощались в сценической игре (*кали*) под музыкальное сопровождение» (Карташова 2010: 479). Тематика новых спектаклей была связана с небесным пастушком богом Кришной, сюжеты черпались из древнеиндийских эпосов «Махабхарата» и «Рамаяна». Своим беспрецедентным успехом театр *катхакали* обязан тому фактору, что эти драмы ставились на смеси санскрита и малаялама – разговорного языка в Керале.

Катхакали – сфера деятельности исключительно актёров-мужчин, которые проходят интенсивное обучение различным видам искусств в течение продолжительного времени начиная с десятилетнего возраста. Все основные фигуры и прыжки выполняются из положения полусидя, при этом танцовщик делает их непринуждённо и легко.

Первый шаг в тонкие миры *катхакали* – это грим, который по своей сути можно считать глубокой медитацией, то есть постепенное «перетекание», перерождение обычных людей в персонажей *катхакали*. За несколько часов до выступления начинается эта подготовительная часть перформанса: на лицо накладывается грим – маски (*чутти*) из пасты рисовой муки. Процесс считается «особенно трудоёмким и выполняется только мастерами-специалистами *чуттикаран* (“тот, кто делает *чутти*”)» (Карташова 2010: 475). Затем прикрепляется ослепительно-белая борода – *чутти* – от челюсти до ушей для чёткого очерчивания контура лица, на ее фоне сложный грим становится наиболее ярким и заметным.

Что касается цвета в гриме персонажей *катхакали*, то здесь просматривается определённая символика, раскрывающая амплуа персонажей. Для богов и положительных благородных героев – *саттвик* – характерен насыщенный зелёный цвет (*пачха*), их внешность отличается особым аристократизмом и утончённостью. На лбу сложный *наман*, или религиозный символ. Их головы украшают достаточно большие *кириды* – многокрасочные головные уборы круглой формы, увенчанные яркими блёстками белого, красного и зелёного цвета. Как отмечают исследователи, «большинство актёров, играющих роль богов, возносят молитву перед тем как надеть корону» (Samson 1987: 130). Персонажу Кришны накладывают на лицо *пачху* (зелёный грим). Но от других божественных персонажей он отличается небольшой короной – *мути*, украшенной наверху символичными павлиньими перьями, и цветом рубашки –

[1] *Кришнаттам* букв. «танец Кришны». Считается, что этот стиль разработал и ввёл в храмы раджа Манадева в 1650 году, включив танец в сценическое действие и поручив хору разговорные диалоги. Новые драматические пьесы исполнялись на чистом санскрите. *Кришнаттам* ставился как ряд спектаклей, рассчитанных на восемь ночей, и на каждый день устанавливался один из тематических циклов *аватар* (реинкарнаций) Кришны начиная со дня его рождения в Матхуре и заканчивая отправлением бога в его небесное жилище (Карташова 2010: 478).

она у него синяя, хотя у всех героев с гримом *пахча* в костюмах используются только белый для юбок[2] и красный для кафтанов.

За основу для тонирования лица саттвиков-богов берётся мягкий оранжевый цвет (*пажуппа*) – это образы Шивы и Брахмы. Следует отметить, что во всех компонентах грима используются только натуральные материалы: кокосовое масло, разноцветные порошки из минералов, сок из деревьев и растений.

Вторая категория – *раджасик* – антигерои (грим *каттхи*): для них характерны ярко-зелёные тона, что свидетельствует о наличии положительных черт (любовь, преданность, великодушие), однако насыщенный зелёный фон «перечёркнут» яркими опознавательными красными линиями на щеках, носу и лбу. Они хвастливы, вспыльчивы, дерзки, высокомерны, но не лишены сентиментальности и нежности в отношениях со своей возлюбленной, появляющейся в их грёзах. Также этих персонажей можно определить по *кадешам*, или *чуттиппо* – белым шарикам из мякоти растений, приделанных на лбу и кончике носа. Если *раджасика* рассердить, то он может продемонстрировать пару клыков как выражение своей ярости. По традиции антигерои пользуются особым успехом у публики и являются запоминающимся украшением спектакля, по ходу которого раскрывается драматический талант раджасика-танцовщика.

Тамасик (сюда входят демоны, злодеи) – это третья группа персонажей *катхакали*, именуемых *тхади* («бородатые»). Отличительной чертой их грима является доминирование чёрного цвета, на котором проступают специфические красные знаки, очерченные белыми линиями; отсутствие бороды (*чутти*), огромные усы, чёрные губы и красный подбородок. Традиционно *тхади* исполняют «сильные выносливые актёры, которые способны удержать в танце массивный головной убор» (Narayan 2009: 44).

Есть *чаванду тхади* (краснобородые) и *карутта тхади* (чёрнобородые); последние олицетворяют собой самые низменные и примитивные качества человека. Их лица раскрашены в чёрный цвет с едва заметным обрамлением глаз белыми и красными линиям. Иногда в уголках рта актёры для устрашения прикрепляют клыки – «драмиштрам, сделанные из раковины или пластмассы» (Samson 1987: 124). Они носят чёрные длинные головные уборы цилиндрической формы; обычно это образы охотников. Краснобородые и чёрнобородые выступают как антиподы утончённым божественным героям. Отличительной особенностью этих персонажей является наличие на носу и лбу *чуттиппо* в форме больших распустившихся белых цветов, служащих символом агрессивности и свирепости, и расширяющиеся кверху чёрные высокие цилиндрические короны.

В плеяде *тхади* – злой персонаж Кали с исключительно чёрной бородой. У Ханумана – бога обезьян – совершенно ни на кого не похожий красочный грим с красной основой, куполообразная корона и изысканный меховой белый кафтан, меховая борода и белые бакенбарды. В цветовом решении грима на носу, лбу и щеках преобладает красный и чёрный фон, который нивелируется весьма витиеватым белым узором. Такая цветовая гамма в целом придаёт любимому в народе обезьяньему божеству нейтральный и уравновешенный характер. Следует отметить, что Хануман – один из наиболее излюбленных героев *катхакали*, поэтому исполнение данной роли доверяется самому опытному актёру, способному передавать тончайшие нюансы различных положительных эмоций.

[2] По традиции на каждого актёра надеваются 24 разноцветные юбки до щикотолок.

Персонажи *кари* – чёрные: это коварные демоны, злые духи, на них исключительно чёрные костюмы (*вешам*) и чёрный грим. Примером может служить *ракшаса* (демонесса) Пурпанакхи, безобразный и уродливый вид которой подчёркивают две большие накладные выпячивающиеся груди.

Семантика цвета присуща и второстепенным героям *минакку* (женщинам, жрецам и мудрецам): актёры-мужчины, изображающие эти роли, отличаются естественностью лиц (грим у них оранжево-жёлтый, ближе к телесному) и простотой костюма.

Процессу накладывания грима придаётся первостепенное значение: во время этого исполнители соблюдают полнейшую тишину, расслабляются и погружаются в медитации. И как только их лица получают новое художественное оформление, надеваются изысканные головные уборы, роскошные костюмы и многоярусные украшения (колокольчики, браслеты, развевающиеся шёлковые ленты, серьги), артисты перевоплощаются в своих героев и полностью растворяются в изображаемых образах.

По традиции танцевальные драмы сопровождаются пением под аккомпанемент инструментального ансамбля, состоящего их четырёх музыкантов – это «два барабанщика и два певца» (Samson 2002: 32). Сугубо мужские инструменты, сопровождающие героев-мужчин, – *маддалам*[3] (горизонтальный барабан) и *ченда*[4] (цилиндрический), на котором играют стоя с помощью палочек. Примечательно, что *эдакка* (небольшой барабан в форме песочных часов) вступает только тогда, когда на сцене появляется женский персонаж, так как имеет более мягкое звучание. Миссия двух других музыкантов-певцов состоит в том, чтобы задавать особый ритм представлению: один из них, помимо пения, бьёт в ручной гонг *ченгила*[5], а второй играет на паре ручных металлических тарелочек *илатталам*. На фоне звучащей музыки и проникновенной игры танцовщиков создаётся волшебное действо из жизни богов, уносящее зрителей в тонкие миры мифологических историй на танцевальных представлениях *катхакали*.

Итак, подводя итоги, отметим, что цветовая символика театра *катхакали*, представляющего собой синтетический вид искусства, имеет большое значение, проявляясь на разных уровнях. Во-первых, особенно ярко это выражается в актёрском гриме: в зависимости от амплуа персонажей определяют по цвету грима, маскообразно наложенного на лицо и отличающегося сложной символикой линий и рисунка. Так, зелёный цвет (*пачха*) характерен для *саттвиков* – богов и благородных героев: это не только символ привилегированности положения, но и, с точки зрения психологии, цвет гармонии, спокойствия и мира. Жёлтый и все оттенки оранжево-телесной цветовой гаммы свойственны простым земным людям. Характерными опознавательными красными линиями на носу, щеках и лбу обозначен грим *каттхи* – персонажей *раждасиков*, которые по своей натуре самовлюблённы, хвастливы, заносчивы. Такой же цветовой палитрой отмечены и *чаванду тхади* – краснобородые. Семантика чёрного цвета в *катхакали* негативна: он доминирует у героев *тхади* – бородатых злодеев (*тамасиков*) и демонов (*кари*), символизируя потусторонность, примитивные качества человека. Специфические детали вносят различие в категории героев: так, *чуттиппо* – белые шарики из мякоти растений на лбу и кончике носа – опознавательный знак *раджасиков*; красный нос – отличительная особенность демонов; специфические красные знаки, очерченные белыми линиями, и ярко-красные подбородки – принадлежность злых *тамасиков*. По мнению самих носителей традиции, эта символика цвета строго канонизирована и обусловлена определённой типологией,

[3] Двусторонний большой барабан Южной Индии, весом от 10 до 20 кг. Исполнитель играет стоя, подвешивая барабан на своей талии.

[4] Считается одним из утончённых перкуссионных инструментов Индии. Ченда сделан из дерева, он подвешивается на плечи исполнителю, ударяющему палочками по верхней мембране барабана. На ченде можно выбивать сложнейшие ритмические комбинации. В Керале многие исполнители на ченде считаются барабанщиками-виртуозами и пользуются заслуженным авторитетом, их приглашают аккомпанировать танцевальным драмам катхакали.

[5] Небольшой ручной гонг, сделанный из колокольной бронзы, в который исполнитель ударяет деревянной палкой.

связанной с санскритской драмой, о чём свидетельствует классический трактат о театре Муни Бхараты «Натьяшастра» (II в. до н.э. – III в. н.э.)[6].

Во-вторых, уникальная черта актёрского грима – красный цвет глазного белка. После завершения макияжа исполнитель кладёт в нижнее веко *чундапо* – маленькое чёрное зернышко лианы, впитывающее влагу, чтобы белки глаз стали красноватого оттенка. Такой «приём» уравновешивает цветовое решение грима, костюма и украшений героев. Как отмечает Лила Самсон, «считается также, что семечко выравнивает повышение температуры тела, вызванное применением разных красителей» (Samson 1987: 120). Это ещё одна из удивительных особенностей и отличительных сторон театра катхакали.

В-третьих, лицо у положительных героев обрамляет выразительная *чутти* – округлая «борода» из рисовой муки ослепительно белого цвета, сцепленные полукруглые полоски которой крепятся на лице актёров для очертаний контуров нижней части лица.

В-четвёртых, особую торжественность и величие танцевальному стилю *катхакали* придают костюмы со свойственной каждому из трёх амплуа определённой расцветкой: *саттвики* в сочетании двух красок – белой (многоярусные юбки) и красной (кафтаны), Кришна традиционно в синем; персонажи *кари* – исключительной в чёрной цветовой гамме; *раджасики* – в красно-белых тонах; *тамасики* – синтез трёх основных цветов – белый, чёрный, красный.

В-пятых, секрет *катхакали* кроется также в необычайно роскошных головных уборах героев. Сами носители традиции считают, что их своеобразные короны с блестящей инкрустацией из драгоценных камней, зеркальных стёкол и золота выполнены в соответствии с конструкцией индуистских храмов. Форма этих «сооружений» взаимосвязана с амплуа героев: большие многокрасочные массивные *кириды* круглой формы – у *саттвиков*, высокими цилиндрическими головными уборами отличаются *тамасики*, небольшая корона с павлиньими перьями – *мути* – создаёт образ Кришны, у Ханумана – куполообразная корона.

Таким образом, пышность ярких костюмов, величественные короны, магический овал лица, очерченного цветным гримом, – всё это неотъемлемой частью входит в стиль танцевально-драматического театра *катхакали*, создавая гипнотический язык цвета и формы, который предоставляет возможность актёрам с помощью своего мастерства и таланта достичь реальности и выразительности в изображении образов «сверхлюдей» – божеств, героев эпических сказаний и «тёмных» сил.

Традиционно представления *катхакали* проводятся на открытых площадках в течение всей ночи. Когда палящее солнце клонится к закату и воздух насыщается ароматами южного вечера, местные жители и гости Кералы под прихотливые барабанные ритмы приглашаются на фантастический перформанс театра *катхакали*, герои которого пришли из древних эпосов и преданий поведать о победоносных сражениях богов с демонами. С наступлением рассвета рассеивается таинство волшебной ночи и зрители, зачарованные магией увиденного танцевального представления, возвращаются в реальность, чтобы на следующий день снова погрузиться в пленительный мир искусства *катхакали*. Да будет так всегда…

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Цвет в традиционной народной культуре украинцев: символика и прагматика (некоторые наблюдения)

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ABSTRACT
The article in question speculates on the colour as a cultural marker in architecture, dressing, practicing rituals, beliefs and folklore and a number of other representations of the Ukrainian traditional folk culture. Without trying to embrace all the aspects of it the author of the article using comparative historical method and on the basis of his own field research observations demonstrates both the basic coloristic representations of the ethnic culture types and their dynamics in time taking in account regional specifics. The main attention is given to the ratio between semantics and pragmatics (especially the apotropic function of colour) and the colour symbolism. In particular it is noted that the white colour was used both in exteriors and in interiors of Ukrainian wattle and daub huts in steppe and forest-steppe zones but dominated as well in the external and internal appearance of stone churches (especially in temples in the style of "Cossack Baroque" of the 17th –18th centuries) and in both of these cases as in the case of white-on-white embroidery (it is considered to be the most ancient) the white colour was associated with the concept of purity and sacredness (i.e. physical and spiritual purity) although in a number of dream interpretations it appears as a sign of the other world and promises death. The characteristics of red and black are also polysemantic. The red colour in clothes prevails among young people. It serves as a sign of their attractiveness and protection from evil spirits. However, women of all ages wore a red beading made of corals around their necks and men until their old age – a red belt which performed the same function – to drive evil spirits away. The black color in the beliefs of the Ukrainians appears ambivalent - on the one hand, a black cat and a chicken are associated with a demonic origin, on the other hand, they are considered the same as a black dog to protect the house from evil spirits.

Key words*: colour, traditional culture, the Ukrainians*

Цвет как культурный маркер в архитектуре, одежде, ритуалистике, устном творчестве и ряде других сфер украинской традиционной народной культуры изучался не столько специально, сколько попутно многими исследователями. Причина ясна: колористическая характеристика дает в большинстве случаев возможность правильно понять то или иное явление народной жизни.

В данной статье мы, основываясь на экспедиционных материалах и используя сравнительно-исторический метод, остановимся на семантике и прагматике лишь некоторых артефактов, поверий и магических действий, в которых цвет играет важную роль.

Белый цвет издревле использовался в экстерьерах и интерьерах украинских хат-мазанок в степной и лесостепной зонах (см.: Красиков 2013), но также доминировал во внешнем и внутреннем убранстве каменных храмов (в частности, в стиле казацкого барокко XVII–XVIII столетий) – и в обоих этих случаях, как и в вышивке белым по белому (она два-три века назад была распространена в особенности на Полтавщине и Харьковщине, хотя встречается и в других регионах), белый цвет ассоциировался с понятиями чистоты и сакральности (то есть физической и духовной чистоты). Не случайно белый цветок эдельвейс считается в Карпатском регионе приносящим счастье, удачу: «Є біла квітка – едельвейс, яка вважається квіткою щастя. Один лісник подарував – у паспорт поклала на щастя» (Коперлёс 2016).

Народный сонник также трактует белый цвет преимущественно позитивно: «біле – на щось надійся», «білий хліб сниться – на життя» (Савчук 2016) (белый хлеб – это еще и символ достатка, ели его не в каждой семье, поэтому такой сон считался предвещающим позитив). Однако когда женщина видит себя во сне невестой в белом платье и фате – это предсказывает смерть (что логически связано с устойчивой семантической парой «свадьба – похороны»: в ритуале свадьбы есть элементы похоронной обрядности, а в похоронах, особенно неженатых молодых людей, – свадьбы, причем девушку наряжают как невесту – в белое платье и белый венок с цветами из воска – и «назначают» ей жениха, если даже такового у нее в реальности не было).

Вероятно, из-за того, что персонифицированный образ Смерти представлялся в белом одеянии, белый цвет приобрел семантику связи с потусторонним миром. Отсюда представления: «сон: білення хати – хвороба, молоко – хвороба» (Магащук 2016); «У хаті у мене білили – перед смертю чоловіка снила» (Гучканюк 2016).

Снег же – хороший сон: «снег – смех: будешь смеяться» (Приходько 2016). Причина позитивной семантики – созвучие этих слов.

Белый цвет имеет еще и гендерный акцент: если беременной снятся белые цветы – родится девочка, красные – мальчик (Савчук 2016).

Красный цвет, однако, в реальности чаще ассоциируется с женским началом. В некоторых местностях было принято подводить красной глиной окна – в знак того, что здесь есть девица на выданье и сватам будут рады. Не случайно в песенном фольклоре «червона калина» – символ девичества, и ее ломанье означает дефлорацию. В народном снотолкователе закарпатцев, по нашим записям, «червоне – любов» (Савчук 2016), хотя, конечно, смотря что.

В народной одежде украинской девушки ярко-красные цвета также были доминантными, что способствовало ее заметности и привлекательности. Тем не менее, красный цвет (как своего рода эманация огня) традиционно выполнял и обереговую функцию, в том числе в одежде и аксессуарах, которые надевались на тело, причем часто степень магической защиты усиливала форма круга: украинская красавица обязательно носила на шее хотя бы одну «низку коралів» («намисто») красного цвета, на «сорочке» вышивка преимущественно красного цвета покрывала грудь, плечи и руки «дівчини», «плахта», прикрывавшая тело ниже пояса, тоже была «огненного» цвета, да и тканый пояс (как женский, так и мужской) был, главным образом, красным, и он осознавался как мощнейший апотропей (нечто вроде огненного кольца): человек, вышедший без пояса, воспринимался как самоубийца, поэтому выражение «распоясался» означало в переносном смысле совсем не то, что сегодня, а «человек находится в крайней степени опасности».

Красная завязка на руке ныне является чуть не мировой модой, но функционально этот оберег ничем не отличается от того, который повязывали и повязывают во всех регионах Украины на хвост или рог коровы. Этот красный кусочек материи или нити должен предохранить от сглаза точно так же, как красные «китиці» (кисточки, одна или две) на голове лошади, воспринимаемые обычно сторонними людьми просто как украшение, на самом деле выполняют отгонную функцию: «Червону нитку корові на роги і на хвіст чіпляють від відьом. Освячують цю нитку у церкві на Миколая 21.05 – сіль, воду, нитку. Піп не заперечує проти нитки» (Которожук 2017); «На коні червоне – від вовка, рисі. Флажки червоні не випадково» (Романюк 2017). В последнем случае речь идет не только о магическом, но и о физическом воздействии цвета.

Кроме того, красная нить используется в лечебной магии: «Червону нитку зав'язують, як болить рука» (Магащук 2016); «Розвилася рука, болить – зав'язують червону нитку і проходить» (Климпуш 2017).

Красная нить может быть и общим оберегом дома: «Червону нитку засилюють у іглу і у шпару (одвірок) у кут встромлюють» (Климпуш 2017).

Завязка именно красного цвета служит оберегом и в таком случае: «Беруть черлену тряпочку (машлик) – зав'язують молоко, коли несуть через потічок, бо потече (пропаде) молоко, як потічок» (Лукачук 2016).

Беременным вообще не рекомендуют ходить на кладбище и особенно на похороны, чтобы ребенок в утробе «не завмер», но красная нить, по народным верованиям, вполне может противостоять даже дыханию смерти: «Вагітна кладе нитку червону на праву руку і може йти на цвинтар. На правій – за то, шо права рука хрестить сі» (Анна Николаевна 2017).

На Сумщине крестик из двух рябиновых веточек, перевязанных красной лентой, кладут под порог в качестве оберега, в том числе при открытии торговой точки (Зима 2016).

Согласно народному толкованию сновидений, красный цвет может быть полисемантичным. Если снятся помидоры – будешь краснеть от стыда, а если кровь – увидишь вскоре кого-то из родных – кровных родственников, кто-то приедет в гости: «кровь – свидание с родными» (Приходько 2016). Однако если снится, что «зуб выпадет или вырвут и кровь будет – умрет кто-то из близких. Одна девочка говорила: снилось, что зуб вырвали, мне так больно было и столько крови… И вскоре дядя погиб в аварии» (Приходько 2016). «Снятся красные, розовые цветы – к перемене в жизни» (Кадурина 2016), а не только к рождению мальчика (если снятся беременной).

Семантика черного цвета в народном снотолковании нередко негативна и часто трагедийна: «чорний, сірий хліб сниться – на невдачу» (Савчук 2016); «Священника снити – на смерть: у чорному священника снила і чорні прапори перед смертю чоловіка» (Гучканюк 2016);«Трава чорна, суха – на велику хворобу, чорна земля – на хворобу» (Довганыч 2016); «Земля, без травы – на смерть» (Приходько 2016).

Черника, именуемая в Карпатах «яфенами» («афенами»), в народном толковании сновидений ассоциируется с черными слезами; вообще считается, что любые ягоды снятся к слезам, неприятностям (благодаря каплеподобной форме), а ягоды черного цвета предвещают смерть близкого человека: «Якщо яфени сі снєт, будут слєзи, якась жура. Незадовго до того, як мій чоловік помер, снилося: я тилько яфен збирала…» (Шепьюк 2017).

Традиционно черный кот считается приносящим неудачу: нужно «перехреститися, викинути якусь річ через ліве плече або плюнути – як чорний кіт дорогу перейде» (Довганыч 2016). Выброшенная вещь – пожертвование, «взятка» нечистой силе, попытка откупиться от нее и изменить неудачное стечение обстоятельств.

Однако домашние животные черного цвета могут служить и оберегами от нечистой силы – в частности, черные пес, кот и курица считаются обладающими апотропеическими свойствами: «Саме чорний кіт і пес оберігають від злих духів»

(Бронтерюк 2017); «Добре мати чорну курку – відганяє нечисть» (Довганыч 2017); «Чорний кіт добрий дома» (Шепьюк 2017). Именно поэтому «пес чорний сниться – вірний друг» (Довганыч 2016), то есть увидишься с другом.

В то же время, хотя считается, что «курка чорна відганяє всьо погане» (Шепьюк 2017), именно черная курица оказывается, по верованиям западных украинцев, причастной к появлению черта – высиживанию его человеком на печи: «Казали, що від чорної курки можна виносити чорта. Сидить 9 днів, нічого не їсть, не п'є, держить яйце під лівов плечем» (Климпуш 2017). В этом случае черный цвет курицы не оказывает нейтрализующее действие на нечисть, а наоборот, как в веровании о том, что перешедший дорогу черный кот приносит неудачу, ассоциируется с окрасом Сатаны. Яйцо от черной курицы берется маленькое – «зносок».

Зеленый цвет в народной культуре исключительно позитивен, поскольку ассоциируется с жизнью, произрастанием, что отразилось в первую очередь в народном соннике: «зелене, що росте, зелені дерева – на добро, трава зелена – на добре» (Довганыч 2016); «Зеленая трава – хороший сон» (Приходько 2016); «Зеленая трава – к перемене в жизни» (Кадурина 2016).

В обряде посвящения в бабушки при рождении первого внука или внучки (см.: Красиков, 2019) в Путивльском районе Сумщины новоиспеченной бабушке мажут пуп зеленкой – как младенцу (Зубко 2016). Зеленый цвет в данном обряде также ассоциируется с ростом, жизнью, молодостью.

Желтый цвет в народном толковании сновидений ассоциируется с негативом: «цветы желтые снятся – нехорошо, к разводу» (Кадурина 2016).

Сами слова «белый», «красный», «черный», «серый», «зеленый», «синий», «голубой», «желтый» и некоторые другие обозначения цвета вошли в пословично-поговорочный фонд, заговоры, песни и сказки украинцев, являются постоянными эпитетами в фольклоре и частью идиом, отражая специфику цветовосприятия этноса, но это тема отдельного исследования.

Мы проследили некоторые экзистенциально значимые колористические ассоциации, сформировавшиеся в традиционной народной культуре украинцев, и установили, что они в большинстве своем остаются актуальными для носителей данной культуры по сей день, а некоторые являются ключевыми для понимания тех или иных культурных явлений, в частности, связанных с магией (особенно апотропеической и лечебной), а также гендером и возрастом человека. В этих представлениях отразились и общемировые универсалии, и общеславянская основа, и украинские, и региональные традиции. Рассмотрение всех указанных аспектов в их взаимосвязи было бы интересно как для понимания контекста местных феноменов, так и для выявления характерных тенденций цветовосприятия носителей традиционной культуры (восходящей к мифологии и архаическим магическим практикам) во всем мире. Отмеченная же нами полисемантичность колористических представлений украинцев, а порой и амбивалентность, заставляет внимательно анализировать факты, так как логика тех или иных акцентов и предпочтений далеко не всегда очевидна даже специалистам и происхождение символики некоторых устойчивых цветовых канонов каждый раз требует специального рассмотрения, выходящего далеко за рамки узкой темы.

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Цвет как образ революции

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ABSTRACT
This article attempts to consider the history of revolutions not from the point of view of historians – the reasons, the current forces, the course, the results, but only on the one hand – the colors used by supporters and opponents of the revolution. In his work, the author used the usual general scientific and special methods of historical research. It should be noted that the source of the work was numerous studies of the history of the revolution, which contain very limited references to the use of flowers by supporters and opponents of the revolution. There are almost no special studies in Russian language. It was found that if at first the choice of color was random, even contemporaries found it difficult to explain why it was with this color or flowers they associated with the revolution, then gradually, already in the early 19th century, this choice is already completely conscious. And the already emerging color associations are widely used, especially those associated with the colors of national coats of arms and flags, or symbols of social revolutions. Among the commonly used historical colors are: white, red, blue, green, yellow, black. And very often created triads and pairs of flowers. Currently, shades - orange, lilac, blue, magenta - are beginning to be widely used. They start using softer colors. This should at least create the illusion of a peaceful nature of action and a positive direction for change. As part of the development of rebranding, even ideas have emerged that in order to activate a particular, even a mass party, it needs to sometimes change color, or at least create a new symbol, becomes more recognizable and attractive.

Keywords: *revolution, color, triad, red*

ВВЕДЕНИЕ
Тема данной статьи носит несколько необычный, в значительной степени синтетический характер. Как правило, революции интересуют либо историков, либо политологов, а цвет – культурологов, искусствоведов, в меньшей степени экономистов. Автор как историк предпринимает попытку рассмотреть исторические события – историю революций начиная с XVIII века до наших дней, не акцентируя внимание на политических событиях, а анализируя те цвета, которые связывались с конкретными революциями. Тема статьи достаточно актуальна, поскольку целый ряд радикальных изменений в различных странах мира начала XXI века даже получил название «цветные революции». В настоящее время мы можем наблюдать противостояние во Франции, где одной из действующих сторон выступают «жёлтые жилеты». В Белоруссии противостояние сторонников и противников президента А.Г. Лукашенко тоже носит цветовой характер. Надо отметить, что отдельные аспекты данной темы уже становились объектом исследования, особенно цветные революции. В работах, посвящённых тем или иным революционным событиям, содержится информация о цветах, с которыми выступали сторонники или противники революции. Однако

обобщённого исследования до сих пор не было. Автор излагает свой взгляд на данную проблему.

При изучении темы цвета в истории революций возникает ряд вопросов: какова роль цвета в революции – выполняет ли цвет роль простого атрибута, элемента имиджа, символа убеждений революционеров и/или контрреволюционеров или за ним стоит что-то более глубокое и существенное с точки зрения ее причин и истоков? Другой вопрос: почему именно с определенным цветом ассоциируются конкретные революционные и контрреволюционные силы?

Методологической основой исследования стали принципы историзма и объективности, общенаучные теоретические методы научного познания, специальные методы исторического исследования (сравнительно-исторический метод, причинно-следственный анализ связей между историческими событиями).

ТЕКСТ

Считается, что первыми буржуазными революциями в Европе были Нидерландская революция XVI века и Английская революция XVII века. Однако обе они имели значительный религиозный подтекст и, наверное, в связи с этим не получили какой-то цветовой ассоциации. Оранжевый цвет, связанный с герцогом Оранским в Голландии, начинает широко использоваться уже после революции. Сторонники и противники революции в Англии назывались по причёскам – «кавалеры» и «круглоголовые».

Фактически первой революцией, где цвет стал играть особую роль в определении как ее сторонников, так и противников, стала Великая Французская революция XVIII века. Первоначально, 14 июля 1789 года, противники королевской власти начали использовать зелёный цвет, цвет листвы, цвет жизни. Этот цвет предложил Камиль Демулен, фактически случайно, но поскольку быстро выяснилось, что зеленый преобладает в гербе графа Артуа (противника перемен), то уже после взятия Бастилии возникла триада: красный, белый, синий. Триада стала своеобразным символом Французской революции и сохранилась до нашего времени. Возникла она почти случайно и была своеобразной попыткой примирить враждующие силы. Именно поэтому были объединены красный и синий (цвета Парижа) и белый (цвет монархии) цвета. По мнению многих историков, это объединение предпринималось сознательно (Ревуненков, 2003: 73, 75). Несмотря на попытку примирения и создания общенационального символа, триада становится символом именно революционеров и поэтому вызывает ненависть противников революции. В частности, в событиях октября 1789 года сторонники короля сознательно срывали с себя и топтали ненавистные трёхцветные кокарды. А именно белое королевское знамя символизировало противников революции. Так что в этот период начинается противостояние трёхцветной триады и белого цвета как символа революции и её противников.

Во время Французской революции начинают отдельно использовать и красный цвет, сначала как сигнал тревоги – знак военного положения в 1791 году (Ревуненков, 2003: 143). Позже его используют некоторые секции Парижа как цвет свободы (красный колпак санкюлота). Причём здесь выбор уже был осознанным. Красный колпак отсылал к временам Древнего Рима, где его надевали на освобождённых рабов, и поэтому во время революции он также стал символом нового освобождения от королевского рабства. Красный цвет воспринимался революционерами как составная часть триады. Об этом свидетельствуют сохранившиеся многочисленные изображения. В последующую эпоху художники часто изображали санкюлотов в красном колпаке и с трёхцветным знаменем.

Когда в ходе революционных войн французские войска занимают Италию и создают в ней дочерние республики, триада получает свое распространение и за пределами Франции. При этом могли использовать как просто французский флаг (Тиберинская республика), так и его гибриды, когда заменялся один из цветов. Так, вместо синего широко используют зелёный (Транспаданская, Циспаданская, Цизальпинская, Итальянская республики) или чёрный (Римская республика). Вместо белого использовали жёлтый (Партенопейская и Анконитанская республики).

В ходе революций XIX века выбор цвета уже выбирал осознанно. Так, цветом всех революций и восстаний во Франции неизменно являлась триада. Одновременно начинают широко использовать красный и, в меньшей степени, чёрный (как символ готовности к смерти). Красный и чёрный цвета становятся классическими цветами социальной революции. Впервые черный цвет использовали во время Лионских восстаний, а красный – во время Парижских восстаний 1830-ых годов.

Во время французской революции 1848 года сначала триада и красный цвет выступали как взаимодополняющие цвета революции, однако уже в июньских событиях 1848 года впервые происходит противостояние под красным флагом и трёхцветным. Фактически триада заняла место белого цвета как некий символ, противостоящий социальной революции и ее образу – красному флагу.

Красный флаг как символ социальной революции начинает широко использоваться в коммунистическом и социалистическом движении. Под красным флагом создавали Парижскую коммуну 1871 года. Под красным флагом проходят русские революции. Наверное, не случайно даже свою книгу об истории коммунизма Дэвид Пристланд назвал «Красный флаг» (Пристланд, 2011). В ходе начавшейся в России гражданской войны сторонники новой власти называют себя «красными». Их противники – «белые». Надо отметить, что, если «красные» действительно сознательно использовали этот цвет и в повязках, и в кокардах, и в звездах, и в знаменах, даже первый советский орден был «Красного Знамени», то так называемые «белые» собственно белый цвет практически не использовали, только как часть национального или андреевского флага. Белый цвет здесь выступал как не просто символ монархии, по аналогии с Францией XVIII века, ведь среди белых было много сторонников республики, – а именно как символ противостояния революции. Особый интерес вызывает вновь использование зелёного цвета, как символа «третьей силы» в русской революции – многочисленных крестьянских отрядов. Причем «зелёные» собственно зелёный цвет не использовали. Само происхождение этого названия вызывает споры у историков. То ли символ леса, где в основном действовали эти отряды, то по фамилии одного из атаманов.

В национальных революциях в странах Европы в XIX веке начинают намеренно использоваться флаги из двух-трех цветов, которые традиционно связываются с данным государством – чёрно-красно-жёлтый в Германии (от черного прошлого через борьбу к светлому будущему – флаг добровольцев, борющихся с Наполеоном), зелёно-бело-красный в Венгрии и Италии (кровь добровольцев пролитая в борьбе, нравственная чистота и благородство идеалов, надежда на будущее; в Венгрии – цвета герба; в Италии – цвета Милана, а зелёный – полиции). Герб Польши – белый орёл на красном фоне. В Италии Гарибальди попытался использовать и красный цвет – поход тысячи краснорубашечников, однако это осталось ярким эпизодом.

Во время антиправительственных и антикоммунистических выступлений в Венгрии (1956 год) и Чехословакии (1968 год) использовались национальные флаги как символы противостояния красному цвету. Эти же флаги стали символами бархатных революций конца 1980-ых годов.

Нельзя не вспомнить и использование тёмных цветов националистскими и радикальными группами: чёрнорубашечниками (Италия, 1922), коричневыми (Германия, 1933), синерубашечниками (Китай, 1927).

Интересно отметить, что в 1960-ых годах проходили «белая революция» шаха в Иране и «зелёная революция» в Ливии. Муамар Каддафи даже написал «Зелёную книгу».

Начиная с конца XX века, в символике революций стали широко использовать цветы. Это можно связать с широким распространением молодёжных движений. Хиппи даже называли себя детьми цветов. Поэтому и в ходе революций стали использовать этот бренд. Первой цветовой революцией стала Португальская 1974 года.

В наше время появляются идеи необходимости своеобразного ребрендинга – изменения, в том числе и цветового. Эти идеи стали основой цветных революций.

Основой для подобных революций стали идеи Джина Шарпа (институт Альберта Эйнштейна в Бостоне), изложенные им в работах «Политика ненасильственного действия» (1973), «Общественная сила и политическая свобода» (1979), «Оборона, базирующаяся на гражданской активности» (1990), «От диктатуры к демократии» (1993). Поскольку движение носит мирный характер, его символом становится неагрессивный цвет или, например, цветок.

Цвет **19,5 %**	**Растительный мир** **36,6 %**	**Окружающий мир** **43,9 %**
Оранжевый (Украина, 2004), голубой, фиолетовый (США, 2016), розовый, жёлтый (Филиппины, 1986) (Франция, 2019), сиреневый (Молдова, 2009), зелёный (Иран, 2010), белый (Россия, 2011), пурпур (Ирак, 2005)	Роза (Грузия, 2003), каштан, кедр (Ливан, 2005), тюльпан (Киргизия, 2005), лимон, дыня (Киргизия, 2011), шафран (Мьянма, 2007), нарцисс, василёк (Беларусь, 2006), кактус, абрикос, подснежник, виноград, жасмин (Китай, 2011), финик, лотос (Египет, 2011)	Бульдозер (Югославия, 2000), кирпич, кафель, булыжник, голод, багет, горчица, белая лента (Россия, 2011), красные рубашки, «Фейсбук», «Твиттер», Андинжан (Узбекистан, 2005), снег, джинсы (Беларусь, 2006), молодёжь, курорт, пирамида (Египет, 2011), зонтики Гонконг, 2014), уксус (Бразилия, 2013)

Таблица 1. Сфера происхождения символов цветных революций

Однако, как показали специальные исследования (Будина, 2014), только в 20 % случаев данные революции действительно были связаны с цветом, в остальных же имели иную символику. Формирование символа – важный PR-метод осуществления цветных революций и средство идентификации единомышленников. Символ должен быть узнаваем, а также легко наносим различными способами в различных общественных местах. Именно поэтому PR-технологи, которые занимались выбором символов цветных революций, выбирали простые, понятные и знакомые объекты.

Примерами этого стали события последних лет на Украине и в Белоруссии. Причём необходимо отметить, что стороны широко используют пары цветов. Так, на Украине происходило противостояние жёлто-голубого (цвет национального флага) и чёрно-оранжевого (цвет георгиевской ленты) цветов. Символом сторонников перемен в современной Белоруссии стал бело-красно-белый флаг (флаг Белорусской республики 1918 года и флаг Белоруссии 1991–1995 годов), которому противостоит красно-зелёный флаг нынешнего государства.

ВЫВОД

Таким образом, мы видим, что если изначально выбор цветов носил почти случайный характер, то в настоящее время он политико-идеологический. Среди широко используемых исторически цветов можно назвать следующие: белый, красный, синий, зелёный, жёлтый, чёрный. Причём очень часто создавались триады и пары цветов. В настоящее время начинают широко применять оттенки: оранжевый, сиреневый, голубой, пурпурный, а также использовать более мягкие цвета. Это должно создавать по крайней мере иллюзию мирного характера действий и положительную направленность перемен. В рамках ребрендинга возникли идеи, что для активизации той или иной, даже массовой, партии последней необходимо иногда менять цвет или хотя бы создавать новый символ, становиться более узнаваемой и привлекательной.

Возвращаясь к вопросу, который мы задавали в начале работы – какой же цвет можно ассоциировать с революцией, можно ответить, что фактически любой – от чёрного до белого. В последние годы предпочтения отдаются либо мягким оттенкам, либо традиционным парам или даже триадам, которые имеют национальный характер. Цель цвета в революции – не только объединить сторонников, но и придать данному событию привлекательность, медийность, что часто играет большую роль в современном информационном обществе.

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Особенности цветовых репрезентаций различных профессий среди молодежи

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ABSTRACT
This study is aimed at studying the color representations of different types of professions by young respondents, determining the features of visual and symbolic components of color perception in professional images. Popular professions related to various subject types were selected (Klimov, 2004) for empirical research. A survey was used as the main method: respondents were asked to choose semantic and color associations for 10 professions in the following areas: the meanings and values of the profession, the professional environment and the professional. The survey involved 128 students of Smolensk State University aged 18 to 21 years. The analysis revealed quantitative and qualitative differences in the color representations of different professions. Professions with the dominant color / colors (doctor, military, IT specialist), as well as "multi-colored" professions (teacher, designer, actor) are defined. In general, it was found that professions differ in the degree of similarity of colors and shades in different components (ideas about meaning, environment and professional): greater uniformity of colors is observed in the characteristics of professions where the physical properties of color are more pronounced in the subject of work: doctor, engineer, military, designer. The greatest number of colors and shades describe the essence and values of professions in which the subject of work is more abstract (teacher, lawyer). When describing the appearance of a representative of the profession, the largest list of colors and shades is typical for creative professions (actor, designer), as opposed to those where there is a uniform or dress code (doctor, military, lawyer).

Keywords: *profession, color, representation, youth*

ВВЕДЕНИЕ

Включение молодого человека в профессиональную деятельность с социально-психологической точки зрения знаменует собой переход на этап трудовой стадии социализации, начало процесса становления субъекта труда. Данная деятельность становится ведущей для молодого человека, способствуя не только развитию необходимых профессиональных навыков, но и психологическому становлению личности профессионала: формированию профессиональной ментальности как особого способа мировосприятия и интерпретации окружающей действительности через призму профессиональных ценностей, установок, мышления.

Многообразие профессий обусловливает их многоуровневую классификацию: по типам объектных систем, по целям, по орудиям и средствам труда, по условиям труда. Е.А. Климов (2004) утверждает, что имплицитные модели, образы мира разных типов профессий, выделяемых по признакам предметных систем, существенно и неслучайно различаются. Основываясь на типологии Е.А. Климова, мы включили в исследование профессии всех пяти типов: «человек – человек», «человек – техника», «человек – знаковые системы», «человек – природа», «человек – художественный образ».

Социально-психологическое восприятие профессии можно рассматривать через понятие «образ профессии», в которое включены ценностно-смысловые аспекты профессии, характеристики профессиональной среды и образ профессионала. Изучение цветовых репрезентаций различных профессий вносит вклад в изучение образа профессии, который представлен в совокупности абстрактно-смысловых и конкретно-материальных компонентов. Поскольку цвет воспринимается различными уровнями психики, то становится возможным рассмотреть и физические, и знаково-символические аспекты изучаемого явления.

Задачи исследования: выявить особенности цветовых репрезентаций различных профессий среди молодежи, определить различия между степенями согласованности визуальных и символических компонентов цветового восприятия в образах разных профессий.

МЕТОД

В качестве метода исследования мы выбрали опрос с открытой формой ответов, чтобы не ограничивать респондентов и не склонять их к выбору. В составленный нами авторский опросник вошли распространенные в обществе профессии, относящиеся к различным типам (по Е.А. Климову): учитель, программист, врач, инженер, рабочий, юрист, дизайнер, военный, эколог, актер. К каждой профессии респондентам предлагалось подобрать смысловые ассоциации (не более трех), а также цветовые ассоциации по трем группам: ценностно-смысловая сфера профессии, профессиональная среда (рабочее место, предметы и средства труда), профессионал (внешний вид).

В опросе приняли участие 128 студентов Смоленского государственного университета, обучающихся на педагогических и социальных направлениях. Возраст респондентов – от 18 лет до 21 года, пол большинства – женский, что объясняется гендерным составом учебных групп на факультетах.

После сбора данных по каждой профессии было подсчитано количество понятийных ассоциаций, которые мы сгруппировали по категориям (предмет труда, условия труда/рабочее место, средства труда, личностные качества профессионала и т. п.), наиболее часто встречающиеся понятия были выделены отдельно. Также проведено линейное распределение названных респондентами цветов и оттенков по трем заявленным выше аспектам профессий.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ

Анализ смысловых ассоциаций изучаемых профессий показывает, что среди названных респондентами понятий можно выделить категории, описывающие самые разные стороны профессий: процесс и результат труда, предмет и средства труда, рабочее место, личностные качества профессионала, особенности его внешнего вида, одежду. Наиболее часто встречающиеся категории и отдельные понятия приведены в таблице 1.

Анализ цветовых ассоциаций требует рассмотрения количественных и качественных показателей как в целом по изучаемым профессиям, так и по трем их аспектам, выделенным в опросе. Всего респондентами были названы порядка 13 цветов и более 50 оттенков. В перечень цветов включены как ахроматические (черный, белый и серый), так и хроматические цвета спектра (красный, оранжевый, желтый, зеленый, голубой, синий, фиолетовый), а также бежевый, розовый, коричневый. Как и следовало ожидать, цветовые репрезентации разных типов профессий существенно различаются как в количественном, так и в качественном аспектах. С точки зрения количественной представленности цветов можно выделить профессии с наименьшим и с наибольшим количеством цветов и оттенков. К первой группе относятся врач (10 цветов и 7 оттенков) и программист (12 цветов, 2 оттенка), ко второй – актер (14 цветов, 22 оттенка), дизайнер (14 цветов, 10 оттенков), учитель (13 цветов, 18 оттенков), юрист (12 цветов, 14 оттенков). При этом в ряде профессий существенно различается количество цветов и оттенков при интерпретации их смысла (см. рис. 1), описании профессиональной среды (см. рис. 2) и субъекта (см. рис. 3).

Профессия	Понятия/категории	Профессия	Понятия/категории
Учитель	Дети, ученики – 32,8 «Доска» - 27,3 Учебники, книги – 23,4 Знания – 21,9 «Школа» – 21,9 Образование – 19,5%	**Рабочий**	Физический труд – 31,3 Тяжелые условия – 24,2 Инструменты – 21,9 Форма, каска – 21,1 Завод, стройка – 21,2
Врач	«Халат» – 36,7 Лекарства, таблетки – 28,9 «Больница» – 24,2 Пациенты, люди – 21,1 Шприц, укол – 20,3	**Инженер**	Чертежи, схемы – 45,3 Проекты, проектировать – 19,5 Техника, механизм – 18,8 Строительство – 14,8 Каска – 9,4
Юрист	Законы – 63,3 Документы – 35,2 Суд – 26,6 Право – 23,4	**Дизайнер**	Предметы труда (одежда, интерьер) – 46,1 Орудия труда (карандаш) – 40,6 Рисунки, эскизы – 39,8 Творчество, креатив – 36,7 Краски, цвета – 22,6
Военный	Защита, долг – 32,8 Военная форма – 32 Оружие – 27,3 Личностные качества – 28,9 Армия, служба – 23,4	**Актер**	Сцена, сценарий – 46,9 Игра, роль, маска – 41,4 Театр, кино – 34,4 Личностные качества (талант) – 18,8 Чувства/эмоции – 11,7
Программист	«Компьютер» – 83,6 Программы, программирование – 30,5 Знаки, коды – 18,8	**Эколог**	«Природа» - 54,7 Планета, окружающая среда – 37,5 Растение, дерево – 28,9 Защита, охрана – 14,1

Таблица 1. Наиболее распространенные смысловые ассоциации для разных профессий, в % от количества респондентов (n = 128)

Наибольшее количество цветов и оттенков описывает сущность и ценности профессий, в которых предмет труда носит более абстрактный характер, а также подразумевает широкий спектр действий (актер – 21, учитель – 19, юрист – 18, инженер – 17). Иными словами, речь идет о большем количестве индивидуальных особенностей в восприятии данных сфер деятельности по сравнению с такими профессиями, как программист и врач.

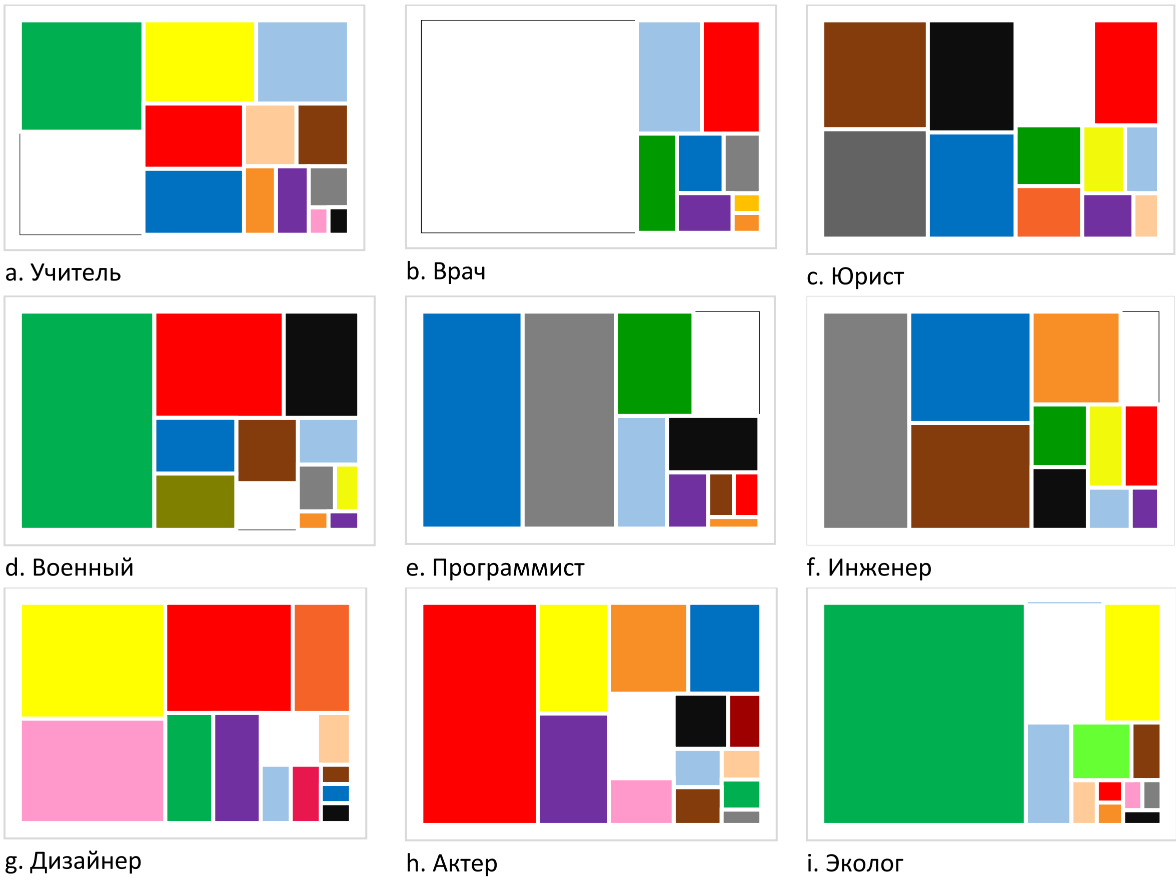

Рисунок 1: Цветовые репрезентации ценностно-смыслового образа различных профессий

Также можно выделить «разноцветные» профессии, профессии с преобладанием в их цветовых репрезентациях основного цвета или нескольких цветов, как относящихся к цветовому спектру, так и ахроматических. Профессиями с преобладанием одного цвета являются профессии врача (64 % респондентов выбрали белый цвет) и эколога (66 % респондентов указали зеленый и его оттенки). Среди профессий с несколькими цветами следует упомянуть военного (зеленый – 46 %, красный – 18 %, черный – 11 %), программиста (синий – 30 %, серый – 27 %), инженера (серый – 25 %, синий – 18 %, коричневый – 17 %), дизайнера (желтый – 22 %, розовый – 20 %, красный – 19 %). Наиболее «разноцветными» оказываются профессии типа «человек – человек» (учитель и юрист) и «человек – художественный образ» (актер).

Прослеживается взаимосвязь между предметной областью профессий и выбираемыми цветами: более рациональные профессии, имеющие дело с абстрактными смыслами и техникой (программист, инженер, юрист), окрашены преимущественно в серый, синий, коричневый, черный, белый цвета. Профессии типа «человек – художественный образ» представляют собой палитру ярких жизнерадостных оттенков. Однако следует отметить, что один и тот же цвет может иметь разную интерпретацию. Так, зеленый цвет для эколога – это природная среда, для военного – камуфляж, а для учителя – жизненный тонус. Красный цвет, означающий активность и несущий сильный эмоциональный заряд, наиболее выражен в профессии актера, которую респонденты отмечают как самую эмоциональную, однако в профессии врача он скорее представляет боль, а в профессии военного – любовь к Родине и долг, сопряженные с опасностью.

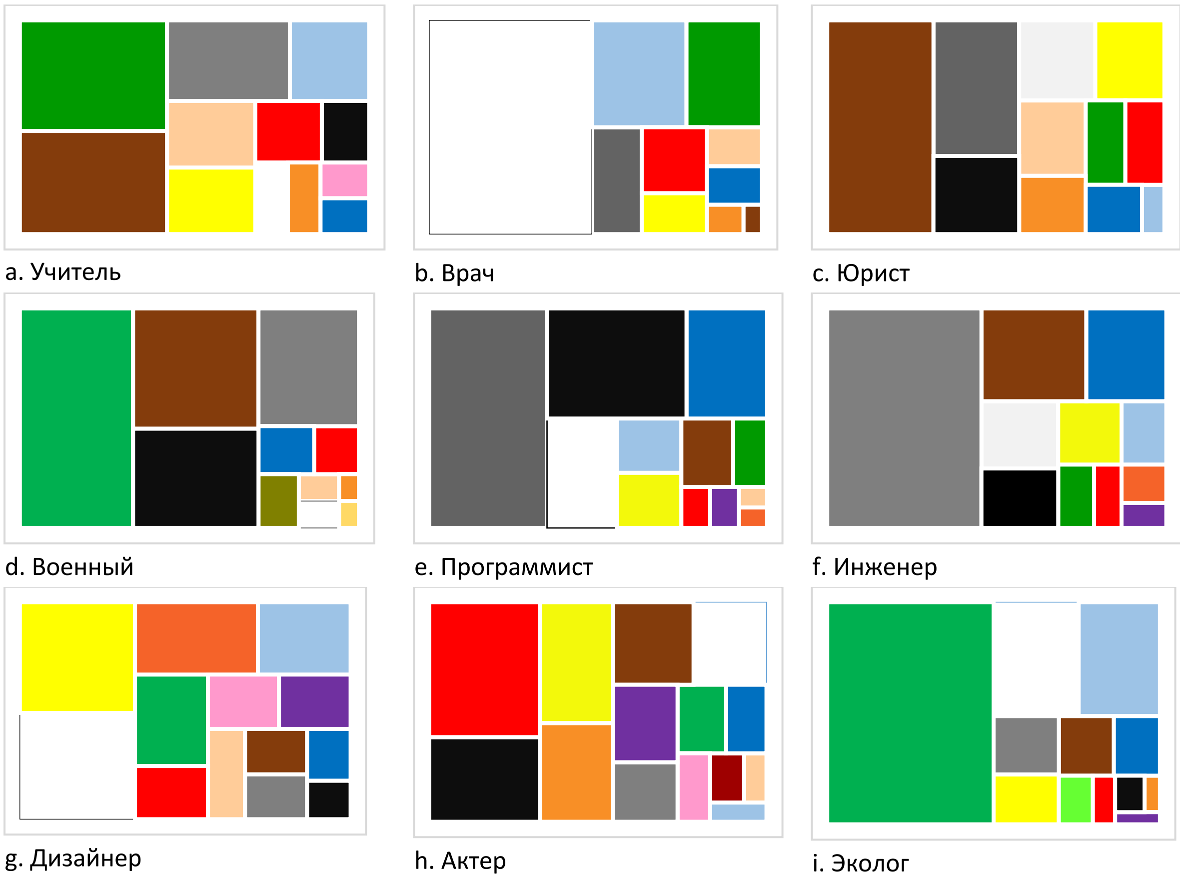

Рисунок 2: Цветовые репрезентации профессиональной среды в различных профессиях

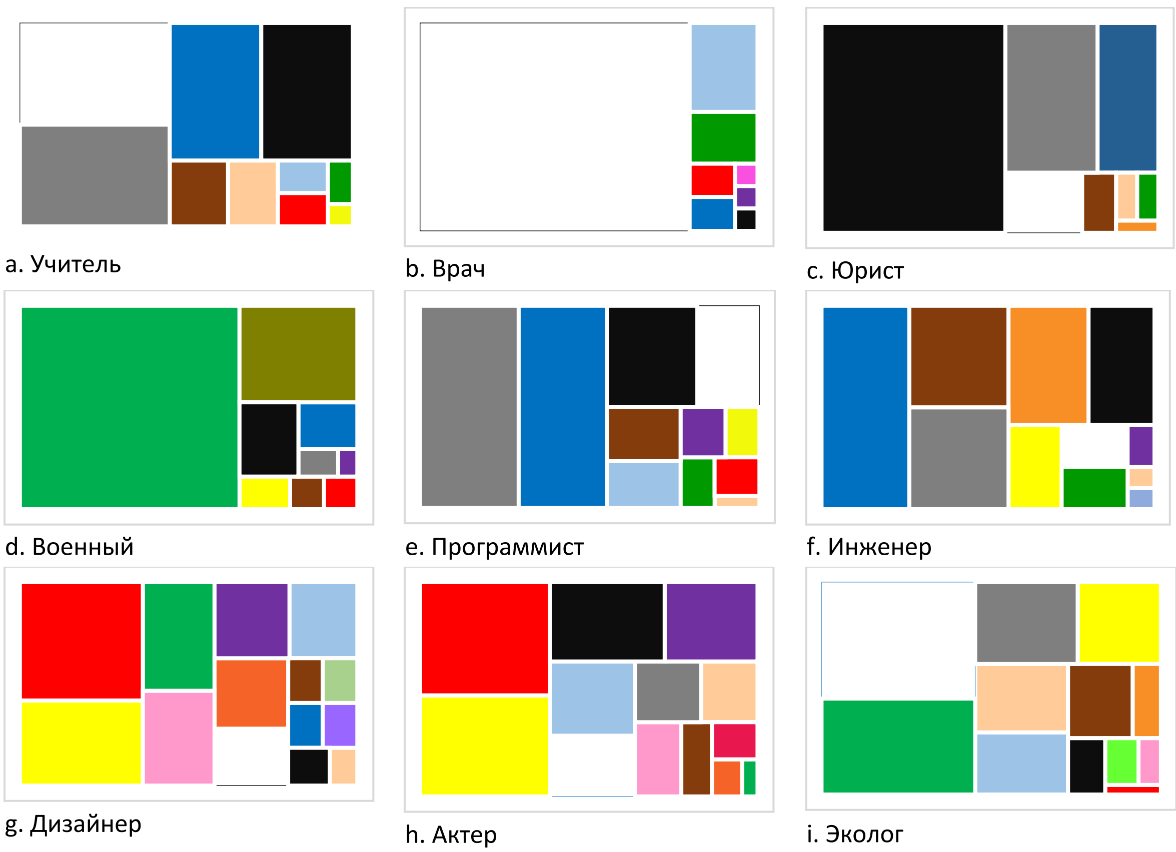

Рисунок 3: Цветовые репрезентации образа профессионала в различных профессиях

Цветовые представления о различных профессиональных средах в целом согласуются со смысловыми ассоциациями и визуализируют цвета рабочих мест, предметов и средств труда (см. рис. 2): природная среда у эколога, техника у инженера и программиста, школьный класс с доской у учителя, сцена у актера и т. п.

При описании внешнего вида представителя профессии самый большой перечень цветов и оттенков характерен для творческих профессий (актер – 23, дизайнер – 21), в противовес тем профессиям, где присутствует униформа или дресс-код (военный – 11, врач – 9, юрист – 9) (см. рис. 3).

В целом мнения респондентов о тех профессиях, где более выражены физические свойства цвета, более согласованы по всем трем аспектам независимо от количества цветов (врач, инженер, рабочий, дизайнер, эколог). В профессиях юриста (см. рис. 1с и рис. 3с) и учителя (см. рис. 1а и рис. 3а), напротив, разнообразие цветов при интерпретации смысла профессии заметно выше, чем при восприятии образа профессионала.

Еще одной особенностью является разнообразие оттенков, названных респондентами для доминирующих цветов различных профессий: зеленый цвет военного дополняется хаки, а зеленый эколога – салатным; красный цвет актера – алым, малиновым, бордовым, вишневым. При этом названия ряда оттенков связаны по семантике с теми или иными аспектами профессиональной деятельности. Например, описывая профессию эколога, наряду с зеленым отмечают такие оттенки, как мятный, оливковый, салатный, травянистый. Для профессии инженера выбирают кирпичный, терракотовый, металлик, мокрый асфальт. В оттенках, описывающих профессию учителя, присутствуют светлые тона цветов (светло-зеленый), а также тепло-коричневый и нежно-фиолетовый.

ВЫВОД

Наибольшее количество цветов и оттенков описывает сущность профессий, в которых предмет труда носит более абстрактный, вариативный характер – соответственно, их восприятие более индивидуализировано; при описании внешнего вида представителя профессии самый большой перечень цветов и оттенков характерен для творческих профессий, в противовес тем, где присутствует униформа или дресс-код.

Мнения респондентов о сферах профессиональной деятельности, где в большей степени выражены физические свойства цвета, более однородны. Наряду с основными цветами выделяются различные оттенки, наименования, которых связаны по смыслу со сферой деятельности.

Дальнейшее изучение цветовых репрезентаций различных типов профессий предполагает включение в качестве респондентов представителей различного возраста, пола и сфер профессиональной деятельности.

СПИСОК ЛИТЕРАТУРЫ

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География цвета

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ABSTRACT

The aim of this paper is to discuss "The Geography of Colour" and how it has become a general approach to deal with colour research and colour design in many different fields. In 1965, as Artistic Director of the Société des Peintures Gauthier a detailed analysis of the colours of the vernacular habitat in the *régions* of France was developed. The goal was to produce colour charts of paint for buildings with the colours reflecting the distinct history and local traditions of the respective habitat. To conduct this research, an original analytical methodology was devised. The results were presented in the form of synthesising charts. Composed of twenty-five colour swatches, in a simplified way each chart illustrates the colours of the components of a dwelling. Based on a modular and standardized system, this way of presenting the colours allows a reading that conveys the local and regional differences of a country. Produced by synthesis, these charts reveal the unique chromatic identity of the place being investigated. My deduction was that the inhabitants of any geographic location are influenced by their environment in developing a particular colour choice or a taste for the colours of their habitat and this preference contributes to identity. These findings were confirmed by research carried out around the world. As a designer with Fine Arts degrees from studies in Paris and Kyoto, subsequently the concept "The Geography of Colour" led to an array of applications in architecture and the marketing of industrial products.

Keywords: *color design, architecture, industrial products, geography of color, color charts*

ВВЕДЕНИЕ: ИСТОЧНИКИ И ИСТОКИ

Цвет – это особого рода феномен, точный язык, подчиняющийся законам. Проблема заключается в расшифровке механизма действия цвета и его аналитического и методического применения. Используемый для расшифровки метод должен быть максимально объективным, по крайней мере, в этом заключается цель моей работы, несмотря на внимание к значимым интуитивным и поэтическим аспектам.

Идея, которую я назвал географией цвета, открылась мне в Японии, где я проходил обучение в 1961 и 1962 годах.

Я родился на севере Франции, в департаменте Па-де-Кале. В этом регионе местная жилая среда формировалась зданиями из красного оксидно-терракотового кирпича с оранжевыми черепичными крышами.

Когда я приехал в Киото, чтобы изучать традиционную архитектуру, я обнаружил, что цвета местного архитектурного ландшафта очень отличаются от тех, которые я знал с детства. Здесь преобладали серые терракотовые крыши и темно-коричневые, почти черные, тона обветренных деревянных стен, которые резко контрастировали с белыми раздвижными окнами, обтянутыми рисовой бумагой. Такой результат сравнительного наблюдения вначале вызвал глубокий и сильный зрительный шок.

Погрузившись в эту новую для меня вселенную цвета, я осознал важность цвета как основополагающего фактора визуальной идентичности архитектуры страны.

Я рисовал на улочках старых кварталов Киото, а в садах храмов, таких как Гинкаку-дзи и Дайсен-ин, я взглянул по-новому на пространство. В тишине этих священных мест я изучил весь доступный мне живописный и хроматический материал. Игра теней, таких близких Танидзаки, помогла мне оценить главенство света, дающего жизнь всем оттенкам.

Именно тогда мне пришла в голову идея, что специфические цвета Японии являются частью ее культурной самобытности. Это откровение родилось из сравнения, которое я провел между цветами моей родной страны и Японии. Углубляя свои размышления, я продолжил развивать, нащупывая по крупицам, свое исследование, которое вскоре материализовалось в концепции географии цвета: каждая страна, каждый регион, каждый город и каждое село имеют свои собственные цвета. Эти цвета обусловлены разнообразными факторами, такими как география, климат, свет, геологическая или водная среда, к которым добавляются история и социально-культурное поведение жителей. Данные цвета вносят решающий вклад в местную, региональную и национальную идентичность страны.

Вернувшись во Францию, я пришел в 1965 году в качестве художественного руководителя в промышленную компанию «Краски Готье», специализировавшуюся на покраске зданий. В этой компании я начал работать фрилансером еще в 1959 году. Приобретенный опыт позволил мне с еще большим интересом задуматься о роли цвета в архитектуре. Как художественный руководитель я отвечал за создание новой визуальной идентичности компании, а также за изучение цветовых карт и цветовых образцов, применяемых в архитектуре.

С этой целью я провел систематический анализ цветовых особенностей, характерных для регионов Франции. Чтобы наполнить свое исследование содержанием, я разработал оригинальный, простой и структурированный метод анализа. Результаты позволили мне обосновать достоинства создания региональных цветовых образцов. Цветовые образцы, которые я приложил к практическому руководству «Выбор гармонии», предназначены для правильного использования этих цветов и улучшения местного наследия.

Таким образом, исследование позволило привлечь внимание консультантов и практиков к необходимости учитывать объективные хроматические данные существующей местной архитектуры для ее обновления или, в определенных контекстах, для создания новой архитектуры.

Оригинальность исследования и данного метода способствовала появлению множества публикаций сначала в Европе, а вскоре и в Японии.

Это было отправной точкой для всех исследований, которые впоследствии проводились по всему миру под названием «география цвета».

Первое из таких исследований – «Цвета Токио» – было выполнено в 1970 году по поручению Масаоми Унагами, директора Центра планирования цвета в Токио. Результатом исследования стала выставка в галерее Ичибан Кан в Токио в 1972 году. Япония, которая оказалась у истоков моего предчувствия существования географии цвета, стала также первой зарубежной страной, где я получил возможность развить мои исследования и сделать их известными (Ланкло 1989).

Позже, в 1977 году, Центр промышленного творчества Центра Помпиду, которым тогда руководил Франсуа Барре, представил все эти исследования на монографической выставке под названием «География цвета».

ГЕОГРАФИЯ ЦВЕТА: АНАЛИЗ МЕСТА

Общие наблюдения и ход исследования

Исследования, касающиеся хроматического анализа архитектурных объектов, начались во Франции в 1960-х годах. Их идея заключалась в том, чтобы ясно и просто показать согласованность местных цветов городской, сельской и иногда промышленной архитектуры. Они определяют существенность хроматического анализа. С этой целью была проведена систематизация цветов региональной жилой среды во Франции. Для первой общей систематизации было выбрано шестнадцать регионов, находящихся в разных частях Франции и обладающих определенной хроматической общностью, в основном из-за преобладающих материалов, используемых в местной городской или сельской архитектуре: кирпича, гранита, известняка, песчаника, минеральных покрытий. Первая книга под названием «Цвета Франции» была опубликована по итогам данного исследования в 1982 году Жаном-Филиппом Ланкло и Доминикой Ланкло (Ланкло и Ланкло 1982).

Глобальное восприятие

Чтобы подчеркнуть доминирование и цветовые особенности архитектурного объекта в его ландшафтном контексте, предметом внимания в рамках нашего подхода становится в первую очередь рассматриваемый ландшафт, видимый издалека. Мы называем это глобальным восприятием. В результате возникает однородная хроматическая гамма, состоящая из нескольких доминирующих оттенков – оттенков кровли и фасадов. На глобальное восприятие влияют несколько факторов, которые вносят свой вклад в богатство палитры:

- Цветовые контрасты и контрасты яркости одного здания по отношению к другому (качественные и количественные), а также контрасты оттенков и различных материалов между собой. Под оттенком подразумевается тонкое различие между цветами, а под цветом – исходный пигмент: красный, синий, желтый.
- Объемы и их пропорции, которые определяют архитектурный стиль, состоящий из прямых линий, вертикалей, горизонталей, диагоналей или кривых, расположение и пропорции которых создают ритмы. Сами они сочетаются с разрывами, полостями и пустотами и действуют на восприятие цветов двух палитр, общей и точечной. По этой причине абсолютно качественная систематизация цветов жилого здания покажет лишь частичное и иногда вводящее в заблуждение значение. Следовательно, необходимо добавить количественное и пропорциональное представление цветов, более репрезентативное и более полное.

Детальное восприятие

Когда человек входит в город или село, у него формируется так называемое детальное восприятие: по мере приближения к жилым зданиям он начинает различать сложные цвета, более богатые, с и более детальными различиями, материалы воспринимаются во всем разнообразии их текстуры, гранулометрии и внешнего вида.

Таким образом, крыша из старых листов сланца или обветренной черепицы после воздействия мхов и лишайников, если рассмотреть ее вблизи, представляет собой настоящий гобелен, в котором каждый элемент имеет свое собственное хроматическое свойство: он может быть светлым или темным, однородным или пятнистым. И каждый лист сланца или плитка, рассматриваемые в отдельности, представляют собой целую хроматическую вселенную и часто имеют редкую живописную характерную особенность.

СИСТЕМАТИЗАЦИЯ ХРОМАТИЧЕСКИХ ДАННЫХ

Общая палитра

Общая палитра состоит из цветов преобладающих поверхностей. К ним относятся фасадные и боковые стены, крыши (за исключением террасных) и перекрытия. Они составляют видимую часть городского пространства.

В региональном жилищном строительстве очевидным визуальным значением обладают главным образом крыши. Они существенно различаются от страны к стране и даже от региона к региону из-за особенностей местного строительства, климатических условий и конкретных используемых кровельных материалов. Крыши помогают выделить особенности архитектурного ландшафта, которые характеризуют самобытность места и страны.

Почва – это измерение городского пространства, которое не всегда воспринимается с должным вниманием. И все же поверхности, покрытые почвой, выступают полноценными составляющими архитектурного ландшафта.

Помимо своей первоначальной функции, заключающейся в том, чтобы служить верхним слоем земли, почвенный слой выполняет различные функции, которые часто дополняют друг друга: полезную функцию сегментации и идентификации пространств и сигнальную функцию. Не следует забывать и о декоративной функции, получаемой за счет распределения цветов и текстур, продиктованных выбором материалов. Так обстоит дело, в частности, в Греции или Португалии, где декоративные узоры, полученные с помощью гальки или белого булыжника, известняка и черного базальта, являются важной частью местной культуры.

Точечная палитра

Точечная палитра состоит из цветов более мелких элементов, таких как двери, ставни, окна, рамы, основания, балконные решетки и заборы. Они представляют собой небольшие, часто контрастирующие по цвету пятна и устанавливают качественную и количественную взаимосвязь с общей палитрой, которые визуально контрастными оттенками оживляют весь фасад жилого здания.

ТРИ ТИПА ВОСПРИЯТИЯ ЦВЕТА

В дополнение к двум предыдущим группам аналитических данных о цветах архитектуры существует три аспекта, характерных для глобального восприятия объекта: постоянные цвета, непостоянные цвета и случайные цвета.

Постоянные цвета. Цвета общей палитры и точечной палитры попадают в эту категорию потому, что это цвета материалов, камня, терракоты, штукатурки, окраски столярных изделий и т. д. Они не поддаются изменениям или изменяются несущественно.

Непостоянные цвета. Эти цвета относятся ко всем изменяющимся элементам природного ландшафта: освещению, лесной или сельскохозяйственной растительности, садам, водоемам, снегу.

Случайные цвета. Что касается меняющихся и непредвиденных случайных цветов, то они возникают из-за падающих теней и цветных элементов, которые иногда разворачиваются на общей палитре или перемещаются перед ней, создавая эфемерную хроматическую анимацию, оживляющую архитектурное пространство. Это могут быть несколько цветов на подоконнике, открывающиеся и закрывающиеся шторы, поднимающиеся и опускающиеся жалюзи, пешеходы или велосипедисты в ярких одеждах, припаркованные машины. Непостоянные цвета и случайные цвета – противоположности статичной архитектуры. Принимая во внимание их важность, данные элементы учитывают во время полевых исследований.

На самом деле цвета местной архитектуры постоянно меняются под влиянием множества факторов: старения и обновления материалов, нанесения штукатурки и новых красок, роста настенной растительности, которая меняет цвета в зависимости от времен года. Кроме того, непрерывное изменение освещенности влияет на восприятие цветов как количественно, так и качественно.

Таким образом, цветные элементы каждого здания более или менее подчеркнуты хроматическими свойствами окружающей их среды. Именно наличие контрастов вызывает взаимодействие цветов друг с другом.

МЕТОДОЛОГИЯ

Определение места

Исследуемый архитектурный объект, город или село определяется заказом, если это исследование, предназначенное для архитектурной программы, создания локальной цветовой карты или цветовых образцов для промышленных строительных изделий.

В других случаях выбор места, как правило, является результатом нашего личного исследования в области географии цвета. Этот выбор делается путем изучения множества региональных документов в библиотеках или в Интернете или, порой, по рекомендации региональных экспертов. Но иногда наш выбор является делом случая. Во время изучения местности некоторые места заставляют обратить на себя внимание. Затем мы переходим к выбору архитектурных ансамблей, улиц, окрестностей, которые являются наиболее репрезентативными для данной местности относительно материалов и цветов. Хотя в некоторых случаях выбор является субъективным, метод исследования места максимально объективен. Итак, когда какое-то место привлекло наше внимание, аналитический процесс проходит в два этапа: первый – на месте, другой – в нашей мастерской.

ПЕРВЫЙ ЭТАП: СИСТЕМАТИЗАЦИЯ ХРОМАТИЧЕСКИХ ДАННЫХ

Цветной набросок места

В данном исследовании в области цвета учитываются все элементы, которые вносят свой вклад в хроматическую характеристику здания или архитектурного ансамбля. После определения места на карте города или села в рамках исследования сначала создается его цветной набросок. Рисование – это эффективный способ запечатлеть и запомнить предмет, а также визуализировать его. Цветной карандаш кажется нам наиболее практичным инструментом, потому что в используемом комплекте цветных карандашей четко представлены тона, из которых состоит хроматический набор.

Фотоснимки

В любом случае фотографии не могут быть использованы для точного воспроизведения цвета во время визуального обобщения результатов. Тем не менее это важные иконографические документы, обеспечивающие запоминание, визуализацию и распространение информации. Кроме того, архивная фотография позволит, оглядываясь назад на историю, установить сравнительные наблюдения и показать эволюцию использования цветов во времени.

Оптическое измерение при помощи шкалы освещенности материалов

Данный пункт необязателен, но может быть полезен для оптического измерения среднего значения оттенков анализируемых материалов или поверхностей. Во многих случаях материалы не обладают постоянной четкостью, некоторые части светлые, другие темные, и установить среднее значение сложно (рис. 1). Для определения данного параметра мы используем нашу собственную шкалу освещенности. Шкала может быть линейной или круговой, ее равномерное градуирование состоит из 10 нейтральных оттенков серого, расположенных между белым и черным.

Рисунок 1: География цвета: образцы демонстрируют исходные цвета зданий и материалов, найденных в их окрестностях. В студии материалы представляются в виде цветовых образцов с использованием гуаши, что приводит к расширению цветовой гаммы. Фото © Жана-Филиппа Ланкло

Отбор образцов материалов и градуирование цветов

Основу исследования составляют главным образом объективные данные, предоставляемые архитектурой и окружающей средой и полученные в результате тщательного обследования места и взятия образцов различных материалов, входящих в состав стен, крыш, почвы, дверей и ставень, на которых могут быть образцы листвы, мхов и лишайников – непостоянных элементов. Возможно, что отмеченные случайные элементы оказывают определенное влияние на хроматический облик здания. Образцы имеют первостепенное значение при использовании этого метода, так как они являются подлинными свидетелями цветов и материалов. Эти фрагменты могут показаться незначительными в их исходном контексте, но они вызывают большой интерес, когда документы группируются вместе и когда восстанавливается информация о цвете, сбор которой является основой результатов синтеза.

Воспроизведение цветов

Когда нет возможности взять контрольные образцы, тональность записывается с помощью цветовых образцов. Мы одновременно используем несколько цветовых систем, некоторые из которых стандартизированы (например, NCS, RAL Design System, Pantone), и другие цветовые образцы, опубликованные производителями красок для зданий. Кроме того, в мастерской мы разработали собственную справочную систему по результатам наших исследований. Таким образом, нам доступны несколько тысяч цветов. Показания цвета можно снимать с помощью спектроколориметра, а данные сохранять в компьютерных файлах. Однако можно усомниться в устойчивости воспроизведения данных компьютером, потому что этот процесс зависит от технологий, которые постоянно развиваются быстрыми темпами. Однако следует признать, что новые технологии, не всегда необходимые, имеют особенность успокаивать технократический мир, от которого данные исследования часто зависят сегодня.

ВТОРОЙ ЭТАП: СОСТАВЛЕНИЕ ЛИСТОВ СИНТЕЗА

Листы синтеза

Подробные данные, систематически собираемые на месте, затем дорабатываются в мастерской для дальнейшего обобщения. Необходимо обнаружить взаимосвязь полученных данных. Затем посредством упрощенной презентации данные отображаются в виде листов синтеза, состоящих из двадцати пяти виньеток, каждая из которых подробно иллюстрирует цвета отдельного жилого здания. Этот упрощенный иллюстративный принцип облегчает процесс сопоставления листов синтеза. Выполнение данной работы в мастерской требует времени и скрупулезного подхода. Сначала необходимо проанализировать собранные данные, затем преобразовать их в цветовые образцы, максимально точно воспроизводящие исходные оттенки.

Для воспроизведения образцов материалов необходимо в некотором роде отстраниться от их структурных и хроматических характеристик. В самом деле, материалы редко бывают монохромными. Кирпич или покрытие, выветрившееся от времени, объединяет на своей поверхности бесконечное множество оттенков, которые сложно передать одним цветом. Хроматический дух материала можно восстановить, составив композицию из цветных пятен, но если необходимо упростить чтение листа синтеза, то воспроизводить следует только доминирующий тон материала. В первом случае воссоздается сложность цветов путем их транспонирования упрощенным способом, во втором – синтез монохромной поверхности.

Листы синтеза, долгое время выполнявшиеся вручную, также можно получить с помощью компьютерного чертежа. Мы привели несколько примеров в книге «Цвета Средиземноморья» (Ланкло и Ланкло 2016). Это еще один способ обработки данных и их эффективного представления. Однако мы предпочитаем ручной метод, который нам представляется более точным.

Классификация образцов

Полученные таким способом образцы затем объединяются на квадратном листе размером 30 x 30 см, образуя палитру из двадцати пяти виньеток одинакового размера.

Они делятся на три группы:

Первая группа. Общая палитра и точечная палитра структурных элементов каждого здания:

A. Общая палитра фасадов внутри города или села.

B. Точечная палитра, в которой отображаются точечные элементы, такие как двери, ставни, окна, рамы, цоколь.

Элементы точечной палитры наклеены на прозрачную основу (родоид). Наложив точечную палитру на общую, мы получаем синтез цветов двадцати пяти исследуемых фасадов. При необходимости может быть составлено несколько листов синтеза в зависимости от количества данных, собранных на месте.

Вторая группа. Палитра качественных и количественных отношений: образцы одинакового размера, составляющие цветовую гамму каждого из структурных элементов здания (крыши, стен, двери, ставень, окон и т. д.), сгруппированы вместе на соответствующих палитрах; такой способ группировки образцов подчеркивает качественные отношения между разными оттенками. Кроме того, для некоторых особенно репрезентативных зданий мы выделяем из образцов в соответствии с размером, пропорциональным площади каждого из элементов архитектуры, количественные отношения оттенков между собой.

Третья группа. Соответствующие цветовые палитры объединяют цвета всех проанализированных зданий: крыш, фасадов, рам, фундамента, дверей, окон и ставень. Сформированные таким образом палитры иллюстрируют доминирующие цвета каждого из этих элементов и позволяют составить визуальный статистический перечень цветов, наиболее часто используемых в данном месте.

Таблица синтеза

Как мы видели ранее, накладывая элементы точечной палитры на общую палитру, можно получить синтетическую реконструкцию каждого из анализируемых фасадов. Таким образом, двадцать пять жилых зданий, отмеченные в данном месте, сгруппированы вместе в виде синоптической таблицы, которая является объективным образцом цветов данного места. Когда это возможно или необходимо, может быть проведено столько сборов данных, сколько требуется, с помощью большего количества листов синтеза (рис. 2).

Таблица синтеза может иметь несколько форм:

A. Основная таблица синтеза состоит из двадцати пяти квадратов, каждый из которых включает дверь и окно, к которым добавлены ставни, цоколь, рамы.

B. Описательная таблица синтеза представляет собой еще один тип упрощенного представления цветов двадцати пяти изученных фасадов. В зависимости от конкретного случая элементы фасада местной архитектуры представляются в более содержательном (описательном) виде: фахверк, полукруглые двери, ленты, карнизы и т. д. В самом деле оказывается, что иногда трудно учесть специфику и архитектурную сложность анализируемого объекта, ограничившись базовым представлением.

Другое дополнительное представление состоит в выравнивании виньеток, которые воспроизводят как есть последовательности улиц. Такой подход приемлем для исторических достопримечательностей, поскольку он позволит в будущем судить об эволюции выбора жителей, их вкусов и обычаев.

Рисунок 2: География цвета: элементы анализа и синтеза: (1) описательные палитры (вверху слева и в центре); (2) общие палитры: цвета фасадов (справа, вверху и в центре); (3) образцы материалов фасадов с соответствующими цветовыми образцами (слева, в центре); (4) образцы материалов, обнаруженные на месте, с соответствующими цветовыми образцами (внизу). Ле Морейшир, Шотландия. Фото © Жана-Филиппа Ланкло

Сравнение таблиц синтеза ясно показывает хроматические особенности каждого изучаемого архитектурного ансамбля: от одного города к другому, от одного региона к другому, от одной страны к другой. Становится очевидным существование географии цвета.

Более того, можно предположить, что для развития истории и социологии цвета на основе этих в большинстве своём датированных наблюдений в дальнейшем будут проведены сравнительные исследования, которые подчеркнут эволюцию материалов и цвета того или иного места.

ОТ ТЕОРИИ – К ПРАКТИКЕ

Работа дизайнером по цвету

География цвета – это концепция, которую я развил в рамках своей деятельности в качестве дизайнера по цвету в компании «Краски Готье». Первоначально это исследование было направлено на создание цветовых карт для строительных покрытий и красок. Таким образом было опубликовано несколько цветовых карт, в частности для улучшения цветового наследия региональной архитектуры.

Чтобы привлечь внимание консультантов и реализаторов к правильному использованию цветов, побудить к проявлению уважения к окружающей среде и местным традициям, я постепенно разработал несколько практических руководств, предназначенных для творческого и гармоничного выбора цветов.

Первое руководство называлось «Выбор гармонии» (Sélecteur d’harmonies). В нем предлагаются сетки выбора, которые позволяют выбрать цвета собственного дома, не нарушая гармонии цвета местной архитектурной среды.

Еще одним практическим инструментом стала публикация справочника цветовых комбинаций, разработанных для коллективного жилья в каждом регионе Франции. Этот документ основан непосредственно на анализе географии цвета.

Одновременно с этими практическими и рекламными приложениями для бренда «Краски Готье» в нескольких журналах по архитектуре и декору были опубликованы статьи, которые помогли популяризировать и распространить важность учета цветовых свойств для сохранения гармонии пейзажей.

После ухода из компании «Краски Готье» я продолжил исследования в области географии цвета со своей женой Доминикой Ланкло. В 1982 году мы опубликовали нашу первую книгу «Цвета Франции» [Les Couleurs de la France] (Ланкло и Ланкло 1982), за которой последовали «Цвета Европы» [Les Couleurs de l'Europe] (Ланкло и Ланкло 1995), «Цвета мира» [Couleurs du monde] (Ланкло и Ланкло 1999a, 1999b, 2009), «Врата мира» [Portes du monde] (Ланкло и Ланкло 2001a, на английском языке 2005a), «Окна мира» [Fenêtres du monde] (Ланкло и Ланкло 2001b, на английском языке 2005b), «Дома мира: цвета и орнамент в традиционных домах» [Maisons du monde: couleurs et décors dans l'habitat traditionnel] (Ланкло и Ланкло 2007) и «Цвета Средиземноморья» [Couleurs de la Méditerranée] (Ланкло и Ланкло 2016).

Мастерская 3D-цветов

После работы в компании «Краски Готье» в 1978 году я основал собственное дизайнерское агентство «Мастерская 3D-цветов» [l’Atelier 3D Couleur], специализирующееся на дизайне и применении трехмерных цветов в градостроительстве, архитектуре и промышленной продукции.

Промышленные строительные изделия

В области промышленных строительных изделий были разработаны другие приложения географии цвета на основе изучения цветовых карт фасадных материалов, таких как стеклянное покрытие, пластиковые панели, лакированные стальные листы и алюминиевые профильные конструкции, а также кровельные синтетические материалы.

Цветовые карты

Оригинальность аналитического подхода к концепции географии цвета и ее новаторский характер вызвали интерес Центра планирования цвета в Токио (Япония). Эта организация, возглавляемая Масаоми Унагами, очень активно продвигала цвета в дизайне и архитектуре. Она спонсировала, то есть поручила провести аналитическое исследование цветов Токио, которому в 1972 году была посвящена выставка в галерее Ичибан Кан в Токио. Данная работа стала предметом многочисленных публикаций, которые вскоре вызвали всеобщий интерес во Франции и других странах (Портер и

Микеллидес [Porter and Mikellides] 1976, Дюттманн и др. [Düttmann et al.] 1980, Портер [Porter] 1982, Баглиони и Гуарнерио [Baglioni and Guarnerio] 1982, Биррен [Birren] 1982, Крекуинкел [Krewinkel] 1985, Линтон [Linton] 1985). В 1990-е годы и позже моя работа продолжала привлекать внимание (Таверн и др. [Taverne et al.] 1992, Портер [Porter] 1993, Ланкастер [Lancaster] 1996, Линтон [Linton] 1999, Портер и Микеллидес [Porter and Mikellides] 2009, Шиндлер [Schindler] 2019), в том числе в области прогнозирования цветовых тенденций (Линтон [Linton] 1994). Мои исследования были источником вдохновения в Азии («География цвета» [The Geography of Color] 1991, «Песня» [Song] 1999), а также для молодого поколения («Фонтан» [Fontaine] 2006). В недавно опубликованной в Китае монографии дается обзор моей деятельности с той поры, когда я учился в художественных школах Парижа и Киото (Жан-Филипп Ленкло: художник и дизайнер [Jean-Philippe Lenclos: Painter & Designer] 2017).

Затем «Мастерская 3D-цветов» получила ряд заказов на создание цветовых карт в региональном масштабе и улучшение колористики городского пейзажа. Так, выполнялись заказы на составление цветовых карт внутри охранных зон некоторых городов с большим архитектурным наследием. В качестве примера из Франции я кратко представлю здесь города Сен-Жермен-ан-Ле и Ним.

НЕКОТОРЫЕ ПРИМЕРЫ ПРИМЕНЕНИЯ КОНЦЕПЦИИ

Города, регионы

Сен-Жермен-ан-Ле. Город Сен-Жермен-ан-Ле, расположенный недалеко от Парижа, с XII века был резиденцией многих королей Франции, в частности Людовика XIV в XVII веке. Это показывает историческое значение данного города, старые кварталы которого свидетельствуют о редкой и уникальной архитектуре. Главный архитектор исторических памятников города Жан-Пьер Жув, обеспокоенный неуместным использованием цвета некоторыми организациями, отвечающими за строительство новых многоквартирных домов, поручил нам разработать цветовую карту на основе метода, применяемого в географии цвета. Как и во всех изученных нами городских цветовых картах, наша философия заключается в том, чтобы начать с анализа местности и наблюдений, сделанных на основе исторического наследия города, далее предоставить задокументированные сведения и привлечь внимание ответственных за применение цвета в архитектуре в целях повышения гармонии городского пейзажа. Дидактические объяснения позволяют пользователям разработать индивидуальный облик здания по своему усмотрению. Применение цветов предложенных палитр гарантирует, что результат будет полностью гармоничным. В Сен-Жермен-ан-Ле был опубликован постер и далее широко распространен среди общественности.

Ним. В 1985 году в городе Ним, расположенном на юге Франции, начался масштабный проект по реабилитации старых районов в центре города, которые являются одними из самых красивых во Франции. Чтобы восстановить это историческое наследие в безупречном архитектурном стиле, нам была поручена разработка цветовой карты, которую затем применили архитекторы города и Служба строительства Франции. Анализ места и предложенные цветовые палитры стали предметом образовательной и технической брошюры, изобилующей иллюстрациями, которая была предоставлена жителям.

Марн-ла-Валле. В 1990-х годах туристический и городской комплекс Евро-Диснейленд был основан в Марн-ла-Валле, в 32 км к востоку от Парижа. «Мастерская 3D-цветов» была назначена для консультирования проектного бюро Walt Disney Imagineering по использованию цветов для отелей, окружающих развлекательную зону парка. В то же время комиссия по региональным объектам была встревожена появлением в окружающих ландшафтах цветов, напоминающих фантастические декорации в детских мультфильмах. Здесь анализ места, основанный на методе географии цвета, также позволил выявить основные хроматические темы регионального архитектурного наследия. На их основе были опубликованы и получили широкое распространение информационные и дидактические проспекты для сопровождения директив, изданных муниципалитетами сел, которые примыкали к объектам Евродиснейленда.

Цвета региона Лимузен. На региональном уровне наиболее показательным будет пример региона Лимузен, расположенного в центральной Франции. Этот регион включает три департамента: Коррез, Верхняя Вьенна и Крёз. В 1980 году Региональное управление по коммунальному хозяйству и благоустройству, Орден архитекторов и Региональная сельскохозяйственная служба, отметив быстрое распространение цветов, не соответствующих колористике данного региона, решили опубликовать и распространить информационную брошюру о цветах в архитектуре Лимузена, которой смогли бы пользоваться муниципалитеты, строительные организации и частные лица. Данная брошюра носит образовательный характер и в ней изложены советы и предложения о том, как выбрать правильную цветовую гамму. Разработка брошюры обусловлена скорее образовательной потребностью, чем нормативной проблемой, поэтому советы не выступают своего рода предписаниями, а носят рекомендательный характер.

Жилищное строительство

Ле Водрёй. Первым крупномасштабным применением географии цвета в 1971–1975 годах стала цветовая карта Нового города Ле Водрёй, расположенного в Нормандии, на северо-западе Франции. Эти исследования тогда назывались генеральным планом покраски. Первый этап строительства 3000 жилых домов по проекту архитектора Анри Боклера должен был стать свидетелем будущего развития города.

Градостроители, архитекторы, дизайнеры сформировали многопрофильную команду, в рамках которой мне было поручено установить основные правила применения цветов. Этот город расположился среди полей, недалеко от старинной деревушки Водрёй. Именно красота сельского пейзажа, типичного для Нормандии, была источником моего вдохновения и моих исследований по определению хроматического климата новой архитектуры. Детальный анализ окружающего регионального архитектурного ландшафта позволил составить листы синтеза местных цветов. Из полученных таким образом цветовых палитр, разумеется, была определена цветовая карта Нового города.

Рисунки 3 и 4: Применение географии цвета: Ле Линанд, Сержи-Понтуаз, Франция. Южные фасады жилого комплекса (вверху). Атмосфера космического пространства, созданная охристо-красными и охристо-желтыми цветами фасадов домов и зеленью деревьев и травы (внизу). Архитекторы: Жан-Поль Вигье и Жан-Франсуа Жодри. Фото © Жана-Филиппа Ланкло

Шато Дубль. Цветовая палитра другой программы – по жилищному строительству Шато Дубль, расположенной в Экс-ан-Провансе, – была результатом анализа местности с использованием метода географии цвета. Речь идет о комплексе из семи зданий, включающем 288 квартир, построенном в 1976 году архитекторами Сиамом и Бессоном. Географическая особенность Экс-ан-Прованса заключается в присутствии в окружающем ландшафте горы Сент-Виктуар. Эта гора прославилась благодаря многочисленным сериям картин Поля Сезанна. Красная охра, желтая охра, бежевый цвет почв окрестностей продиктовали палитру данного жилого комплекса. В таком контексте цветовая гамма приобрела географический, эстетический и ярко выраженный культурный аспект благодаря воспоминаниям о работах Поля Сезанна.

Цветовые карты, которые начинались в городских условиях (рис. 3 и 4), были затем расширены исследованиями, предназначенными для промышленных зон, таких как Ла-Сиота, Онфлер, Бастия, Порто-Веккьо.

Промышленный ландшафт

Судостроительная верфь. Однородная историческая архитектура города Ла-Сиота, расположенного на берегу Средиземного моря, способствует повышению туристической репутации региона. В связи с этим его территория является охранной зоной. Однако на другой стороне небольшой бухты, на которой находится Ла-Сиота, расположилась важная судостроительная верфь, представляющая собой промышленный ландшафт, цвета инфраструктуры которого, вряд ли сопоставимые с цветами города, встревожили Региональную комиссию по промышленным объектам. В 1974 году Жан-Жак Террен, архитектор судостроительной верфи, начал исследование с использованием метода географии цвета. Анализ колорита древнего города позволил выявить общую палитру оттенков охры и известняка. Средние тона этой цветовой гаммы были выбраны для ремонта всех зданий, мастерских, офисов, складских помещений, а также портовых надстроек, портальных рам и кранов. Доминирующие цвета городского пейзажа, простирающегося над верфью, придавали общему ландшафту больше визуального единства, значительно осветляя промышленный облик архитектуры судостроительной верфи.

ПРИМЕНЕНИЕ ГЕОГРАФИИ ЦВЕТА В МАРКЕТИНГЕ

Цветовой дизайн для автомобильной промышленности

Одновременно с градостроительством и архитектурой концепция географии цвета вскоре распространилась на промышленную продукцию. Монографическая выставка «География цвета», представленная в Центре промышленного творчества Центра Помпиду в 1977 году под руководством Франсуа Барре, способствовала очень быстрому налаживанию контактов с промышленниками, которые открыли для себя профессию колориста, представленную на этой выставке как новую сферу развития дизайна. Среди новых клиентов наиболее важной промышленной группой был производитель автомобилей «Рено», где я отвечал за создание творческого подразделения, посвященного материалам и цветам. Независимо от дизайна и цветовой гаммы интерьера и кузова различных моделей, ожидания потребителей на международном рынке должны были быть оправданы. Действительно, менеджеры по маркетингу осознали, что цвета кузова, а также их согласованность с гармонией интерьера оказали влияние на выбор клиентов, который существенно различается от страны к стране.

Это было началом важного исследования географии цвета в автомобильной промышленности, которое привело нас в основные страны европейского рынка. В рамках данного исследования были получены предпочтения по оттенкам, контрастам и шкале яркости. Например, одним из открытий стало то, что в Германии предпочитают резкий контраст между кузовом и интерьером автомобиля. С другой стороны, во Франции предпочтение отдается комбинациям оттенков одного цвета.

В качестве примеров для демонстрации разнообразия промышленной продукции, связанной с географией цвета, я приведу два бренда: DMC и L’Oreal.

Цветовая гамма ниток для вышивания

Мировому лидеру в производстве ниток для вышивания, компании DMC, в 1980 году понадобилось найти решение, как справиться с ассортиментом из 5000 наименований проданных ниток. Для улучшения управления производством перед «Мастерской 3D-цветов» была поставлена задача составить новый диапазон, сокращенный до 3000 цветов. Задача была сложной, потому что требовалось уменьшить количество цветов, избегая при этом слишком большого ограничения выбора покупателей, привыкших к традиционным и специфическим тонам. Проводя исследование во многих странах, мы обнаружили, например, что красный цвет пользуется большим спросом в Швеции; однако тот же красный цвет не был таким же для покупателей на севере, как для покупателей на юге Швеции. Таким образом, анализ и собранная статистика позволили создать новые, более сбалансированные цветовые карты с соблюдением социально-географических особенностей покупателей.

Цвета в косметике

Несмотря на разнообразные сферы применения, тонкости выбора цветов распространяются в первую очередь на мир моды. Особенно это касается косметики. Таким образом, в 1991 году бренд «L'Oreal», обнаружив эффективность учета концепции географии цвета в своих программах развития, доверил нам экспериментальную миссию в этой области. Мы провели сравнительный анализ в Швеции, Франции, Испании и Италии. Статистические результаты были убедительными и способствовали, с одной стороны, маркетинговому плану, созданию цветовых карт, более подходящих для соответствующих рынков, а с другой стороны – экономическому плану, так как позволили лучше управлять запасами в сфере снабжения, производства и распределения.

ЭПИЛОГ

Разве нужно напоминать о том, что сегодня стал популярным дизайн цвета? Фактически он распространяется на архитектурное пространство в целом, от градостроительства и крупных городских объектов до жилых домов и заводов. Памятники и старые кварталы охраняются, реставрируются и являются предметом самых тщательных исследований и экспертиз. Во многих странах региональные и городские цветовые карты становятся правилом для демонстрации старого и будущего наследия.

Но еще более очевидно, что при нашем образе жизни цвет вторгается в повседневность через потребительские товары и товары длительного пользования. В самом деле, каждый живет с цветом и одеждой, продиктованными модой.

Каждый развивается в среде, где мультимедиа и социальные сети передают свои сообщения в цвете. Любой потребитель, на которого влияют информация и сообщения об искусстве жизни, хочет и может выбирать свои повседневные предметы в широком диапазоне цветов, богатых и разнообразных, постоянно обновляемых и пополняемых. Он подсознательно подвергается уточнению ценностей привлекательности, продвигаемых маркетингом. Среди этих ценностей цвет и его материальные аспекты играют важную роль в формировании привлекательности персонализации и сегментации продуктов, поставляемых на рынок. В промышленности цвет стал серьезной и неизбежной экономической проблемой.

Таким образом, цвет подразумевает постоянное исследование, в котором встречаются и пересекаются разные дисциплины дизайна, искусства, гуманитарных и других наук.

По этой причине цвет, обобщенный феномен поведения, участвует в культурном самовыражении любого общества и каждого человека.

Это предполагает перспективу неиссякаемого развития исследований в области географии цвета!

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Цветовые решения в двух портретах Дмитрия Шостаковича

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ABSTRACT
Tatyana Apraksina's memorial portraits of Dmitry Shostakovich (1986, 1996), on permanent display in the House of Composers in St. Petersburg, present contrasts related to the artist's perception of aspects of the composer's work and personality. The two images, synesthetically linking music, color and psychology, offer approaches to the phenomenon of Shostakovich, as well as to his and the paintings' eras. The portraits may be studied in the context of N.V. Serov's examination of world color canons, as well as in light of cultural anthropologist M.S. Kagan's description of the first portrait, *Faces of Shostakovich*, as a contemporary Russian version of a medieval "group portrait of a single person." Also relevant is Apraksina's characterization of the first portrait as "posing a question" and the second as an "answer, although many might not see it as an answer." Shostakovich's music has a mercurial, fragmentary quality which ultimately gives way to an ambivalently transcendent and monumental whole, staying grounded in tradition and tonality. The shift from the first to the second portrait corresponds to this pattern, critical for the composer's equilibrium amid complex, risk-fraught cultural realities. The composer and the artist share a common struggle against what Apraksina defines as the "threat...of low consciousness." As the artist embraces "complete separation" in affinity with Shostakovich's own trajectory, image and color reveal depths of fortitude in the composer's inner life.

Keywords: *Dmitry Shostakovich, "Faces of Shostakovich," Tatyana Apraksina, Nikolai Serov, Moisey Kagan*

ВВЕДЕНИЕ

Два портрета композитора Дмитрия Шостаковича работы Татьяны Апраксиной постоянно находятся в Санкт-Петербурге в Доме композиторов, которому эти картины принадлежат. Художница, посвятившая значительную часть своего творчества сюжетам, связанным с классической музыкой, написала портреты с интервалом в десять лет: первый (1986) был приурочен к 80-летнему юбилею композитора, а второй (1996) совпал с его 90-летием. В композиционной и цветовой контрастности двух портретов можно увидеть взаимодополняющие тематические ракурсы, образно обобщающие аспекты музыки, личности и времени.

Живопись Апраксиной на музыкальные темы синестетически воспринимает общую психофизическую природу музыки и цвета, соединяя ментальную и внешнюю реальность не умозрительно, а как эталон уравновешивания и воспитания бытия. Синестетические портреты предлагают отношение к Шостаковичу, соответствующее его проявлению в музыке. Этот подход дополняет общепринятые способы музыковедческого, биографического и социологического исследования, направленного на определение сути и контекста музыкальных явлений. Не составляя визуальный ряд к музыке, портреты фиксируют закономерности отстаивания жизненной установки в сугубо рациональном мире. Откликаясь на созданное Шостаковичем звуковое пространство для удерживания целостности, портреты поддерживают нормативное, непредвзятое восприятие композитора, культурной среды и реальности в целом.

«Когда люди приходили смотреть на "Лики Шостаковича" и спрашивали, довольна ли я портретом, – говорит Татьяна Апраксина, – я всем говорила, что этим я поставила вопрос, открыла тему» (Апраксина 2020). Подразумеваемая постановка вопроса о том, каков композитор и какова его музыка в образной трактовке, отражена в цветовой и композиционной динамике. Один из внуков Шостаковича спросил о портрете: «Почему деда пять?» (Апраксина 2020). С другой стороны, второй портрет описан автором как «ответ, хотя многие могли бы считать, что это не ответ» (Апраксина 2020). Почему же это ответ – или не ответ? Разъяснению подобных «почему» в частности и посвящен этот анализ.

Рисунок 1: Татьяна Апраксина и ее два портрета Дмитрия Шостаковича (справа 1986, слева 1996). Дом композиторов, Санкт-Петербург, 2010


Рисунок 2: Татьяна Апраксина. «Лики Шостаковича». Х., м. 1986
Рисунок 3: Татьяна Апраксина. «Портрет Д.Д. Шостаковича». Х., м. 1996

ТЕОРЕТИЧЕСКАЯ ОСНОВА ИССЛЕДОВАНИЯ

Поскольку цвет – референт психофизических состояний, предпосылки цветовой семантики присутствуют в состояниях, порождающих музыкальные сочинения и отраженных в них. Портреты создаются и воспринимаются как общие указатели высших личностных реалий музыкального субъекта и адресанта. Творческие состояния вдохновляют синестетику, как для творческой личности, так и для восприятия ее. Для прочтения синестетики портретов оказывается ценным сочетать работу Н.В. Серова по цвету и взгляды М.С. Кагана о «Ликах»:

«Стремление довести до возможного предела тех сложных процессов, которые протекают в недрах человеческой психики и приводят к раздвоению или даже к "растроению" личности, ведет в наше время все чаще к развитию уже известного нам по средневековому искусству приема, который можно было бы назвать созданием "группового портрета одного лица", – опыты такого рода мы встречаем в творчестве М. Сарьяна, Т. Нариманбекова, а в наши дни интересный пример решения такой задачи сделан в портрете Д. Шостаковича, написанном петербургской художницей Т. Апраксиной; личность великого композитора действительно предстает перед нами в этом "групповом" портрете как "*республика субъектов*", по образному определению личности, сформулированному нашим замечательным психологом и философом С. Рубинштейном» (Каган 2018: 230).

Включая метафизические измерения, личность развивается в средневековом искусстве, а у русских «амбивалентность характера станет одним из главных предметов художественного анализа и в портрете, и в сюжетной картине» (Каган 2018: 229–230). Многоликий портрет может и нейтрально, и положительно констатировать изменения или неизменность. Особенность русского отношения, «рельефного на фоне утрачивавшегося... на Западе интереса к человеческой психологии и социальной детерминированности ее проявления в практическом действии личности» (Каган 2018: 229-230), иллюстрирована культурологом сравнением с диптихом из повторяющихся целлулоидно-рекламных субъектов Э. Уорхола. Уорхоловская Монро – антипортрет, штамп знакового отождествления как логотип, стереотип, отгороженный от психологической образности. Раскрашивание играет роль бессмысленного механизма, вызывающего судорогу восприятия. Пестрота портретов и соседняя монохромность бутылок Coca Cola одинаково выражают тупой, обманчивый шарм, противоположный объединяющему смыслу цветовых канонов.

Представляется справедливым расценить второй портрет Шостаковича как применение цвета для многомерности уже единого образа, продолжающего явление цветообраза как целесообразное соавторство решений. А в каждом из портретов субъективный контекст творческого действия определяет перевод от музыкального на цветовой строй. Выбор цветовых градусов зависит от сочетания внутренних потребностей со степенью благоприятности или враждебности среды творческого поиска, определенной автором, эпохой и судьбой.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ

Контрастность «Ликов» сопровождается четким изображением возрастных вариантов композитора. В этом есть и смущающая разобщенность, и положительная множественность, как отдавание дани полноте пожизненных творческих проявлений. Изобразительная часть картины отражает аспекты подготовки к работе: изучение документальных материалов, общение с кругом Шостаковича и с видевшими его только мимоходом. Портретные решения принимались под впечатлением как от конкретных сведений, так и от трепета, возникавшего при воспоминаниях о Шостаковиче, чью неординарность ощущал каждый. Фотографические лица, переведенные в коллаж, приобретают автономный смысл посредством расположения, пропорций и цвета. Хотя настороженность лиц поэтапно нарастает, тонирование, оттененное окружающим насыщенным цветом, живо наполняет статичные публичные образы. Цвет активной музыкальной натуры пронизывает лица. Фон, выявляющий внутреннее пограничное состояние и сгущающийся к периметру холста, оформляется за счет неспокойного сосуществования двух главных цветов.

Бинарная оппонентность фиолетового и темно-коричневого фона и комплиментарна, и конфликтна. По Серову, «фиолетовый... обычно связывается с такими обобщениями, как религиозная страсть, святость, трезвость, покаяние, печаль, умеренность, ностальгия, горе, траур, старость» (Серов 2004: 255). Ведь фиолетовый – последний цвет спектра, цвет высшей чакры тела, атмана, цвет грани физического существования и осознания жизненной потребности осуществить переход на уровень духа. Налеты белил в портрете местами преображают фиолетовый в сиреневый предельной духовности. По Серову, «как считают психологи, все оттенки фиолетового выражают тягу к простору, свободе, ... к творчеству» (Серов 2004: 258). Творчество как наиболее обобщающее значение пурпурных цветов представляется Серову «болезненным» рождением «того, что еще не знал человек. ... Творец же своим подсознанием входит в мир виртуальный» (Серов 2004: 259).

Естественно, творчество нуждается в опоре в реальном мире, но и стремится к его изменению – подобно отношениям комлиментарных цветов. Как раз противоположный цвет фона «Ликов», темно-коричневый, «ассоциируется... с приземленностью» (Серов 2004: 190), с чем связан ряд нарицательных коннотаций. Однако допускается, что «лицу, увлекающемуся излишней рассудочной деятельностью и пренебрегающему земной жизнью, могут быть рекомендованы именно коричневые цвета. ... Вообще говоря, коричневые цвета выражают телесные жизненные потребности, которые в той или иной степени определяются оттенком или светлотой» (Серов 2004: 193). Темный почти до черноты коричневый в «Ликах» соответствует потребности композитора обращаться и к низким темам – в том числе к теме тоталитаризма, который Серов связывает с «коричневым сублиматом» (Серов 2004: 193). Уместно и то, что «в христианской символике этот цвет обозначает даже духовную смерть. Так коричневый цвет одеяний Христа в западной живописи обычно связан с отречением от мира» (Серов 2004: 190). Размежевание цветовых архетипов в психологическом портрете намекает на жертвенную упорядоченность, проходящую насквозь темной тематики свободным творческим выбором, не теряя связи со светом, «смертью смерть поправ». В контрастах можно видеть и аспекты композиторского оперирования мирскими материалами – вызывающими то удовольствие, то чувство протеста – и большей приподнятостью личности и деятельности. Дух в картине, как и в музыке Шостаковича, сохраняет аспект страдания, оставаясь в мире при тяге к отрыву от него, но и не падает, не теряет доступ к обусловленности от материальных влияний.

Творческий подвиг искупает земное для обновления гармонических соотношений. Такое воздействие, знакомое из многочисленных музыкальных сочинений Шостаковича, показывают «Лики». Но для переворотного воздействия нужна крепкая, грамотная внутренняя основа. Об этом сообщает второй портрет. Как определила художница во время работы над «Ликами», в разговоре с ученым Дмитрием Фредериксом, племянником композитора, в музыке Шостаковича «боль собирается в одну точку, пока не становится невыносимой, а потом снимается одним аккордом» (Апраксина 2020). Второй портрет – проявление именно такой всеобщей разрешенности.

Более поздний портрет избирательнее сконцентрирован. Вместо интенсивной цветовой диалектики и фотографической четкости ликов здесь применяется предельно смягченная гамма для уже единого образа, теперь с плечами, торсом, сложенными руками. При этом действительная гамма – та же, что в первом, но видоизмененная обильными белилами, меняющими эмоциональную и смысловую нагрузку. По Серову, «обыкновенно же белый цвет ассоциируется со святостью, чистотой и целомудрием» (Серов 2004: 139), а также с рациональностью. «По своей природе, белый цвет как бы нейтрализует действие полихромных цветов, да и вообще весь материальный мир» (Серов 2004: 137). В частности, «в христианской традиции нередко белое вообще обозначает родство с божественным светом» (Серов 2004: 133). Белый канонически «наделялся свойствами божественности в необозримых временах прошлого» (Серов 2004: 130). Во втором портрете духовность, приземленность, страдание смиряются преобладанием белизны рационального, надрационального, неземного духа музыки. Эта многомерность создается не разнообразием, соединенным цветом творчества, а уже внутренним цветом самобытной запредельности.

На сей раз образ явился без фотографий. Как сказала знакомая композитора, увидевшая портрет и подтвердившая сходство, она «могла увидеть Дмитрия Дмитриевича таким, когда он сидел в гардеробе консерватории и завязывал шнурки на ботинках». По словам художницы, «в первом портрете Шостакович показан таким, каким он был для людей – для публики или для друзей. Во втором он такой, каким он был для себя» (Апраксина 2020). Страсти еще намечены в темноте за спиной выстраданно утонченной, музыкально насыщенной фигуры, но здесь Шостакович затворен в душе, где цвет музыкально натянут, однако свободен от постороннего напряжения. Прозрачная невесомость белизны кристаллизуется в двух вложенных друг в друга прямоугольниках, обрамляющих голову и левое плечо. Незамутненные помыслы создают многомерность вне фигуры без раздвоения ее самой. Очертания фигуры второго портрета мягче, но не менее четкие, чем у «Ликов». Второй просто пропитан той белизной, которая в первом проглядывает в туманах. При сосредоточенности на деле призвания портреты говорят совокупно, гармония личности не уступает земному мраку, совершая творческие выходы.

ВЫВОД

В «поставленном вопросе» «Ликов» осмысленное единообразие цветовых закономерностей указывает на высший порядок фактического единства, превосходящего существующий набор лиц. Несмотря на отсутствие единичного образа, настройка на общий дух «Ликов» наводит на незримый обертон сверхлица. В этом смысле «вопрос» уже подсказывает решение, принятое впоследствии во втором портрете.

Второй портрет, оспариваемый «ответ», утверждает целостность над уровнем отдельной творческой и событийной актуализации. Невзирая на узнаваемый музыкальный почерк, разноплановость Шостаковича может производить впечатление раздробленности, отражающей способность реагировать на влияния личного и культурно-исторического масштаба. Однако оба портрета указывают на менее конкретизированное творческое восприятие. Благодаря шостаковической «эклектичной прогрессивности, укоренившейся в традиции и тональности» (New Grove 1986: 202), сквозь изменчивость и фрагментарность возникают запредельность и монументальность противоречивого целого.

В переходе от первого на второй портрет разрабатывается сюжет равновесия, необходимого для переживания сложных, рискованных культурных реалий. Шостакович стремился не только к творческим сражениям, но и к благотворной фундаментальной отстраненности в пользу музыкальной незыблемости. От этой опоры и зависит способность реагировать в должном масштабе, доступном для полноценного человеческого камертона. Правильное звучание требует душевной и моральной обороны от экзистенциальной угрозы, являющейся лейтмотивом в произведениях Шостаковича.

Важно, при популярной склонности подчеркивать предполагаемые политические измерения творческих произведений, что автор портретов, отмечая, что «знала это чувство угрозы на своей шкуре», уточняет, что это «угроза не политическая, а низкого сознания - политика всегда на низкой основе» (Апраксина 2020). Не случайно, что первый портрет Шостаковича был написан на стыке перестройки, при многолетней невписанности художницы в общественный строй, – а второй на фоне разрастающейся пошлости девяностых, при смене на эпоху коммерческого давления. Соответственно, оба портрета выражают кредо. Во-первых, пример Шостаковича, как и других композиторов, музыкантов и мыслителей, достоин солидарного выдерживания ориентации на подлинные ценности личности. Во-вторых, при условиях переходных времен тем важней служить культуре. Отказываясь от переориентации, решаясь на «полный отрыв, при предоставленности самому себе» (Апраксина 2020), автор портретов настраивается на вневременную среду и проникает, образом и цветом, в недра непоколебимости, лежащей в основе замкнутости Шостаковича.

БЛАГОДАРНОСТИ

Благодарен авторам упомянутых работ, соучастникам создания портретов и председателю правления Санкт-Петербургского Союза композиторов Григорию Корчмару.

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Колористика в архитектурной школе (опыт Московского архитектурного института)

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ABSTRACT
The author discusses the role of color theory in color design, as well as the application of theoretical and practical foundations of architectural coloristics in architectural design. The report contains analysis of the mechanisms of design using polychromy, the possibility of creating a visual sense of a new form and the ability of color to organize it plastically in different ways on the example of the discipline "Architectural coloristics", which is taught to students of all branches of studying at Moscow Institute of Architecture (State Academy). This discipline is aimed at forming an exhaustive knowledge of color as an organic component of the architectural environment for student, as a future professional in the sphere of architecture, and also develops coloristic thinking and the ability to reflect professional design, using the laws of color theory. The author explores the factors that most influence the process of creating a three-dimensional form, revealing in detail the phenomenon of chromatic stereoscopy and such properties of the form as size, geometrical type, mass, texture, etc. The author of the report has been working for many years at Moscow Institute of Architecture on issues of color theory and color design. The practice of referring to this topic has formed a fundamental basis in the educational process for studying the problems of the influence of polychromy on the design and architect art-project activity.

Keywords: *color, theory, architectural coloristics, architectural design*

Цвет – одно из важнейших художественных средств, влияющих на способность пластически организовывать архитектурную форму. Преемственное развитие теории цвета, ее преобразование с учетом новейших поисков в колористическом формообразовании, взаимодействие традиционного и нового, несомненно, представляют одну из актуальных проблем современной архитектурной науки. Обращение к открытиям в теории цвета, знаковым и ярким периодам в науке, образовании, искусстве и архитектуре XX века, повлиявшим на формирование общего интернационального художественного пространства, позволяет рассматривать цвет сквозь призму проблем формообразования и представляет важный аспект научных исследований сегодня.

Наука по изучению цвета в настоящее время включает два основных раздела: цветоведение и колористику. Колористика в контексте данного исследования с одной стороны – наука о цвете в окружающей среде, значительно расширившая рамки традиционного цветоведения, с другой – сама цветовая среда (природная или созданная человеком). Колористика синтезирует опыт ученых, изучающих физическую природу цвета, психологию его восприятия, основы цветовой гармонии, знания цветовых теорий, систем и открытия мастеров пластических искусств. Архитектурная колористика – неотъемлемая составляющая архитектурного творчества, она изучает механизм воздействия цвета на пространственное формообразование, средства и методы цветовой организации архитектурной среды. Знание основ архитектурной колористики положительно влияет на формирование комфортной, информативной и эстетически совершенной архитектурной среды, помогает избежать раздражающего многословия пестроты или уйти от монотонности в архитектурной среде, лишенной выразительности, и достичь при этом высшего художественного эффекта. В этом состоит главная профессиональная задача архитектора-колориста.

Поэтому не случайно на кафедре «Дизайн архитектурной среды» Московского архитектурного института (государственной академии) существует столь необходимая в настоящее время дисциплина «Архитектурная колористика», преподаваемая студентам всех направлений подготовки. Дисциплина основана в 1970-х годах на кафедре «Живопись» МАРХИ профессором Андреем Владимировичем Ефимовым, который в настоящее время развивает ее вместе с автором данной статьи. В отличие от академической традиционной методики преподавания живописи и скульптуры кафедра «Дизайн архитектурной среды» использует творческую интеграцию этих дисциплин в архитектуру во время проектного поиска. Цвет в данном процессе выполняет не только роль художественного компонента, но и средства создания архитектурной формы. Этот творческий процесс сопровождается рядом упражнений, посвященных взаимодействию цвета и формы, в том числе с использованием приемов и технологий дигитального искусства.

Курс «Архитектурная колористика» содержит теоретические основы и практические задания, которые посвящены изучению формообразующего действия полихромии как наиболее востребованного аспекта проявления цвета в архитектуре. Данная дисциплина направлена на формирование у студента – будущего профессионала в сфере архитектуры – исчерпывающих знаний о цвете как органической составляющей архитектурной среды, колористического мышления и способности отражать профессиональный замысел, используя законы колористического формообразования. Колористика современной архитектуры рождается на фундаменте достижений живописи, скульптуры и инсталляции XX–XXI веков, поэтому в процессе освоения дисциплины наиболее пристальное внимание уделяется изучению художественных течений этого периода.

Практические задания позволяют студентам осваивать анализ композиционного строя произведений выдающихся мастеров живописи, а также методику колористического формообразования, опираясь на широкий круг художественных течений. Приобщение учащихся к мировому опыту пластической культуры позволяет им осознать многогранные проблемы стиля в процессе архитектурного проектирования — основной дисциплины архитектурной школы.

Одним из заданий, предлагаемых студентам в рамках дисциплины «Архитектурная колористика», является создание архитектонической формы на основе произведения живописи. В процессе выполнения данного задания студенты анализируют механизмы формообразования с помощью полихромии, возможности создания визуального ощущения новой формы и способность цвета пластически по-разному ее организовывать. Они исследуют факторы, в наибольшей степени влияющие на процесс создания объемно-пространственной формы, подробно изучая феномен хроматической стереоскопии и раскрывая такие свойства формы, как величина, геометрический вид, масса, фактура и др. Эффект хроматической стереоскопии, используемый в колористике, можно охарактеризовать как эффект «выступания-отступания» цветов. Локальные цвета, находясь на фронтальной плоскости, по-разному локализуются в пространстве, то есть воспринимаются лежащими в нескольких плоскостях, не одинаково отстоящих от зрителя (см. рис. 1).

На эффект хроматической стереоскопии влияет ряд факторов. Самое большое влияние оказывает такая характеристика цвета, как светлота. Например, светлые и насыщенные цвета визуально выступают вперед, а темные уходят в глубину.

Цветовой тон – вторая характеристика цвета, влияющая на явление хроматической стереоскопии. Например, если рассмотреть двенадцатичастный цветовой круг швейцарского художника и теоретика искусства И. Иттена, размещенный на черной основе, то цвета, находящиеся в верхней части цветового круга (желтый, желто-зеленый, желто-оранжевый), выступят вперед больше других. Самыми заглубленными будут цвета спектра, находящиеся в нижней части цветового круга (фиолетовый, сине-фиолетовый, красно-фиолетовый). Если разместить цветовой круг на белом фоне, восприятие глубины будет несколько иным. Фиолетовый цвет как самый темный будет восприниматься выступающим, а цвета, находящиеся в верхней части цветового круга, в частности желтый, который близок к белому по светлоте, будут восприниматься с ним на одном уровне (см. рис. 2).

Третья характеристика цвета – насыщенность – также влияет на явление хроматической стереоскопии. Насыщенные цвета визуально локализуются в пространстве выше по отношению к менее насыщенным цветам, близким с ними по светлоте.

Соотношение теплого и холодного, а также контраст оказывают разное влияние на феномен хроматической стереоскопии. Например, теплые цвета ближе визуализируются в пространстве, чем холодные, а контраст является неотъемлемым важнейшим условием колористического формообразования. Эффект хроматической стереоскопии дает визуальную объективную основу для возможностей колористического формообразования, однако проявление этого феномена зависит от многих субъективных факторов, например, нюансов цветоразличий, индивидуальных особенностей восприятия, ассоциаций, связанных с восприятием определенных цветов, цветовыми предпочтениями и другими факторами.

Величина, геометрический вид, масса, фактура, положение в пространстве, светотень – те свойства объемно-пространственной формы, которые будут подвергаться изменениям под воздействием полихромии и освещенности. Не стоит забывать, что приведенный анализ в значительной степени условен. Условность связана с тем, что, рассматривая влияние полихромии на одно из свойств объемной формы, мы временно нивелируем другие ее свойства.

На восприятие различных цветов оказывает влияние геометрический вид формы. Вспомним, что многие исследователи обнаруживали прямую связь между цветом и формой, например И. Иттен, который проводил ассоциацию цвета с определенной геометрической фигурой. Красный цвет он сопоставлял со статичной формой квадрата, насыщенный желтый ассоциировал с треугольником, а синий как самый пространственный цвет сопоставлял с непрерывностью круга. Конечно, перечисленные ассоциации условны, однако архитекторы, дизайнеры и художники по-разному опираются на эту взаимосвязь и творчески интерпретируют ее в зависимости от цветопластического замысла работы.

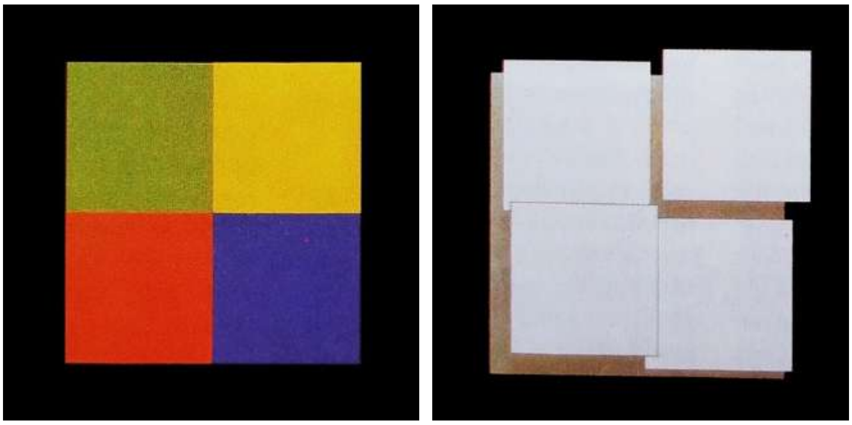

Рисунок 1: Явление хроматической стереоскопии. Различные цвета по-разному локализуются в пространстве

Рисунок 2: а) Эффект «выступания-отступания» хроматического цвета на черном фоне; b) пространственная локализация хроматического цвета; с) эффект «выступания-отступания» хроматического цвета на белом фоне

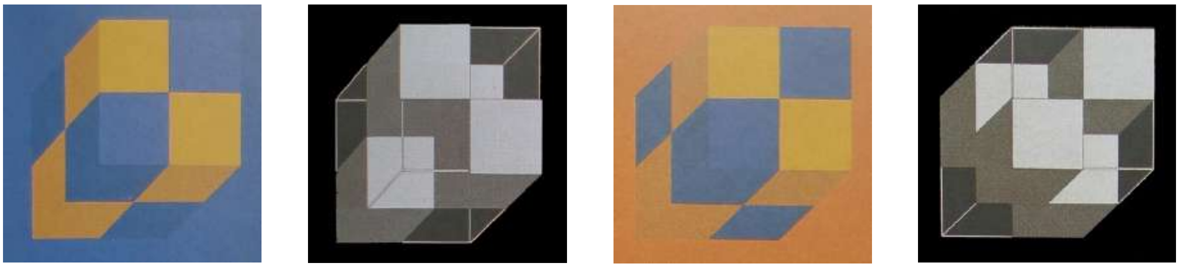

Рисунок 3: Объем (куб) зрительно преобразуется в пространственную форму в зависимости от сочетания цветовых элементов на его гранях и отношения к цвету фона. Одна и та же объемная форма воспринимается по-разному при изменении цвета фона

Свет, будь то естественный дневной или искусственный, имеет большое влияние на восприятие пластических характеристик формы. Следует отметить, что при рассеянном дневном освещении полихромия воспринимается наиболее правдоподобно, а при изменении степени освещенности светлотные отношения полихромии изменятся. Например, при дневном освещении фиолетовый цвет воспринимается темнее красного. В сумерках красный цвет будет казаться темно-серым, а фиолетовый – серым. Такой эффект, при котором в условиях низкой освещенности различается меньше цветов, чем при дневном освещении, носит название «феномен Пуркинье». Холодные цвета воспринимаются более светлыми, а теплые, напротив, более темными. «Искусственный свет, его цветность сильно влияет на восприятие формы, моделирует ее и оказывает заметное формообразующее действие. Искусственный свет с точки зрения оказываемых им композиционных свойств разделяют по характеру направленности и распределения (прямой, рассеянный и отраженный). Для прямого искусственного света характерны открытые источники света, образующие яркое, четкое световое поле. Для рассеянного искусственного освещения свойственно прохождение света через прозрачные экраны или люверсы и образуемое более мягкое и обширное по площади световое поле. Для отраженного освещения свойственна плавность перехода от света к тени. Искусственный свет способен выявлять композиционную суть формы (плоскостной, объемной, пространственной), акцентировать внимание на ее пластических свойствах, усиливать или нивелировать ее особенности» (Ефимов А., Панова Н. 2014).

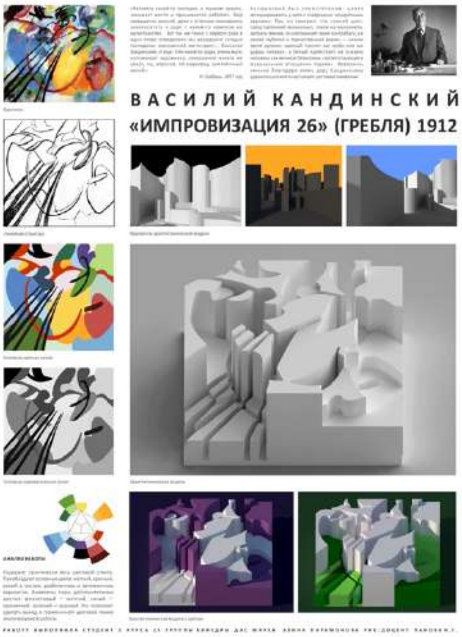

Рисунок 4: Курсовой проект по дисциплине «Архитектурная колористика». Студент Парамонова Э. Руководитель профессор Панова Н.Г. 2017/18 уч. год

Рисунок 5: Курсовой проект по дисциплине «Архитектурная колористика». Студент Батанов Д. Руководитель профессор Панова Н.Г. 2019/20 уч. год

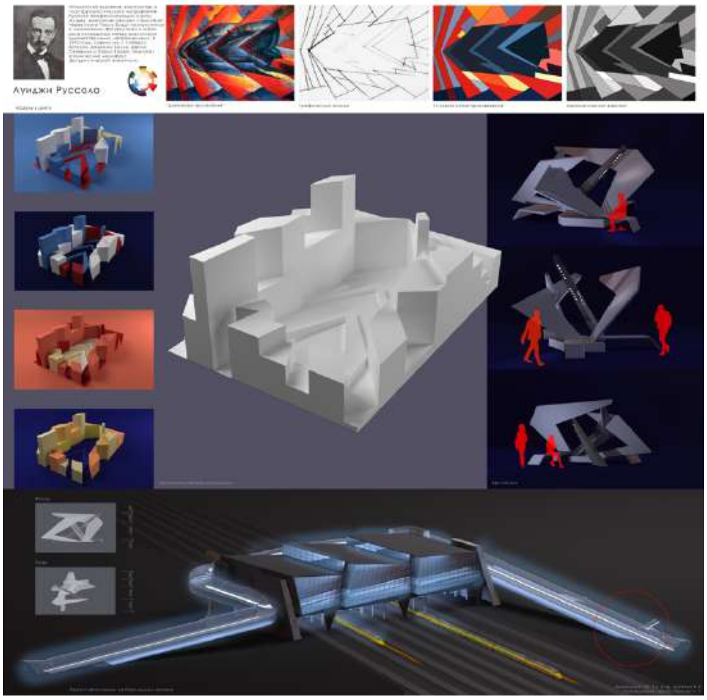

Рисунок 6: Курсовой проект по дисциплине «Архитектурная колористика». Студент Лаптева В. Руководитель профессор Панова Н.Г. 2019/20 уч. год

Цвет фона, на котором расположена полихромная модель также будет влиять на ее визуальное прочтение. Например, теплые желто-оранжевые цвета объемного тела будут нивелироваться на близком по светлоте и насыщенности фоне, а холодные темные цвета на этом фоне будут восприниматься пространственной доминантой (см. рис. 3).

При выполнении курсовой работы по дисциплине «Архитектурная колористика» студенты знакомятся с особенностями цветопластического языка произведения живописи XX – начала XXI веков и анализируют его композиционный строй, для чего исследуется композиционная структура и цветовая палитра произведения. Исторически живопись возникла как отражение объективной реальности. Так, в начале XX века появились течения, направленные на освоение одной из сторон этой реальности: фовизм отдавал первенство цвету, кубизм — строению формы, футуризм — движению в пространстве. Эти течения стали пограничными между фигуративной (изобразительной) живописью и абстрактной, не имеющей отношения к натуре, создающей новую реальность. Она сразу была взята на вооружение архитекторами и дизайнерами, которые профессионально занимаются созданием новой реальности — среды жизнедеятельности человека. Достижения абстрактной живописи остаются источником новых идей формообразования и в наши дни. С момента своего возникновения в 1910-х годах абстрактная живопись породила множество версий, которые условно можно свести к двум векторам: органическому (лирическому), представителями которого являются Василий Кандинский, Хуан Миро, Аршил Горки и др., и геометрическому — Казимир Малевич, Пит Мондриан, Тео ван Дусбург и др. Фигуративная живопись и живопись органической абстракции, как правило, оперируют широким спектром форм, многочисленных деталей, поэтому нуждаются в формализации, порой значительном обобщении, нацеленном на решение задач формообразования, тогда как геометрическая абстракция часто уже обладает чертами минимализма, готовностью непосредственно выйти в третье измерение. Поэтому формализация различных произведений живописи при выполнении курсовой работы может быть использована в разной степени (см. рис. 4).

Используя знания феномена хроматической стереоскопии, студенты создают объемно-пространственную форму (архитектоническую композицию) на основе формализованного произведения мастера и его ахроматической версии. Ахроматический (черно-белый) вариант условной (формализованной) копии выполняется с целью прояснения светлотных отношений между элементами композиции и инициирования процесса создания трехмерной формы. Возникшая объемно-пространственная форма трактуется как своего рода архитектон, не имеющий конкретных отсылок к реальной архитектуре. Необходимо следовать стилистике мастера — рассматривать формализованное произведение как плановую проекцию будущей архитектонической композиции. 3D-модель выполняется с помощью компьютерного моделирования, воспринимается с боковых сторон и сверху на белом, черном и цветном фонах, создающих его окружение. В результате возникает несколько интерпретаций этой пространственной формы на разных фонах, представляющих различные типы контекста.

На этапе доразвития пластики объемно-пространственной модели она разрабатывается цветами в новой теме, изменяющей ее пластику. Визуальный образ полихромной формы создается ее взаимодействием с полихромией основания и фона. Например, если элементы объема темные, то на темном фоне они будут иметь тенденцию визуально сжиматься и исчезать, а светлые – вырастать и расширяться. Перемещение мобильного фона и изменение его цвета приводит к новому визуальному ощущению одной и той же полихромной формы. Таким образом, наглядно анализируется визуальное изменение пластики объемно-пространственной формы под действием цвета в зависимости от фона, на котором она расположена. На этом этапе решаются задачи визуального изменения пространственных характеристик модели, например, выявление центра или композиционной доминанты; изменение значимости ее отдельных элементов; визуальное преобразование объема с целью соединения, разрушения либо деформирования объема и др. (см. рис. 5).

Перечисленные этапы анализа колористического формообразования могут быть дополнены созданием объекта нового типа (арт-объекта, городского объекта, малой архитектурной формы и пр.). Тогда архитектоническая модель или формализованное произведение мастера могут служить их прообразом. В качестве пластических прототипов студенты используют произведения следующих мастеров: Х. Арп, И. Ногучи, Р. Смитсон Э. Каро, Д. Смит, Т. Смит, А. Калдер, Д. Шапиро, К. Олденбург, Сол ле Витт, К. Андре, Д. Джадд, О. Хайек, Л. Барраган, К. Рохас и др.) (см. рис. 6).

На протяжении многих лет работы в Московском архитектурном институте автор статьи занимается вопросами цвета и колористического формообразования, практика обращения к которым в учебном процессе сформировала фундаментальную базу для изучения проблем влияния полихромии на формообразование и художественно-проектную деятельность архитектора. Изучение открытий в теории цвета в искусстве и архитектуре XX – первой трети XXI века, несомненно, дает будущим архитекторам одну из важных основ в решении современных задач в области архитектурного формообразования и формирования целостной архитектурной среды.

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Концептосфера цвета флористического пространства прозы К.Г. Паустовского

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ABSTRACT
The purpose of this pilot study, the relevance of which is due, on the one hand, to the constant attention of modern linguistics to the study of idiostyle uniqueness, on the other, to new research opportunities that linguistics of color reveals in the reconstruction of a unique linguistic personality, – is to describe the color conceptosphere of K. Paustovsky's prose floristic space. As a result of the research carried out on the material of the works of fiction included in 1-8 vols. of Collected works in 9 vols., using a complex of methods, including descriptive and analytical, the method of analyzing compatibility, contextual method, based on the linguistics of color fundamental foundations presented in A. Vasilevich's, V. Kulpina's, R. Frumkina's, V. Kharchenko's works, the composition of color concepts that form the color conceptosphere of K. Paustovsky's prose floristic space was revealed; the pictorial and expressive possibilities of color terms in color conceptosphere of floristic space creating were revealed; a wide range of the author's color painting features was described, which explicates K. Paustovsky's individual author's coloristic picture of the world, manifests the writer's contribution to the enrichment of the Russian language color fund.

Keywords: *linguistics of color, color term, concept, phytonym*

ВВЕДЕНИЕ

Значимость в аксиологической системе координат К.Г. Паустовского пространства природы и роль колористической составляющей в его художественном мировосприятии обусловливают актуальность исследования, ***целью*** которого является описание цветовой концептосферы флористического пространства прозы писателя, что в свете антропоцентрического характера современного языкознания представляется важным для реконструкции индивидуально-авторской колористической картины мира К.Г. Паустовского, с позиций лингвистики цвета – для создания полной версии цветовой концептосферы русского языка (В.Г. Кульпина 2019).

Материалом данного исследования послужили произведения, включенные в первые 8 томов девятитомного собрания сочинений; ***теоретическую базу*** составили работы, посвященные проблеме картины мира и ее отражения в языке (Ю.Д. Апресян, Ю.С. Степанов, Е.С. Яковлева), раскрывающие теоретические, прикладные аспекты лингвистики цвета (А.П. Василевич, В.Г. Кульпина, Р.М. Фрумкина, В.К. Харченко); в основе ***методологии*** исследования – метод описательно-аналитический, анализа сочетаемости, контекстуальный анализ.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ

Результатом исследования стало описание ядра цветовой концептосферы флористического пространства прозы К.Г. Паустовского. Из насчитывающего более 400 единиц фитонимического фонда произведений извлечены лексемы, коррелирующие с терминами цвета, формирующими цветовые концепты. Цветовые концепты в составе концептосферы цвета упорядочены согласно классификации имен цвета Р.М. Фрумкиной (Фрумкина 1984). Установлен диапазон сочетаемости каждого термина цвета, что позволяет выявить роль того или иного цвета в визуализации флористического пространства прозы Паустовского, воссоздать колористический облик того или иного растения. Такие попытки предпринимались нами ранее и доказали свою плодотворность, например, см.: «Колористические доминанты прозы К.Г. Паустовского в визуализации фитонимического пространства произведений писателя: *черный*» или «Термины цвета в визуализации флористического пространства прозы К.Г. Паустовского. Цвет розы» и т. п. (Сивова 2020a; 2020b и др.).

1. Модель описания. Концепт красного цвета (хроматическая категория). Концепт **Красный** (более 100 словоупотреблений): *астра*, *болотная трава*, *ботва*, *брусника*, *водокрас*, *водоросли*, *гвоздика*, *гроздь рябины*, *дерево*, *дубовые листья*, *ипомея*, *камелия*, *кашка*, *кипрей*, *клевер*, *клен*, *кленовый лист*, *конский щавель*, *кора*, *кора лозняка*, *крапинки на лепестках каштанов*, *красная смородина*, *лес*, *лист*, *листочки брусники*, *листья осин*, *листья клена*, *мак*, *мальва-монашка*, *мох*, *осина*, *перец*, *петуния*, *помидор*, *райские яблоки*, *самсун*, *смола сосны*, *смородина*, *споры папоротника*, *ствол сосны*, *табак*, *томат*, *филлофора*, *цветы*, *цветы кипрея*, *цветы настурции*, *цветы герани*, *цветы дерева ало-ало*, *цикламен*, *черешня*, *шишка*, *щавель*, *ягода*, *ягоды бузины*. Примеры контекстов: ***От*** *голых* ***кустов с красной*** *глянцевитой* ***корой*** *пахло терпко и славно* (Паустовский 1981a: 383); *то поляну с вереском, то иволгу на ветке, то* ***красноватый ствол сосны*** (Паустовский 1982a: 135); *Среди них, как большая капля крови,* ***краснела*** *твердая* ***ягода*** (Паустовский 1981b: 368). **Розовый** (около 60 словоупотреблений): *батат*, *бересклет*, *вереск*, *водяная гречиха*, *гортензия*, *жимолость*, *земляничный сок*, *иван-чай*, *кипрей*, *кисть винограда*, *лепестки дикой мальвы*, *листва осокоря*, *листва яблоневых садов*, *листья*, *листья платанов*, *листья рябина*, *лишай*, *лотос*, *мальва*, *миндаль*, *олеандр*, *персик*, *роза*, *сад*, *свечи каштана*, *сосновая кора*, *сосновый ствол*, *таволга*, *тамариск*, *цветы*, *цветы иван-чая*, *цветы яблонь*, *частуха*, *ягоды брусники*. В диапазоне от 10 до 20 – **Багряный** *виноградник*, *долина*, *лес*, *листва*, *немезия*, *роза*, *роща*, *чаща*. **Пурпурный** *арбуз*, *виноградные листья*, *гладиолус*, *дерево*, *клен*, *листва*, *олеандр*, *осиновый лист*, *палый лист*, *сад*, *шафран*, *ягоды шиповника*. **Кровавый** *бурьян-татарник*, *вишневая мякоть*, *мак*, *ягоды остролистника*, *томат*, *цветок мака*, *цветы чертополоха*, *ягода*. **Алый** бурьян-татарник, гвоздика, кустарник, листва, розан, роза, цветы. **Пунцовый** головка татарника, иван-чай, кисть кипрея, лепесток кипрея, мальва, роза, свечи кипрея, чашечки сирени. Менее 10 – **Багровый** *виноградник*, *листва*, *листья осин*. **Карминный** *лепестки бересклета*, *хурма*. **Бордовый** *роза*. **Рдяный** *чашечки сирени*.

Концепт оранжевого цвета. **Рыжий** (более 20); **Ржавый**, **Оранжевый**, **Бронзовый** (в диапазоне от 10 до 20); **Огненный** (менее 10). Примечательно, что корреляция термина цвета *рыжий* с фитонимом *хвоя* носит в прозе Паустовского константный характер: *завалы из стволов и высохших веток* ***с рыжей хвоей*** *казались непроходимыми* (Паустовский 1982a: 159); *шуршит дождевая влага, просачиваясь* ***через*** *палую* ***рыжую хвою****, устилавшую землю* (Паустовский 1984: 369). *Рыжий* доминирует в цветовом спектре, используемом писателем для создания колористических описаний хвои.

Концепт желтого цвета. **Желтый** (более 200); **Золотой** (более 130; исключая библионим *«золотая роза»*); **Лимонный** (свыше 20); **Янтарный**, **Охряный** (менее 10).

Концепт зеленого цвета. **Зеленый** (более 200); **Изумрудный**, **Оливковый**, **Малахитовый** (менее 10).

Концепт синего цвета. **Синий** (более 40); **Голубой** (менее 15); **Лазурный**, **Бирюзовый** (единичные случаи).

Концепт фиолетового цвета. **Лиловый** (более 40); **Фиолетовый**, **Сиреневый** (менее 10).

Концепт серого цвета. **Черный** (более 150); **Серый** (более 40); **Пепельный**, **Свинцовый** (менее 5); примыкающие **Серебристый** (около 40); **Сизый** (менее 10). *Черный*, являясь доминантой цветового континуума многих произведений Паустовского (повестей «Золотая роза», «Кара-Бугаз», «Черное море», романов «Романтики», «Блистающие облака», «Дым отечества», гексалогии «Повесть о жизни») не стал цветовой доминантой в описании растительного мира.

Концепт белого цвета. **Белый** (более 140); **Белесый** (единичный случай).

Концепт коричневого цвета. **Коричневый**, **Бурый** (около 15).

2. Цветовыми доминантами флористического пространства прозы Паустовского являются *Зеленый*, *Желтый* (более 200), сильные позиции занимают *Черный* (более 150), *Белый*, *Золотой*, *Красный* (более 100).

3. Представляет научный интерес описание функционального потенциала выявленных корреляций, реализующегося в моделировании колористических пространственных плоскостей. Помимо пространства природы это **а)** пространство человека – соматический код произведений: *Григ заметил, что **зрачки** у нее* [девочки] ***зеленоватые** и в них **поблескивает** огоньками **листва*** (Паустовский 1983a: 495); *Доктор Равиньяк, высокий и **желтый, как высохший тростник**, встретил меня на палубе* (Паустовский 1983a: 74); вестиальный код: *я увидел немного кряжистого человека с явными чертами внутреннего и внешнего изящества – вплоть до **красной гвоздики** в петлице пиджака* (Паустовский 1983b: 484); *Верди. Венеция. Старинный рояль и вино. Песенки студентов, седые актеры и молодая женщина **с красной камелией**, приколотой к корсажу* (Паустовский 1981b: 38); **б)** пространство творчества – живопись: [картины Гогена] ***Золото в лимонах, в мимозах**, в вечерах и на бедрах женщин* (Паустовский 1981a: 69); фольклор: *По весне степь покрывалась его* [татарника] ***алыми цветами**, похожими на капли крови. И старики, вспоминая прошлое, рассказывали детям байки, что всюду, **где пролилась казацкая кровь**, вырос на ней и расцвел **татарник*** (Паустовский 1981b: 508); поэтическое слово: [интертекст] *Какая простота и звонкость языка, какая осанная звонкость **у Пушкина** в стихотворении «Роняет лес багряный свой убор»* (Паустовский 1984: 351); в связи с последним интерес вызывают случаи смысловых, ассоциативных параллелей: ***Ржаные поля**, как бы видимые до этого через слюду, сухо шелестели и **золотились** вокруг. И я понял, что это и была та **лермонтовская желтеющая нива**, которая помогла ему постигнуть земное счастье* (Паустовский 1984: 380); **в)** пространство города: *Я рассказал **о Таганроге**, **городе белых акаций**, сонном и чистом, на берегу бледного моря* (Паустовский 1981a: 105); ***Мариуполь** – **пестрый**, как платок молодухи, **базар, красный от помидоров, синий от баклажанов**, росистый и свежий от капусты и арбузов, пахнущий топленым молоком, вишнями* (Паустовский 1983b: 69); **г)** пространство страны: *щедрый **край**, звенящий от песен веселых дивчат, **красный от черешен**, рассеченный белыми косами и зелеными водами Днепра* (Паустовский 1983b: 72); реализацию получает и этнический колористический стереотип: ***Петунию** высадили **национальных польских цветов** – красную и белую* (Паустовский 1983b: 228).

Помимо пространственной координаты, актуализируется темпоральная – ТК «Время года» (весна, осень): *Весь город был **в зеленоватом** и **золотистом блеске первых листьев*** (Паустовский 1982b: 29); а также *с тех пор я полюбил туманные **дни**, особенно **осенью**, когда они подсвечены вялым **лимонным цветом палой листвы*** (Паустовский 1982b: 686); ТК «Время суток»: ***Закат** тяжело **пылает на кронах деревьев**, **золотит** их старинной позолотой* (Паустовский 1982a: 614); *Что это были за **дни**! Они расцветали из голубоватого тумана, **как** легкие **золотые цветы**, и цвели в тишине* *до заката* (Паустовский 1981b: 529); а также *Прошлое тяготило его. Дни обрастали* ***серым мхом****, беззвучностью, бесплодностью* (Паустовский 1981a:229).

Закономерная связь цветового пространства и времени лежит в основе создания цветового хронотопа флористического пространства прозы Паустовского: *Оно* [озеро] *стояло как бы чуть набок, и в нем мимолетно отразилось множество* ***багровой листвы****,* ***желтые стены камышей*** *и гаснущий огонь заката. Круги от рыбьих всплесков превратили эти отражения в путаницу всех мыслимых* ***красок северной осени*** (Паустовский 1983b: 125); *Стояла уже* ***лиловая южная осень****. Листья платанов не желтели, а лиловели, лиловый дым курился над морем* (Паустовский 1981a: 336); *и на берегах расцветает* ***розовая от миндаля*** *и туманов* ***черноморская весна*** (Паустовский 1981b: 85).

4. В ходе исследования раскрыты черты цветописи К.Г. Паустовского, среди которых **а)** демонстрация широкого колористического диапазона (*золотой – пурпурный – алый – фиолетовый – коричневый – черный – серый – белый* и др. цепочки цвета): *Я видел листву, не только* ***золотую*** *и* ***пурпурную****, но и* ***алую****,* ***фиолетовую****,* ***коричневую****,* ***черную****,* ***серую*** *и почти* ***белую*** (Паустовский 1983a: 157); **б)** внимание к оттеночной палитре, тонкая дифференциация цвета: *Ведь всем известно, что в самой малой капле отражается калейдоскоп света и красок, – вплоть до* ***множества оттенков совершенно разного зеленого цвета*** *в листьях бузины или в листьях черемухи, липы или ольхи* (Паустовский 1983a: 420); **в)** фиксация причины окраски растений (преимущественно влияние внешних факторов): *лепестки* [кипрея] *покрылись ржавчиной* ***от едкой росы*** (Паустовский 1983b: 372); *Пожелтевшие* ***от холода*** *цветы гортензии стояли на длинном столе, покрытом клеенкой* (Паустовский 1982b: 314); *Леса были заржавлены, их* ***покрывала*** *желтая* ***плесень*** (Паустовский 1983a: 196); **г)** интенсификация цветового восприятия: *заросли шиповника прерывались, и в прогалинах цвел стройными свечами* ***синий****,* ***почти до черноты****,* ***шпорник*** (Паустовский 1983a: 460); **д)** взаимосвязь цветовой и световой характеристик: *Солнце еще за горами, но верхушки лесов на западных склонах уже зажигаются ржавчиной* ***от его первых лучей*** (Паустовский 1983a: 316), в результате чего актуализируется способность цвета излучать свет: *В избе сухо, светло от сада, –* ***сад дает*** *от себя* ***желтое излучение*** (Паустовский 1983a: 335); *заметил, что* ***сосновые стволы*** *тоже* ***отбрасывают свет*** *на подлесок и на траву – очень слабый, но такого же* ***золотистого****,* ***розоватого тона*** (Паустовский 1982a: 9); **е)** ассоциативность цветообозначения, актуализация его когезионных свойств: ***все напоминает по цвету гренландский лед*** *– и небо, и синие огни в воде,* ***и*** *увядшие* ***фиалки*** *в петлице пиджака, и даже глаза Наташи* (Паустовский 1984: 185), так цвет приобретает всеобъемлющий характер: *От зноя* ***все стало желтым*** *– и небо,* ***и поля****, и воздух. Как будто зной долго крепчал, томился и наконец приобрел этот тоскливый и зловещий оттенок* (Паустовский 1982a: 37).

5. В визуализации растительного пространства К.Г. Паустовский использует широкую цветовую палитру, что обусловлено как спецификой художественного дискурса, так и индивидуально-авторскими особенностями цветовой перцепции писателя. Помимо описанного ядра в цветовую концептосферу растительного пространства включены **а)** термины цвета, не входящие в ядро, но зафиксированные лексикографией: *дарил старушкам суперфосфат – подсыпать в вазоны с геранью, чтобы вырастить на диво соседям огромные* ***шарлаховые цветы*** (Паустовский 1982b: 111); **б)** авторские цветономинации: *среди травы подымались высокие и узкие, как факелы,* ***цветы конского щавеля****. У них был* ***цвет густого красного вина*** (Паустовский 1983a: 586); ***канны*** *– самые заметные цветы батумских палисадников – будут просвечивать в солнечных лучах* ***цветом винной крови*** (Паустовский 1982c: 313); [листья] *дуб –*

коричневые, ***хмель*** *–* ***листья цвета рогожи****, рябина – розовые, а конский щавель пылает в сухой траве, как рыжее пламя* (Паустовский 1983b: 390); *осенью, когда рощи и сады, пажити и даже дальний край неба отливали* ***коричнево-красным цветом высохших на солнце початков кукурузы*** (Паустовский 1983b: 507); *открытки золотоволосых девушек* ***с*** *розовыми носами и* ***глазками цвета капусты*** (Паустовский 1982a: 438); **в)** лексемы с корнем -цвет-: *Нежная синяя вероника, бегония и множество* ***разноцветных анемон*** (Паустовский 1982c: 373); **г)** термины изобразительного искусства с семой ‘цвет’: *пробивались,* ***как*** *свежие* ***брызги киновари****, маленькие, величиной с ноготь,* ***маки*** (Паустовский 1982c: 117); **д)** лексемы, содержащие сему с цветовым признаком имплицитно: *медленно падали* ***съеденные зимой листья каштанов*** (Паустовский 1981a: 174); **е)** лексемы со значением интенсивности: *каштаны покрылись* ***сочной листвой*** *и расцвели почему-то особенно пышно* (Паустовский 1982b: 637); **ж)** лексемы со значением ‘утратить первоначальный цвет’: *на этом песчанике растут, вытягиваясь из щелей, слабые колоски, а иной раз и* ***вылинявшие цветы*** *величиной со спичечную головку* (Паустовский 1982c: 217); **з)** образные колоративы: ***шиповник*** *стоял, повернувшись цветами к солнцу,* ***нарядный,*** *совершенно* ***праздничный****, покрытый множеством бутонов* (Паустовский 1983a: 446); **и)** лексемы с цвето-световым значением: *красные, оставшиеся с осени* ***гроздья рябины пылали*** *среди снежных лесов* (Паустовский 1983a: 239). Представленные в модели поля перечисленные группы лексем иллюстрируют закономерный переход от цветовой к световой составляющей, основанный на физической природе цвета.

ВЫВОД

Таким образом, установленный состав и специфика функционирования концептов, формирующих цветовую концептосферу флористического пространства произведений Паустовского, только ядро которой репрезентируется 42 концептами, а расширение свидетельствует о своеобразии авторского идиостиля, позволяют сделать вывод о доминировании *зеленого* и *желтого* в колористических описаниях растительности, несмотря на превалировании *черного*, *белого*, *красного* в цветовом континууме произведений Паустовского; о широкой сочетаемости терминов цвета с фитонимами, эксплицирующей функциональный потенциал цветового хронотопа; об особенностях колористической визуализации отдельных растений. Проведенное исследование раскрывает новые возможности в реконструкции колористической картины мира писателя, вносит некоторый вклад в описание цветовой концептосферы русского языка.

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Ассоциативный потенциал цветовых символов

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ABSTRACT
The problem of color symbolism has always been the focus of researchers, but the emphasis at different times was on different tasks. Currently, due to the increasingly frequent use of visual and figurative languages in communications, the problem of color symbolism has become urgent again. Just like words, colors have different conceptual potential, by which we mean the associations they generate. The study tested the hypothesis about the existence of differences in the psychological structure of associations arising in response to the perception of different color standards. These differences can be due to both the spectral characteristics of the colors and their culturally specific symbolic meanings. Red, yellow, green, cyan and magenta were used as color references. The main research methods were the method of "semantic differential" by Ch. Osgood and the method of free associations with subsequent processing of responses using content analysis. Content analysis of associations caused by colors showed the presence of two main parameters by which they can be distributed: typicality-individuality and concreteness-abstractness. There is a set of standards, most common associations, as well as individual associations. The greatest number of typical associations was caused by red and cyan colors, the most diverse – by magenta; green and yellow occupied an intermediate position. The peculiarity of individual associations is associated with the unique life experience of the respondents. According to the parameter concreteness-abstractness, four types of associations were identified: concrete-objective, figurative, emotionally figurative and abstract. The associative potential of each of the colors has its own structure, which consists in a certain ratio of these four types of associations. The opposite of the ratio of the types of associations in additional colors is noted. The potential for color associations also depends on the socio-demographic characteristics of the respondents.

Keywords: *perception, color symbolism, color associations, content analysis*

ВВЕДЕНИЕ

Проблема цветовой символики всегда была в центре внимания исследователей, но акцент в разных дисциплинах делается на разные задачи. В инженерной психологии исследователей больше волнуют практические вопросы, связанные с цветовым кодированием – различимость, читаемость, информативность цветовых знаков. В эргономике цвет и цветовые символы рассматриваются как факторы психофизиологического комфорта, эмоционально-эстетического воздействия и средства передачи информации (Эргономика 2009). На другом полюсе находятся эзотерические практики, ищущие в цветовых символах мистические смыслы. Наибольший багаж знаний о цветовой символике накоплен в культурологии и искусствоведении, где без исторического анализа цветовой символики невозможно понять становление культуры и живописные произведения других эпох (Волков 1965, Серов 2003 и др.). Хорошо известна серия работ Мишеля Пастуро по истории цвета.

В настоящее время в связи с все более частым использованием в коммуникациях визуальных и образных языков проблема цветовой символики вновь стала актуальной. Как и на заре цивилизации, цвет стал приравниваться к слову. Если по отношению к информации применимы критерии читаемости и однозначности, то по отношению к слову и языку – критерии понимания, насыщенности и содержания высказываний, соотношения означающего (знака) со своим значением и с означаемым (денотатом). Но так же, как разные слова, цвета обладают разным понятийным потенциалом, под которым мы понимаем порождаемые ими ассоциации. Поэтому одним из возможных способов изучения информационно-психологических возможностей цветовых символов является изучение вызываемых цветами ассоциаций, в том числе с точки зрения их формальных характеристик. Хотелось бы заметить, что появление цветных дисплеев сразу породило вопросы, связанные с цветовым восприятием и интеллектуально-информационным воздействием цвета. В частности, работая вместе с инженерами над проблемой цветопередачи на экранах СОИ, мы решали также и задачу подбора и комбинаций цветов при создании информационных моделей оперативной реальности, которые способствовали бы ускорению и облегчению принятия решений операторами. Отчасти эта задача была решена (Алексеева и др. 1988).

МЕТОДИКА ИССЛЕДОВАНИЯ

Целью исследования было определение особенностей и структуры ассоциаций, вызываемых цветами. Была высказана гипотеза о существовании различий в психологической структуре ассоциаций, возникающих в ответ на восприятие различных цветовых эталонов. Эти различия могут быть обусловлены как спектральными характеристиками цветов, так и их культурно-специфическими символическими значениями. В свою очередь, культурная специфика символических значений может быть связана с социально-демографическими особенностями респондентов.

Основными методами исследования были метод семантического дифференциала Ч. Осгуда (СД) и метод свободных ассоциаций с последующей обработкой ответов с помощью контент-анализа. Использовались пять цветовых эталонов: красный, желтый, зеленый, голубой и пурпурный. При отборе цветов мы руководствовались критериями спектральности, первичности и значимости в культуре. Процедура эксперимента заключалась в следующем: на общем экране, чтобы исключить влияние индивидуального монитора, высвечивался поочередно один из цветовых эталонов. Респонденты должны были заполнить бланк СД и записать в свободной форме все возникающие в памяти ассоциации, связанные с этим цветом.

Респондентами были учащиеся (студенты и аспиранты) высших технических учебных заведений Санкт-Петербурга в возрасте 18–35 лет, объем выборки – 180 человек. При анализе результатов мы рассматривали как ответы всей выборки респондентов, так и отдельно в зависимости от пола, возрастного и образовательного уровня.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ

Анализ и обработка результатов методики СД с использованием стандартных факторов «сила», «активность», «красота» показали наличие достаточно устойчивых закономерностей в восприятии символических значений цветовых образов. Значения стандартных факторов представлены в табл. 1.

Цвет **Факторы**	**Красный**	**Желтый**	**Зеленый**	**Голубой**	**Пурпурный**
Сила	+0,75 (*0,86*)	-0,06 (*0,81*)	+0,06 (*0,82*)	-0,27 (*0,96*)	+0,40 (*0,87*)
Активность	+1,43 (*0,96*)	-0,20 (*1,01*)	-0,27 (*0,98*)	-0,83 (*1,03*)	+0,74 (*0,83*)
Красота	+0,87 (*1,09*)	+0,23 (*1,24*)	+1,35 (*0,84*)	+1,34 (*1,12*)	+1,13 (*1,06*)

Таблица 1. Средние значения и дисперсии факторов СД пяти основных цветов

Наиболее сильно различаются красный, самый сильный и активный, и голубой – слабый, пассивный, красивый. Эти различия были использованы нами при изучении психосемиотических механизмов цветового восприятия (Соловьева 2019). Желтый и зеленый цвета занимают промежуточное положение, факторы пурпурного цвета в тенденциях приближаются к красному цвету.

Вывод о наиболее четких и соответствующих житейским представлениям символических значениях цветовых образов красного и голубого цветов подтверждается и с помощью факторного анализа, который позволил выделить два основных фактора для большинства цветов. В первый фактор вошли главным образом прилагательные, характеризующие пространственно-временные синестезии, во второй – оценочные определения. Только при оценке голубого цвета используется еще и третий фактор – температурные синестезии. Результаты представлены в таблице 2.

Цвет	**Фактор 1**	**Фактор 2**	**Фактор 3**
Красный	Быстрый, активный, горячий, напряженный	Большой, сильный	
Желтый	Маленький, слабый, мягкий	Некрасивый, недостойный	
Зеленый	Хороший, приятный, легкий	Кислый, тонкий	
Голубой	Маленький, легкий, тонкий	Хороший, красивый, приятный	Холодный, медленный
Пурпурный (фиолетовый)	Напряженный, угловатый, активный	Красивый, достойный	

Таблица 2. Содержание признаков, входящих в цветовые факторы СД

По результатам факторного анализа красный цвет оценивается как быстрый, активный, сильный, напряженный, а голубой – маленький, легкий, хороший, красивый и медленный. В оценке пурпурного цвета наблюдается некое противоречие. Это напряженный, угловатый цвет, но в то же время красивый и достойный.

Контент-анализ возникающих у респондентов свободных ассоциаций с разными цветами показал наличие двух основных параметров, по которым может быть формально распределено все многообразие ассоциаций: типичность–индивидуальность и конкретность–абстрактность.

Как и следовало ожидать, существует набор стандартных, наиболее часто встречающихся ассоциаций, что свидетельствует о существовании устойчивого культурного ядра цветовых символов. Но встречаются также и индивидуальные ассоциации. Наибольшее количество типичных ассоциаций возникало с красным и голубым цветами, что может быть связано с их устойчивыми семантическими значениями (см. табл. 1). Наиболее разнообразные ассоциации вызывал пурпурный цвет, что отчасти также может объясняться и противоречивым содержание его цветовых факторов (см. табл.2). Зеленый и желтый цвета занимают промежуточное положение. В качестве примера типичных ассоциаций можно назвать следующие: красный флаг, небо, море, закат солнца, трава, спокойствие, бесконечность, губная помада и пр. Примером индивидуально-своеобразных ассоциаций являются такие, как «фильмы Тарковского», «замшелый антиквариат», «свечение Черепанова в атомном реакторе», «яд и трапеза» и др.

По параметру конкретность–абстрактность были выделены четыре вида ассоциаций:

– конкретные, связанные с окраской предметов (красный флаг, зеленая трава);
– образные, ориентированные на цвет явления (закат солнца, дорога в поле);
– эмоционально-образные (веселье, лень, усталость);
– абстрактные (иррациональность, бездна).

Оказалось, что ассоциативный потенциал каждого из цветов имеет свою формальную структуру, заключающуюся в определенном соотношении четырех видов ассоциаций. Наблюдается противоположность соотношений типов ассоциаций у дополнительных цветов. Структура ассоциативных полей разных цветовых эталонов представлена на рисунке 1.

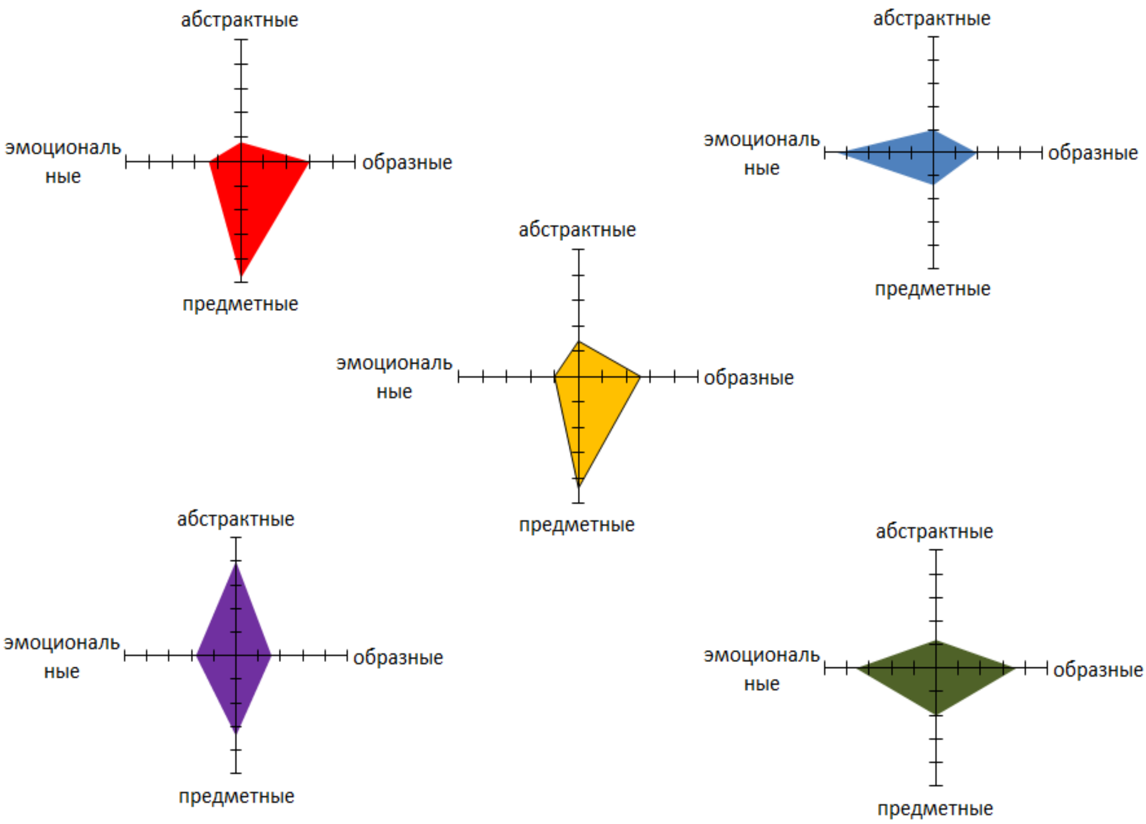

Рисунок 1: Структура ассоциативных полей различных цветовых тонов

Можно видеть, что среди ассоциаций с красным и желтым цветами преобладают предметные и образные, а голубой вызывает преимущественно эмоциональный отклик. Пурпурный чаще всех цветов ассоциируется с абстрактными понятиями, зеленый – с эмоциональными и образными. Большинство исследователей связывают цветовые ассоциации с синестезиями. В частности, Л.Н. Миронова пишет о том, что пурпурные цвета вызывают противоположные синестетические реакции, объяснением чему может служить двойственная природа этого цвета (красный плюс синий). Желтые и зеленые цвета вызывают наибольшее количество синестезий, так как в данной области спектра глаз различает наибольшее количество оттенков (Миронова 1984). Благодаря синестезиям реконструируется целостный психический образ на основе восприятия одной модальности. Однако природа ассоциаций не ограничивается чувственной реальностью, она дополняется рациональными сущностями значений. Образ, в том числе и цветовой, отражающий только то, что в данный момент непосредственно действует на органы чувств, не мог бы обеспечить целенаправленности человека, и в этом случае окружающая среда полностью управляла бы поведением субъекта (Завалова и др. 1986).

Своеобразие индивидуальных ассоциаций может быть связано с уникальным жизненным опытом респондентов, объясняющимся особенностями деятельности, личными переживаниями, а также возрастным и образовательным уровнем респондентов. На рисунке 2 приведены графики (качественные, но не числовые) распределения частоты встречаемости ассоциаций по выделенным нами критериям типичности–индивидуальности и конкретности–абстрактности в разных социодемографических группах.

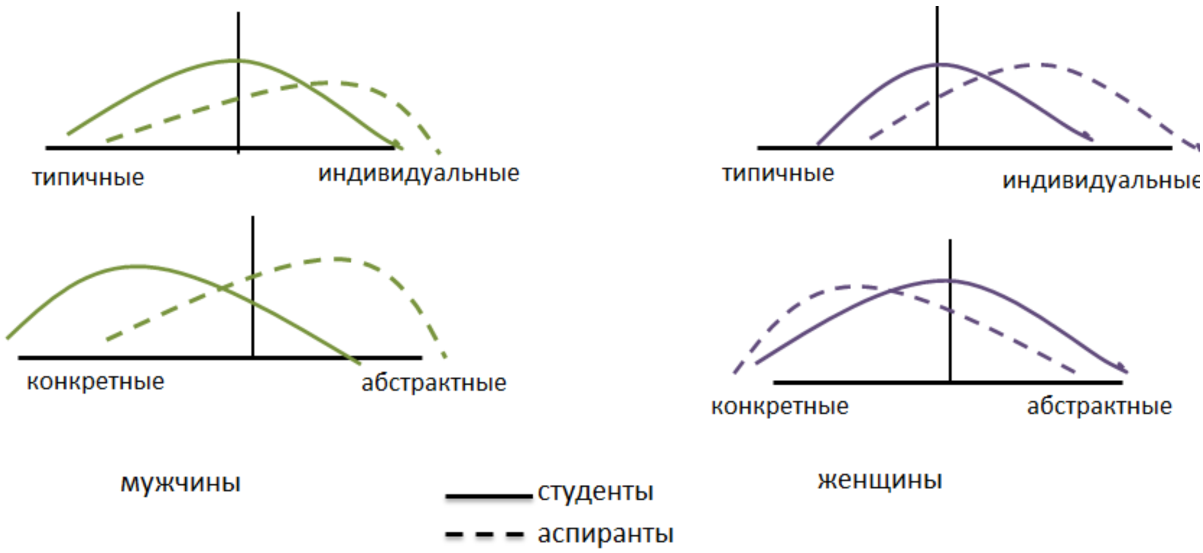

Рисунок 2: Распределение ассоциаций по параметрам «типичность–индивидуальность» и «конкретность–абстрактность» в зависимости от пола и образовательного уровня респондентов

Независимо от пола респонденты, имеющие более высокий образовательный, возрастной и культурно-интеллектуальный уровень (аспиранты), предлагали более индивидуализированные ассоциации. Фактор пола парадоксально сказался на степени конкретности–абстрактности ассоциаций. Юноши-студенты чаще предлагали конкретные, преимущественно предметные и образные, ассоциации с цветами, чем аспиранты. В группе аспирантов преобладают абстрактные ассоциации. У девушек-студенток в равной степени встречаются типичные и индивидуальные, а также конкретные и абстрактные ассоциации, а аспирантки чаще предлагают конкретные, хотя и индивидуализированные ассоциации. Возможно, это связано с техническим профилем подготовки.

ВЫВОДЫ

Таким образом, нам удалось доказать, что цвета обладают разным ассоциативным потенциалом. Ассоциации, вызываемые разными цветами, различаются по параметрам: типичность-индивидуальность и конкретность-абстрактность. По параметру конкретность-абстрактность можно выделить четыре вида ассоциаций: конкретно-предметные, связанные с окраской предметов; образные, ориентированные на цвет явления; эмоционально-образные и абстрактные.

Каждый цвет характеризуется своим сочетанием четырех видов ассоциаций, который мы назвали ассоциативным потенциалом цвета. Красный цвет вызывает преимущественно конкретные предметные и образные ассоциации, голубой – эмоциональные и образные. Типология ассоциации с желтым цветом подобна ассоциациям с красным, но менее выражена. Ассоциации с пурпурным цветом распределись между абстрактными и конкретными, а с зеленым – между эмоциональными и образными.

Потенциал цветовых ассоциаций зависит также от социально-демографических характеристик респондентов: пола, возраста, образовательного уровня.

Практическим результатом данного исследования могут быть рекомендации по использованию цвета в визуальных коммуникациях и в рекламе. Разные цвета порождают ассоциации, разные не только по содержанию (связь цветового знака и денотата), что очевидно, но и по своей структуре (связь знака и значения). Знание подобных закономерностей может способствовать пониманию некоторых эффектов цветового воздействия.

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Экологические мотивы при проектировании сценической одежды

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ABSTRACT
When interpreting the theatrical character through the costume, designers choose textile and their color from an aesthetic point of view. The article proposes using nature design elements that reflect national authenticity and historical periods in stage costume, the harmonization of fashion and color with the natural environment. Authors present the cultural heritage and traditions in the modern interpretation of compositional and aesthetic appeal of the theater stage costume. Ethnic and nature design reflects trends in the presentation of universal human values: the preservation of national culture and «islands» of untouched wildlife. The article analyzes the requirements for the composition of costume using the example of the female costume of the heroine of the fairy tale «Su Anasy» («Mermaid»). The model features of the stage costume reflect the semantic load of the performance. Aesthetic requirements for the costume are determined by the plot of the folk tale retold by the national Tatar poet Gabdulla Tukai, which transfers us to natural places: the river shore and deep backwaters. The main conclusions obtained as a result of the research are the following requirements for the stage costume: 1) taking into account the plot of the play; 2) nature design approach in accordance with the design of the play; 3) consideration of the scenery of the play, which should not be in dissonance with the color combinations of the heroine costume; 4) the use of technological visual effects, which should be based on physical optical effects, including the reflective properties of materials; 5) the coloristic choice from the color wheel, which is formulated as «similar», using blue-cyan shades, and should be tested due to distortion towards neutral grey on stage.

Keywords: *nature design elements, national authenticity features, color, stage costume*

ВВЕДЕНИЕ

Современная интерпретация традиционных ценностей культурного наследия находит выражение в композиционной и эстетической привлекательности сценического костюма. В модельных особенностях сценической одежды отражается смысловая нагрузка соответствующего спектакля.

Целью настоящего исследования стал анализ особенностей композиционных требований к проектируемой сценической одежде на примере женского платья героини сказки «Су Анасы» («Водяная»). Необходимо было оценить, удовлетворяет ли проектируемое швейное изделие следующим требованиям к сценической одежде: 1) учет замысла произведения; 2) использование экологических мотивов в оформлении спектакля и, в частности, одежды; 3) рассмотрение декораций спектакля, которые не должны входить в диссонанс с цветовыми сочетаниями костюма театральной героини; 4) использование визуальных эффектов технологического характера, основанных на физических принципах оптических эффектов, в том числе светоотражающих свойствах материалов; 5) выбор колористического решения с использованием цветового круга.

ТЕОРЕТИЧЕСКАЯ ОСНОВА ИССЛЕДОВАНИЯ

Своеобразие национального колорита в искусстве основывается на фольклорных традициях. Выдающиеся русские художники – А. Головин, И. Билибин, М. Добужинский, Н. Рерих, Л. Бакст, Е. Лансере – принимали активное участие в оформлении спектаклей с уникальными декорациями и сценическими костюмами. Красота сценического движения, живописи декораций, света, уникальных орнаментальных костюмов в произведениях о восточной культуре «Половецкие пляски», «Шахеразада» и др. описывалась в отзывах как бурная праздничность звука и цвета; зрелищность, неистовство движения, звука, формы и цвета (Коржуева А.Р., Сидоренко В.Ф. 2016: 72).

Одним из четких воплощений художественного стиля времени, своеобразным «почерком эпохи», является орнамент. Считается, что орнамент нацелен на украшение изделия, что стимулом орнаментального искусства является желание гармонизировать окружающий мир, внести в него порядок (Уваров В.Д. 2010: 3). Известно, что орнаментальные мотивы классифицируют по типу применяемых изобразительных форм. Для современного орнамента заимствуются архаичные орнаментальные формы народного искусства, в частности это может быть лоскутный фон и цветочный орнамент, что придает новому текстилю национальное своеобразие (Коржуева А.Р., Сидоренко В.Ф. 2016: 78).

В произведении искусства эстетические требования воплощаются в цветовой культуре: использовании языка цвета, приведении цветовых отношений в гармонию, иначе говоря, в гармонии цветовых отношений и выразительности колорита (Долгих Н.Н. 2016: 57).

Экологическое направление дает ориентир для решения о путях приведения цветовых отношений в гармонию. Для экологического направления в дизайне (то есть экодизайна) характерен поиск и развитие стратегии формообразования костюма, художественно-образных и стилевых решений с использованием аналогии, сходством с живой природой. Культурное наследие, с его эстетикой и тектоникой, определением пропорций, площадей и орнаментальных форм, является источником принципов и решений дизайнеров экологического направления (Данилова О.Н. 2017: 200). В концептуальных направлениях экологического проектирования отражаются основные тенденции решения задач представления культурного наследия в контексте общечеловеческих ценностей (Ермилова Д.Ю. 1997: 12). В этно- и экодизайне уделяется особое внимание выявлению композиционной целостности и художественной привлекательности образа для современной интерпретации традиционных ценностей (Каяк А.Б., Данилова О.Н. 2018: 291).

Общепризнано, что в народном костюме, как в фокусе, сосредоточены черты народного сознания. При постановке спектаклей с национальными истоками в сценическом костюме используются детали традиционной татарской национальной одежды (Мухамедова Р.Г. 1997: 5). Для татарского женского костюма отмечаются особенности композиции: приталенный силуэт, использование продольных воланов, тканей с объемным цветочным рисунком, отсутствие больших плоскостей белого цвета, вышивка цветочного орнамента (Захарова Л.Н., Фахрутдинова Ф.Д. 2010: 236).

ОСОБЕННОСТИ КОМПОЗИЦИОННОГО ПОСТРОЕНИЯ СЦЕНИЧЕСКОГО ПЛАТЬЯ ГЕРОИНИ СКАЗКИ «ВОДЯНАЯ»

При проектировании одежды для сцены важно подобрать материалы и цветовую гамму с эстетической точки зрения (Березкин В.И. 1980). Кроме того, сценический костюм несет смысловую нагрузку, что отражается в модельных особенностях швейного изделия. Современная интерпретация традиционных ценностей культурного наследия находит выражение в композиционной и эстетической привлекательности сценического костюма.

Для сценического платья важно учесть замысел произведения. Сюжет народной сказки, пересказанной национальным татарским поэтом Габдуллой Тукаем, переносит нас в природные места: берег реки и глубокие заводи.

Современные информационные технологии позволяют рассмотреть фото и видеозаписи прежних постановок для обеспечения исторической преемственности оформления спектакля (рис. 1). В основу проектируемого швейного изделия положен подход, который учитывает экологические мотивы в оформлении спектакля и визуальные эффекты технологического характера – подбор цветовой гаммы и использование оптических эффектов (от света и блеска). Однако, как свидетельствуют естественнонаучные знания, используемые визуальные эффекты технологического характера должны основываться на физических принципах оптических эффектов, в том числе светоотражающих свойствах материалов (необходим учет искажения в сторону нейтрального серого цвета в свете электрических ламп). Элементы экодизайна находят отражение в проектировании модели сценического платья с точки зрения исторической национальной преемственности, гармонизации его цвета и модельных особенностей с природным окружением.

Необходимым этапом проектирования швейного изделия является рассмотрение декораций спектакля. Несмотря на сказочное содержание и возможное использование самых неожиданных сочетаний цветов в декорациях, природная составляющая сюжета приводит к необходимости учета экологического аспекта в окружении героини: цветовые сочетания декораций окружающего мира и костюма героини не должны входить в диссонанс (рис. 2).

В перечень свойств материалов входят волокнистый и полимерный состав, цветовая гамма (в том числе для основных, отделочных, дополнительных и прикладных скрепляющих материалов). Отметим, что требования конечного потребителя (актера) обычно рассматриваются с точки зрения эксплуатации изделия, а именно гигиеничности, устойчивости к загрязнениям и чисткам. При проектировании модели сценического платья на основе анализа характеристик материалов подобран пакет материалов (креп-шифон, креп-кошибо, состав 100 % полиэфир; ниток 45 ЛЛ, лавсан). Для сценического платья предлагается использовать подкладочный материал искусственного состава – вискозу (целлюлозу). Для сценического платья в качестве основных («тканей верха») предлагается использовать материалы синтетического состава, имеющие поверхностный оптический эффект блеска. Лоскуты из таких материалов – вертикальные воланы в юбке изделия – имитируют движение волн воды при перемещении героини.

Рисунок 1: Изображения героини сказки в художественных произведениях (картина на холсте, мозаика в метрополитене, иллюстрация в книге)

Рисунок 2: Фрагмент декорации спектакля

Экологическое направление дает ориентир для решения о путях приведения цветовых отношений в гармонию. Выразительность колорита, количество каждого цвета по площади, а также диапазон цветового ряда национальных орнаментов сценической одежды главной героини находятся во взаимной увязке с ее окружением, то есть в гармоничных отношениях с колористическим оформлением костюмов других героев и декораций нетронутой дикой природы.

При декорировании женского сценического платья предлагается применение лоскута различных форм (рис. 3). В членениях одежды используются линии, которые служат одновременно в качестве основных границ лоскутов. Орнамент вышивки и аппликации состоит из фрагментов, созвучных экологичным, цветочным национальным татарским мотивам. При подборе цветовой гаммы швейного изделия по схеме для определения гармоничных цветов подбирались природные оттенки в соответствии с сюжетом сценария.

Для выбора цветовой гаммы использованы аспекты теории цвета: сочетания цветов через треугольники в двенадцатичастном цветовом круге (рис. 4).

С использованием классификации сочетания цветов, выделенных из цветового круга, при проектировании сценического швейного изделия было подобрано аналогичное цветовое решение. Зеленый цвет в дизайне платья сопровождается материалами с переходными в желтый и синий оттенками, что создает эффект переливания воды при движении героини в виртуальном водоеме. Ввиду присутствия сине-голубых оттенков в цветовой гамме швейного изделия материалы нужно апробировать в свете софитов театральной сцены, проверяя возможное искажение в сторону нейтрального серого цвета.

Новым является то, что в основу проектируемого швейного изделия положен подход, учитывающий экологические мотивы в оформлении спектакля, а также визуальные эффекты технологического характера – подбор цветовой гаммы и использование оптических эффектов.

Рисунок 3: Технологические приемы для оформления сценического платья и спектакля (лоскутные технологии, софиты, вышивка, текстильный материал с эффектом блеска)

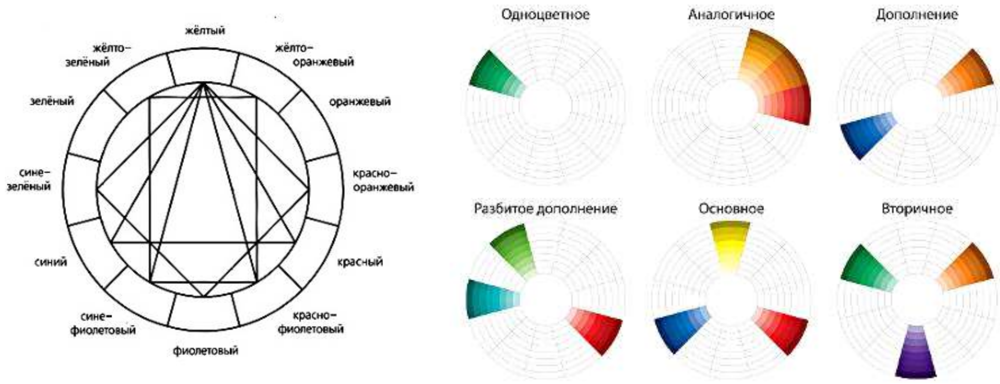

Рисунок 4: Схемы для определения гармоничных цветов

ВЫВОД

Сценическая одежда героини спектакля «Су анасы», отражая замысел произведения Г. Тукая, имея выразительность колорита и национальный орнамент, играет роль носителя татарского культурного наследия.

В моделях сценической одежды, проектируемой для национальных спектаклей с участием природных компонентов, должны быть учтены исторические, национальные источники творчества, экологический аспект, который отражается в колористическом решении, выбранном для оформления костюма: подборе цветовой гаммы швейного изделия с использованием природных оттенков в соответствии с сюжетом сценария, а также в соответствии со схемой (цветовым кругом) для определения гармоничных цветов.

Обогащению и художественному развитию сценических моделей одежды с национальными мотивами способствуют композиционные (определенным силуэтом, лоскутным фоном), фактурные (с оптическим эффектом блеска от материалов) и орнаментальные (с цветочными формами) решения.

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Роль символики цвета в драме Оскара Уайльда «Саломея»

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ABSTRACT
The article considers Oscar Wilde's play "Salome" as an example of English aestheticism. The role of color symbolism in depicting internal conflict, contrasting characters and constructing the space of "Salome" is emphasized. Wilde, based on biblical text, masterfully interprets a limited color palette that directly or indirectly refer to "The Song of Songs" and the gospel story of the beheading of John the Baptist. Another source of inspiration for the playwright is J.-K. Huysmans's novel "À rebours" describes the pictures of Salome by the French artist G. Moreau. Color plays a key role in the description of central characters, and especially the image of Salome. With the help of color, the author highlights the difference in Salome's perception of other characters: a young Syrian sees her purity and integrity; accordingly, his vision is painted by white. Herod's vision changes as the action develops, as Salome herself changes - white gradually gives way to red, passion takes over the virginity of the princess.
Using color symbolism, Oscar Wilde creates an image of space in the text of the play: the light of the moon, the blood stain on the ground, the reflection of the color of blood in the color of the moon creates the dynamics of space, then open - facing upwards, then closed boundary of blood color, which creates a sense of hopelessness - in the finale the scene is immersed in the dark. Thus, the symbolism of color becomes the most significant artistic method in "Salome".
The authors of the study come to the conclusion that the role of color in O. Wilde's play is due, on the one hand, to the concept of aestheticism, the theorist of which was the author, and on the other - the influence of the aesthetics of the Parnassus School, which embodies the idea of "pure art", the tradition of ecphrasis.

Keywords: *color symbolism; the myth of Salome; the image of the moon; Oscar Wilde*

ВВЕДЕНИЕ

Эстетизм, теоретические основы и художественная практика которого нашли своё выражение в творчестве Оскара Уайльда, отражает идею приоритета формы над содержанием. Особенностью поэтики английского писателя становится пристальное внимание к внешнему облику персонажей и предметов, декоративность изображаемого и символизм. Использование символов помогает подчеркнуть вневременность проблематики и образов текста, наполнить произведение скрытыми, подчас непостижимыми разуму смыслами.

Цвет и его значение является предметом исследования философии и символики искусства. С древних времён символика цвета играла значимую роль в культурах разных регионов: цвет играл роль оберега, соотносился с какой-либо стихией или обозначал статус и социальную роль. О философии цвета говорил ещё древнегреческий философ Аристотель, о его символике – Иоганн Вольфганг Гёте, автор знаменитого «Учения о цвете». Как правило, знания из области колористики связаны в первую очередь с визуальными видами искусства, однако цвет играет не менее значительную роль и в литературных произведениях.

ЗАМЫСЕЛ УАЙЛЬДА: МИФ О САЛОМЕЕ В ИСКУССТВЕ ПОСЛЕДНЕЙ ТРЕТИ XIX ВЕКА

В драме Оскара Уайльда «Саломея» (1891) библейский сюжет об обезглавливании Иоанна Крестителя получает принципиально новое воплощение в духе эпохи декаданса. Перед нами не история смерти ветхозаветного пророка, но сцена всеразрушающей страсти, кульминацией которой становится языческий танец Саломеи и поцелуй отрубленной головы Иоканаана. Проследить динамику внутреннего конфликта драмы возможно, обратившись к цветовой символике и изменению цвета, так как именно колористическая метафора становится основным художественным средством при воплощении центральных образов «Саломеи».

Уайльд долгое время вынашивал замысел истории о библейской царевне и её страстной любви к пророку. Возможно, в его жизни бывали «периоды абсолютной одержимости Саломеей» (Нежинская 2018: 175). Писатель был знаком буквально со всеми, даже самыми незначительными, литературными произведениями конца XIX века, в которых воплощался образ Саломеи. Особое влияние на Уайльда оказал роман Ж.-К. Гюисманса «Наоборот» (1884), где дочь Иродиады показана через описание картин Гюстава Моро. Таким образом, в восприятии английского драматурга Саломея изначально предстаёт как произведение искусства, что отражается на поэтике языка драмы.

СИМВОЛИКА ЦВЕТА В СОЗДАНИИ ОБРАЗОВ САЛОМЕИ И ИОКАНААНА

Изначально мы видим Саломею глазами молодого сирийского война, влюбленного в царевну. Любуясь красотой луны, он говорит: «She is like a little princess who wears a yellow veil and whose feet are of *silver*» / «Она похожа на маленькую царевну в желтом покрывале, ноги которой из *серебра*» (Wilde 1997). Луна отождествляется автором с Саломеей, «что, с одной стороны, характеризует саму героиню, с другой – тех персонажей, которые сравнивают её с луной» (Валова 2010: 87). Некоторые исследователи, в частности, Н.Ю. Бартош, возводят образ уайльдовской Саломеи к архетипу Великой Богини, «к её Лунной, или *Белой*», ипостаси (Бартош 2008: 138). В греческой мифологии луна отождествляется не только с Селеной, но также с Гекатой и Артемидой. С последними связана «функция запрета на лицезрение богини» (Бартош 2008: 139). Подобные запрет мы видим и в «Саломее»: сначала паж Иродиады просит сирийского воина не смотреть на царевну, после сама Иродиада упрекает Ирода в том, что тот слишком часто смотрит на её дочь. Однако в видении тетрарха и молодого сирийца существует значительная разница. Ирод, прислушиваясь к словам пророка, наблюдает за изменением луны и чувствует, как меняется Саломея. Если при первом появлении он говорит, что царевна болезненно *бледна* («never have I see her so *pale*»), то по мере приближения к кульминации – танцу Саломеи – ее образ в его восприятии приобретает оттенки *красного*: «How *red* those petals are! They are like stains of *blood* on the cloth» / «Как *красны* эти лепестки! Они как пятна *крови* на скатерти» (Wilde 1997). Кровавый цвет приобретает и луна. В восприятии молодого сирийца Саломея предстаёт как чистое, непорочное создание: царевна подобна отражению *белой* розы в *серебряном* зеркале («the shadow of the *white* rose in a mirror of silver»), лилии, нарциссу и *серебряному* цветку («a *silver* flower»). Подобные сравнения отсылают читателя к эстетике Парнасской школы и жанру экфрасиса, который предполагал описание живых существ как произведений искусства.

Поэтичность образов и языка Уайльда в «Саломее» во многом восходит к «Песне Песней» царя Соломона, однако и здесь английский драматург интерпретирует библейский текст соответственно собственному эстетическому видению. Древнееврейская поэма состоит из ряда фрагментов, в которых «изображается страстная и нежная любовь между Влюбленным и Возлюбленной, которые встречаются и разлучаются, ищут и находят друг друга» (Нежинская 2018: 181-182). Маскулинное и феминное начала в поэме разграничены чётко, тогда как в драме Уайльда мы видим трансформацию образов Влюбленного и Возлюбленной. Саломея становится носительницей языка Влюбленного, тем самым перенимая на себя активную, маскулинную роль в развитии конфликта; роль Возлюбленной достаётся Иоканаану. Уайльд по-своему трактует цвета, встречающиеся в «Песне Песней», что помогает добиться гендерной инверсии центральных персонажей. В Библии Влюбленный восхищается глазами Возлюбленной; в драме Уайльда Саломея с ужасом смотрит в глаза Иоканаана: «They are like *black holes* burned by torches in a Tyrian tapestry. They are like *black caverns* where dragons dwell. They are like the black caverns of Egypt in which the dragons make their lairs. They are like *black lakes* troubled by *fantastic moons*…» (Wilde 1997) / «Они точно *черные дыры*, прожженные факелами в тирских коврах. Точно *черные пещеры*, где живут драконы, черные пещеры Египта, где находят себе пристанище драконы. Точно *черные озера*, возмущенные *призрачными лунами*...» (Уайльд 2017: 3 3). Глаза пророка предвещают гибель, так как чёрный цвет традиционно символизирует смерть, отчаяние и боль. Особый интерес вызывает последнее сравнение: Саломея, подобная луне, нарушает уединение Иоканаана – и сразу видит в его глазах собственное отражение в качестве палача пророка.

Ужас, испытанный царевной от взгляда Иоканаана, сменяется восхищением его телом. Влюбленный в «Песне Песней» также воспевает красоту избранницы: «Округление бедер твоих, как ожерелье, дело рук искусного художника; живот твой – круглая чаша, в которой не истощается ароматное *вино*; чрево твоё – ворох пшеницы, обставленный *лилиями»* (Песн. 7: 2–3).

В формах Возлюбленной Влюбленный видит символы богатства, плодородия и процветания. Белый цвет лилии и красный цвет вина в поэме ассоциируются с девственной чистотой и красотой девушки. Саломея, говоря о Иоканаане, сравнивает его с тонкой фигурой из *слоновой кости* («a thin *ivory* statue»), фигурой из *серебра* («an image of *silver»*), с *месяцем* и *серебряным лучом луны* («a *moonbeam»*); тело пророка белее, чем *лилии* луга («*lilies* of a field»), *розы* в саду аравийской царицы, *лоно луны* («the *breast of the moon*»). В подобных сравнениях ярко проявляется сходство между царевной и пророком, подчеркивается андрогинность персонажей. Саломея воспринимает Иоканаана так, как её саму видел в начале пьесы молодой сириец – отвергнутый Влюбленный. Однако восхищение белизной тела практически мгновенно сменяется отвращением: «Thy body is hideous <…>. It is like a *whitened sepulchre* full of loathsome things» (Wilde 1997) / «Твое тело отвратительно <…>. Оно точно *выбеленная гробница*, которая полна мерзостей» (Уайльд 2017: 33). Здесь белый уже не ассоциируется с чистотой и невинностью, на первый план выходит холодность и *мертвенная бледность* Иоканаана, ведь пророк обязан блюсти целомудрие, потому не может даровать любовь и жизнь.

Подобно библейскому Влюбленному, Саломея воспевает кудри Иоканаана: волосы пророка чернее, чем *гроздья винограда* в садах Эдома («the clusters of *black grapes*»), долгие *чёрные ночи* («long *black nights*»), *безмолвие*, что таится в лесах («the *silence* that dwells in the forest»). Мишель Пастуро, посвятивший изучению семантики и символики цвета ряд монографических работ, отмечает двойственную семантику чёрного в древних культурах. Если вновь обратиться к описанию взора Иоканаана, то в данном случае актуализируется представление о черном как цвете страдания и несчастья; такой вывод подтверждает и ассоциативный ряд, выстроенный Саломеей (пещеры, где обитают драконы). Однако когда царевна восхищается волосами Иоканаана, «черный как цвет земли ассоциируется с плодородием» (Пастуро 2017: 19), о чём свидетельствует сравнение волос с гроздьями винограда. В «Песне песней» Влюбленный сравнивает волосы Возлюбленной со «стадом коз, сходящих с горы Галаадской» (Песн. 6: 6), тем самым подчеркивая красоту девушки. И вновь вслед за восхищением чернотой волос следует отвращение и ужас: «Thy hair is horrible. It is covered with mire and dust. <…> It is like a *knot of black serpents* writhing round thy neck» (Wilde 1997) / «Твои волосы ужасны. Они покрыты грязью и пылью. <…> Точно *узел черных змей*, которые вьются вокруг твоей шеи» (Уайльд 2017: 34).

Наконец, Саломея понимает, что влюблена в рот Иоканаана. В цветовом отношении именно описание губ пророка становится переломным моментом в пьесе – белый, до этого выступавший в качестве ведущего цвета, уступает красному. Саломея говорит, что рот Иоканаана как *алая перевязь* на башне из слоновой кости («a *band of scarlet* on a tower of ivory»), *гранат*, разрезанный ножом из слоновой кости («*pomegranates* cut with a knife of ivory»), *цветы граната*, что цветут в садах Тира («*pomegranate-flowers* that blossom in the garden of Tyre»), *красные крики боевых труб* («*red blasts of trumpets*»), лук персидского царя, выкрашенный *киноварью* и с рогами из *кораллов* («the bow of the King of the Persians, that is painted with *vermilion*, and is tipped with *coral*»). Красный, «цвет огня и крови» (Пастуро 2019: 18), обладает наиболее широким спектром символических значений в трагедии: изменение цветовой гаммы от белого к красному сопровождает трансформацию самой Саломеи. Если в начале пьесы перед нами предстаёт царевна, поклявшаяся хранить девство и неспособная вытерпеть взгляда Ирода, то в момент кульминации мы видим Саломею, опьяненную страстью к Иоканаану, «богиню вечного исступления, вечного сладострастия» (Нежинская 2018: 179). Царевна танцует в луже крови молодого сирийца, любовь которого она отвергла, для своего отчима, который ей омерзителен, чтобы получить то, что она желает более всего – поцелуй пророка-фанатика, который никогда не сможет увидеть и полюбить её.

Если основной колорит драмы выдержан в оттенках белого, черного и красного, то для описания отдельных деталей Уайльд значительно расширяет цветовую палитру. Из второстепенных цветов особое место занимает зелёный. Саломея, стремясь увидеть Иоканаана, обещает бросить молодому сирийцу маленький *зелёный цветок* («a little *green flower*»), что отсылает читателя к уайльдовской зелёной гвоздике. Примечательно, что после самоубийства сирийского воина паж Иродиады, убитый горем, вспоминает, что дарил ему *кольцо из агата* («a *ring of agate*») – камня зелёного цвета – и признаёт, что молодой сириец был ему ближе, чем брат. Наконец, Ирод предлагает Саломее самый большой *изумруд* в мире («the largest *emerald* in a whole world»), лишь бы та отказалась от желанной кровавой награды за танец семи покрывал. Для Саломеи ценность изумруда совершенно ничтожна. Для сирийского война маленький зеленый цветок, что обещала ему царевна, ценнее агатового кольца, подарка ещё одного отвергнутого Влюбленного. Оттенки драгоценных, полудрагоценных камней, упоминаемых в «Саломее», придают пьесе вид произведения ювелирного, а не литературного искусства – что, впрочем, характерно для эстетики Уайльда.

ВЫВОД

Символика цвета в «Саломее» является основным средством выражения внутреннего конфликта героев драмы Оскара Уайльда. Ни опьяненная любовью Саломея, ни фанатичный в своём воздержании Иоканаан не выходят победителями в этом противостоянии – олицетворяя две крайности одного чувства, они слишком похожи. Царевна и пророк видят то, что хотят видеть, и отвергают любовь, что им готовы дарить. Цветовая гамма меняется от белого, цвета девственной чистоты, к красному, цвету всеразрушающей страсти, – но итогом остаётся лишь чёрная пустота.

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The colors of "Toute Une Nuit": a study of color restoration in film

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ABSTRACT
"Toute Une Nuit" (1982) is a Belgian-French drama written and directed by Chantal Akerman. The film takes place during a whole summer night in Brussels, where different characters go out in the city, have chance encounters and romantic contacts. The restoration of this film presented different challenges concerning the color correction. While it was essential to restore the original film colors preserving the color cast of the night scenes but removing the effect of film aging and decay. To this purpose, we tested two different approaches: the traditional manual color correction and the color enhancement through Spatial Color Algorithms (SCAs).

The first approach follows the standard movie restoration workflow, which employs video editing software to make standard operations like white balancing or contrast and saturation enhancement. On the other hand, the restoration through SCAs, allows to enhance every pixel in the image in a controlled and objective way. In particular, SCAs enhance colors with a local and global approach, simulating some specific characteristics of the Human Visual System. Thus, SCAs permit an alternative approach to color restoration, re-creating the original color appearance.

In this work, we present the restoration of some frames and scenes from the film "Toute une nuit" using the two different approaches. The limits and potentials of each method are analyzed and discussed, with a particular focus on the problems that restorers must face when trying to preserve and restore a film from the unavoidable damage of time.

Keywords: *movie restoration, color correction, color enhancement*

INTRODUCTION

Cinema is born as a show, a commercial means to fascinate the audience and earn money and fame. Film preservation and conservation started just in the 1930s, with the birth of the first film archives and libraries, and from that year onwards, films started being considered as physical objects in need of protection and safeguard (Catanese 2013). Therefore, it is not surprising that today it is estimated that only 25% of the films released between 1900 and 1913 and only 35% of the films released between 1913 and 1930 have been preserved (Cornwell-Clyne 1936, Kehr 2010).

Thus, film restoration and preservation are fundamental, because films are subject to the decay of the film base and to the aging of the emulsion dyes. In general, the traditional film restoration workflow is composed by the following steps: historical research, analog restoration, digitization, digital restoration and conservation (Cornwell-Clyne 1936, Enticknap 2013). Today, the scientific research in the field of historical research and analog restoration is widely spread, and there are many threads focused on topics like film authentication, historical reconstruction or developments of new materials for base and emulsion conservation and physical restoration (Fossati 2009). Nevertheless, the research in the fields of digitization and digital restoration is still limited and left to private companies and software developers (Plutino and Rizzi 2020).

Film restoration can be divided in two main fields: digital restoration *per se* (e.g., dust and scratch removal) and color restoration (e.g., white balancing, color enhancement) (Enticknap 2013, Kokaram, 2013). The main advantage of the digital technologies is that every restoration process is reversible and controllable, so much that today those methods raise the issue of an excessive intervention. In fact, the main issue in film restoration is that, color correction is often made through image editing softwares and it is subjective, and dependant by the experience of the restorer. From this, many laboratories and archives defined different guidelines and regulations to perform film restorations, but in every case the final restoration assessment and evaluation is left to the subjectivity of the film curator (Boarini and Opela 2010).

This paper presents an alternative objective approach to film restoration in order to better support the work of the restorer in the color correction step. Furthermore, the main limits of the traditional manual restoration are underlined and discussed. All the tests and results are evaluated on the frames of the Franco-Belgian film "Toute Une Nuit", written and directed by Chantal Akerman in 1982.

MATERIALS AND METHOD

The film. "Toute Une Nuit" is a film shot with a 35mm format, lasting 90 minutes, in color. The film direction, subject and screenplay are by Chantal Akerman. The whole film is guided by the *leitmotif* "love will forgive" by Gino Lorenzi and is about love affairs and relationships taking place in a long and silent summer night in Bruxelles. The film can be divided in three main parts: night, dawn and morning. This film, can be described as a visual artwork, which defines the development of the artistic path of the director. In this work, the whole film has been divided in scenes, and just some frames and sequences have been subject to the manual restoration and the SCAs color enhancement.

Manual color correction software. The software Da Vinci Resolve (Black Magic Design 2020) has been used in order to perform the manual color correction of some selected sequences of the film "Toute Une Nuit". The manual color correction has been performed on PCs with calibrated Eizo monitors. In this work, the software has been used also to perform the automatic division of the film in sequences. This step is fundamental in film restoration, because it allows a faster video elaboration and the color correction of all the frames belonging to the same sequence. After the scene detection and subdivision, the manual color correction has been performed on some selected sequences following the steps of white calibration, saturation correction and contrast correction (Haine 2019). The white calibration has been performed operating manually on the three RGB primaries bars, balancing each channel and equalizing the values of each channel in the range [0, 255]. The contrast and saturation correction have been made manually and the lack of references and standard guidelines produced subjective results depending on the restorer's experience.

Spatial color algorithms (SCAs). The main idea behind the use of Spatial Color Algorithms in film restoration, is to restore the original appearance of the frames. This alternative approach was proposed by Ernst Gombrich (1960) and has been already tested in different works (Barricelli et al. 2020). In film restoration, in fact, a color reconstruction from the physical and chemical characteristics of the support and the emulsion is impossible. A colorimetric dye reconstruction is often not sufficient to obtain a satisfying restoration result, in fact, the colors of a film are not defined just by the dyes used in the emulsion layer, but are the result of the projection of the film through specific instruments and in defined environments. Today, much of the data about film dyes and analog film production have been lost, and, in this context, even if an accurate colorimetric characterization based on film materials is performed, the gamut differences across the many devices in the film production and restoration pipeline make the effort worthless (Plutino and Rizzi 2020).

From these considerations, we performed color appearance restoration using SCAs, a family of algorithms which simulate some features of the Human Visual System (HVS). Spatial Color Algorithms are based on the idea that a color does not depend just by the physical stimulus, but also by the spatial arrangement of a scene (McCann 2016). This family of algorithms, thanks to their ability to simulate visual features like simultaneous contrast and lightness constancy, are particularly appreciated for HDR (High Dynamic Range) renderings, gamut mappings or analog-to-digital dynamic range reconstruction.

Among SCAs wide family, for this study, we selected ACE (Automatic Color Equalization) algorithm presented for the first time by Rizzi et al. (2003). ACE algorithm performs a local and global image enhancement comparing every pixel in the input image to compute the output. Giving an input image (*I*), the enhanced image (*O*) is produced:

$$O = \frac{\frac{\sum_{p \in I, p \neq q} slope\ (I(p) - I(q))}{\|p - q\|}}{\sum_{p \in I, p \neq q} \frac{1}{\|p - q\|}}$$

Where, *I(p*) and *I(q)* are respectively the value of the considered pixel and the value of every other pixel in the image at coordinates *p* and *q*. || · || denotes the Euclidean norm and the slope function is a non-linear amplification function:

$$slope\ (I(p) - I(q)) = \begin{cases} -1 & if\ I(p) - I(q) \leq -thr \\ \frac{p_i - p_j}{thr} & if\ -thr < I(p) - I(q) < thr \\ 1 & if\ I(p) - I(q) \geq thr \end{cases}$$

The slope function causes the contrast tuning effect in ACE algorithm, in fact the growth of slope value causes a growth in contrast. The value of slope is the only parameter in ACE algorithm (Figure 1). In this work ACE parameter tuning is performed on the key-frame extracted from every scene. Since the analyzed film was in a good conservation condition, we generally used a low slope parameter (≈ 5).

RESULTS AND DISCUSSION

Figure 1: Frame restored with different ACE slope parameters.

Usually, in the traditional film restoration workflow, the quality control is performed by the film curator or the project manager, who defines the best restoration parameters from their experience. This quality assessment is totally subjective and dependant on the expertise of the film curator. This problem of film restoration quality assessment has already been underlined by Plutino and Rizzi (2020) and has been addressed by Barricelli et al. (2020) with the proposal of a new framework for the evaluation of image quality in film restoration. In this work, in order to assess the quality of the restored frame and to compare ACE and manual restoration, some features of the Image Quality Cockpit presented by Barricelli et al. (2020) has been used. Table 1 reports the considered values of brightness, contrast, histogram flatness (HF) and coefficient of local variation (CLV).

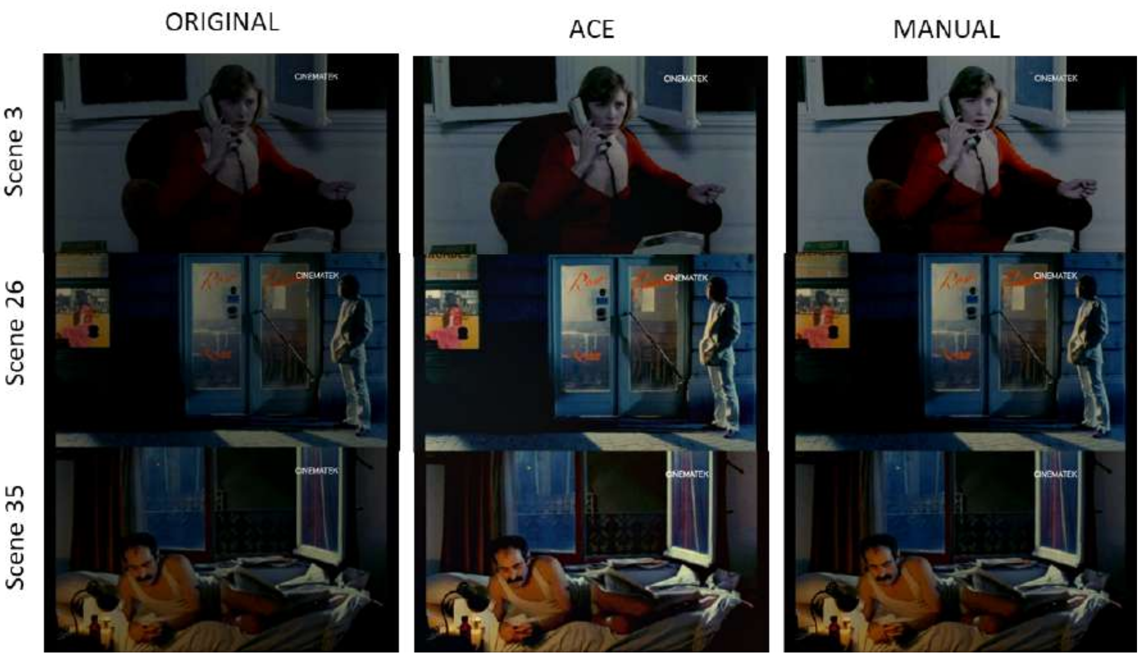

Figure 2: Frames in original version, restored through ACE algorithm and manually through Da Vinci Resolve.

The brightness evaluation is useful, mainly to define how much the different enhancement method increase not only the general luminance (L*) channel, but also the single RGB channels. A significant example is represented by the frame of scene 26 restored through ACE. In this case the RGB values are doubled and the L* value goes from 10.6 to 19.7. In the same scene, the manual restoration still provides a brightness enhancement, but it is not as strong as in ACE. Considering now the single values of RGB, the variance among them could indicate the presence of color contaminants. Anyway, since in this case the variance among the average RGB values is below 5, the possible color casts are not visible in the output images.

The main advantage of evaluating different restoration methods using the Image Quality Cockpit is that the work of the restorer or of the curator can be supported by objective metrics. Furthermore, the possibility to identify the modifications made in different features of the images is useful to identify the alterations introduced by the enhancements.

In conclusion, visually comparing the results in Figure 2, it is clear that the output produced by ACE is fully acceptable and satisfying. Furthermore, the data shown in Table 1 evidence many similarities among the manual and ACE restoration and it is clear that ACE enhances many image features. In this context, it must be considered that ACE is a fully automatic and unsupervised algorithm. As a consequence, this method does not require user expertise in film restoration or in the use of image editing softwares and could be easily performed in shorter timescales by non-professional users.

Scene 3							
	Brightness						
	L*	**R**	**G**	**B**	**Contrast**	**HF**	**CLV**
Original	9.36	21.15	23.37	25.45	0.01	35784.17	3.63
ACE	11.81	26.90	29.25	31.85	0.01	23810.98	1.78
Manual	20.35	47.24	47.82	50.28	0.01	32012.16	1.54
Scene 26							
	Brightness						
	L*	**R**	**G**	**B**	**Contrast**	**HF**	**CLV**
Original	10.64	21.22	27.14	29.23	0.02	1064.79	0.68
ACE	19.72	40.53	49.43	53.10	0.03	784.74	0.46
Manual	14.61	29.14	36.00	39.60	0.03	892.45	0.61
Scene 35							
	Brightness						
	L*	**R**	**G**	**B**	**Contrast**	**HF**	**CLV**
Original	9.01	23.57	22.64	19.77	0.02	1122.23	0.72
ACE	17.14	46.29	40.38	37.12	0.03	880.73	0.54
Manual	12.09	31.21	29.00	25.94	0.03	1010.00	0.68

Table 1: Values of brightness, contrast, histogram flatness (HF), and coefficient of local variation (CLV).

CONCLUSION

The film “Toute Une Nuit” by Chantal Akerman presented many challenges concerning color correction. In fact, it was necessary to restore and preserve the original colors, faded by time, and to do so, two different approaches have been tested. The first approach required the use of a video editing software to manually restore the original colors of the film frames. This approach requires expertise in film restoration and knowledge in the use of the software in order to avoid errors, excessive intervention, or wrong equalizations. The second approach involved the use of ACE, an algorithms of the SCAs family, which performs automatically a global and local pixel enhancement simulating some features of the visual system. This approach follows the alternative idea of restoration of the original appearance, instead of the original physical colors.

In this work, the two enhancement methods have been compared and a quality assessment using the Image Quality Cockpit has been performed. Thanks to this objective evaluation it has been possible to evaluate ACE color correction, providing an alternative way to restore colors in films, which is no more dependant on the professionalism of the user and prone to long restoration times and high costs.

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A colour is worth a thousand words! A colour-based tool to foster communication in culturally-plural teams

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ABSTRACT
Design institutions have increasingly adopted collaborative design-based learning in culturally plural classes, which supports the development of soft skills. In this context, teams could face differences in language, background and approaches to design, and students may find difficulties in communicating their own thoughts and feelings when evaluating teamwork, self and peers. The researchers glimpsed the possibility of conveying students' reflection by using the visual language, focusing on communication through colours. The method was designed with the idea that colours can take on very different meanings for each individual, providing a wider freedom of expression. The paper presents a visual evaluation tool, the Teamwork Colour Matrix (TCM), and its preliminary test within a plural design class. The TCM has been used by students for the spontaneous representation of teamwork by coding the experience through the personal association of feelings with eight given colours. The results showed that all the students were able to evaluate their experiences using colour communication. With the TCM, students find their own individual way of communicating to teammates, through the abstract representation of their personal experience in the team. The test of the TCM shows that even novice designers could communicate complex messages and feelings by using a language based on colours, and that a further development of colour-based tools could represent a useful resource for students and teachers beyond the design discipline.

Keywords: *colour in communication, colour psychology, design education, cross-cultural teamwork*

INTRODUCTION

In recent decades, organisations have increasingly adopted cross-cultural teamwork as an effective strategy to address complex contemporary challenges. Besides, educational institutions are also supporting international and interdisciplinary study programs (Larrick 2016) and, consequently, cross-cultural teamwork is becoming the daily reality of many students and teachers especially in design education, where collective project-based learning is widely used (Dutton 1987). Team members need to be supported to serenely contribute to the projects and express their different knowledge. Academic training should therefore provide the tools to strengthen mutual understanding by overcoming cultural and language barriers. Alternative forms of communication could be combined with the spoken language to help overcome the challenges related to cultural plurality. The visual elements are fundamental knowledge in the field of design and could be the key shared understanding to foster communication in design groups. Design and visual arts have a long history of techniques for teaching visual elements (e.g., line, shape, tone, colour, pattern, texture), which are considered as the alphabet that allows designers to develop their visual communication skills. The need to develop a new knowledge about cross-cultural collaboration is a necessity of our time, but this new knowledge can be supported by the ancient knowledge of colours.

THEORY

Soft skills, defined as the abilities to work constructively and harmoniously with others, are widely recognised as fundamental skills to be competitive in the work field (Davies et al. 2011). A breeding ground for the development of such skills is provided by collaborative design-based learning (collaborative DBL), defined by Gómez Puente (2014) as the pedagogical approach where students learn how to design by developing a design project collaboratively. In this context learners must confront teamwork which becomes a crucial activity that runs with the project work. Hence, being trained through collaborations, students also improve their soft skills (e.g., social skills, communication skills) (Tracey et al. 2014). Students also face the challenges related to teamwork such as time management, disagreements, different working and communication styles, just to mention a few. When collaborative DBL takes place in international and interdisciplinary classes, the students face the harder challenge to perform cross-cultural teamwork, which brings together people from different ethnicity, religion, language, gender, nations, professions, religions, backgrounds (Mahadevan 2017). The presence of different worldviews in the team requires members to undertake cultural adaptation. Mattioli et al. (2019) showed that teachers can support students' critical reflection on teamwork through structured activities about team, self-evaluation and peer evaluation. These activities can provide a space for students to ask themselves some relevant questions (i.e., How did we work as a team? What could have been improved? What worked well? How did I and the others contribute to teamwork? How did I feel during the experience?), enhancing students' awareness about the individual soft-skills developed throughout the teamwork. However, it's not always easy for everybody to freely reflect and share their thoughts and feelings. This becomes even harder if it should be done in a foreign language, assuming English as *lingua franca*. In this regard, cultural barriers and language barriers could constitute an obstacle for students during this kind of activity. Referring to language as the "shared vocabulary within a specific context" (Patel et al. 2018), the researchers glimpsed the possibility of conveying the students' reflection by using a shared language among all designers: the visual language, which is the basis of design discipline. Indeed, when design concepts become visible, they acquire a shape, colour, measure and texture. In other words, visual elements are the way we really see a concept (Wong 1993). The representational or symbolic level of visual grammar is governed intensely by direct experience that goes beyond perception and, as a common, complex and intuitive language, it is conducive to breaking communication barriers through the association of concepts. The potentialities of visual language to communicate between cultures, generations, or plural groups of people, is related to our ability to deduct information and to associate feelings and emotions to images or visual elements or, as up to Dondis (1976:26), "sometimes to see a process is enough to understand how it works." We propose the use of the principles of visual communication, mainly through colour and shape, to activate the dialog inside the team, where the regularity of the 'grid' element becomes a starting point, from which the possibilities of total or partial transformation, modification and deviation can be sought through the use of colours.

METHOD AND EXPERIMENT

The method was designed to prove that visual elements could effectively support communication in culturally-plural design teams, especially when it comes to evaluating the way teamwork has been carried out. This first research was aimed at investigating if culturally-plural students could be supported by visual communication through colours for evaluating the team, self-evaluation and peer evaluation for building mutual understanding. To this extent, we designed a tool and qualitatively tested it within a plural design class. The tool consists in the realisation of a Teamwork Colour Matrix (TCM) for the spontaneous representation of the complete teamwork experience by using colours. This matrix is a blank orthogonal grid (Figure 1), intended to be the canvas where students express their personal interpretation of the experience by creating a composition with coloured paper. The grid consists of two essential parts, one for the group evaluation and other for individual performances. The group evaluation (part 1) is composed by a succession of 10 vertical rectangles, that can be interpreted as portions of time, moments or percentages aimed at dividing the teamwork experience. The individual performance (part 2), as well, presents a succession of 10 squares for each student in the team (1,2,3 … n) as the different performances can be compared with the different moments represented on the group evaluation. Together with the canvas, the students receive a selection of colours to create the visual composition inside the matrix. For a reliable reproduction of the experiment, it was decided to work with Canson Mi-Teintes pulp-dyed top-quality colour paper, which complies with the ISO 9706 standard on permanence, a guarantee of excellent colour performance and conservation. The chromatic palette consists of eight colours (Figure 1, from top to bottom): White (111 Ivory), Grey (431 Steel Grey), Violet (113 Blueberry), Green (480 Light Green), Orange (453 Orange), Red (116 Burgundy), Blue (140 Indigo Blue), Black (425 Black). Colours were selected by their heterogeneity, this is, different hues (chromatic and achromatic hues; secondary or tertiary colours); different brightness (from high to low) and different saturations (from high to low). The diversity of the chromatic palette is intended to motivate the students to visually represent different moods, moments or meanings when communicating the teamwork experience. In other words, the eight selected colours are conducive to be linked to semantic poles (Osgood et al. 1967, Valdez and Mehrabian 1994) such as positive-negative, intense-dull, active-passive and simple-complex associations, among others.

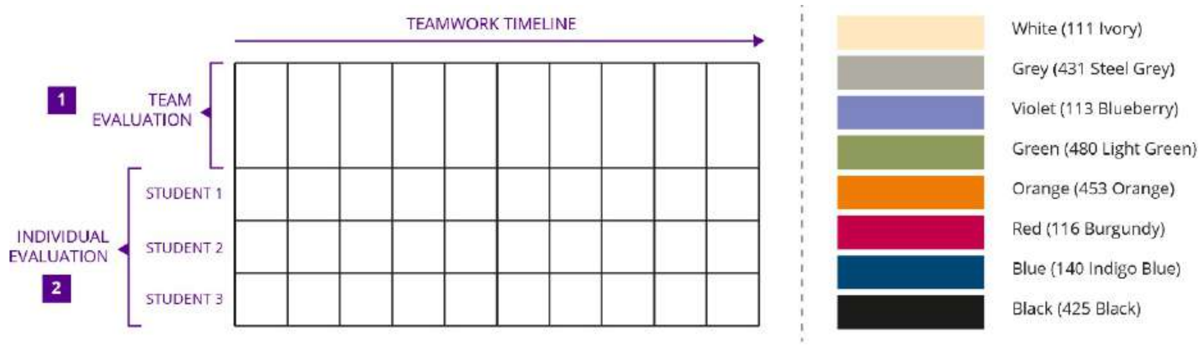

Figure 1: Teamwork Colour Matrix (detail) includes Part 1, team evaluation with teamwork timeline divided in ten units (top), and Part 2, individual evaluation divided in student 1, student 2, student 3 (right bottom, three rows). Selected palette of coloured paper Canson Mi-Teintes: white, grey, violet, green, orange, red, blue, black (left, top to bottom).

After the realisation of the visual composition (part 1), students are asked to produce a brief written document to support the chromatic representation and rationalise their feelings and associations. Then, students visually represent the self and peer performances (part 2). Again, after colouring the matrix, students are asked to write a brief explanation of their use of colours. After the matrices are done, students gather in the teams with the purpose to explain and discuss their TCMs, as a starting point to motivate conversation about teamwork supported by visual communication. This activity is meant to discuss and share their individual experiences and to produce a shared understanding of the collective experience of the work together. Finally, every team meets with the researchers to review the results of the activity and to externalise the shared understanding, providing and receiving feedback.

The tool was preliminary tested at the end of the design studio course of the interdisciplinary one-year master program Industrial Design for Architecture of POLI.Design, Politecnico di Milano. The students, architects and designers, are trained to design high quality projects in the field of interior design and architecture, with a strong focus on industrially-produced building components. The learning path is composed of several theoretical modules (e.g. materials, architecture history, design strategy) and by three design studios, where students perform collaborative project works. The students come from different countries (i.e., Brazil, India, Lebanon, Mexico, Russia, United Arab Emirates) and they also have different levels of expertise (i.e., novice designers/architects, professionals) in different fields. The sample-class was composed of 12 students, divided into 4 teams of 3 individuals each. The teams were decided by the professors mixing origins, backgrounds and level of expertise. The teams worked for one month to design a high-end kitchen being supervised by three teachers. Data has been collected from each part of the test (Figure 2, Activities) and has been qualitatively analysed.

ACTIVITIES	DATA COLLECTION
0. Brief introduction about TCM and how to individually realise it	
1. Individual and non-guided choice of TCM colour composition	Direct observation, photo, TCM collection
2. Production of a written document to describe the TCM composition	Collection of the descriptions
3. Sharing each TCM with other teammates	Direct observation, photos
4. Team discussion about the results	Direct observation, photos
5. Review with tutors (researchers), explaining the results	Audio recordings and transcripts, participant observation, notes
6. Qualitative feedback about the activity	Audio recordings and transcripts, participant observation, notes

Figure 2: Summary of the activities run during the test and data collection strategies per each activity.

RESULTS

From the written documents produced by students, it was possible to notice some interesting ways of facing the exercise. First, about the narrative of the text; some students approached the explanation by telling a story and included colours as symbolic qualities of the different moments of it, others started by writing a list of the colours they used and describing the

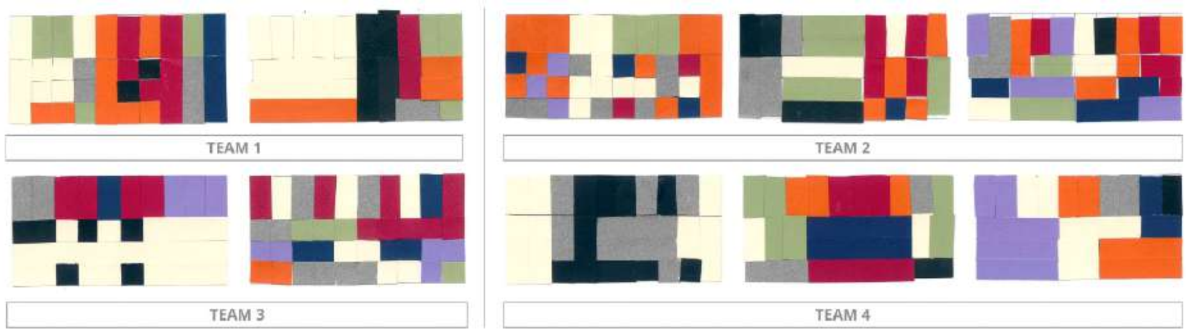

Figure 3: Overview of the results of the Teamwork Colour Matrices made by the students of the four teams. Top row: team 1 (left), team 2 (right); bottom row: team 3 (left), team 4 (right).

meanings they associated to them. This means, some of them started from the lived experience and the others started from colour as a trigger to communicate. Secondly, regarding the comparison between the 'teamwork' and the 'individual' visual representations, some students expressed similarities between the colour palette they applied to part 1 and part 2 of the TCM, visually and in terms of meaning while others codified part 1 and part 2 very differently, emphasizing a different perception of the teamwork and the individual performances (Figure 3). Other noticeable results regarding colour associations is that most students attributed a particular meaning to a colour hue and maintained it during the entire composition (e.g., red used for representing several moments of tension), but one used the same hues with different meanings every time (e.g., red means focussing on hard work, evolution and changing, depending on its position), extending the consideration of the meaning of hues to the harmonisation with other colours. Another interesting case is a student, who decided to attribute meanings to the achromatic colours of the palette by using brightness (e.g., associating positive moods to white, regular moods to grey, and negative moods to black), simplifying the exercise and not using variations of hues as a vehicle to communicate meaning in a more specific way (Figure 3, team 4). In a less radical way, the majority of the students noticeably used brightness and saturation variations to differentiate associations and feelings.

During the review (activity 5), it was evident that students used the TCM to communicate, between each other and then to the researchers, the outcomes of the previous discussion (activities 3 and 4). Most students were using the TCM as a support for their storytelling of the experience, by directly pointing to the grid and making references to the different colours applied. In one case (Figure 3, team 1), students summarised their teamwork by using one of the TCMs (the most accurate, according to them), showing agreement and shared understanding of the experience. All the teams were able to establish some comparisons between their TCMs or to recognise analogies and differences based on colour and shape. In all the cases, the TCM worked as a trigger for students to share their own perception of the teamwork experience.

Some of the most relevant feedback by students regarding the use of visual communication, was about how the TCM has helped them to organise the ideas, to build a discourse, to understand the teamwork process, to communicate the emotions felt, and to explain their feelings by "using more than just words". Additionally, some students declared that they would have wanted to receive a "colour code" (i.e., predefined or cultural associations of colour and meaning) before the activity, because they were a bit lost at the beginning, not being used to communicating through colours.

CONCLUSION AND DISCUSSION

The results show that all the students were able to evaluate teamwork by using visual communication through colours. The TCM allowed a certain degree of freedom in the approach to the evaluation process because students created their individual abstract representation of the teamwork experience. During the sharing activity, students relied very much on their TCMs to tell to others their own experience within the team. Pointing, confronting, making analogies and finding differences between TCMs, students showed that mutual understanding of a shared experience could be supported by visual communication. Being also students' feedback about TCM very positive, we do think that this preliminary test showed the potential of colours to foster communication in culturally plural academic and professional contexts.

Regarding colour, the documentation of the activity resulted in a great amount of data (e.g., recordings, transcripts, photos, observations), and most of it related to associations of colours with emotions and feelings. While the same hues received very opposite meanings, even from the same student, the importance of brightness and saturation is evidenced in the relation to the semantic poles as positive-negative (brightness), active-passive (saturation) associations, among others. These results confirmed that the future analysis of colour associations should no longer be related only to hue, but should also consider the importance of brightness and saturation. For this reason, further trials of the tool could include a modified colour palette (other hues and more levels of brightness and saturation), to study in detail the relationships between meaning and the three properties of colour.

This is leading to further development of the research; after this preliminary test, during 2020, the TCM has been optimised, adapted to remote activities and tested with around 100 students. The results so far can be considered as a first positive contribution to address the initial research questions.

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The use of color in spaces central to social life in contemporary residential housing in Recife, Brazil

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ABSTRACT
This paper aims to clarify the connection between classicism and contemporary housing projects in Recife, Brazil. It investigates what has conditioned the architect's and interior designer's choices for a specific chromatic palette, which contains shades of brown and beige, gray, white and black applied to residential architecture of the wealthy. It was researched whether these colors constituted a "classical chromatic palette" that could be associated with "classicism" as an aesthetic reference. Thus, historical references were first identified since the sixteenth century classicism. Subsequently, the research explored ten case studies of contemporary housing in Recife and its surrounds. This so-called classical chromatic palette was found in all projects. Later on, when this investigation began to analyze one of the biggest national architecture and interior design exhibitions, this palette was found in most of the spaces central to social life, such as entrance hall, living and dining rooms, prevailing over decades. Thus, in a survey conducted among architects and interior designers, the results revealed that a classic chromatic palette was understood to be shades of brown and beige, white and gray. Finally, the research concluded that the initial perception of the respective palette's choice is real and connected to the historical symbolism of civility, modernity, and "good taste," associated with classicism.

Keywords: *color symbolism, color palette, residential architecture, classical colors, Recife*

INTRODUCTION

Considering color as a sensation received by the eye and communicated by the brain (Guimarães 2000:11) shows how relative this sensation could be and how many constraints are involved in choosing a chromatic palette for architectural projects.

It is assumed that color is one of the fundamental elements of space composition. Thus, this research seeks to clarify what has conditioned the professional choice of the architects and interior designers, i.e., the palette composed of shades of brown and beige, gray, white and black in contemporary projects of the wealthiest housing in Recife, Brazil. Also, this research investigates the possibility to consider after all a so-called "classic color palette" that contains the above-mentioned colors.

The authors identified among Recife's architecture a similarity of chromatic proposals for the spaces central to social interaction, such as halls, living and dining rooms, as well as for the exterior front façades of buildings. For decades the classical reference and its rules have apparently been the ideal of beauty that prevails in these design conceptions.

This research started by verifying when color was applied since the Antiquity, when classicism was first introduced to European residential architecture. These historical moments are important references to construct a symbolism linked to a classic palette, which is valued by local architects and designers. Thereafter, it was investigated how this symbolism was constructed in Recife's local society, influenced by European architecture. After investigating the history of classicism, the authors carried out field research, with photos and analyses of residential buildings, as well as with a survey inquiring into the issues related to classicism and the use of color in the respective spaces.

REFERENCES OF THE USE OF COLOR IN CLASSICISM(S)

The starting point of our investigation of color in classicism is Classical Antiquity. The Greeks added black to the set of earthy colors widely used in Antiquity and in the architecture of Ancient Egypt. It is known that the Greek temples were exhaustively colored, but the image we have of them today is only of bare stone, the result of the action of time on their surfaces. We attribute to the Romans the use of white, orange, purple, blue, yellow, and gold. The frescoes in the Roman temples demonstrate the use of sober colors, where ocher and green predominated, as well as shades of red and purple. In Italy of the 1st century AD, the luxurious residences of Herculaneum and Pompeii were also adorned with the art of colorful stained glass (Farina 1990).

Furthermore, Annie Sloan and Kate Gwynn point out that in the 16th century, the stone colors of the temples, such as beige and white shades of marble, were used in the development of the "Palladian style" for homes in Europe. These colors, along with light green, were widely used for 18th-century interiors, and in the second half of the century, white became the "trend color" for painting walls and ceilings. White was also used for fabrics and bedding. According to Sloan and Gwynn (1996), beige also enjoyed much popularity throughout the century. Sometimes beige was associated with gold, or gray, which was also widely used in wall paintings. Still in the 17th century, with the profusion of elaborated wood carving, different brown shades made up the interior decor of the time. These colors were also widely used in the Victorian Era, foremost in interiors composed of heavy and opulent furniture (Sloan and Gwynn 1996).

Since the colonial period and until the mid-19th century, the exterior of the houses in Recife were mostly whitewashed. This feature was first observed by the French engineer Louis Léger Vauthier, by the English travelers Henry Koster and Maria Dundas Graham Callcott, and also by the French Louis-François Tollenare, who lived in Recife from 1816 to 1817. Tollenare wrote, "[the houses] are built of stone, whitewashed, except for the door and window frames that are made of conchiliferous sandstone very well carved" (Carvalho 2002:39). Some townhouses were painted "ox-blood red," yellow, green, or blue, and some of the more affluent houses were covered with tiles (Freyre 1996). Vauthier described what the colors were like in the interiors of houses in Recife at the time, "The walls of the rooms are whitewashed; the wooden elements painted light gray" (Carvalho 2002:31). At the beginning of the 19th century, the walls of the noble rooms of the townhouses were covered with painted paper, with certain parts of the room whitewashed, and others painted in "showy" colors, with bars and friezes that could be yellow, pink, and blue. The older houses had paintings of figures and arabesques on the walls. Also, in the 19th century, the interior walls were whitewashed or tempered with yellow ocher or some other light color" (Carvalho 2002:37).

It is known that throughout the 19th century, the wealthy in Brazil have had a great fascination with the classicist aesthetic ideals furthered by those countries turning into industrial societies, such as France, England, and the United States. The classicist ideal was a symbol of the "bon-goût of civilized man" and have since projected an image of power and modernity for the country. Gilberto Freyre illustrates very well how the “colors of modernity” became part of the daily practices of everything involving aesthetics, “[...] This period of Europeanization of our landscape through black and gray – civilized, urban, bourgeois colors, [are] in opposition to the rustic, the oriental, the African, the commoners [...]” (Freyre 1996:137). In this century, a new color palette came to be valued, contributing to the differentiation of social classes, since the wealthier classes sought to stand out, also through colors. In a country of strong and contrasting colors, originating from tropical natural environments, as well as from the great mixture of foreign cultures of the people who formed the local society, such as the Indians, Africans, and the Portuguese, the effect that “neutral” tones provoke, continues to achieve great prominence.

However, in the 19th-century Europe, the adoption of the classic palette by neoclassicism was being questioned in a debate about polychromy that took place in Paris starting in the 1810s. Quatremère de Quincy’s, and subsequently Jacques-Ignace Hittorff’s, discoveries of the use of strong colors in the temples of classical Antiquity triggered polemics about the previous exaltation made to the absence of color in the ancient temples. The basis of the European neoclassical movement was led by its key figure, Johann Joachim Winckelmann, who, in his writings 1750–1760, claimed that “the whiter a body, the more beautiful it is,” valuing form rather than color (Mallgrave 2005:4). However, the adoption of various shades of browns, beiges, and grays, as well as white and black, was a constant throughout the 18th-century neoclassicism, and in the 19th century associated to other forms of classicism in Europe and the Americas.

At the beginning of the 19th century, the cult of whites, browns, beiges, grays, and blacks from the “carboniferous civilization” dominated in Recife, as put by Gilberto Freyre (Freyre 1996:137).

In European modern architecture of the early 20th century, color was often reduced to white. Protagonists, such as Adolf Loos and Le Corbusier, turned to pure volumes as the basis of their architecture. Using white provided a suitable option for valuing geometric solids and also opposing the new architecture to eclectic historicisms of the past.

During the late 20th century, the same cherished chromatic palette was applied with the intention to remain within the symbology already being decoded by the society. As accurately stated by Tom Fraser, the significance of this palette was enhanced by the fact that if you “enter a house decorated by a real estate agent for resale: it is almost certain that you will find all the walls painted white or beige” (Fraser 2011:92).

Thus, several references throughout the history of architecture in Europe and Brazil demonstrate that the valorization and adoration by the local society of the so-called “neutral” palette is justified, as well as its connection with the classicisms that occurred in Europe since the 16th-century.

COLOR AND SYMBOLOGY

In addition to the compositional effects and issues of taste that permeated the choice for a particular color palette, some reasons that contributed to this specific color choice and how it has been perceived will be explored.

Considering the three approaches proposed by Modesto Farina (1990:24) for the use of color, the sensitive (impressive), psychological (expressive), and intellectual-symbolic (structural), this research focuses on the latter, this is, the action of passing on an idea, a meaning attributed to color. In the intellectual-symbolic approach, the adoption of a certain chromatic palette in Recife’s architecture, in particular, in decisions made by architects and users, is closely linked to the image that they intend to convey, and to the symbolism socially related to the use of a certain color palette.

Figure 1: Example of residential housing in Recife's outskirts, where brown and white predominate in the exterior of the building. Photo: Esc. Ana Lúcia Andrade Lima.

Figure 2: This example of residential housing in the outskirts of Recife, Brazil, shows a dining room where the so-called classic palette dominates, consisting of brown, beige, white and black. Photo: Thiago Freire Fotografia.

Color option for a certain purpose is described by Newton Cézar as an approach of the use of color in advertising, when consumers buy the products either based on emotion or reason. Purchasing by reason is characteristic for items that are part of a house, as they involve planning of the users' space and meeting their needs. The consumers "know what they want, where they will use it, and what for" (Cesar 2000:198). For the consumer market, the higher the socioeconomic status of the groups, the "less color is necessary for the satisfaction of the eye"; whereas, more color is applied when it is intended to pass on information to other social groups (Guimarães 2000:111). The option of using "classic" colors recurrent in the living spaces we analyze in this paper, is more perennial and meet the desires and expectations of those with a high standard of living.

The use of the palette of browns, beiges, grays, whites, and blacks discussed here applied to contemporary residential architectural projects by professionals working in the city of Recife is similar to projects of other large urban centers around the world. This similarity identified in such distant places of different cultures can be explained by the phenomenon of globalization, which unifies the proposals for housing projects, constantly and repetitively disseminated a certain image further transmitted by the mass media. The impact this kind of image has on people interferes with their behavior, altering their desires and expectations, as well as directing tastes and attitudes. In the sociological field, these images end up creating a new way of life (Farina 1990:25).

RECIFE'S RESIDENTIAL ARCHITECTURE: COLOR IN SPACES CENTRAL TO SOCIAL LIFE

The research has been carried out in the spaces of ten contemporary residential buildings and interiors of the more affluent class, located in the Metropolitan area of Recife, in the countryside, and remote beach houses in the coastal area. Five spaces in apartments of multifamily buildings, and five spaces for single-family houses were investigated (Figures 1 and 2).

Another stage of the research took place during Brazil's largest annual trade fair dedicated to design, architecture and landscaping. Comparing the projects conceived over the last two decades and the spaces essential to a family's social life, we found an almost total predominance of the use of the palette analyzed. Only three projects presented colors other than those studied here.

Analyzing the palette reduced to the so-called "neutral" colors for interiors of residential architecture, Tom Fraser writes that the use of other colors than these selected ones "[…] is a challenge, often avoided even by designers, who make use of chromatic minimalism instead of risking a disaster" (Fraser 2011:92). Thus, when choosing colors for a project, the professional may consider the personal preferences of users, which are varied, and the effects that colors cause. However, with the use of unexpected colors, the fear of making an error causes colors to be chosen "based on prejudice and convenience," abandoning the issues of psychological, personal, and cultural order.

In the final stage of the research, a questionnaire was distributed to a specialized public, composed of architects, designers, and other professionals, mostly postgraduates. The vast majority stated that they understood the classic palette to be harmonic, proportional, elegant, and giving pleasure to the eye. Among the colors presented, the majority selected as classic the following: white 87%, brown and beige 76.9%, and gray 63.9%. The survey also proved the direct connection made by professionals between the classic palette and colors they prefer, leaving no doubt that these chromatic features are those that the wealthier people hope to include in their homes.

CONCLUSION

This research is part of a broader research project investigating the relationship between classicism and residential architecture in Recife, Brazil. Thus, we seek to clarify what has conditioned the choice of architecture and interior design professionals for a supposed "classic chromatic palette" composed of shades of brown and beige, gray, white and black in contemporary housing projects of the wealthy.

Presuming that in Recife the use of these colors is associated with classicism as an aesthetic reference in architecture and considering a symbolic approach to using these colors, in a survey of ten architectural and interior projects, all of them unanimously used the classical palette.

When the research turned to the shared living spaces exposed in one of the largest design, architecture and landscaping show in Brazil, the total predominance of the use of this palette was evident.

In a survey questionnaire addressed to a specialized audience, browns and beiges, gray, and white were selected by the vast majority of respondents as classic colors, directly linked to "good taste."

Thus, the research demonstrated that the supposed initial perception of a predominance of the use of the so-called classical color palette in the spaces socially relevant of the local dwellings is a reality in the researched universe, given that the society associated the palette to symbolic values of civility, modernity, and "good taste," historically related to classicism.

According to the results of this research, the authors intend to extend the questionnaire to a more significant number of local architects and designers, as well as to analyze their contemporary housing projects, to reinforce the relationship established between the choice of the "classic palette" and classicism as a persisting aesthetic reference.

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Visual grouping: a study on preponderances of color or shape in match-three games

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ABSTRACT
A category of entertainment that stands out for its popularity is the Match-three electronic games, in which the player needs to form groups of, at least, three similar objects to score points. Thus, the study of how players perceive visual groupings becomes an important tool for future developments. This research investigated color and shape relationships in Match-three games, looking for preponderances in the visual grouping of color or shape in the psycho and neurological response. For this, a bibliographic and an empirical research were carried out. A beta and a final version of two match-three games, created for this research, were applied to a sample of 64 participants. One of the games was black and white with different shapes, and the other, colored formed only with one shape. Results of the visual language and psychologic bibliographic research indicated that color and form belong to the similarity aspect of visual groupings, without showing any preponderances between them. The studied authors affirm that the greater the resemblance of the observed objects, the greater the perception of grouping. The neuroscience literature showed that the visual grouping of color and shape are perceived in different ways depending on the context in which they are inserted. Experiments present that color and form are perceived without prominence, others show that for lower exhibition rates, color is perceived before orientation. The empirical research showed that, for the category of games studied, visual groupings of color are perceived more quickly and more easily than visual groupings of form.

Keywords: *design for games, color, form, visual grouping, match-three games*

INTRODUCTION

An entertainment category that grew with the greater use of smartphones (Coutinho 2014) were digital mobile games (Gualà et al. 2014:1–12), and the popularization of the category of match-three games stands out in the world (Perez 2020).

For individuals with normal vision, the perception of visual groupings is the most important part to this type of game, as its main dynamics is making groupings of three or more similar icons by color or shape to score (Juul 2010).

This study aimed to understand response in relation to visual groupings of color and shape and visual comfort in the scenario of match-three games. This happened through a bibliographic research, two empirical tests developed by the authors and a qualitative questionnaire.

VISUAL GROUPING IN PSYCHOLOGY, VISUAL LANGUAGE AND NEUROSCIENCE

Visual perception is defined in modern psychology as an active combination of sensorially received stimuli and organic interpretation, which organizes and relates them to previous experiences (Dondis 2007:44–46).

Arnheim (2008:70–79) affirms that visual groupings are perceived by similarity, proximity, clarity, configuration, direction, speed, consistency (regular, homogeneous) and contiguity.

The author mentions that color and shape belong to the same type of grouping (similarity), highlighting only that depending on how they will be formed, they will be seen more or less united, "A visual object is all the more unitary the more closely its elements are in factors such as color, clarity, speed and direction of movement" (Arnheim 2008:79).

Kepes (1995:15, 45–50) determines that a visual grouping can be perceived through two factors, similarity due to the object's own quality or proximity.

The three authors, Arnheim (2008), Dondis (2007) and Kepes (1995) place color and shape as characteristics belonging to similarity group and don't emphasize any preponderance between them.

For neuroscience, the diverge of perception of this clusters involve the way the brain perceives, organize and relates these two types of visual stimuli. Several studies debate whether color and shape are perceived in different brain zones or whether they are processed by the same neurons group. This affects the understanding of speed and the way visual material is perceived (Viviani and Aymoz 2001:1).

In an experiment carried out by Moutoussis and Zeki (1997 apud Rentzeperis et al. 2014:3), the researchers understand that distinct visual aspects simultaneously presented perhaps aren't perceived at the same moment, which would indicate different manners of processing. They also noticed that colors were perceived about 63 milliseconds previously orientation.

In another experiment, Viviani and Aymoz (2001:2–8), investigated the perception of three visual attributes: color, shape and movement. Results conveyed that color and shape are processed almost simultaneous.

Clifford et al. (2003 apud Rentzeperis et al. 2014:3) tested color and orientation perception using gratings with the same time frequency. Results showed that for faster presentation frequencies, color and orientation were perceived simultaneously, but, for a lower presentation frequency, color was perceived 50 milliseconds before orientation.

To understand these differences in perception, Rosenholtz et al. (2012 apud Rentzeperis et al. 2014:4) propose that depending on the target of the vision, the visual system considers or disregards the other parts of the visual plane. Thus, depending on the relationships involved, neurons work in different ways (parallel or serial) and in distinct brain locations.

Moreover, it is possible to state only that, depending on the interaction, distinct preponderances between color or shape will be noticed in the visual grouping.

METHOD

To understand preponderances in visual groupings of color and shape in match-three games, two games and a qualitative questionnaire were developed by the authors to test the speed with which players group similar sets.

One of the games applied was black and white, with the shapes: square, circle, rhombus and triangle. The other was colored or polychromatic (multiple hues), with only one shape (circle) of pure RGB hues (yellow, blue, red and green), with the same brightness and saturation.

The game and the questionnaire were applied to a sample of 52 volunteers, between 18 and 30 years old and attended higher education at ESPM College in São Paulo, Brazil. Female and male individuals were tested, forming two equal groups of 26. The selected subjects claimed not to have color blindness or any other visual compromising pathology.

The tests had a determined order of application, half of the tested participants started playing the black and white game, the other half the polychromatic one so that the learning of the mechanics did not influence the speed of resolution of the objectives. Each group of 26 was divided into two new groups of 13 individuals, who alternated the game initially tested (13 started with the black and white game, the rest with the polychromatic one).

The average resolution speed of each game was compared in order to understand possible preponderances in the cognitive response of color and shape grouping.

Before the final tests, a beta test was carried out to detect aspects that could be improved. Regarding the application of the tests and methodology, the sample used was 12 individuals, 6 males and 6 females.

A qualitative questionnaire for data collection was carried out at the end of each test. It asked the name of the individual for further identification of the data, age, biological sex and the following questions:

- Which one of the two games, black and white or color, did you find easier to group? Why?
- Which of the two games did you find most pleasing to see? Why?
- Did you notice anything different in the way you perceived the groupings in the two games?
- Do you have any observations or suggestions? If so, which one?

THE TESTS

The games were created in “Unity 3D” and “Adobe Illustrator”, using code of Gkanatsios (2015). Programmer Mario Sérgio Affonso Junior was hired to assist in the creation of the codings of both games.

Both games work the same way, containing the same programming code, only the visuality being different, ensuring that the two tests had the same level of complexity.

At the end of each game, the game program automatically generates a report informing the amount of groupings made. The groupings considered in the report are those of moves made manually, thus the formations that occur in a chain are not counted.

Both games have a black background to isolate the object of this research, in this case, the color and shape groups, without distractions. The authors also intended to create greater contrast between figure and background. According to Csillag (2015:71–81), light colors are perceived prominently in contrast to a black background. This way, it was decided to use figures with 100% brightness on a black background.

For the black and white game, four basic shapes were chosen: square, rhombus, circle and triangle. The square had reduced height in comparison to the other geometric shapes in order to appear the same amount of empty area around it, guaranteeing the perception of individuality when close to other squares. Thus, as previously explained, it is also possible to form visual groupings by proximity of items, but the objective of the study is the groups formed by similarity.

Both the colored and the black and white games have 100% brightness of their items and a black background (R = 0 G = 0 B = 0; # 000000), in order to obtain equivalent contrasts.

Both games had a home screen where information about the participants is given, such as name, biological gender and the option of the game being colored or black and white.

The two games had a 30-second timer at the top of the screen (see Figure 1), indicating the time remaining to group the largest possible number of similars. The stopwatch was implemented as the limiting mechanics of these games. After the 30 seconds of the stopwatch, a game over screen appeared.

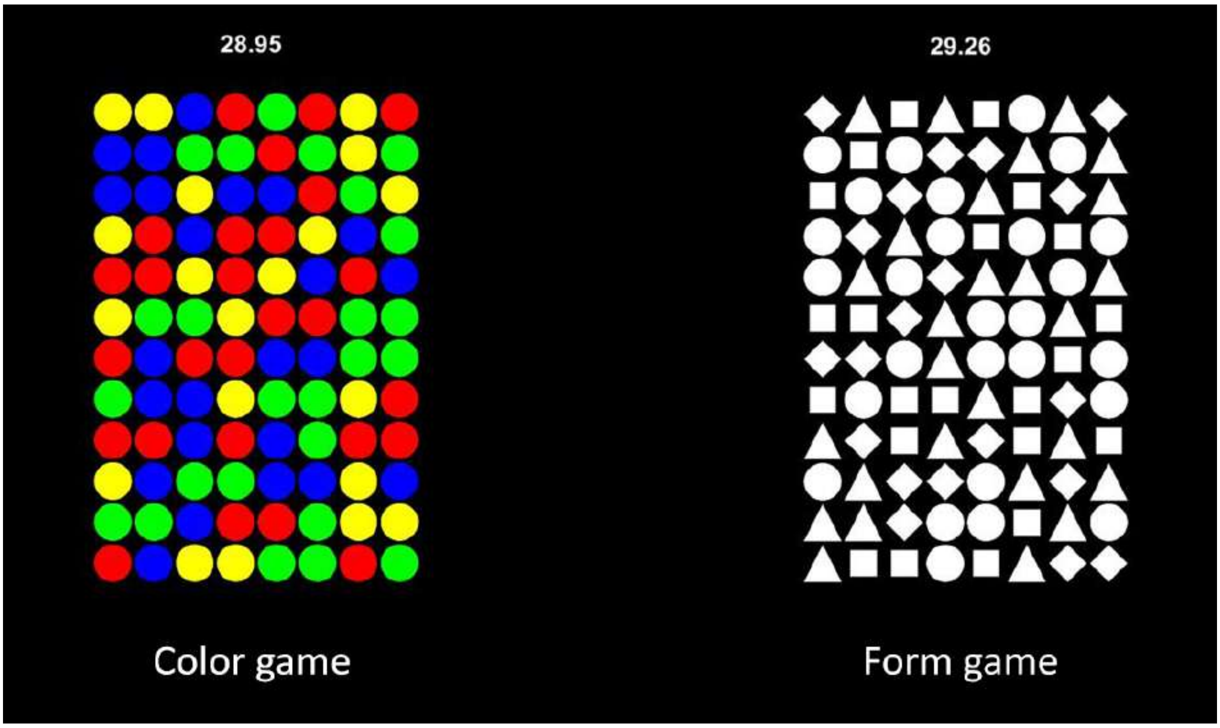

Figure 1: Printscreen of the colored or polychrome "color game", with timer at 28:95 seconds at the top (left) and black and white or monochrome "form game", with timer at 29:26 seconds at the top (right) designed by the authors.

TESTS AND RESULTS

At the beginning of the tests, a brief explanation of how the tests worked and how to perform the combinations in the game was given. At the end of the test with the games, the qualitative questionnaire was presented on Google Forms.

The final games found that visual color groups were perceived more quickly by players, as soon as the programs accounted for a total of 644 color grouping and 435 form grouping made by the participants. These results were made up of 47 participants of a total of 52 (90%) who made more color groups than form, 3 females and 1 male (8%) who made more combinations by shape than by color, and 1 female (2%) who made equal combinations in games of color and shape.

A little difference was noted between the number of combinations made by male and female players in both games. In the color game the male respondents made 333 combinations, while the female respondents made 311. In the black and white game, the male respondents made 221 combinations and the female 214.

It may be concluded that, even though male participants had made more combinations, the preponderance in combinations of the colorful game are perceived, in both sexes.

The qualitative questionnaire based on the players perception also demonstrated greater facility and comfort to make colored groups.

For the question, "Which one of the two games, black and white or color, did you find easier to group? Why?", 90% of respondents (47 participants) replied that they preferred colored groups, 8% shaped ones (4 participants) and 2% (1 participant) presented an incongruous answer.

For participants who responded that they had a preference for colored groupings, the following aspects were highlighted: greater visuality, groups more visible, ease of grouping, easy assimilation, more agile, more attractive, forms not sufficient to integrate the player and the game, and greater emphasis in perception.

For participants who responded that they preferred shape groupings, the following aspects were highlighted: shapes are easier to differentiate, shapes help to group, more pleasant to play with less intensity than color, and colors cause confusion.

For the question, “Which one of the two games did you find most pleasing to the eye? Why?”, 79% of those who answered the survey (41 respondents) replied that they preferred the colored game, 21% the form game (11 respondents).

For the colored game test the highlights were: there is more familiarity in playing colorful games, it is easier to understand the possible combinations, better to identify the colors, better to perceive, recognize and discern, the homogeneous shapes and saturated colors help, livelier and happier, better mental organization, there is greater visibility, more homogeneous space between shapes, it is more intuitive, more attractive, more flashy and appealing, because it is colorful it is more beautiful, the shapes were not enough to cause “integration” with the game, greater differentiation and visualization, with only shapes it is more confusing and difficult to concentrate, color increases perception, “it hurts” less the eyes, greater similarity in the grouping, less effort to group, in the game with only shapes and no colour everything is mixed.

For the black and white game test, the highlights were: the colored game confuses the perception, more pleasant, caused relaxation and made the test less intense, personal preference for black and white, too saturated colors in the colored game, more aesthetically pleasing, the contrasts were unpleasant in the colored game.

For the questions, "Did you notice anything different in the way you perceived the groupings in the two games?" and “Do you have any observations or suggestions? If so, which one?”, not all participants had observations to make. The observations that stand out from the points already presented are the following:

In the black and white game: the need for greater concentration to find the combinations, everything was perceived as a unique visual mass, “fright” when the white shapes appeared, it took a player a long time to "understand" the shapes, another person noticed that he made combinations looking at the tips of the shapes and thought that he did not make many combinations with the circles.

In the color game: finding the blue circle was easier, the feedback of groupings was more visible, a player used the intensity of the colors to form combinations, it was easier to have equal shapes, a player thought that perceiving colors is something more natural than thinking about which shapes are identical, a player said that he managed to form “color patches” that facilitated the game.

Overall: One player found the tests very fast and one player thought it would be beneficial for the game to combine colors with shapes.

CONCLUSION

The visual language and psychologic studies show that color and form are visually group by similarity, and the greater the resemblance, greater the perception of grouping. The neurologic studies show that sometimes color and form are perceived without prominence; sometimes color is perceived before, and for lower exhibition rates, color is perceived before orientation.

With the results of the tests, it may be concluded that the factor that facilitates the speed of visual grouping in a match-three game is the use of different colors (hues) in the game icons.

This study demonstrates that for visual groupings of color and shape in match-three games, color is predominantly seen as a factor of better and faster assimilation of groupings. Most respondents also reported a greater comfort when playing the colored game.

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The construction of the chromatic sign in the Brazilian political and social environments

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ABSTRACT
Colors acquire a polysemy of interpretations when observing scenarios that are sometimes difficult to understand by people outside that sociocultural environment, as these are discursive conventions specific to each culture. Thus, this research aims to explore how the symbolic assimilation of colors in fashion products, in particular in the Brazilian political and social scenario, is altered through the contexts in which they are observed. To this end, analytical research has been carried out using the triadic concepts delimited in Charles Peirce's semiotics. The focus is on the symbolic order of colors. Thus, connecting historical turning points where the color contextual change in the Brazilian scenario has resulted in the modification of its interpretation. Considering only the Brazilian scenario, the political-social event called Domingo Negro (Black Sunday) is discussed as an exponential event in Brazilian history in which colors were used as an element of protest. Through this analysis, it is possible to exemplify how color gains a new temporal and contextual perception. Finally, in this same line of political thought, a modern parallel is emphasized between the colors adopted by groups, accentuating the Brazilian Left and Right political dichotomy. In 2018, both parties had a strong representation in the Brazilian elections through the figure of the Workers' Party wearing the color red, and the President Jair Bolsonaro wearing the colors green and yellow as their visual identity for the symbolism of patriotism, which also are the colors of the Brazilian football team.

Keywords: *color psychology, semiotics, clothing, communication, society*

INTRODUCTION
The perception and interpretation of colors tend to change depending on several factors, such as cultural insertion, environment, age range, omitted and perceived influences, influence of people on surrounding groups as well as by the alteration of understanding inherent to the physiology of the human eye, such as hue, luminosity, and saturation. Those observer's perception changes will demand a series of special characteristics to be considered during the choices of the colors during the design of a product (Heller 2013). Far beyond these aspects of ambience, the object or surface on which the color is used will also serve as a link for altering the chromatic perception between artifact and spectator, especially when understanding that shape and color are inseparable aspects (Farina et al. 2006, Gray et al. 2014).

The visual information is developed through a message that can contain elements of verbal or non-verbal characteristics. It articulates itself in such a way that the sender encodes it in a configuration that the receiver was able to understand (Dondis 2003). Santos and Mendes

(2017) classify the elements of visual language as the aspects of communication that aims to serve as a syntactic contribution to deliver a visual message adequately. Pina (2009) highlights the importance of color among those visual language elements when explaining that one's first reaction to any fashion product is a response to its colors. Battistella et al. (2010:16) demonstrates the connection and hierarchical relationship of consumers when it comes to the chromatic design of the packaging of a product, by delimiting four basic functions for color, "attracting attention, maintaining attention, transmitting information and making the information easy to remember."

The synthesis of chromatic symbology is linked to the meanings imposed under certain color characteristics. Gamito (2005:103) classifies the color symbology effect as "the set of associations and impressions, consecrated by the traditions that have been transmitted to us through the centuries, through civilizations and religions". While Santos (2017:30) completes explaining that "color does not depend exclusively on the outside world, it is perceived by our mind individually, it influences our behavior." So, there is a construction of an individual repertoire as well as a collective repertoire, each with its characteristics, existence, and importance.

In clothing products, communication is done quickly and instantly through the color design, being the use of visual language strategies decisive to obtain different perceptions and interpretations. Far beyond intentionality, colors sometimes take on discourses resulting from the transition of scenarios. From a psychological and social order, the pre-established conventions by society can be observed and analyzed through semiotics, a science that investigates the relationships between signs and the object they represent. In this sense, colors carry symbolic connotations that characterize them as a product, both cultural and temporal, i.e., colors can be analyzed and discussed within the semiotic parameters proposed in Charles Peirce's concepts.

Discussing Peirce's semiotics, the author proposes three dimensions of sign interaction: firstness, secondness, and thirdness. Firstness describes that point where the information is purely received, being something much more sensorial, it refers to the qualities, a qualitative representation of its object, maintaining a similarity. Secondness consists of a situation in which messages are received and the observer performs a kind of primary action; it can be better understood through the notion that this stage is a conflict between actions and habits, an associative analogy. Finally, the most complex of all, thirdness, comprises a deeper reaction, based on the laws surrounding the sign; this category is related to the concept of symbol, as it deals with pre-established social conventions and how signs enter and can be read in this context (Niemeyer 2003).

This paper aims to study the symbology of colors from the cultural, social, and historical perspectives as signs of firstness, secondness, and thirdness which in turn determines and changes aspects of the visual quality of fashion products, changing as a consequence its meaning depending on a certain context, whether historical, social or locational.

This study uses the guiding concepts of Peirce's triadic semiotics, with a focus on the symbol. It is characterized as exploratory research with a predominantly qualitative approach (Gil 2008). Concerning the technical procedures, it follows a historical and semiotic based research (Santaella 1983). This aim is to identify and correlate historical turning points in which the change and the usability of colors in different contexts or cultures changed their symbolic perception, bringing to the fore, contemporary social issues that support parallels between past and present.

RESULTS AND DISCUSSION

Passive and unchallenged acceptance of signs can present itself in an ambiguous situation, as at the same time as it relates to the trickle-down effect, where the information continues from higher classes, that is, from the top of the pyramid, until it reaches the classes socially or economically disadvantaged (Rech and Perito 2009). As a consequence, the less favored classes do not have great access to information and thus only adhering to what they are offered.

This signification process can also follow the opposite, the bubble-up, where it starts from the bottom and gradually reaches the top, mainly as an effect of the massification and rooting of information (Rech and Perito 2009). These forms of identification become identity signs of the symbolic order, as they represent and speak for a group, in which their mere presence already makes reference to this code and is easily understood by individuals inserted within that social context. Its transformation process continues to stop being a simple set to become its communication code recognized in a particular social context.

Colors are something commonly used in society when there is a need to perform the role of faster and more dynamic communication, this comes, according to Pereira (2011) as a consequence of easy visual assimilation because it is not necessary to have texts since basically a simple colored square shape is capable of determining a variety of messages.

In this perspective, the cultural chromatic sign can be categorized mainly in thirdness, more specifically referring to the symbolic dimension of the observations brought by Peirce. Thus, serving as a basis to demonstrate how the social conventions projected on the chromatic elements determine the way people live and consume clothing products, projecting values that are capable of altering consumption, creating affections or refusals depending on the laws established in that circle, even if it is not based on any factual event of a logical nature.

This does not only occur within geographically parallel cultures. In the case of Brazil, it is also worth noting that localities, even if geographically close, present opposite cultural and world views. Therefore, it is understandable that both color symbologies will present different semiotically significant constructions. Commonly in towns in the countryside of Brazilian states, the portability of political chromatic projects as the banner of local parties makes it common to bring out the observation of this development of divergent cultural visions in the same social context of a national character. The qualities of the colors are covered in local discourse. Red no longer connotes passion and becomes a political flag.

It is in this perspective that the next topic is debated. As for historical events in Brazil, political issues are one of those that most make use of chromatic codes to carry information, as shown in the *Domingo Negro* (Black Sunday) event. The event took place in 1992 and its beginning arose from the departure of the then president of the republic Fernando Collor on television asking that people wear the colors green and yellow, colors commonly used to represent Brazil, associated, in national territory, with the Brazilian flag and, when used in clothing, they carry the symbolism of patriotism (França 2014).

In return for their request, the population adhered to the color black, using the signs of clothing combined with color codes to protest against their government (Figure 1). Guimarães (2000) exposes the relationship created between the black color and the symbolism of death and mourning, in this case, used by the protesters of the time to expose their refusal to the government; the chromatic sign assumed quality of sadness, mourning, and melancholy, forms of the disapproval of the population. The absorption of Peirce's three categories in this scene is emphasized by the action and reaction of the population through the color application.

Figure 1: Protest known as Domingo Negro (Black Sunday), 1992

It is possible to make a comparison with the current events and the demonstrations for and against the politicians of the Brazilian government, where the chromatic designs of clothing are brought to the fore and used to represent political parties or strands. The two biggest current examples, still representing a modern dichotomy, are those of the government of the liberal social party (PSL) together with the linked movements in support of the right party and those of the government of the Workers Party (PT) linked to the left party.

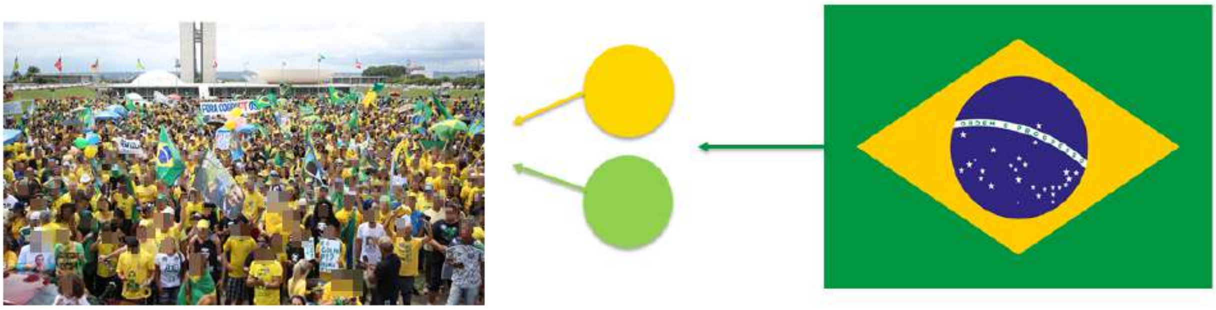

Figure 2: Protests in favor of the extreme right adopting the color code of the Brazilian flag, 2017

In the first example, the symbolism of patriotism is used, bringing to you what Collor wanted the population to do in 1992, using the colors of the flag to show support for the government. By joining this chromatic project of clothing, the groups assume a social responsibility due to the stigmas and opinions they carry. These colors take root and become something so well-known and widespread, that even people who do not show support for that government, from the usability of a simple shirt with the green and yellow chromatic design, end up serving as a reference for the connection between the colors and the movement, being part subconsciously and becoming part pre-judged by the environment.

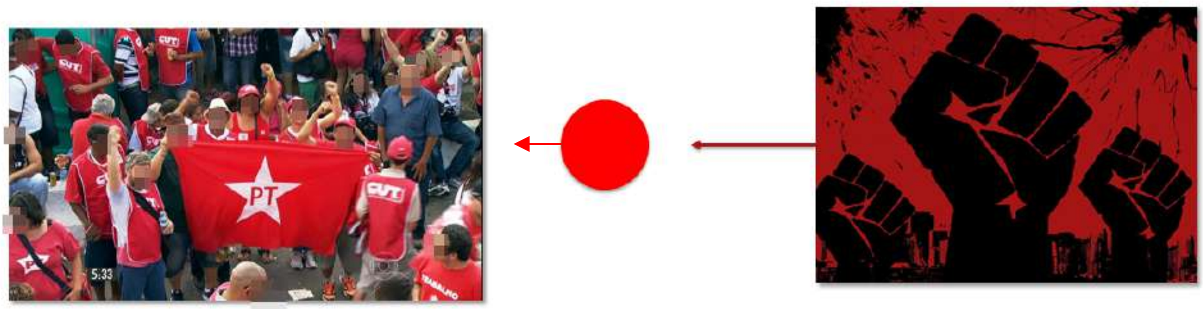

Figure 3: Protests in favor of the left using the red color code symbolizing the workers' Revolution, 2017

It is possible to observe from this point of view how the color signs are easily hierarchized by the visual perspective and the inherent qualities of Peirce's firstness. Color becomes something more valued concerning the primary observer than the other two characteristics, such as secondness and thirdness, if there is not a great process of thought involved and the passive acceptance of its symbology as a tool of common sense is something recurring. Even though the outsourcing plan is more responsible for the development of these conventions, the category of firstness is attributed to the notion of primary, instantaneous, and qualitative contact, in this sense, sensory and inductive (Santaella 1983). The colors green and yellow in other parts of the West have no material or symbolic connection with these manifestations, yellow is scientifically related to light, summer, large flowers, and straw, while green is associated materially with freshness, foliage, nature, and the plains, far from the concept being used in this case. In this way, a conventional process is projected in third parties in the chromatic elements in society (Farina et al. 2006).

In the second point of the demonstrations in favor of the left government, the Worker's Party (PT), the colors that most prevail are the shades of red, spread both through the graphic project linked by the party and highlighted in the social clothes of the representatives, linked mainly during the presidential campaigns (Figure 3), adhered as a color that would represent the whole party.

To understand in a more practical way the effects of the reframing given to colors, the consequences of identifying the choice of red as a representative for the PT are seen in the pro-party manifestations, also acknowledged as chromatic symbolism of that group by effect starting from the top of the pyramid, that is, from the leaders of that group and becoming popular with the descent to supporters, the base.

This usability of colors in the manifestations is not related to their common symbolism, but a symbolism conventionally attracted and accepted by human contextual needs used to raise a flag and show power before other chromatic signs. It is interesting to observe how colors are opposed socially and politically, even if in the literature they are not opposed, as in the case of antagonistic red the green and yellow consonance, where scientifically they are complementary and analogous to the first color, respectively, while in a socio-historical context Brazilian, these colors came to be shown as ambiguous.

FINAL CONSIDERATIONS

Semiotics always proves to be a very applicable science, especially within chromatic projects, a place where symbolism has such a broad implication, going through so many areas that it is necessary to analyze effective scenarios. The main objective of this work was to understand how color presents itself in a polysemic and changeable way in society by varying its application contexts. With this, the historical-based analytical research methodology was applied, bringing debates about the main moments when color demonstrated primordial observation paradigms. Globally, we analyzed the historical punctualities of Brazilian socio-cultural dynamics.

In the topics discussed above, groups of people transformed a set of color codes into identity symbols, with inherent qualities, adopting all the figures and opinions that their use entails. Scientifically, the color codes presented are not directly related to the symbolism shown, but once a society transforms common codes into something of its own, it automatically becomes a cultural system recognized by the medium in which it is inserted, but incomprehensible initially for external individuals.

When it comes to colors, it is plausible to note that it is necess**Solino**ary to be increasingly cautious. Therefore, when creating a collection or a fashion product, the color chart or the unique chromatic design, shows itself as something that should be semiotically thought, taking into account all the contexts in which that product will be inserted so that there is no misunderstanding and the intended message is delivered satisfactorily to the recipient. It is even an aspect that can determine the success or failure of a fashion product.

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Color as a narrative tool in the tale "The Yellow Wallpaper" by Charlotte Perkins Gilman: a discursive semiotics analysis

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ABSTRACT
This paper discusses the role of color in the literary narrative and the use of symbologies as a means of guiding the character in the trajectory and impacting the construction of relationships with the surrounding people. *The Yellow Wallpaper* is a short story first published in January 1892 by the American writer Charlotte Perkins Gilman. The story is representative of literature for the feminism debate. It describes a marriage relationship, and the young wife's suffering from "temporary nervous depression" after the birth of their baby is mediated by the yellow color. From that narrative, thus, this research aims to discuss and encourage the use of color as a narrative tool, based on the studies of discursive semiotics. In this sense, the objective of this work is to analyze and discuss how the chromatic element is used and how it interferes with the narrative of the short story *The Yellow Wallpaper*. To do so, the methods and concepts used for the analysis are based on Julien Greimas' Discursive Semiotics, with a focus in this paper only on the fundamental level. The results point to a range of meanings that vary along with the text according to the protagonist's relationship with her environment and its yellow wallpaper. From consternation to excitement, yellow color plays the role of guiding the character from a feeling of melancholy, going through a context of disgust and refusal, changing to a feeling of instigation and pleasure, and finally reaching a state of obsession with the yellow wallpaper.

Keywords: *Greimas, color psychology, color symbology, literary theory, American literature*

INTRODUCTION

In addition to being one of the main works of feminist literature of the 19th century, Charlotte Perkins Gilman's *The Yellow Wallpaper* has a narrative permeated by a climate of suspense and mystery worthy of great authors of the horror literature of its time. The short story, as well as the author, surprised the critic by addressing themes such as female emancipation and the bonds of patriarchal society at the same time that the work was able to develop tension (Santos 2018).

Bearing in mind that written texts such as short stories, novels, and poems make use of verbal language for their narrative construction, associating the configuration of the text with aspects of the theories of visual communication, at first, seems a complex job. However, in *The Yellow Wallpaper*, we can see very representative uses of the chromatic element for the construction of the work's atmosphere. Gilman uses the yellow color of the wallpaper that gives the tale its title as an important element for the construction of this suspense narrative, becoming a spatial object (Borges 2019). Thus, curiosity arose in verifying and analyzing these uses made by the author through the perspective of discursive semiotics, understanding the process of development and projection of meaning of yellow color as a catalyst for the spirit of madness.

Vilém Flusser (2008) explains that individuals tend to attribute symbologies to colors to make the human experience less empty, giving it meanings and motivations. Heller (2013) denotes that these constructions are not random phenomena, but common experiences pervaded and established in the individual's linguistic repertoire, fruits of the pre-established conventions in society.

In a known way, these symbologies appear according to the inherent characteristics of color and its social use. As a part of the research, this work explores the reality of the yellow color in face of the symbologies that the hue has acquired over the years. Heller (2013) classifies the yellow color as the most contradictory color of all, which is perceptible through the symbologies exposed by the main color researchers in Table 1:

	Pedrosa (2004)	Farina et al. (2006)	Pastoureau (1997) (2011)	Aballí (2010)	Heller (2013)	Goethe (2013)
AMARELO	Love Heat Clarity Disrespect Energy Eternity Faith Wisdom Betrayal Christian Virtues	Adolescence Alert Jealousy Comfort Selfishness Hope Spontaneity Euphoria Expectancy Enjoyment Idealism Lighting Envy Hate Proud Originality Variability	Joy Heat Disease Energy Madness Light Melancholy Lie Gold Prosperity Wealth Betrayal	Joyful Awake Softness Exciting Volatile	Acidity Kindness Avarice Jealous Selfishness Aged Spontaneity Hypocrisy Infidelity Intelligence Envy Youthfulness Ludic Light Optimism Other Betrayal Summer	Stimulant Vivacious Active Serene Lively Warm Nice **Greening:** Unpleasant Shameful Repulsive

Table 1: Meanings of the yellow color presented by color researchers

Thus, one perceives the inherent duality in the yellowish chromatic hue, ranging from youthful and enlightened aspects, positive feelings in that sense, to feelings of jealousy, avarice, and betrayal, feelings with a negative character. The context turns out to be crucial in determining the symbologies. In his book, Wassily Kandinsky (2000) explores the visual sensations that colors connote, where blue would have a concentric power, while yellow would be the opposite, with an eccentric power. The author adds that when trying to make yellow a cold color, it would be transformed into a greenish tone, losing its eccentric power.

Derived from these chromatic sensations, colors command much of the influence of the relationships that people have with the environment, changing issues such as individual mood, climate, or even the appearance of individuals, all at the mercy of chromatic applications on walls, furniture, or floors (Luft 2011) explains through this the need to look for chromatic compositions that are considered more harmonious and coherent for the context in which we are working. A study conducted by Boccanera (Boccanera et al. 2006) demonstrates this notion about the Intensive Care Units of three public hospitals in Brazil, and shows the most pleasant colors to be light blue and light green, while red and black were considered the most unpleasant, perceived mainly due to their symbology and intrinsic sensation.

Observing discursive semiotics as an ally of literary theory and seeking to better understand the use of colors in the elaboration of a literary text, a semiotic analysis was carried out to justify the story's choice of yellow color to provoke certain reactions and feelings in the characters as well as in the reader, which is possible according to Johann Wolfgang von Goethe’s theories about the effects that colors have on human cognition (2013).

RESULTS AND DISCUSSION

Originally published by New England Magazine in January 1892 and written by Charlotte Perkins Gilman, *The Yellow Wallpaper*, seen at the time as a great horror tale along the lines of Edgar Allan Poe (Melo 2018:50), is also considered today as one of the first and most important texts of the so-called feminist literature. Gilman was one of the main representatives of the feminist movement in the United States at her time, according to Ferreira (2019). Her work includes nonfiction texts, such as *Women and economics* (1898) and literary texts, such as the famous utopian novel *Herland* (1915), and several short stories, among them *The Yellow Wallpaper*. The text masterfully portrays the customs and thoughts of American bourgeois society at the end of the 19th century, making a strong critique of the gender roles imposed at that time.

The tale is narrated in the first person, from the perspective of a woman, whose name is not mentioned, who suffers from an unspecified disease, treated in history as a nervous problem. Her husband, John, is a medical doctor and has repeatedly stressed the importance of taking his wife's treatment seriously. The treatment, which consists of social isolation with absolute rest and a specific diet, makes the couple move to a colonial mansion in a remote place, where they will have more peace. Her room is reserved on the top floor. The narrator is deprived of any activities that stimulate her intellectually. Reserved exclusively for her thoughts, she often demonstrates her frustration at her inability to perform actions that were so basic and commonplace, even considering herself a burden in her husband’s life.

At a fundamental level, the semantic parts that compose the discourse are subtracted, also identifying the oppositions, from that, classifying the values that carry the meanings of the text, whether positive, posed as attractive or euphoric, or negative ones brought up as repulsive or dysphoric. In the analysis, this will be applied through how color creates opposition and is used as a performance objective positive-negative enunciation in the work (Dariz 2015, Dias 2016). The fundamental level follows a semiotic square, that is, a basic rule laid down by Fiorin (2013:23) mentioned in the research by Batista *et al.* (2017:222) where it delimits that “given a category such that versus *(b)*, the following relationships may appear: (1) affirmation of a denial of *(a)* statement of *(b)*; (2) statement of *(b)*; the negation of *(b)*, statement of *(a)*”. Its development focuses mainly on delimiting the intentionality of the terms that make up the discourse, being categorized as euphoric or dysphoric.

Bearing this in mind, it was observed that the text *The Yellow Wallpaper* places the yellow color within objects of value, “consternation” and “excitement”, categorizing them as antonyms, possible and perceptible symbologies in Table 1. When denying them, generates “not consternation” and “non-excitement”. In this sense, “consternation” along with “excitement”, are bound to “obsession”, to be instigating. Alike, when denying "consternation" leads to "excitement", the result is "pleasure". In turn, when "excitement" is denied, "consternation" is sought, the result of the subject's perception is repulsion and "disgust". However, when there is a convergence between the two negations, "non-consternation" and "non-excitation", "melancholy" is reached (Figure 1).

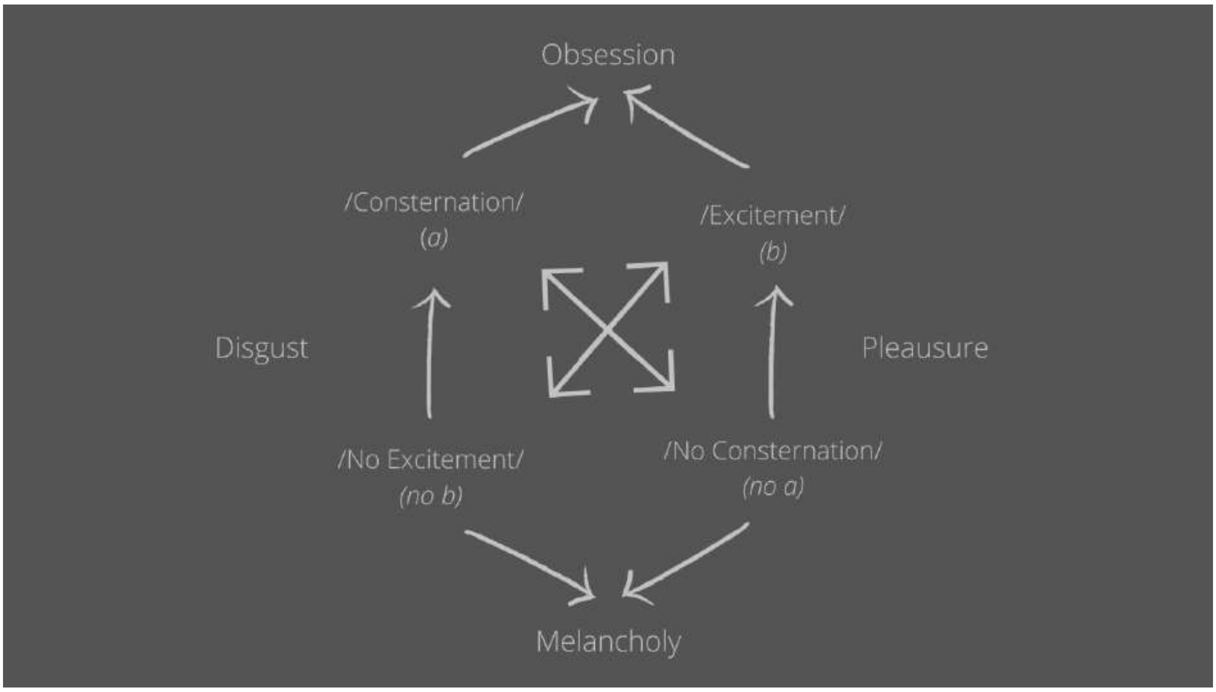

Figure 1: Semiotic frame applied to color in the short story *The Yellow Wallpaper* showing the color relationships in the tale

Charlotte Perkins Gilman's text presents two relations from the perspective of the color element with the narrative. First, there is a relationship between the protagonist and the yellow wallpaper, where within this dynamic, the object of value "excitement" denotes euphoric value, as "consternation" is understood as a dysphoric element.

Still, there is a relationship between the protagonist's husband and the color of the wallpaper that adorns the room, it is justified by perceiving in the narrative construction the incentive of the husband's figure towards the negative effects of the yellow wallpaper on the protagonist's mental health. For the performance of this character within the narrative, the role of the color plays a euphoric level when in "consternation", she feels disgusted about the yellow wallpaper at her wall, while from the perspective of the protagonist experienced as "excitement" demonstrates a dysphoric sense when she feels attracted to the wallpaper, admiring it and being curious about it.

Several themes are worked on in Charlotte Perkins Gilman's short story. Among them, the feminine condition stands out, here restricted to the American bourgeois reality of the 19th century, as commented by Gianvechio *et al.* (2019:200), when explaining that, "It is evident how exhausting and tiring it is to write with a constant opposition, even if this writing is done in a 'covert' way – as a strategy – but still it is not free of judgments and retaliation".

As well, madness is identified as one of the main themes present in the tale which is supposedly developed by the character. As one of the symbologies exposed by Pastoureau (Table1) for the color yellow, yellow can be easily categorized as one of the catalysts of madness in *The Yellow Wallpaper*, which can be seen throughout the narrative.

FINAL CONSIDERATIONS

Thus, a dichotomous attribution of color was identified in the short story mentioned above, inserting it into two parameters of influence: “consternation” and “excitement”, categorizing both elements in a dysphoric and euphoric sense, either through the protagonist’s view or her husband’s. Besides, the symbologies inherent in the yellowish color of the wallpaper played a fundamental role in the construction of the plot that guides the story of the protagonist from her pre-facial phase, going through the discoveries and observation of the environment to the outbreak in a maximum state of madness.

It is believed that it is also valid to develop this same analysis through the theories of other semioticians and semiologists. It is also worth mentioning that color delimited important aspects for the narrative, however, it is not the only one, comprising a valuable consonance with other elements and principles of design, as commented by the protagonist herself in the story. The contributions of this research relate to the areas of linguistics, the theory and practice of color, and semiotics.

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Beyond hue: the affective response to value and chroma

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ABSTRACT
Historically, research into the emotional response to color has involved assigning a single emotion to each hue (e.g., blue is calming), an approach useful in branding, where few colors are used to convey an abstract idea, or in research where they are studied one at a time. This way of thinking about color ("Hue Paradigm") is less useful in design applications where more than one color is used simultaneously, such as in a painting or an interior space. Also, research has focused on more chromatic versions of the hues which are a narrow subset of color space. In recent years color researchers have observed that value and chroma may exert an equal or even greater influence than hue on people's response to color, a finding that introduces an entirely new way of thinking about how people experience color, introduced in this paper as the "Value-Chroma Paradigm". This study explores whether adjusting only value and chroma rather than hue in "colorsets" (graphic image containing all the hues) changes their meaning. The colorsets were Light Chroma, Medium Chroma, High Chroma, Dark Chroma, Dark Neutral and Medium Neutral. A total of 143 subjects, ages 18-91, completed an online survey in which they selected their responses from word-pair opposites. There was broad agreement among subjects, especially in their responses to High Chroma, Light Chroma, Dark Neutral. This study supports the general findings of previous researchers and also suggests that qualitative studies of colors in combination may yield useful evidence for the design context.

Keywords: *affective meaning of color, color-emotion association, color and design, color psychology*

INTRODUCTION

This study is as much an exploration of how people think about color, i.e., color paradigms, as it is about colors themselves. Until now, the questions and conversations we have about color, whether in research, design or everyday discourse, have been based on what this study terms the "Hue Paradigm" (Figure 1), a mental construct that categorizes colors according to hue (e.g., red, blue, yellow, etc.). This paradigm has its roots in the centuries-old work of Isaac Newton, who produced the visible spectrum and then arranged the resulting hues around a circle. Since then, the color wheel (with varying number of hues) has been adopted as the model used for the study of and discussion of color in physical research, in education, art instruction, and the field of marketing and branding. The Hue Paradigm is a deeply embedded way of thinking about color and may, in fact, be hindering progress toward understanding and articulating how people respond to color in a design context.

The Hue Paradigm, by its very nature, fosters comparisons between distinct hues, and the research that underlies much of what is commonly termed the "psychology of color" has used this model to organize emotional responses to the hues, e.g., red is exciting, blue is calming. While this approach may work for single-color applications, such as designing a logo, it does not lend itself well to design contexts where multiple colors are used at the same time, such as environmental design. After all, emotions are not "additive"; that is, there is no third emotion that arises from combining "exciting" red with its opposite "calming" blue in a palette. Complicating matters is the reality that color research has primarily studied chromatic versions of the hues, and has virtually ignored the wide range of low chroma colors which are the workhorses in many design palettes. Ironically, the vast majority of the colors in the natural world, humans' first environment, are not high chroma, leading one to wonder why so much attention is focused on these types of colors that appear much less frequently in nature. The answer probably lies in the power of these colors to command our attention! In any event, this "chroma bias" leaves sizable gaps of color space unexplored when it comes to interpreting how people respond to color. These issues highlight the fact that the way researchers approach color and the way designers approach it are starkly different. One honors the scientific method by tightly controlling colors and presenting them one at a time to subjects, the other juggles multiple colors (plus many other variables) within the physical reality of space. Until we acknowledge these differences and look for ways to bridge this application gap, designers will have to continue to rely on subjective intuition and trends, rather than evidence, for guidance in making color decisions.

This study takes into account a designer's thought process where color begins as an idea, rather than a specification as it would in the first stage of research. During what is known as the "concept" stage of design, the designer analyzes the needs of the people who will occupy the space and considers possible solutions. Color at this stage may be nothing more than a general idea such as "light", "dark", "neutral", or "colorful". The question is, do these color ideas have specific meanings? If they do, then understanding those meanings enables the designer to be intentional in setting the color direction for a project. The survey described in this paper investigates the possibility that color exists as ideas, as general categories, and is an effort to explore the meanings associated with these categories.

Figure 1: Hue Paradigm: Red, Orange, Yellow, Green, Blue, and Violet (from left to right).

THEORY

In 1994 Valdez and Mehrabian demonstrated in their study "Effects of Color on Emotions" that a shift in value and chroma alters the emotional meaning of a hue. They investigated subject responses to hue, chroma (saturation) and value (brightness) using the Pleasure-Arousal-Dominance (PAD) model. They found that "saturation (S) and brightness (B) evidenced strong and consistent effects on emotions" (Valdez and Mehrabian 1994:394?) with chroma generally associated with Arousal, value with Dominance and Pleasure with colors having both higher value and higher chroma. Other researchers have also noted more recently that value and chroma exert consistent effects on how people respond to colors in a variety of contexts: culture (Gao et al. 2007), study spaces (Al-Ayash 2015), bodily expressions (Dael et al. 2016), facial expressions (Da Pos and Green-Armitage 2007), positivity (Specker and Leder 2018) palette design (Bartram 2017) and mood (Jonauskaite et al. 2019). As these papers demonstrate, there is an increasing acknowledgment that hue is not the only player in the world of color affect. This will come as no surprise to designers who consciously or unconsciously have used color in this way for a long time, even without the evidence to back them up.

METHOD

Six "colorsets" were created representing six distinct color ideas named Light Chroma, Medium Chroma, High Chroma, Dark Chroma, Medium Neutral, and Dark Neutral (Figure 2). Each colorset is a square graphic comprised of small rectangles in the 10 Munsell hues (R, YR, Y, GY, G, BG, B, PB, P, RP); each contains the same hue arrangement, yet varies in value and chroma (HEX codes documented).

Eight word-pairs were created by the researcher that describe design impressions: soft-hard, strong-delicate, cheerful-serious, intense-relaxed, calm-exciting, mature-young, light-heavy and friendly-aloof. The pairs loosely fit the Arousal and Dominance dimensions of the PAD model as interpreted by the researcher. Two versions of the same survey were created using SurveyMonkey.com where word-pairs were reversed to counterbalance order of responses. A gray square with the instruction "Rest your eyes" was presented between colorsets to offer subjects a visual break. As a warmup, images of two color-field paintings by Mark Rothko offered subjects an opportunity to become acquainted with word pairs before the actual survey began. Subjects were drawn from a variety of locations, including a local women's college, radio station employees, a retirement community and other volunteers in Raleigh, NC (USA). There were 142 participants whose ages ranged from 18 to 91, with 112 females and 30 males.

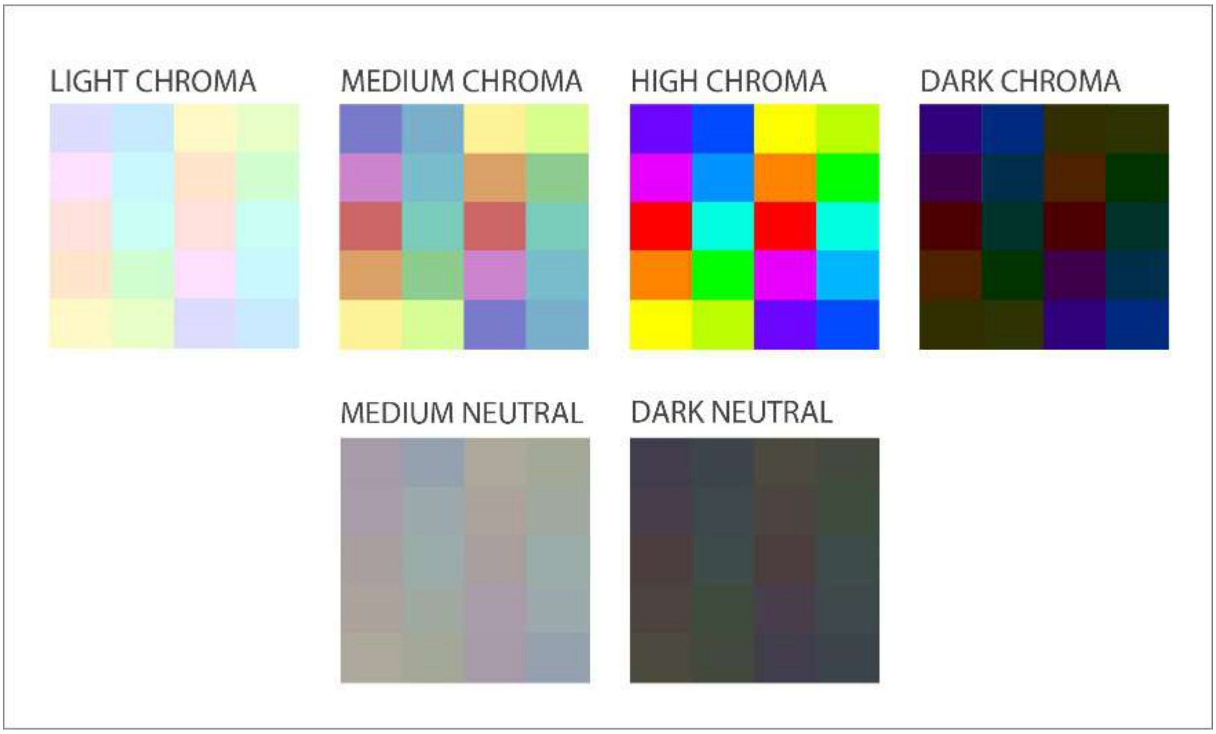

Figure 2: Named Colorsets: Light Chroma, Medium Chroma, High Chroma, Dark Chroma, Medium Neutral, and Dark Neutral (from left to right).

A Dell 27” (U2718Q) monitor was used with all subjects with brightness calibrated to the ambient lighting conditions (target luminance of 20) using XRite i1 Display Pro, and it was set approximately 14” from the edge of desk at eye level height of the researcher. After signing a consent form, subjects completed an online Ishihara 38 Plate CVD Test (color-blindness.com) to screen for red-green color blindness (there were no color-blind subjects). Next, subjects completed the online survey where they were instructed to “evaluate each colorset as a whole, not based on any individual colors.” To simplify the survey process, elderly subjects could elect to have their verbal response recorded by the researcher. Following survey completion, the subjects were thanked and dismissed.

Based on previous findings, it was anticipated that the colorsets with higher chroma would be perceived as more Arousing (intense, energetic, friendly); lower chroma/low value colors will be perceived as more Dominant (intense, aloof, serious, strong, mature, calm, hard, heavy); and high value/lower chroma would appear less dominant (soft, relaxed, delicate, light) and less arousing (calm, relaxed). Colorsets away from hue and value extremes were expected to show mixed results.

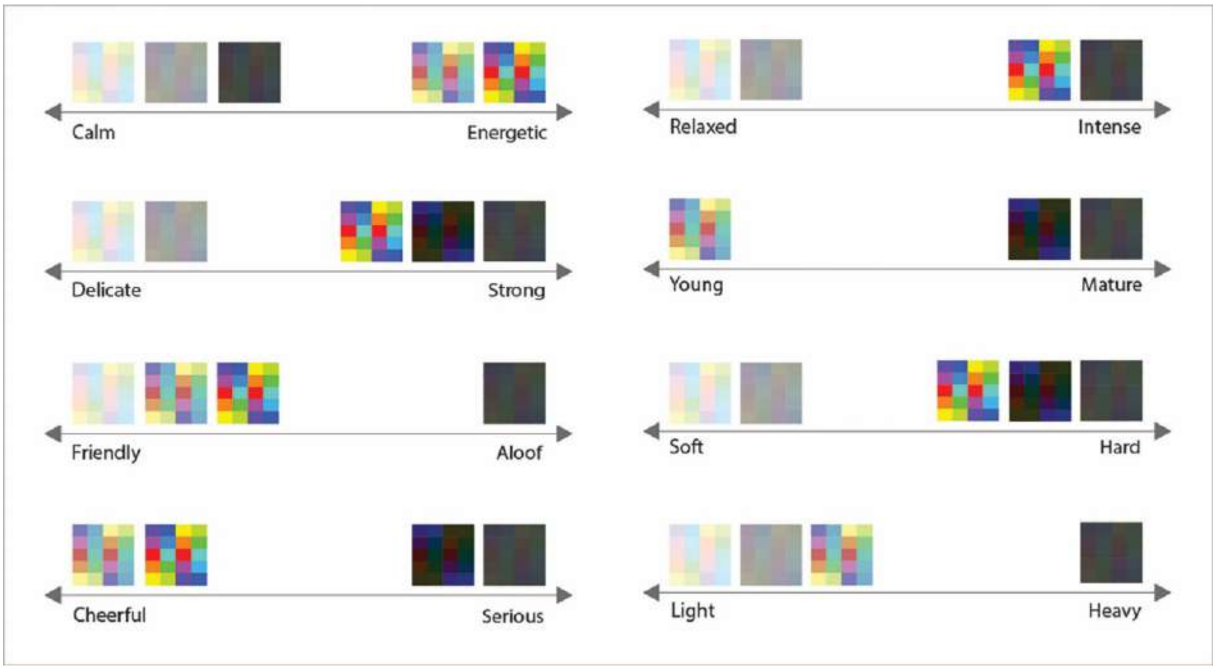

Figure 3: Colorsets by word-pair: Calm–Energetic, Relaxed–Intense, Delicate–Strong, Young–Mature, Friendly–Aloof, Soft–Hard, Cheerful–Serious, Light–Heavy (from left to right).

RESULTS AND DISCUSSION

Subject responses were in line with predictions, with 80% or more of the subjects agreeing on the impressions conveyed by 75% of the 48 survey questions (Figure 3). As expected, the strongest agreement lay in the extremes: High Chroma, Light Chroma, and Dark Neutral; there was less agreement about the “in-between” colorsets representing Dark Chroma, Medium Chroma and Medium Neutral.

Three key findings may be relevant to a designer’s thought process, using as an example the selection of color palettes for healthcare environments. First, High Chroma was rated “intense”, “hard” and “strong”, suggesting that these colors may be less compatible with designs where relaxation is the goal. Often, these high chroma colors are associated with children because, as subjects in this study indicated, they are “friendly”, “cheerful” and “energetic”. Yet a better choice might be Medium Chroma colors which also have these attributes but are not “intense”. Second, Dark Neutral and Dark Chroma were both experienced as “serious”, “hard”, “strong” and “mature”. For Dark Neutral the ratings were more pronounced, adding “heavy”, “aloof”, “intense” and “calm” to the mix. Therefore, extensive use of Dark Neutrals might be best reserved for spaces specifically designed to convey these impressions or used in small amounts as accents in spaces where a friendlier impression is intended. Third, Medium Neutral and Light Chroma colors are “calm”, “relaxed” and “soft”, but Medium Neutral did not produce as high a rating for “friendly” or “cheerful” as Light Chroma, Medium Chroma and High Chroma. This suggests that neutral color schemes may be perceived as friendlier and more cheerful through the addition of chromatic elements.

There were minor differences between males and females, with women rating Medium Chroma as more energetic than men. A comparison of the 30 youngest (age 25 or younger) and the 30 oldest (age 70 or older) subjects also showed significant agreement, with the disparity happening along the “energetic-calm” word-pair Dark Chroma, Medium Chroma and Dark Neutral. The elders found Dark Chroma and Dark Neutral to be more energetic and Medium Chroma to be less energetic than did the younger subjects. Overall, as predicted, it appears that Arousal is primarily a function of chroma: low chroma was associated with low arousal and high chroma with high arousal. On the Dominance dimensions value played a significant role, with lower value associated with higher dominance.

Figure 4: Value-Chroma Color Paradigm.

CONCLUSION

As a study of color ideas this survey has demonstrated that, *independent of hue*, certain types of colors are associated with certain impressions, a finding which is in line with existing research on color and affect. It proposes that a second color model, the Value-Chroma Paradigm (Figure 4) is better suited than the Hue Paradigm for design applications because it addresses real-world design where more than one hue, in a range of values and chroma, may be presented at one time. Understanding how people respond to the extremes of color can help anchor a designer’s thought process during the initial phase of design when the color direction is being established. It encourages an evidence-based approach to color decisions rather than exclusive reliance on subjective preferences and trends. Deciphering the human response to color requires innovative and qualitative approaches to the study of color that acknowledge the designer’s thought process. This study departs from controlled quantitative research methods that yield narrower results toward a more qualitative approach that yields broader, less clear-cut findings, yet which may have more real-world design application. Ultimately, the development of a body of knowledge for the application of color in design may depend on the inclusion of a designer's point-of-view when developing research questions and methods.

ACKNOWLEDGMENTS
My deepest gratitude to Dr. Mark O'Dekirk, professor of Psychology at Meredith College for both his guidance in the planning of this study as well as his commitment to encouraging his students to participate in the survey. Also, my thanks go to my father John Divers for his efforts to recruit elderly subjects, my lifelong friend Shirley Davenport for recruiting middle aged subject at her place of work, and my husband Greg Martin for his patient and incisive editing of this paper.

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The theory of urban color environment

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ABSTRACT
The author discusses the role of color in the creation of the urban color environment. As human beings developed interior and exterior spaces, color appeared in man-made environments. The color of prehistoric structures remained passively subordinate to the materials and processes of building. The predominance of one material led to monochromy as the simplest color expression of architecture. However, through color differences of the materials polychromy was born, although it remained passive as it was not the result of skilled planning and execution. Active polychromy appears as a result of a creative act and as a tool for endowing building with a new image. Coloristics of the city is a coherent color set of the natural and artificial environment that forms a transferable color-spatial field that can be applied to suit different needs and situations. Coloristics of the city is determined by three parameters: by structure, i.e., construction of and connections between color masses and chromatic content; color palette and dynamics; and, the measure of the mobility or transferability of structure and palette in space and time. Coloristics of the city actually performs utilitarian and artistic-aesthetic functions. Many factors dictate its formation: natural and climatic features, the morphology of architectural and urban planning forms, the color culture of local inhabitants, etc. The development of color culture is associated with the improvement of color harmonization tools based on modern color systems. Since coloristics of the city is considered as a phenomenon caused by the natural features of the region and socio-cultural processes, it is useful to consider the combination of all these factors as a kind of space-time context that brings a certain color field to life and is perceived as a specific color environment.

Keywords: *urban color environment, theory, practice*

The phenomenon of urban color-light environment is often ignored by architects, although it exists during both day and night and, respectively, is capable of being visually perceived under two different conditions: daytime (natural) and nighttime (artificial). Color and light are intrinsically related. During the day global white light makes the chromatic relations of objects in the surrounding clearly distinguishable. At night chromatic relations are tonal being visually determined by more contrasting light. The transition from the color environment becoming a lit surroundings constitutes the dynamics of the color-light environment by which humans not only gage their existential sense of time, but also state of emotional being. Even when the color characteristics of architecture stay constant over the years, the light characteristics can instantly and radically change, creating sometimes unpredictable images of the surrounding material objects.

Since ancient times urban planning has shown that the “object color” of buildings under natural illumination – along with volumetric and spatial aspects – is a full-fledged means of articulating the urban environment. Historically, how has the urban color environment been formed?

The oldest cities of the world were built from natural materials that was lying under the very feet of the inhabitants of ancient civilizations. Clay cities were built by Muslim, Buddhist, and Native American cultures. For millennia the passive polychromy of the artificial environment has remained a vast backdrop for later bursts of bright color. In the folk architecture of North and South Yemen, of Burkina Faso and Nigeria, and of Mexico and Peru, it is still possible to see mudbrick buildings that are partially painted with bright colors. Older than most ordinary buildings, these unique structures evidence the spiritual cultures, ideologies, and aesthetics of past eras. An integral part of material culture, the polychromies of these structures reflect the worldviews, i.e., religion, science, and art of different groups living in particular periods. The semantics of these architectural polychromies largely relied on the symbolism of color (Figure 1).

Assimilated by Mesopotamia, the symbolism of color of Ancient Egypt was passed on through the countries of Asia Minor, being adapted to the new form of culture of Ancient Greece in which the cities were expressly pigmented. Ancient Greek architects did not consider the natural color of marble, wood, and ivory to be inherent to architecture. The entablatures of many temples had a bright color encaustic on a wax base that did not hide the marble structure and created the effect of a deep glow. The Greeks could not ignore color – a powerful essence of nature itself (Zabello et al. 1942, Bunin and Savarenskaya 1979, Dethier 1981, Choisy 2019) (Figure 2).

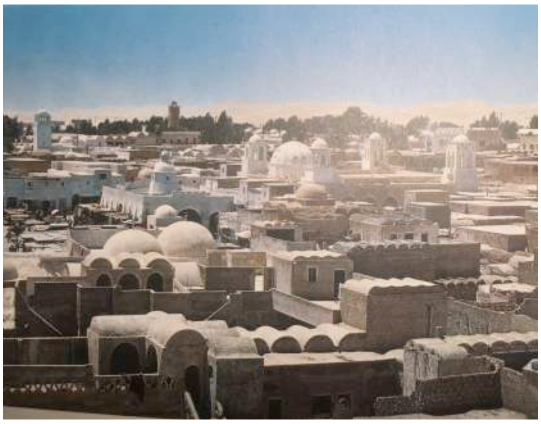

Figure 1: El Oued (Algeria).

Figure 2: The polychromies of fragments of Ancient Egyptian architecture (left) and of the entablature of an Ancient Greek temple (right).

How could the opinion have developed that in architecture, as in sculpture, there should only be one form, as if everything in relief should be colorless?

In 1857 G. de Rochefort writes in the magazine Architect: “For centuries a throng of routinarians, called classicist fans, preached that only bare marble, white and cold...could produce the highest impression of elegance. Both in architecture and in sculpture, they unwittingly rejected the beginnings of the Greek Art that had captivated them” (de Rochefort 1857:51).

The Romans preferred the restraint of gray emphasized by expensive materials. Only in the interiors of Pompeian houses were many colors employed that were brighter than those of the Greeks. The gloomy splendor of the Baths of Caracalla or the Baths of Diocletian represented the calm greatness of Ancient Rome. The Byzantines sought to add the greatness of Rome to Constantinople through civilian buildings. Constantinople was the same Rome yet lacked the restrained harshness of marble façades. Bricks, tiles, and pink plasters gave the city a warm reddish-pink color.

In Europe the city blocks of the Middle Ages were a combination of wood (framed houses), stone, and brick. Beginning in the 12th and 13th centuries Gothic cathedrals began to dominate and unify this colorful diversity. Over time these colossal gray and brown limestone Gothic structures became almost black. Spires and church roofs were not only covered with colored tiles, but more often with copper sheets that eventually oxidized and became bright green. Common to many European cities, the combination of dark gray and bright green colors not only contrasts with the graphic black and white of framed houses with red tiled roofs, but also towers over the gray mass of plastered buildings that create a lower tier mosaic of the city's color field.

In Venice the tradition was preserved of façades inlaid with precious marbles coming from Byzantium. The masonry of the walls of the Doge's Palace was made of white and pink marble. In Italy the tradition of mosaic paving is particularly cherished. During the Renaissance the renewal of a spiritual atmosphere associated with the humanization of the sciences and arts opposed the asceticism of the medieval understanding of color.

The chronicle of architecture and urban planning of the northern countries of Europe is undeniably “cut from wood.” Until the 18th century the Russian city was built mainly of wood. The color image of the oldest Russian cities is associated with the color restraint of larch, oak, aspen, pine, and spruce. The log and the general color merged the buildings into a single ensemble in harmony with the natural environment (natural module). All the main elements of the city were made of wood: citadels, temples of worship, most residential houses, and even the paving of streets. This color homogeneity of the ancient Russian city existed until the 16th–17th centuries until the beginning of the use of brick and stone in fortress, palace, and temple buildings. A fundamentally different understanding of architectural form in the Baroque and Classical periods was also reflected in color. The aesthetics of European Classicism of the 17th century was based on balance and proportionality of forms, constructive use of the order, and geometrically clear layout of cities.

At the end of the 18th century Catherine II approved the general plans of two hundred Russian cities and in 1814 Alexander I issued a decree on urban color design in soft pastel colors in St. Petersburg, Moscow, and other cities. Couriers with color samples rode through the Russian Empire cities up to Irkutsk carrying out the control of architecture color. No other country in the world has ever seen such a large-scale and purposeful transformation of color urban environments. Two colors were dominant in the pastel color ranges: gold and white, which even on cloudy days created a golden glowing atmosphere.

Against the backdrop of the general decline of color in European cities at the end of the 19th century, an attempt at color transformation can be perceived in Turin. The basis of this plan was laid at the beginning of the 19th century when an urban color plan and strict requirements for urban color design were developed. The main streets and squares of the city were transformed according to this plan. The “color paths” leading to the Piazza Castello (the public center of Turin) created a quite diverse, extensive sequence of eighty hues. These paths were connected through a system of streets and squares (Figure 3).

During the second half of the 19th century "The City Color Palette" was published demonstrating the practical result of one-half-century of urban coloring. The twenty color tones that had been most widely used were encoded and referenced in official documents. The experience in Turin of using planned color citywide is a unique phenomenon that was further developed at the end of the 20th century.

Before the First World War, the German Society of Garden Cities built the village of Falkenberg (near Berlin), whose polychromy not only inspired the general population but also specialists. The author was Bruno Taut. He applied polychromy via multi-colored plaster. His program was “Simplify the form and you can successfully act with color” (Taut 1918). After being implemented in Falkenberg, Taut’s concept was used in Magdeburg and other cities. Color became a real means of building a city-planning form. Color was intended to liberate residential building “from the tyranny of the alien forms of the 19th century.” Taut appraised color as a means of freeing architecture from “the straitjacket of gray style decor, material, and all the jumble of old concepts” (Efimov 1990:187) (Figure 4).

Taut's concept, however, was compromised by its vulgar implementation. The economic interests of entrepreneurs were hidden under the slogan “Color in the Design of the City.” Nonetheless, Taut's initiative found a wide response in the movement of color renewal of intraurban spaces. A number of such actions were carried out in other German cities. Along with Taut, Otto Haesler and Ernst May also considered color as a cheap and noble means of reviving standard buildings.

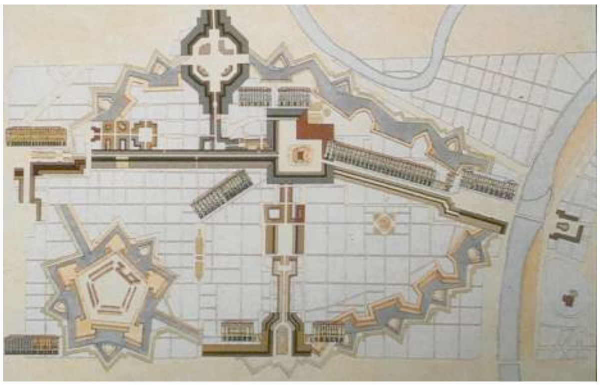

Figure 3: Regular color plan (Turin). Early 19th century.

Figure 4: Polychromy of Falkenberg village (near Berlin) executed in the 1920s. Architect: Bruno Taut.

In Holland artists and architects incorporated bright local colors into the architecture experimentally and practically. The artist Theo van Doesburg proclaimed the need to use colorfulness as a means of organizing space. Architects Gerrit Rietveld and Jacobus Johannes Pieter Oud developed building projects introducing bright colors. The neoplasticism of the De Stijl group had a powerful impact on architectural polychromy. Featuring right angles and clean planes, the visual structures of neoplasticism were easily assimilated into the functional style of architecture. This trend has continued to the present day.

Figure 5: The Plan of exterior urban color design of Moscow (1929). Author: L. Antokolsky. Reconstruction: A. Efimov (1970). I – circular coloring; II – district coloring; and III – arterial coloring.

In December 1929, artist Lev Antokolsky submitted “The Plan of Exterior Urban Color Design of Moscow” to the Moscow City Council on behalf of “Malyarstroy.” The notes of the plan state that “The main lines connecting the city center to the suburbs (Tverskaya, Lubyanka, etc.) have to be especially highlighted. Intermediate streets, passageways, and boulevards can have color shades that dominate the nearest colorful area or square” (Efimov 1990:186). Three general color models were assumed for the final version of the plan (Figure 5):

The first model – Circular Coloring – considers the Red Kremlin with the Red Square as the city center. From the center to circle “A” all buildings have warm colors from reddish-orange to yellowish-green; from circle “A” to “B” there is a prevalence of green and blue; up to the

Kamer-Kollezhsky rampart, there are bluish and purplish colors; in the suburbs, light grey; and, the farther from the center, the closer the color approximates white.

The second model – District Coloring – ascribes specific colors to all seven Moscow districts apart from the Red Kremlin and Red Square. Saturation increases to the central square of the district. Within each district street colors are arranged as follows: the closer to the city center, the more intense the color; the closer to the green suburbs, the more the color approximates white.

The third model – Arterial Coloring – envisions the Kremlin and Red Square as the red center of the red capital. All streets that radiate from the center to the suburbs have a bright reddish-orange color that turns white in the suburbs. The main squares of the central part of Moscow have their own individual color and the intermediate streets enact transitions of colors that approximate white as they approach to the suburbs.

Unfortunately, numerous discussions have not confirmed the need to carry out works based on an artistic concept on a city scale. The massive color change of buildings carried out in 1931 did not focus on a single plan. With some exceptions “red design” was expressed in changing the color of many streets to gray. The polychromy of the historical redesign was ignored. As a result, this negative experience compromised the idea of building an urban color environment for a long time.

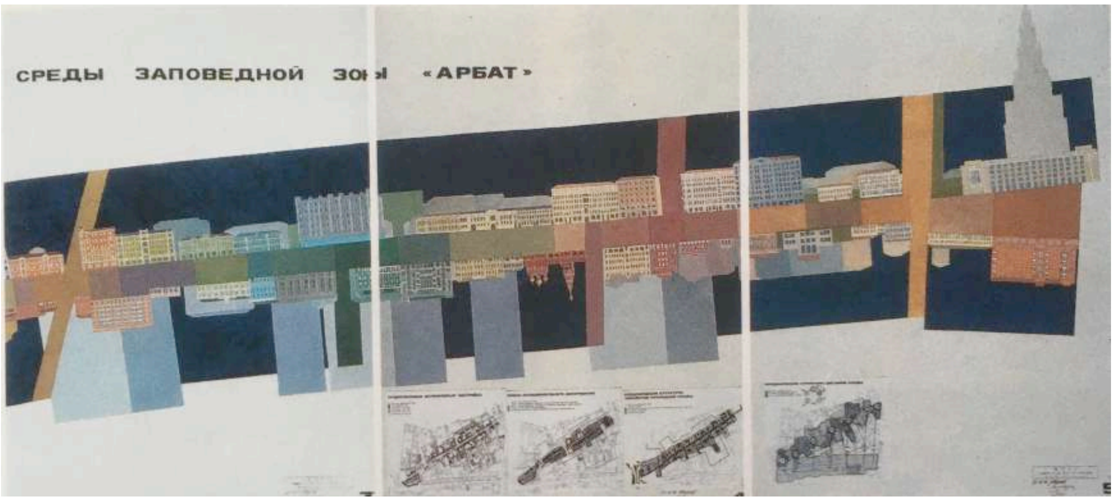

Figure 6: Reconstruction of the color environment of Arbat Street (fragment) (1976, Moscow).

Figure 7: Variants of the color structure of Irkutsk (1984, Eastern Siberia).

By the last third of the 20th century, the above-mentioned original colors of Turin had almost completely disappeared. However, in 1979–1980 a group of specialists led by architect Giovanni Brino developed the "Regular Plan of Turin Polychromy" based on historical attempts to use "tourist yellow" (Biffi Gentili and Brino 1982). The main slogan of the plan was "Diverse Unity." Each building was supposed to be in harmony with the environment and the square, in harmony with the street. According to the plan the main roadways and squares formed the basis of color for the city, which determined the adjoining color of the streets. A perspective color map of the city was created and served as a tool for control. This initiative is the only one that has largely restored the original appearance of the city. During the first three years of implementation, more than 2,000 buildings were colored. The Turin group has also carried out polychromy projects in Giulianova in Abruzzo, Carmagnola, Cavallermaggiore and Banchette. The revival of the architectural polychromy of Turin gave rise to a Neo-Renaissance of historical color appearance of other Italian cities (Brino and Rosso 1980).

The principal feature of the works of French colorists in architecture and urban planning is the understanding of the role of color on an urban and even regional scale. Jean-Philippe Lenclos considers the natural landscape with the results of human activity (historical, architectural) as a holistic environment. In the middle and late 20th century Lenclos explored the polychromy of entire regions of France: Bretagne and the Loire Valley, Normandy and Provence, Burgundy, Limousin, etc. His methodology includes three phases: landscape analysis, visual synthesis, and the development of an "alphabet of colors" adapted to the terrain. Lenclos systematized the results of his long-term work in the map-form of regional color schemes of many French provinces. This work is unique and may be useful for a similar study of natural polychromy in our country, which is characterized by an exceptional variety of contrasting natural landscapes. Colors of the World is a unique study of Lenclos that includes materials of architecture and landscapes of Brazil, India, Iran, Japan, South Africa, Russia, the United States, and other countries (Lenclos and Lenclos 1999).

The phenomenon of coloristics of the city is understood by us as an integral space-time system of the multiplicity of colors of architecture, natural objects, technical structures, decoration, sculptural artworks and other components that form a mobile color-space field under a variety of daylight conditions. Coloristics of the city is determined by three parameters: by structure: connections between and construction of color masses and chromatic content; color palette and dynamics; and, the measure of the mobility or transferability of structure and palette in space and time. Coloristics of the city actually performs utilitarian, social, and artistic-aesthetic functions. Its formation is due to a complexity of main factors: natural and climatic conditions; the city's structure; historical architectural polychromy; and, the color culture of the society (Efimov 1990).

This interpretation of coloristics of the city allows considering it as a special object of architectural and urban planning design with its own specific features: methodology, design language, technical means, and its use. Frameworks and objectives of this project work should not disrupt the self-regulation of the color environment.

This concept of city coloristics became the theoretical basis for the development of the "General Plan of Coloristics of Moscow" (1998, Head: A. Efimov), which was based on the urban planning framework and the rich historical color diversity of the city. In particular, the study of the historical architectural polychromy of Moscow demonstrated that a traditional "Russian pattern" appeared in the 17th century with the Baroque era; with the Classical era pastel colors prevailed, a color palette of white, pink, red, blue, and greenish colors with gold; with Art Nouveau and the architecture of retrospective trends of the late 19th and early 20th centuries, stone, gray plaster, bronze, and glass appeared; with Constructivism, gray plaster; and, with Stalinist architecture, there were shades of ochre. These assessments were approved at a meeting of the government of Moscow and included in the Moscow General

Plan (1999). A reconstruction of the color environment is presented in the scheme below (Figure 6).

Coloristics of the city not only enabled the development of large-scale color concepts for major urban complexes and structural city elements (e.g., the Garden Ring, etc.), but they also served as the basis for the color concepts of individual buildings. Changing the color of buildings was regulated by the "Color Concept Passports," which helped recreate the historical color atmosphere of the "architectural body" of the city center and at the same time served in creating a unique coloristics for new developments.

In accordance with this coloristics scheme of the city, a group of architects of the Scientific Research Institute of Theory and History of Architecture and Urban Planning (A. Efimov, V. Elizarov, V. Timofeev) developed proposals for coloristics for a number of cities: Moscow, Yaroslavl (Central Russia), Surgut (Western Siberia), Irkutsk (Eastern Siberia), Yalta (Crimea), Kairakty and Kulsary (Kazakhstan), Ashgabat (Turkmenistan), etc.

An example of such a color scheme is demonstrated by the one for Irkutsk (Eastern Siberia, 1984) (Figure 7). As a huge mass of water, the Angara River surges out of Lake Baikal and gushes through Irkutsk, not even freezing at thirty degrees below zero. In winter there is a constant fog hanging over the river and the surrounding areas. Better than other colors, in winter, and only red can pass through this damp haze. That is why red should prevail in architecture.

After color analysis of the local architecture and its natural environment as well as of the color preferences of the local inhabitants to reflect the character of the coloristics culture of the region, the following were developed: the color scheme of the city and models of the coloristic structure based on its urban planning framework. Based on these studies, a basic scheme of the coloristics of Irkutsk was proposed, which became the foundation for the color concepts of individual fragments of the city, i.e., for embankments, streets, squares, etc.

The artistic image of the city is largely determined by the potential of its coloristics. Therefore, primarily, the activity of the architect-colorist should be manifest at the highest level of functional activity, i.e., the framework of the city, the concentration of historical and cultural objects, wildlife areas, and other informative and valuable, most intensely perceived fragments of the urban environment.

"Color is as essential to humanity as vitamins," proclaimed Victor Vasarely, an outstanding artist of the 20th century and it is difficult to disagree with him. Color design is urgently needed in cities where the greater part of population of this planet lives.

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Analytical study of pigments (colors) of the Wildlife Scene at Ra-shepses Burial Chamber (Saqqara, Egypt)

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ABSTRACT
Although symbolism and traditional rules were most important artistic values reflected in artworks of ancient Egypt specially for gods and death, the concept of using colors was sometimes applied to realistic representations of nature and daily life scenes. Saqqara is the main necropolis of Memphis, capital of ancient Egypt during the Old Kingdom. The burial chamber of Ra-shepses is considered the most ancient decorated burial chamber discovered until now. Ra-shepses was one of the most important figures during the Fifth Dynasty. He was the first to receive the title of Responsible for the South, and was a vizier at the time of King Jedkara. The colors of the wildlife scene of the burial chamber of Ra-shepses are unique. The ancient artist used shadows for the first time. More than ten different colors were used. It shows how skilled the artist was to create new colors that were not used before. In this study, SEM and EDX were used to identify the components of each pigment, and a polarizing microscope was used to identify the technique of applying pigments. FTIR was used to identify the binding media. The yellow pigment was probably yellow ochre (iron oxide). Clay minerals such as kaolinite may have been added with iron oxide. Iron oxide was also detected in red, dark red, brown, orange and Paige pigments. The blue pigment was Egyptian blue (cuprorivaite), the white pigment a mixture of gypsum and calcium carbonate, and the black pigment graphite (carbon). The binding media was animal glue.

Keywords: *pigments, ancient Egypt, wildlife scene, yellow ocher, Egyptian blue*

INTRODUCTION
The burial chamber of Ra-shepses is one of the most beautiful burial chambers at Saqqara (Ewais et al. 2017). The ancient Egyptian artist showed skill and talent in using natural pigments. The marvelous and unique wildlife scene covers the north end of the west wall (Figure 1). The scene consists of five registers or rows of different male animals. The last one depicting butchers is not included in this research. The first register at the top shows four partially damaged oryxes, which were called *ma-hedj* in ancient Egyptian language. They have typically long and only slightly curved horns. They are painted white with red-brown throats and bellies with dark brown color around their eyes. Around their necks are ropes tied to wedges in the ground. The second register contains four screw-horn antelopes (ancient *nudju*). The front parts of their bodies are painted with bright azure color while their hindquarters and legs are white. They are also tied with ropes around their necks to wedges. The third register displays five Nubian ibexes (wild goat, *nia* in the ancient Egyptian language) that are marvelously colored. The first ibex is colored light yellow, the second one is hidden and only its head and legs are visible. The other three are painted brown, with individual dark hairs executed by the artist. The shapes of the animals provide evidence of the artist's corrections

as he painted them larger at first, then he revised the drawing at a smaller scale. The ibexes are also tied to wedges by ropes around their necks. The fourth register is quite damaged but still shows parts of four gazelles (*gehes* in the ancient Egyptian language) painted red, with only their bellies and mouths white. Above the first and the second gazelles are the remains of a badly damaged hieroglyphic text describing them as 'young gazelles.' The ropes around the necks of the gazelles can be seen but the wedges are lost (El-Tayeb 2013).

Figure 1: Wildlife scene at Ra-shepses burial chamber.

ANALATYICAL STUDY OF THE WILDLIFE SCENE PIGMENTS

It was important to identify the components of all pigments (yellow, blue, orange, white, grey, red, dark red, black, Paige and brown) with analyses, tests and scanning, to investigate all elements of minerals and their impurities found with the pigments, and to examine the texture and size of the pigment grains (Stuart 2007). The technique used by the ancient Egyptian artist had to be identified as well as the investigation of any reason for the degradation of the pigments. It was also important to identify what kind of binding media had been used to fix pigments. It is known that animal glue was commonly used at the time of the Fifth Dynasty.

The ancient Egyptian artists used natural pigments found in the natural surroundings, however, they also could manufacture some of the pigments such as the Egyptian blue and the Egyptian green since the time of the Old Kingdom and exported them overseas (William 1987). The ancient Egyptians did not use only one source for a pigment but different materials as well. No one knows if they knew the chemical components of the materials (Lucas 1962). It was necessary to analyze the pigments to identify their sources and components. In this paper the yellow pigment and the light blue pigment will be discussed.

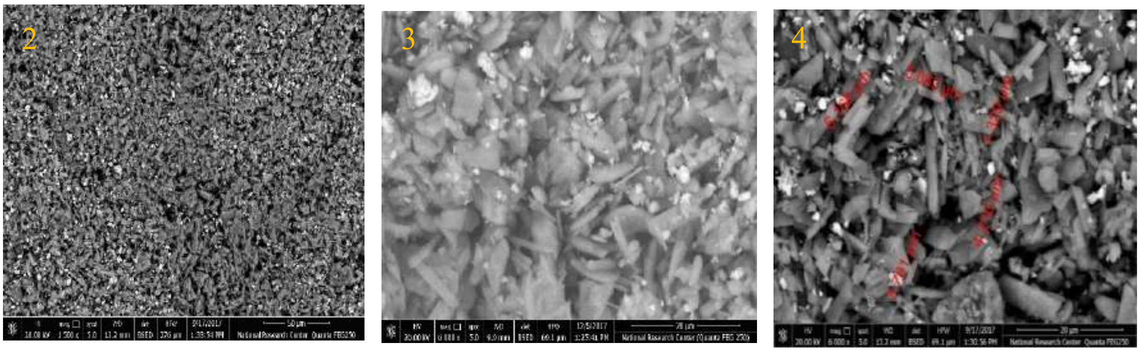
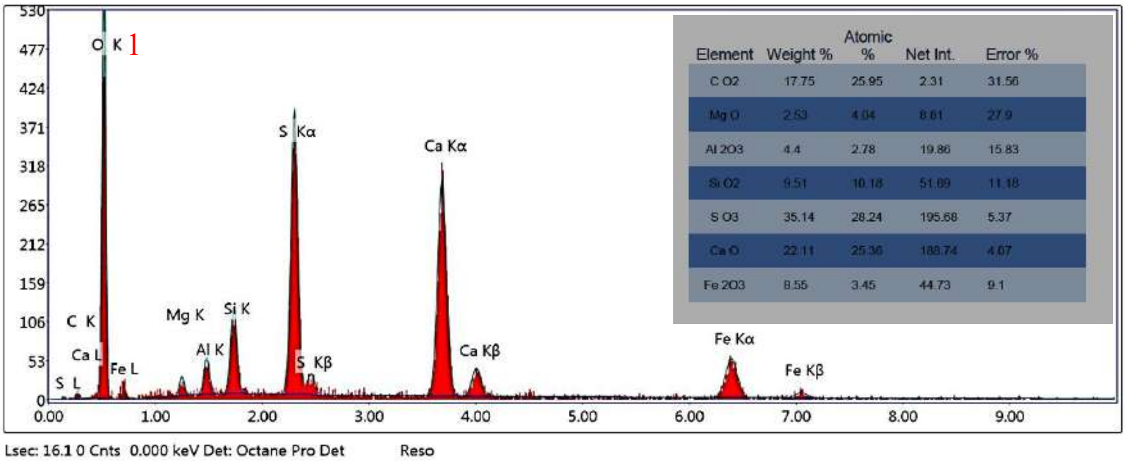


Figure 2: Scanning Electron Microscope (SEM) images (2–4) illustrating the yellow pigment; they show that there are crystals of gypsum together with grains of goethite



Element	Weight %	Atomic %	Net Int.	Error %
C O2	17.75	25.95	2.31	31.56
Mg O	2.53	4.04	8.61	27.9
Al 2O3	4.4	2.78	19.86	15.83
Si O2	9.51	10.18	51.09	11.18
S O3	35.14	28.24	195.68	5.37
Ca O	22.11	25.36	188.74	4.07
Fe 2O3	8.55	3.45	44.73	9.1

Figure 3: The EDX pattern shows the components of the yellow pigment. Iron Oxide exists.

Figure 4: Photos (5-7) illustrate the cross-section investigation for the yellow pigment and the plaster to which the pigment was applied.

YELLOW PIGMENT

The yellow pigment, used since the time of the Old Kingdom and called Limonite in the past, was yellow ochre ranging from yellow to brownish yellow. It was used in ancient Egypt from the Fifth Dynasty to the Romans (El Goresy et al. 1986, El Goresy 2000). It is found in Saqqara in tombs and burial chambers such as Ptah-shepses burial chamber (Ahmed et al. 2014). In this study, yellow pigment was found in many places at Ra-shepses burial chamber; in the wildlife scene it was used to color one of the ibexes (the first one) in the third register and the head of one of the two behind it (Figure 1).

The Energy Dispersive X-ray (EDX) microanalysis illustrates that the yellow pigment is yellow ochre (goethite Fe O OH), because iron (Fe) was found. Calcium and silicon were also found, which must have come from the plaster. The percentage of iron (Fe) is 8.65%, calcium (Ca) 22.11%, sulfur (So) 35.14%, silicon (Si O2) 9.51%, and carbon dioxide (Co2) 17.75%. Figure 3 shows the presence of aluminum and silicon (aluminum silicate), and illustrates that clay minerals such as kaolinite may have been used with iron oxide as a yellow pigment. This may also mean that iron oxide was used alone as a yellow pigment whilst kaolinite is an impurity from the bedrock.

The Scanning Electron Microscope (SEM) of the yellow pigment illustrates that the grains of the pigment take almost a pin shape and there are some irregular shaped grains, i.e., the ancient artist used gypsum as a white pigment mixed with goethite to get light yellow color, or a very thin layer of yellow pigment was directly used on the plaster. This is the reason why pin-shaped crystals of gypsum appear clearly in the micrographic photographs. The size of the grain ranges between 7 and 3µm, which means that the ancient artist tried to get fine grains by milling the natural pigment (Figure 2).

The cross-section investigation of the yellow pigment illustrates that the layer of the yellow pigment ranges between 5.27 and 8.96 µm, showing how thin the layer of yellow pigment was. The cross section of the yellow pigment also illustrates that the thickness of the plaster layer ranges between 181.21 and 304.55 µm. The yellow pigment was applied directly on the plaster and it shows how thin the plaster layer is in some places, which led to the deterioration of the plaster layer and fine cracks appeared everywhere (Figure 4).

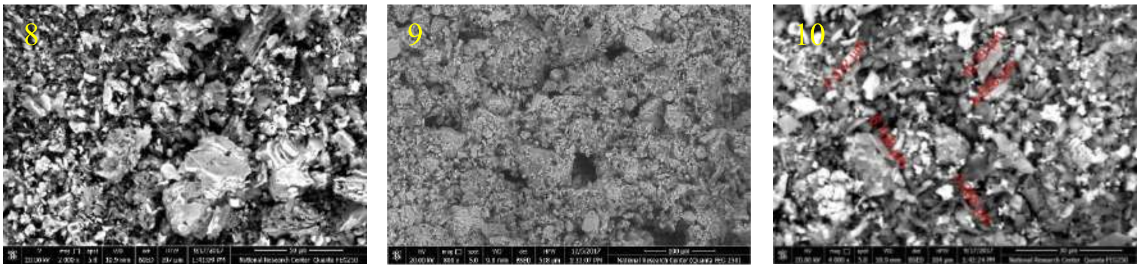
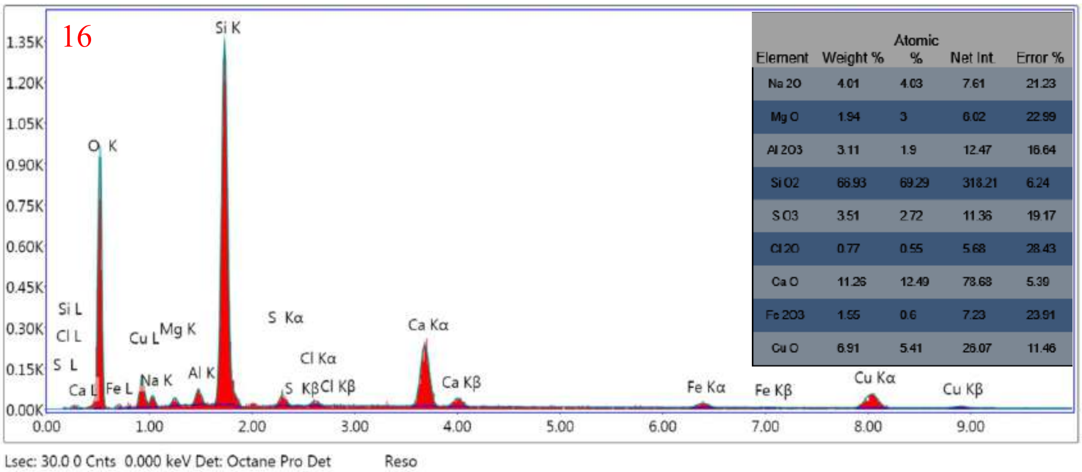


Figure 5: Scanning Electron Microscope (SEM) images (8–10) illustrating the light blue pigment.



Element	Weight %	Atomic %	Net Int.	Error %
Na 2O	4.01	4.03	7.61	21.23
Mg O	1.94	3	6.02	22.99
Al 2O3	3.11	1.9	12.47	16.64
Si O2	66.93	69.29	318.21	6.24
S O3	3.51	2.72	11.36	19.17
Cl 2O	0.77	0.55	5.68	28.43
Ca O	11.26	12.49	78.68	5.39
Fe 2O3	1.55	0.6	7.23	23.91
Cu O	6.91	5.41	26.07	11.46

Figure 6: The EDX pattern illustrates that the components of the blue pigment, copper and silica, exist.

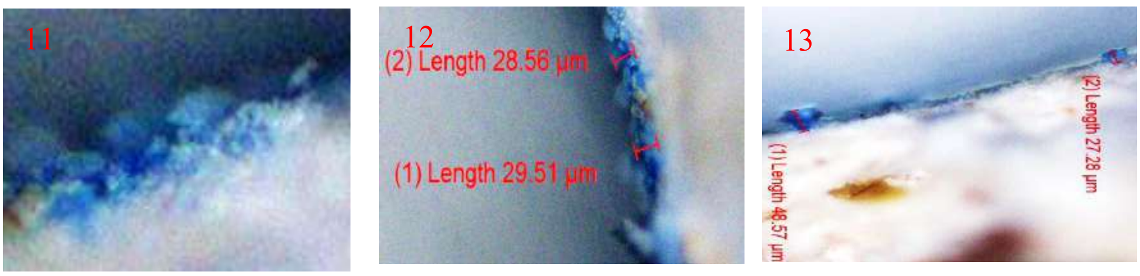


Figure 7: Photographs (11–13) show the cross-section investigation for the light blue pigment.

LIGHT BLUE PIGMENT

The ancient Egyptian artist used two main sources of blue pigment: azurite is thought to have been used since the time of the Fourth Dynasty; and Egyptian blue (cuprorivaite) that began to be made and used since the time of the Fifth Dynasty (Bruni 1999). It was ground and bigger grains were used as dark blue, whilst, finer grains were used to get light blue pigment (Akarish et al. 2017).

The EDX analysis illustrates the presence of copper (Cu O) 6.91%, silicon (SiO2) 66.93%, and calcium (Ca O) 11.26%. There are other elements such as sodium (Na 2O), magnesium (Mg O), aluminum (Al2 O), and chloride (Cl O2) (Figure 6). This means that the blue pigment used at Ra-shepses burial chamber is cuprorivaite (CaCuSi4 O10); however, silicate and calcium may have come from the plaster. The most famous blue pigments used at that time were cuprorivaite (CaCuSi4 O10) and azurite, basically copper carbonate (2Cu2Co3(OH)2), because there is no carbonate (Co3) appearing in the EDX chart.

Scanning the surface of the blue pigment using SEM illustrates that the grains of the blue pigment are irregular in shape because the Egyptian blue is an artificial pigment. The grain size ranges between 10 and 3 µm (Figure 5). This means that the size of the grains was various. Pin-shaped crystals can also be seen, which means that the ancient Egyptians used gypsum as a component in the plaster and as a white pigment. The ancient artist may have mixed white pigment (gypsum) with blue pigment (Egyptian blue) to get the light blue color. That can be illustrated by using optical digital microscope, which illustrates that the colors were applied directly on a colored background so they may have been mixed before application on the plaster.

The cross-section investigation for the light blue pigment illustrates that the light blue pigment layer ranges between 28.56 and 29.51 µm and the size of one of the biggest grains of the light blue pigment is 48.57 µm. The cross-section investigation illustrates that the connection between the light blue pigment grains is not very good and the light blue pigment was applied directly on the plaster layer. It also illustrates that the ancient artist used white pigment mixed with blue pigment to get the light blue pigment (Figure 7).

Further pigment analyses were done for the colors: orange, white, grey, red, dark red, black, Paige, and brown, which will not be included in this paper.

CONCLUSION

This study shows that pigments used in Ra-shepses burial chamber are unique; they illustrate how skillful the artist was. It is rare to find ten different pigments in one tomb (Ewais 2019). The yellow pigment used at Ra-shepses burial chamber was probably yellow ochre. The presence of aluminum and silicon (aluminum silicate) shows that clay minerals such as kaolinite may have been used with iron oxide as a yellow pigment. It may also mean that iron oxide was used as a yellow pigment whilst kaolinite is an impurity coming from the bedrock. The blue pigment used at Ra-shepses burial chamber was Egyptian blue (cuprorivaite), which also was common from the beginning of the Old Kingdom to the late period. To get the light blue pigment, the ancient artist may have used fine grains of cuprorivaite after fine milling or it may have been mixed with gypsum or calcium carbonate or both. The ancient Egyptian artist understood that pigments could not be applied on the surface of the plaster for a long time without mixing them with binding media that helped the pigments to be fixed on the plaster or stone surfaces. Binding media has usually been used in the tempera technique. Pigments were minced and amalgamated with a binder to be laid on a pictorial surface. Protienaceous with a basis of egg, animal glue or polysaccharide constitutions such as plant gums are the main materials and were commonly used as binding media at the time of ancient Egypt (Masschelein-Kleiner 1995). Binding media can be identified by using different methods such as direct infrared (IR) (Low and Baer 1977), pyrolysis mass spectrometry (MS) and Raman beam. Four samples were chosen to be analyzed to identify the binding media that was used at Ra-shepses burial chamber (blue pigment, orange pigment, black pigment and brown pigment). The Fourier Transform Infrared (FTIR) technique, which offers a quick analysis of small samples (about 0,5mg), was used to identify an unknown sample comparing it to known spectra. Through comparing the result of samples from the chosen pigments to the FTIR binding media standards, it was obvious that the binding media that was used at the burial chamber of Ra-shepses was animal glue, and that agrees with the results from other places in Saqqara such as the tomb of Idout (Akarish et al. 2017) and the tomb of Ptah-shepses (Ahmed et al. 2014) where animal glue was used as a binding media.

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The impact of Spanish colonization on color semiotics and worldview in Prehispanic Mexico

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ABSTRACT
The aim of this paper is to identify how the arrival of the Europeans in the American continent influenced indigenous worldviews, particularly regarding their use of color. We will be focusing on the Nahua peoples of Mesoamerica during the Postclassic Mesoamerican period (900–1521 CE).

Color is a key element in a nation's identity, and since nowadays most of Mexico's population is of Indigenous and Spanish descent, it is essential to understand how the perspective on color, both as a communication tool and as an identity feature, morphed into what it is today.

Indigenous color meanings were deeply connected to nature as well as their entire worldview, whereas the meanings assigned by Europeans had a more religious and even political load. The colonization process in Mesoamerica engaged in a great ideological process through the imposition of European religious values. A key factor for the Christianization was carried out through art and the use of images for indoctrination. This paper aims to discover how much of Mexico's visual identity is made up of the meanings assigned to colors from the indigenous worldview and how much of the colonization process permeated these meanings to the artistic and visual expression of current Mexican identity.

Keywords: *color semiotics, Prehispanic colors, Mexican colors, syncretism, identity*

INTRODUCTION

The use and symbolism of color throughout Mexican history is a compelling topic, considering both its indigenous and European backgrounds. The love of color is deeply rooted in Mexico's identity. The Aztec's place of origin, Aztlán, even means "the country of color white." Once the Aztecs established in Central Mexico, however, they changed their name to *Mexicas*. This indigenous group also belongs to the broader term *Nahuas*, which encompasses Náhuatl-speaking indigenous groups in Central Mexico, and which will be referred to in this paper as well. So, the main question is, what sort of colors painted their worldview and why? And most importantly, how did their perception of color change with the imposition of Spanish religious and cultural values?

In this paper, we will be analyzing indigenous meanings for colors and their application in instances such as mural paintings in Central Mexico's most prominent archeological sites. We will also discuss color semiotics in Europe, particularly Spain prior to the Conquista. We intend to find how the clash of these two cultures shaped the meaning we give to colors today in contemporary Mexico considering color as an identity feature. Our hypothesis is that our current Mexican views regarding color were shaped by keeping some of the meanings taken from the Prehispanic era, however, these were overshadowed by meanings brought by Europeans, which is apparent in our color education, mainly seen through a Eurocentric vision.

METHOD

Given the historical focus of this paper, its research will be approached by consulting the pertinent sources, mainly books and articles written by experts in the subjects of color in Mexico, its presence throughout history and archeological research pertaining to the subject at hand. Texts on Spanish semiotics of color will also be considered, as well as on Mexican art during the Colonial period. We will also be looking at visual art examples to make out how color was applied by both cultures. Regrettably, field research is impossible at this time due to lockdown.

Firstly, we will extrapolate the most relevant information, thus being able to observe the differences between both cultures; secondly, we will determine how the syncretism between these two main cultures impacted color meanings and how it is reflected on our country's modern society. For the last sections, we will focus on Mexican color identity by looking at examples we see in our everyday lives, from specific contemporary artists to architecture, design, crafts and so on. We will draw our conclusions based on our findings.

THE MEANING OF INDIGENOUS COLORS

According to anthropologist Danièle Dehouve, whose line of work will be followed throughout this paper, the most important thing to understand is that the Nahuas had two different systems for designating colors: a descriptive one and a metaphoric-symbolic one (Dehouve 2003:52). The descriptive aspect meant that they used the name of an object to designate its color; one might think of the color orange as an example. Opposite to this, the metaphor-symbolism nomenclature consisted in using colors to describe an object; this could be applied both direct and indirectly, and one metaphor could vary depending on the context, as well as the symbolism. This system was, evidently, of much greater importance.

Within the Nahua worldview there were certain colors associated with the cardinal points. For example, white was linked to the west, where the sun travels to every evening, only to be reborn the next day as the first rays of white light. White was a representation of mystery. The Nahua people found in the night sky the most powerful manifestation of white and light – the Milky Way, a white snake of clouds (Ortiz 2016:70). However, it could also mean disease, decadence, or old age, like the ashes. Some other associations were to elements found in nature, such as salt, copal, or even animals like herons or eagles.

The naming of the colors differed from western conceptions during the 16th century, so what we know today as black was rather understood as "dark". As explained by historian Élodie Dupey García, colors such as brown, purple, and black, were considered shades of the same dark color, night and darkness, directly associated with the night gods (Dupey 2016:180).

Red, on the other hand, is probably one of the most powerful and symbolic colors of all. Humans have a physiological response to red, since it is vital to the human experience; thus, it is no surprise that it played a primary role within the Nahua worldview. Blood is the precious liquid of life, so red is youth, fertility, and love. Yet, when spilled it means death, war, and destruction. Even so, that same spilled blood nourishes the earth and gives way to new life. Red is the sunrise from the east and the rays of light. Cochineal red was of great importance for textile dye, and for other types of art they used the mineral hematite.

Yellow, as red, was also the color of the sun and the fire; however, it had a different connotation. It was the color of spring, as yellow were the beloved pumpkin flowers; it was related to the ripe harvest and fertility of the land. On a social level, it was associated with beauty, love, and femininity. It is worth mentioning the direct relation of yellow with the god Xipe Totec, who was always depicted with skin dyed yellow, said to have been obtained from skinning a sacrificed warrior. According to some interpretations, "the skinning" is a metaphor for removing the leaves from the cob (Dehouve 2003:67).

Just as black included all "dark colors", the word for both green and blue was the same. Green/blue was a very important color given its presence in nature, and was also deeply connected to life, since it can be found in the water, the forests and the feathers of the quetzal. However, since dead decaying bodies start turning a greenish shade, it could also be associated with death. Green was the color of jade and emerald, two of the most precious stones for the Nahua people, hence its social connection with worth and value. This also had a beautiful and metaphoric concept: jade and emerald were precious, but what could be more precious than a human heart? Hardly anything, since the human heart is nourishment for the sun, offered through sacrifice.

Associations could be made as well based on the intrinsic power of the colors (Dehouve 2003:67): for example, green and red had the most poetic and deep of relationships, since from the most precious of stones, the human heart, flows the red liquid of life, evoking the green liquid of emerald life that flows across the fields. These colors, white, dark, red, yellow and green/blue, were the five main colors they contemplated within their worldview, and one of the reasons is that they were deeply associated with the colors found in the many varieties of corn native to Mexico, which also had deep symbolisms and were essential for indigenous diet.

In order to understand how they incorporated color into their art, it is worth examining what are probably the most famous sites in central Mexico: Teotihuacan, Cacaxtla and Templo Mayor.

COLOR IN CENTRAL MEXICO'S ARCHEOLOGICAL SITES

The first example for discussing the application of color in Prehispanic art is Teotihuacan, which reached its peak during the Early Classic Period (200-600 CE) and is located northeast of Mexico City. Teotihuacan is most famous for its pyramids, but it is also home to some incredible pieces of art, including murals. They depict Teotihuacans' worldview and history in a heavily symbolic way, still being deciphered by experts. Being in a region rich in minerals, its inhabitants took full advantage in order to create a variety of pigments. Different shades of greens stand out, and they seem to represent different aspects of natural phenomena, like vegetation or rain. About 300 CE, dark red made from hematite started to depict nighttime events, taking on a major role as a background color.

Moving on to Cacaxtla, built around 350 BCE to 100 CE, during the Preclassic era, its full splendor actually came about until 650 CE, with the arrival of the Olmeca-Xicalanca people. This Nahua group (not to be confused with the Preclassic Olmecas) dominated part of Central Mexico during the late Classic Period (650-900 CE), and took advantage of Cacaxtla's strategic position for trade. This site, located in the state of Tlaxcala, houses some of the best-preserved murals, painted slopes, walls and floors of Prehispanic Mexico. They tell the story of the Olmeca-Xicalanca, their view of the cosmos, depictions of water deities, rituals, and war. Also, this city is a prime example of how various groups could influence one specific place; there are in fact characters with Mayan features, and it is noteworthy the use of the pigment known as Mayan blue, a mix of several minerals and indigo which was used by several Mesoamerican peoples. The color red is also particularly prominent in the murals, acting as background for various scenes. These murals are particularly known for their dramatic realism, as opposed to Teotihuacan.

Finally, let's examine Templo Mayor. Located in the heart of Mexico City, this site is the last important vestige of the great city of Tenochtitlan. With the help of modern technology, research has revealed that the site was once filled with colors, now lost due to the passage of time. They would rely heavily on the concept of duality, using binary symbolic patterns to represent, for example, water and fire, or the most important seasons, which of course were very significant for harvesting. What archeologists observed (López Luján et al. 2009:17–23) is that for the walls they had a reduced palette of red, ochre, white, black and blue, using different minerals: for red, they would use hematite; for ochre, goethite; for white, calcite; for black, graphite, and for green/blue, they would use Mayan blue, achieving a beautiful turquoise tone.

THE MEANING OF EUROPEAN COLORS

According to psychologist Georgina Ortiz, in Spain during the 16th century, color was mostly seen through a religious lens, taking the meanings of the liturgy colors (Ortiz 2016:71), but they were deeply connected to power as well. The color red is a prime example of this. On the one hand, red signified the burning bush, the sacrifice and the blood of Christ. Interestingly, during the Middle Ages red and green were considered akin, since they were believed to be intermediate colors in the chromatic scale, representing beauty and harmony, respectively. Art historian and color expert John Gage states that people would often wear both red and green garments, particularly in northern Europe (Gage 1993:90). Notice the way these parallels with how the Nahuas would pair up red and green as well, albeit symbolizing different things. On the other hand, Europeans also associated red with magic, and it was commonly linked with sin and lust. But even with its negative connotations, during the 15th century onward red became a symbol of luxury and power, used by the highest hierarchies of the Catholic Church.

For its part, blue was associated with royalty, as well as purity and virginity (Ortiz 2016:73). One of the main reasons was that blue pigments made from woad were considerably expensive to produce, both for textile dye and for paint; so only the higher spheres would use blue, and painters reserved the color for the most important topics, such as the Virgin Mary.

White was deeply connected to angels and saints, representing purity and divine light; blue, as previously mentioned, was also a symbol of purity as well as virginity. Meanwhile, black symbolized the death of Christ, grief, penitence, and sadness. Green was the only one somewhat related to nature, representing life, hope and joy; it also symbolized immortality and renaissance.

SYNCRETISM

The Mexican Viceroyalty, period in which the colony of New Spain was established, lasted from the 16th century through 1821, when Mexico was officially declared an independent nation. During the colony's early days, the most powerful institution was the Catholic Church for its religious indoctrination towards indigenous peoples. Anything that did not match with the Christian canon would be considered an enemy of the faith and had to be destroyed.

Even though missionaries learned the indigenous languages to spread the gospel, they recurred to imagery and art to convey certain concepts. Since labor workers were needed to build churches, missionaries taught the natives the European way of the visual arts, taking advantage of their artistic talent. In this period, syncretism can be observed in all its splendor (Reyes-Valerio 2000:140).

Marvelous mural paintings, sculptures and even feather artworks were created. However, indigenous people did not give up entirely on their symbolisms. Many examples of art produced by indigenous people are known that combine Christian themes with their own motifs and colors. But alas, indigenous art soon became muted, overpowered by the loud Baroque style. During the 300 years of colonialism, several artists flourished in this new artistic movement. Perhaps one of the most renowned is Cristóbal de Villalpando (1647–1714), whose use of color is based on European interpretations. One only needs to observe his use of blue in Virgin Mary's garments in his painting *Inmaculada concepción* to see how he applied colors with a European point of view.

On a separate note, it is also worth mentioning the impact different aspects of indigenous life had in European society, for instance, the use of cochineal red, the most potent and lasting red pigment ever seen by Europeans. It became the most coveted raw material by merchants, artists, popes and royalty alike (Butler Greenfield 2017), furthering red's association with power.

Returning to the subject of syncretism, not every single aspect of the indigenous way of life was lost. Borrowing from the French term *métissage*, the mixing of cultures was key in the development of New Spain as a society. A caste system was soon established, where the offspring of Spaniards born in the colonies, *criollos*, faced constant rejection, amongst many other groups. They developed an intense need for a national identity of their own during the second half of the 18th century and early 19th century. There was a call for the revindication of Mexico's indigenous past, sentiment that endured well into the 20th century.

MEXICAN COLORS AND IDENTITY

The idealization of the nation's indigenous past is a particular feature of artists such as Diego Rivera, José Clemente Orozco and David Alfaro Siqueiros, leading exponents of Mexican muralism, one of Mexico's most important art movements developed during the first half of the 20th century as a result of the Mexican Revolution. This idealization soon became an ongoing theme, not only for artists but for Mexican society as a whole.

Furthermore, a new appreciation of colors also arose during this time. A prime example is a shade of pink similar to magenta popularized by fashion designer and illustrator Ramón Valdiosera in the 1950's. Valdiosera was inspired by indigenous attires he encountered in his travels across the country to create entire collections with this shade of pink. To this day, this color is known as "Mexican pink", and was also popularized by renowned architect Luis Barragán.

The colorfulness of our culture is something Mexicans are quite proud of. This can be seen in art, crafts and clothes, and architecture all across the nation. It is present in cultural traditions that also stem from the above-mentioned syncretism, such as Day of the Dead, a festivity now very popular worldwide. Also, there seems to be a trend in contemporary Mexican graphic design to resort to Prehispanic elements and strong colors, highlighting and shaping our national pride.

CONCLUSIONS

We conclude that although the Conquista had an enormous influence over the perception of color, art, and beliefs, Mexicans have shaped their own relationship with color.

Most of the meanings given to color, as stated in the hypothesis, indeed come from the European art theories.

However, there is another level of color semiotics that is rooted in the Prehispanic tradition, as can be seen everywhere, from arts and crafts to the colorful, syncretic rituals and festivities still celebrated today. Prehispanic influence can also be found in the relationship of color with nature and the affinity for bright hues. Perhaps the most interesting finding is that some of the most beloved colors are nor European nor indigenous, but the result of the quest for a national identity, resulting in new contemporary meanings and links to color, such as Mexican pink.

The idealization of Prehispanic cultures that started in the 19th century prevails today, impacting the way Mexican art and design are appreciated. Mexicans are as much of indigenous descent as European, and it is something to be embraced, not rejected. As a nation, we are a wonderful mix of colors with endless combinations forming a bright new palette. So, what we can take away from this is that our colorful culture would not be what it is today without the syncretism of these two powerful cultures.

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Analysis of natural dyes color characteristics – subjective vs. objective

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ABSTRACT
A study has been performed in order to analyze the nature of specific appearance characteristics of dyes obtained with natural dyes, given the still insufficiently investigated characteristic discrepancy between visual perception of color obtained with natural dyes versus their objectively defined spectral characteristics. As a source of dye following raw material have been used: pomegranate peel (chromophore: punicalagin and punicalin), onion peel (chromophore: quercetin), green walnut shells and young walnut leaves (chromophore: juglon), Aleppo pine, chamomile, ash, mint and madder. Pre-treatment of the material was performed with metal salts (wetting agents): potassium aluminum sulfate dodecahydrate, copper(II) sulfate pentahydrate and iron(II) sulfate heptahydrate. Wool, silk, polyamide PA and cotton fabric samples non-treated and pretreated with metal salts were dyed with natural pigments listed above. After the dyeing, a colorimetric study based on objective spectrophotometric measurement was performed. An evaluation of the color parameters of each sample was performed (L *, a *, b *, C *, h). Based on objective and subjective analysis of color hue, an analysis of specific differences between subjective perception and objective measurement in the area of specific chromatic-achromatic shades obtained by natural pigments, has been carried out. In addition, an analysis of the color strength regarding the different types of fabric samples as well as different types of mordanting was performed.

Keywords: *dyes, metal salts, visual experience, spectrophotometric analysis*

INTRODUCTION

In the field of revitalization of natural dyes in textile design and production, numerous research projects are conducted which can be defined in several directions: research on conventional, traditional methods of pre-processing of textile material with metal salts in order to achieve better bonding of dyes to fiber and greater durability (Glogar et al. 2020); innovative textile pre-treatment methods that would be more environmentally friendly (Peran et al. 2020); research on UV protective and antibacterial properties of natural dyes as an added value to the indisputable aesthetic component possessed by the color obtained by natural dyes (Sutlovic et al. 2020). A study analyzed the effect of pre-mordanting and post-mordanting with aluminum sulphate, ferrous sulphate under different and found out that there was significant influence on hue and Chroma value of achieved coloration due to a difference in pre or post mordanting (Ali et al. 2009). Two studies confirmed that the *K/S* value of pre-mordant samples of cotton and wool were higher than of those simultaneously mordanted or post-mordanted (Shin and Cho 2003, 2004). In the area of novel, more environmentally friendly textile pretreatment methods investigated the application of bio mordant and enzyme in silk dyeing with natural dyes, (Vankar and Shanker 2009). Another study confirmed oxygen plasma pre-treatment as an efficient and environmentally friendly technique for improving hydrophilicity, mechanical properties and dye ability of wool fabrics, providing a welcome alternative to traditional mordanting, as it improved color yield and fastness properties of dyeing with natural pomegranate dye even when the common mordant KAl(SO4)2 was not used (Peran et al. 2020). The positive effect of oxygen and even more nitrogen plasma treatment on the dye ability of silk with natural dyes extracted from Phytolacca Drcandra L. was, also confirmed in another research (Dayioglu et al. 2016). In addition to the research on the chemical constitution of natural dyes and the mechanism of their complexation with metal ions, the challenge is to investigate the specific appearance characteristics of colors obtained with natural dyes, given the still insufficiently investigated characteristic discrepancy between visual perceptions versus their objectively defined spectral characteristics. In this paper, the objective evaluation of dyed samples color has been defined by CIELAB system. Since the first introduction of CIELAB system, a number of research projects have been performed in order to understand color appearance phenomena and various upgraded systems have been developed, mostly aimed to overcome the problem of cross media color reproduction, providing an optimal color appearance prediction across a wide range of viewing conditions (Luo 2007). In this paper a colorimetric study based on objective spectrophotometric measurement was performed. Based on objective and subjective analysis of color hue, an analysis of specific differences between subjective perception and objective measurement in the area of specific chromatic–achromatic shades obtained by natural pigments has been carried out.

MATERIAL AND METHODS

The following raw materials were used as a source of dye: pomegranate peel (chromophore: punicalagin and punicalin), onion peel (chromophore: pelargonidin and quercetin), green walnut shells and young walnut leaves (chromophore: juglon), Aleppo pine (chromophore: (flavonols and proanthocyanidins), chamomile (chromophore: apigenin, quercetin and apigenin 7-glucosied), ash-tree (chromophore: rutin, quercitrin, isoquercitrin and astragalin). The natural pigment was extracted by boiling the 150 g of herbal material in 5 l of water, at 100 °C, for 1 hour, with the addition of 10 g/l Sodium Chloride (NaCl). After leaving the solution at ambient temperature for two days, it was filtered and the residual water has been evaporated by drying at 70 °C, obtaining pigmented crystals that will further be used for printing pastes preparation. Wool, silk, polyamide PA and cotton fabric samples were chosen for the analysis.

Treatment of textile material was carried out before the dyeing process, with 2% (by weight of material) of the following salts: potassium aluminum sulfate dodecahydrate $KAl(SO_4)_2 \cdot 12H_2O$, copper(II) sulfate pentahydrate $CuSO_4 \cdot 5H_2O$ and iron(II) sulfate heptahydrate $FeSO_4 \cdot 7H_2O$; Chemistry, Zagreb. Pre-treatment of wool, silk, polyamide and cotton fabrics was performed in a laboratory apparatus for wet processing Polycolor, Mathis with a bath ratio of 1:30, at 50 °C, for a period of 30 minutes. After processing, the fabrics were washed in the cold. Dyeing samples before and after treatment with metal salts, was performed in Polycolor Mathis laboratory apparatus, with a bath ratio of 1:30, at 95 °C, for a period of 60 minutes. After processing, the fabrics were washed with soap. The dyeing was carried out at pH 4, adjusted with 20% acetic acid.

The evaluation of color characteristics of dyed samples has been obtained objectively by spectrophotometric measurement using a remission spectrophotometer DataColor Spectra Flash 600 PLUS – CT (with constant instrument aperture, D65, using d/8 ° geometry). The results are presented as color parameters values (L *, a *, b *, C *, h) and as color depth value according the Kubelka-Munk coefficient (K/S) calculated using equation (1).

$$K/S = (1 - R)^2/2R \qquad (1)$$

Where K is the absorption coefficient, S is the scattering coefficient, and R is the reflectance of the dyed fabric at the wavelength of maximum absorption. The results of spectrophotometric measurements are given based on one single measurement per dyed sample.

RESULTS AND DISCUSSION

The colors obtained with natural dyes belong to the group of tertiary colors. Their relationships are highly harmonious with no pronounced contrasts and are characterized by a specific discrepancy between actual experience and objective measurements. Color hues that belong to the group of tertiaries belong to the so-called marginal chromatic-achromatic region. Unlike the chromatic region, in which the human eye perceives a dominant hue, in the chromatic-achromatic region, the ability to perceive the true dominant hue is limited. In the samples prepared in this research, a visually emphasized diversity is observed which is not in accordance with the objective measurement that the results show. Regarding these facts, a study has been performed in order to analyze the nature of this discrepancy and to explain the chemical, physical and perceptive aspects of this specificity.

The dyeing of samples was performed in alkaline pH 8 and in acid pH 4. The results obtained for samples dyed at pH 4 (acid dyeing bath) are more emphasized, which arises from chemical constitution being acid-mordant for most of the natural dyes. On Figure 1, the appearance of PA, silk and wool samples dyed in acid pH 4 is shown.

Polyamide PA **Silk** **Wool**

Figure 1: Sample of cotton, PA, silk and wool dyed in acid (pH 4) medium (1-no mrdanted sample; 2-sample treated with $KAl(SO_4)_2$; 3-sample treated with $CuSO_4$; 4-sample treated with $FeSO_4$).

Alkaline **Acid**

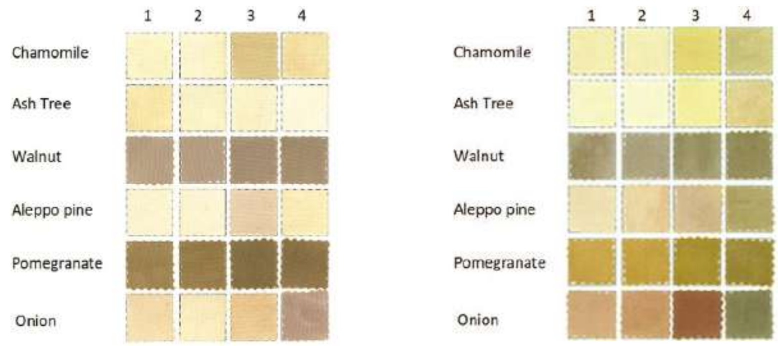

Figure 2: **Cotton** sample dyed in alkaline (pH 8) and acid (pH 4) medium (1-no mrdanted sample; 2-sample treated with KAl $(SO_4)_2$; 3-sample treated with $CuSO_4$; 4-sample treated with $FeSO_4$).

On Figure 2, the appearance of cotton samples dyed in alkaline and acid medium (pH 8 and pH4) is presented. It can be seen that the shades of cotton obtained in acidic dyeing bath are more colorful having more chromatic appearances, is not common for cotton that is otherwise dyed in an alkaline medium. This is confirmed by the results of color strength K/S for cotton sample, given graphically on Figure 3. The higher K/S values, in general, are obtained at pH 4 (acid), which. This led to the fact that the adjustment of the dyeing bath pH in favor of a dyestuff is more important than in favor of the textile material. Exceptionally, different results were obtained for pomegranate, which show a higher K/S value in the alkaline medium, due to the fact that the pomegranate is a tannin dyestuff and the tannin is having a property of behaving as a mordant, but also, the pomegranate dye is natural substantive dye, which makes it suitable for cotton dyeing in alkaline medium.

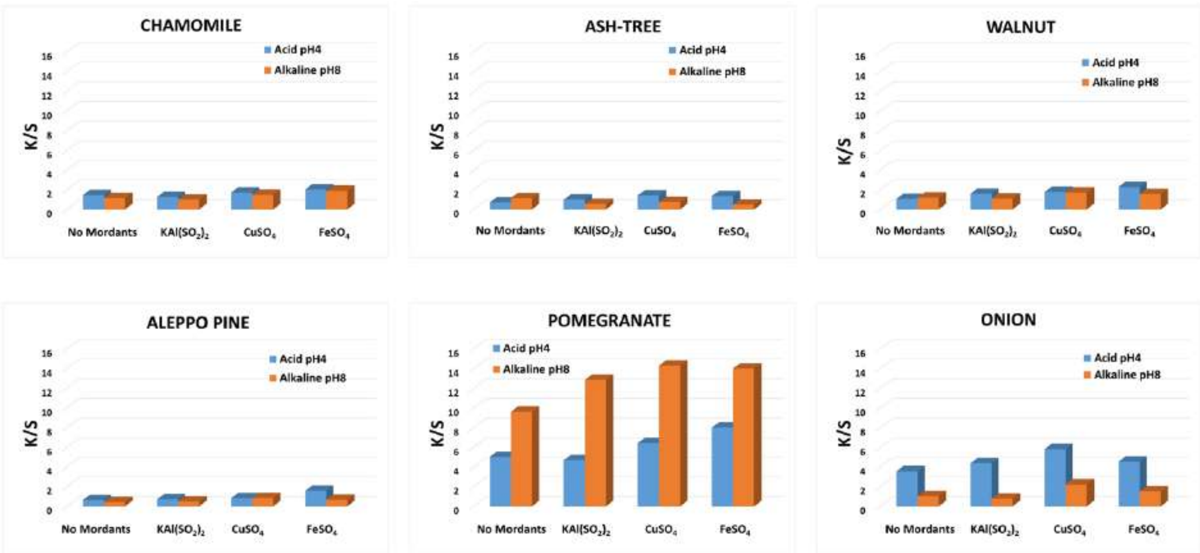

Figure 4: K/S value obtained for cotton dyed in alkaline (pH 8) and acid (pH 4) dyeing bath

On Figure 4 the comparative analysis of basic color parameters (L*, C*, h) and color strength (K/S) values is shown. The results are given in respective to fiber sort as well as to pretreatment. So the groups of columns are given for no mordanted sample and for $KAl(SO_4)_2$, $CuSO_4$ and $FeSO_4$, while the differently colored columns in each group are presenting the textile materials starting with cotton to PA, silk and wool. The effect of mordants on lightness (L*) values of shades showing no significant difference between no mordanted samples and samples mordanted with potassium aluminum, for all six natural dyes used. As for the samples dyed with walnut, there is practically no difference regarding the pretreatment. Regarding the fiber sort, the lowest lightness value is obtained for woolen samples, in general. The highest Chroma (C*) value has been observed for woolen sample pre-mordanted with potassium aluminum ($KAl(SO_4)_2$). For hue (h°) parameter, rather interesting results have been obtained, as it was already indicated in the Introduction. Chamomile dyeing, for example, resulted in typical yellow appearance only on PA sample (Figure 1). Objectively, all obtained shades are in the range of yellow-orange hues, but visual experience of silk and woolen samples pretreated with $CuSO_4$ and $FeSO_4$ metal salts, are being greenish. This visual change from yellowish to greenish pallet can be explained with the mechanism of complexation with given metal salts, but it does not fully explain why the objective evaluation are not showing this transformation.

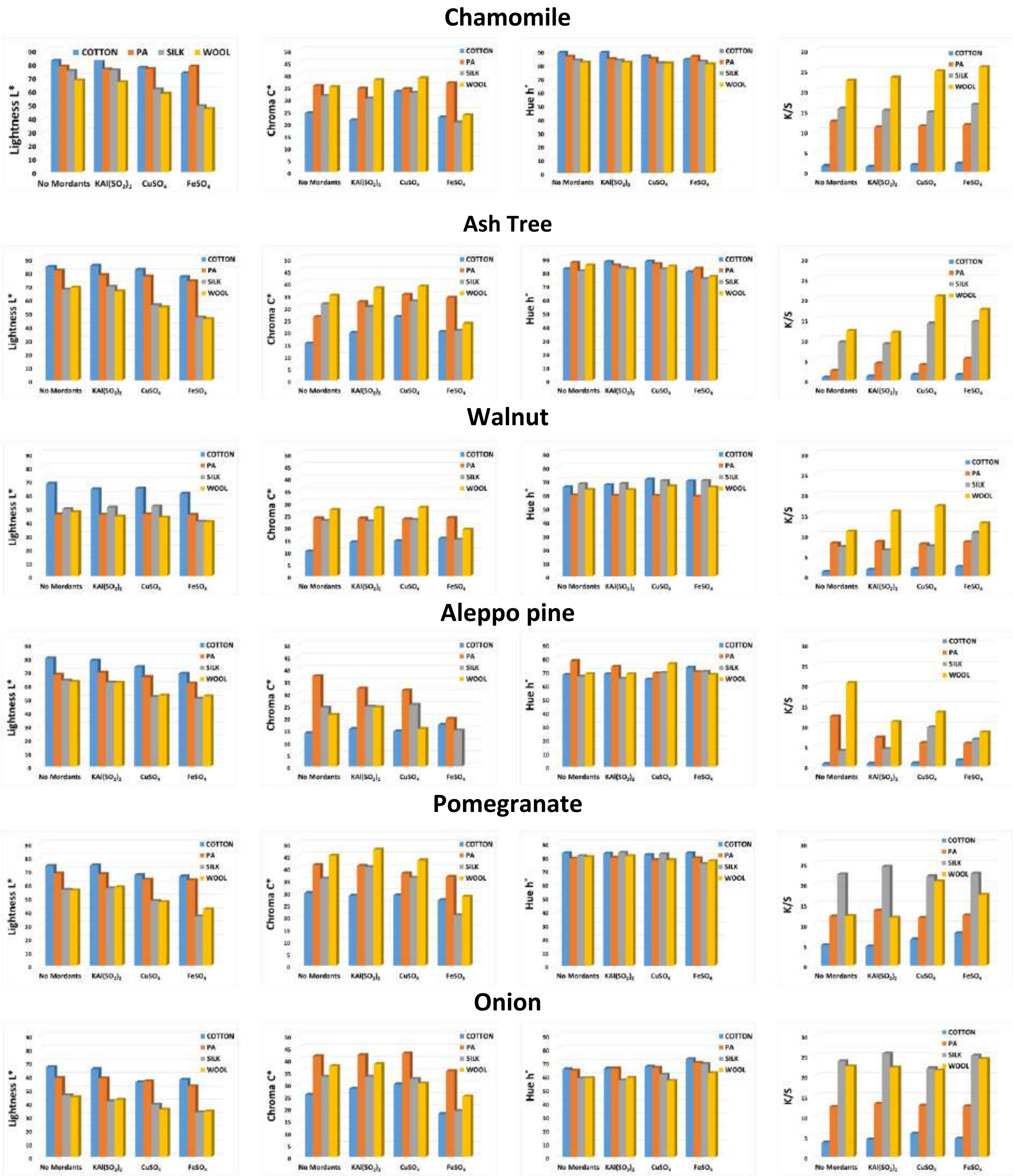

Figure 5: Color parameters (L*, C*, h) and color strength (K/S) for samples dyed in acid (pH 4) dyeing bath.

This can be related to Mansell's theory in which he confirmed that, regarding the relationship of Chroma and lightness, that we are not equally sensitive to all parts of the spectrum. Yellow being one of the lightest and the brightest color in the spectrum, is having the highest Chroma on the highest levels of lightness. At lower chromes, those shades cannot be perceived in dominant spectral characteristic, but the visual appearance is moving towards neighboring spectrum such as green being analogue to yellow in spectrum composition. As for the objective hue evaluation, it can be seen on graphs on Figure 5 that the average hue value is in the range 60 to 88° (yellow-orange) and the problem also lie in the imprecise interpretation of yellow shade that lies on the b*+ axis in a*/b* CIELAB color space. The similar results are obtained for samples dyed in Ash Tree dye. A pale yellow pallet is achieved on cotton and PA, while on silk and wool, although objectively in yellow-orange hue range, the shades visually appeared in greenish-brown due to lower Chroma. The walnut being naphthoquinone-type dye with smaller molecule is suitable, as for natural fibers, also for synthetic fibers dyeing, which can be seen on results obtained for PA samples.

CONCLUSION

It is confirmed that, regardless of the inaccuracy of conventional CIELAB system in defining the color appearance, in any case in colors obtained with natural dyes, there is a specific discrepancy between the visual experience of color and objective evaluation. Although this paper does not present an analysis of the remission properties of the obtained colors, such analysis confirms that the visual experience of the presented natural colors is defined by the specific complex chemical constitution of the dyes that causes non-uniform reflections along the entire spectrum and the coloristic properties of the coloration in the marginal chromatic-achromatic region.

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Colour. Extensive and intensive approaches

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ABSTRACT
In the present paper we argue that the use of colour in the field of visual art might be approached both from an extensive an intensive point of view. Colour might be defined on the one hand by its extensive character as in the perspective of Isaac Newton, that characterized colour as a physical phenomenon. On the other hand, one might look at colour with an intensive regard, like in the work of J. W. Goethe, acknowledging it from the point of view of an emotional register.

We associate the use of colour on images with a clear structure or metric to an extensive approach. Colour might also be used on images that are more related to abstraction and to the scope of sensation, and we will refer to these as dealing with an intensive approach.

The scope of this paper is to research and develop our argument that in colour use and rendering in the visual art field, intensive values might reach crucial points and attain an extensive character. We attempt to demonstrate that in special and particular cases colour use might allow the production of images that not only engage our visual capacity but further than that go into the realm of sensation.

In these particular conditions, intensive values might then reach crucial points and break away from the realm of pure sensation – they might "become" something more and they might attain extensive dimensions and generate extensive understandings.

Keywords: *colour, perception, visual art, extensive, intensive*

INTRODUCTION

In this research we explore and question processes through which intensive approaches to colour might produce extensive colour perceptual interpretations within the framework of visual art. We find two complementary concepts in the work of Gilles Deleuze. These are related to two kinds of substances: those with intensive properties and those with extensive properties.

> "That which you can grasp, cut, twist, and turn is extensive; that which affects you, but does not yield to your attempt to contain it, is, like wind in your face, intensive. Intensive differences are, as Deleuze points out, indivisible." (DeLanda 2005)

Manuel DeLanda refers how for Gilles Deleuze change was only possible if all substances were at least partly intensive, i.e., capable of that form of variation he describes as "becoming" (Deleuze 1981, DeLanda 2005).

This is a particular aspect of Deleuze's thinking that is crucial in the present research. In the scope of this study, we argue that in some cases of colour use and rendering in the field of visual art, intensive values might reach crucial points and attain dimensions that we are able to perceive as extensive (Deleuze 1981, DeLanda 2005). We argue that these notions in Gilles Deleuze's thinking might bring new perspectives into the exploration and discussion on colour. The methodology in this work consisted of a literature review of sources we found most pertinent, complemented with empirical analysis of case studies. In the ambit of the research development, we discuss perception and vision questions, different approaches to colour perception, and the concepts of extensive and intensive colour. We try to point out how developments made both in science and philosophy have developed diverse insights into colour. We argue that in some cases of colour use and rendering in the field of visual art, intensive values that engage on our visual domain also reach a level of sensation. We study a number of examples and attempt to demonstrate that on these particular conditions, these intensive values might then reach crucial points and break away from the realm of pure sensation – they might "become" something more and they might attain extensive dimensions and generate extensive understandings.

APPROACHES TO COLOUR PERCEPTION

Colour might be defined on the one hand by its extensive character as in the perspective of Isaac Newton that characterized it as a physical phenomenon (Newton 1730, Gage 2017). On the other hand, one might look at colour with an intensive regard, like in the work of J. W. Goethe, acknowledging it from the point of view of an emotional register (Goethe 1970, Gage 1999). We associate the use of colour on images with a clear structure or metric to an extensive approach. Colour might also be used on images that are more related to abstraction and to the realm of sensation, and we will refer to these as dealing with an intensive approach.

EXTENSIVE AND INTENSIVE COLOUR

Developments in both science and philosophy enabled different endeavours to develop diverse insights into colour. First with Newton's corpuscular theory that we might associate with an extensive interpretation of colour as it tries to dissect light into discrete units – corpuscles (Newton 1730, Gage 2017). From Albers to Chevreul we retain the ambiguity and difficulty in ascertaining colour as non-dependent on context phenomena (Chevreul 1854, Albers 1963, Gage 1999). Both describe in their research how colour might change in its apparent nature – or on our own perception of what its nature might in fact be. When we look more broadly at our own cultural nature as human beings and at our very nature and worldview and on how language constructs and affect perception in itself, we realize that an extensive understanding of colour is too simple and that it might be impossible in itself (Arnheim 1974, Wittgenstein 1991, Gage 1999). But, on a different approach, the nature and ambiguity of colour might be an interesting ground both theoretical and practical. As we have mentioned, in the development of diverse colour approaches from Newton's interpretation to Goethe's, we find diverse understandings for the construction of colour theory. But one fact seems to us most pertinent in our present study. This fact is the capacity of values that come from an intensive perspective to become visible in an extensive perspective and acquire an extensive character. The various assumptions drawn from Goethe's colour theory and Itten's "seven-contrast theory" represent disparate approaches coming from conceptual universes that we can qualify as intensive but which, in fact, have been incorporated as tools and methods of work). So, in a certain way, intensive qualities that are abstract and on the plane of sensation can and are used in an extensive perspective. For instance, a designer or an artist often uses strategies regarding colour that might be more related to Goethe's ideas than those of Newton. And here lies a certain ambiguity, that we regard as particularly relevant and that we want to address and emphasize in the present study. According to Manuel DeLanda, and his interpretation of the work of Gilles Deleuze, intensive differences are productive, as they eventually generate extensive changes. This for us is a very relevant notion (Deleuze 1981, DeLanda 2005). We argue in this paper that Deleuze's notions might bring new perspectives into the exploration and discussion of colour. That from abstract and non-material assumptions, extensive interpretations and results might become apparent – and that those might have an operative use in the field of design and art. This we will try to investigate with our case studies.

METHOD OF INVESTIGATION (CASE STUDIES), RESULTS AND DISCUSSION

We believe that in the field of visual art we can find interesting examples and material manifestations of different approaches to colour and particularly to what we have tried to bring forward in this study. In that regard we suggest three different examples of these diverse manifestations of colour, placing these interpretations as representative of extensive and intensive colour constructions and outcomes. In these three cases studies we will try to exemplify and correlate each of the frameworks that we tried to identify with an example in the field of visual art.

We chose these specific examples on the basis of the clarity and rigour by which they represent each particular way we try to illustrate and reveal each situation. In our first example we searched for an example of a clear metric situation that illustrates our first notion of an extensive frame leading to an intensive outcome. In the second case study we were interested in exemplifying how an unclear intensive construction is able to reach different levels of intensive manifestations. In the last case we will illustrate the main objective of this paper that we will analyse and explain in the discussion and conclusions.

In Bridget Riley's *Cool Place* (Figure 1), a discernible material construction renders an image that is clearly extensive. But that fact simultaneously produces an intensive visual outcome. Clearly based on a metric structure, Riley's work defines a distinct number of geometrical entities that are discernibly located and define by themselves the structure of the painting. There is a methodology in Riley's work and in the way a structure of equal size and distinct colour polygons is composed. However, the results on a perceptual level are far from a stable ordered whole. The image – like many of the artist's works – vibrates and causes our vision to be in a permanent flow of movement and disorientation. A very clear and ordered extensive structure on the painting is therefore capable of producing a very unstable perceptual outcome, we might argue.

Gerhard Richter's *18.4.88* (Figure 2) features a notorious absence of an extensive structure in its construction. The assembly has an almost "pure" intensive character, in which colour establishes force fields of intrinsic and abstract sensitivity. In Richter's approach we have an abstract work which in a certain sense is the opposite to Riley's. There is no clear and distinct metric – or even a metric at all. Diverse concentrations and saturations of different colours produce abstract structures that drive our own perception and create almost pure fields of sensation. There is no clear structure in Richter's work to be able to support some sort of logical inference of the effect that this work has on us and on our perception. We argue that further to vision, our body, as a body capable of sensation, receives these stimuli and we are moved by them in one or another way and by our own particular level of sensation. That particular sensitivity is enabled by our capacity to feel diverse levels of sensation – the famous Deleuzian "sentiendum" – made possible by the intensive body – the body of sensation – our own body (Deleuze 1981).

Finally, we reach Turner's example and the main focus of our present research. There is here a particular kind of atmosphere that we find in many of Turner's paintings and watercolours. We might acknowledge clearly in this example that it embodies a relevant case of our analysis on how intensive values might reach an extensive dimension. Without an apparent constructive metric, "SnowStorm – Steam-Boat off a Harbour's Mouth" by J.M.W. Turner (Figure 3) builds an image using nuances of saturation and a limited colour range. However, in this example – as opposed to Richter's – the generated image conveys violent movements and a strong sense of visual depth and so it builds a strong extensive character. We would say that in this particular case an apparently intensive construction of an image produces a clear extensive outcome.

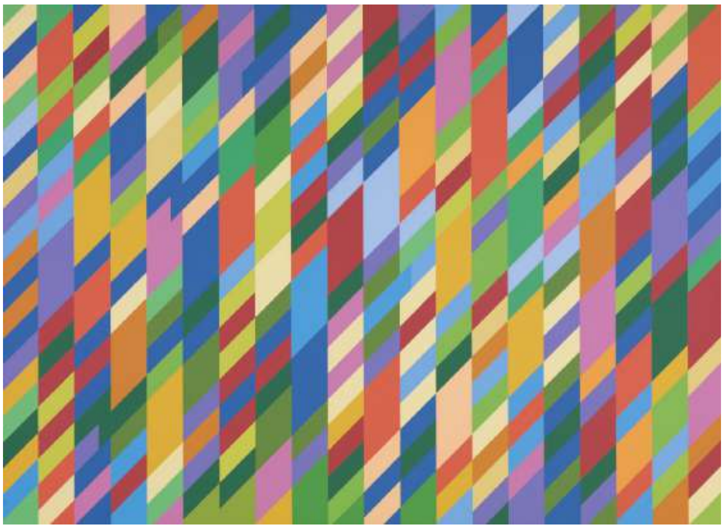

Figure 1: Bridget Riley, *Cool Place*, 1990. Source: https://www.karstenschubert.com/news/29/

Figure 2: Gerhard Richter, *18.4.88*, 1988.
Source: https://www.gerhard-richter.com/en/art/watercolours/18488-18840/?referer=news-results

Figure 3: Joseph Mallord William Turner, *SnowStorm - SteamBoat off a Harbour's Mouth*, 1842.
Source: https://www.tate.org.uk/art/artworks/turner-snow-storm-steam-boat-off-a-harbours-mouth-n00530

The lack of a clear and recognizable structure or metric does not preclude the conception of an image that through the use of colour and its nuances, vibrancy and saturation, conveys further to Turner's characteristic atmospheric treatment and reaches a very unmistakable impact in the field of sensation. We patently feel the wind, the violence of the sea and the turmoil in the sky. These undetermined and complex feelings are rendered in the space of the frame due to the way that colour is used, in our particular interpretation. So, what is abstract and diffuse – and without a framework or extensive and metric logic to it –, that which belongs in a very substantial and clear manner to an intensive construction of the image, is perceived and then interpreted as extensive qualities such as movement and depth of field of the image itself. We are literally taken from the exterior of the image to its interior and become part of it as if we were witnessing the scene in itself.

CONCLUSIONS

We think that the last case study clearly articulates the focus of our research. We consider that we can justify our argument according to which, in colour use and rendering, intensive values might induce extensive dimensions. As we've shown, in quite special and particular cases, colour use might allow the production of images that relate to sensation. Images that not only engage our visual capacity but further than that, go into the reach of sensation. In these particular conditions, those intensive values might then reach crucial points and break away from the realm of pure sensation – they might "become" something more and they might attain extensive dimensions and generate extensive understandings.

This investigation comes within the overall context of our PhD studies. It rests on the basis of development of an investigation regarding the importance on the body, of the body of sensation, in the operationalization of the use of drawing within the design project process. Obviously, colour plays a major part in these studies. We regard this first paper on this subject and area, as the first of several attempts to clarify and develop our studies regarding extensive and intensive dimensions and attributes. We explore these questions within the PhD on a more enveloping scale and depth, but the particular study of extensive and intensive values in the field of colour within the context of the visual arts remains for us a very important segment in the field and scope of the overall research. And one that we will definitely address and pursue in the future framework of our research.

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Phenomenon of white in contemporary architecture, art and design in Europe and Russia

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ABSTRACT
Nowadays white is often used in architecture, art and design in Europe and in Russia. This paper aims to analyze the white color as an independent concept with different functions and meanings. There are various interpretations of white architecture such as an idealized view of antiquity, vernacular functionalism, or novelty. Besides the use of total white in new architecture as an aesthetic manifesto of pure form, the use of white in governmental and religious buildings is a symbol of virtue. White as a social position is used to describe office managers reflecting the turn to a post-information society. Contemporary art has often used white in various semantic aspects and formal qualities, from Piero Manzoni to Olafur Eliasson. After the popularity of white minimalism and the white cube, a trend to “return to nature” can be observed. Off-white colors are now favored in fashion and design, while the always wider use of lighting technologies to characterize the space makes white surfaces perfect screens for lighting effects. In recent times, with the actual pandemic crisis, we notice that white has also returned to be associated with medical environments and has the new meaning of a tabula rasa and hope for the future.

Keywords: *Valery Orlov, Manzoni, ideal white, white architecture, off-white fashion*

INTRODUCTION

The idea to study white as a cultural phenomenon is based on a visit to the Moscow studio of the artist Valery Orlov in 2014, during which he showed his works on paper with a white on white effect. In reality, white on white in modern art is a separate formal artistic expression, to which the interpretation of white is often reduced. We therefore consider to overcome this cliché, since the concept of white cannot be reduced to neither totality nor transparency. We therefore want to analyze the phenomenology of the wider concept of white in contemporary culture in all its forms, but for this this short research paper we reduce our investigations to examples in architecture, the environment, visual contemporary art, interior design, and fashion design.

Two aspects today, the ubiquity of the use of white in artificial environments and its association with the protection against Covid-19 in daily life, have given rise to the study of white as a cultural phenomenon. That is why it is actually interesting to analyze this turn to white in art, design and architecture. White as color is very often banalized as a symbol of purity, religion, power, festivals, electric lighting and natural cold. So, we pay much more attention to white color as an independent and self-sufficient phenomenon. The semantic field of white today, in the post-postmodern era, based on descriptions of this color in creative industries, gives us the impression of opposite symbolism of color in visual arts, e.g., protect versus hide, identify the social status versus universalize, illuminate totally versus be neutral. Finally, our hypothesis is that today the abundance of compulsory medical items due to the Covid-19 pandemic has changed the attitude towards white.

RESEARCH METHOD

We aim to compare the last decade with the context and symbolism of white in the last 70 years of European and Russian culture. described in this article like history of contemporary art, supported by the impact of cultural memory of the beginning of the twentieth century and great influence of traditional cultural heritage as a whole. For architecture we use Umberto Eco's semiotics (1973), for design Michel Pastoureau's historic approach (2008), and for contemporary art we use post-structuralist and formal analysis according to Rosalind E. Krauss (1985).

RESULTS AND DISCUSSION: WHITE IN CONTEMPORARY ARCHITECTURE

White colour in architecture is firstly associated with the myth of ideal white. It is the myth of the idealization of a white antiquity, connected to the misinterpretation dating back to Johann Joachim Winkelmann's theories (Didelon 2019) that ancient architecture and sculpture was made of uncolored white marble. This interpretation influenced all the revival of classicism, and even when fragments of colors in Hellenic sculptures were discovered, it was difficult to eradicate the myth of the classical pure whiteness. It is not just a simple aesthetic formal association of the concept of beauty with the supposed classical whiteness. It has an older origin, it is related to the myth of the white goddess, present in many ancient religions (Biasi 2002), and is based on the fact that white is total light, pure emanation of light, from which it is generating the colored world. It can be considered that white is an expression of the ideal world that generates the perceptible world. Absence of color as the expression of pure form, against the sensuality of the colors of the immanent world, is therefore a central theme of western aesthetics, with the debate of *Disegno* versus *Colore*, idealization versus perception, chromophobia versus chromophilia (Batchelor 2000).

But white color in architecture is also vernacular white. It is the white of rural architecture characterizing especially the Mediterranity praised by Le Corbusier in his *Voyage d'Orient*, that is now creating sometimes even what is considered a brand landscape. It is possible to find many features in vernacular white architecture that later influenced the modernist architectural interpretation of white (Tarajko-Kowlska 2014). Some characteristics are, a) the functional white, for heat control, maximizing solar reflection, or, for simply protecting the construction; b) the hygienic white, whitewash as an antibacterial coating; and, c) the concept of novelty, whitewash is something that must be renewed, always new it remains white, freshly painted whitewash is a symbol of novelty, renewing for purification, connected with the idea of purity.

Both the ideal white and the vernacular white are fundamental of the white color of modernism. Coatings of whitewash was praised by Le Corbusier in his books and articles, e.g., *Quand les cathédrales étaient blanches* [When the cathedral were white] (1937). In Weissenhof Siedlung in Stuttgart, built for the Deutscher Werkbund in 1927, flat roofs and white walls are dominant in the image of the housing estate, and even if in reality not all the buildings were totally white, black and white photographs of the Weissenhof internationally sprawled the idea of white as the color of the modern movement. That does not necessarily mean a total absence of chromatism (presence of colour), but a predominance of white plaster as a counterbalance of defined, chromatic elements or of material surfaces. Modernist white is related to the myth of ideal white, as an expression of purism of form, pure form modelled by light. In the words of Le Corbusier (1986:29), “Architecture is the masterly, correct and magnificent play of masses brought together in light”. At the same time, as we have mentioned above, it is also related to the concept of novelty (whitewash must be renewed), remarking the value of permanent novelty of modernism, to the concept of functional white (becoming an expression of the functionalism of the modern age), and finally, to the concept of hygienic white that is interpreted by Wigley (1995) as the hygiene of the view. White colour remains a constant feature in postwar international style and in contemporary architecture, and white purism is emphasized especially by the so called “white architects” (Didelon 2019), such as Richard Meier, whose architecture aims to be the expression of a sort of classicism of the contemporaneity and is therefore made by white walls, white structure and transparencies, allowing visual permeability and penetration of light to the interior. In white (as total light), black (as absence of light) and transparency (as transmission of light) can be synthesized the surfaces of most contemporary architecture. If white walls characterize the plastered walls of a great part of contemporary architecture, where we can find the clearest expressions of white purism is in the works of Portuguese contemporary architects, such as Álvaro Siza Vieira and Manuel Aires Mateus and the Spanish architect Alberto Campo Baeza. Their works can be considered a total white minimalism, where architecture is a pure white volume, modelled by light.

Besides this new pure white architecture, often an expression of aesthetical purism or, in other words, aestheticism of the pure form, there is old white architecture, where white has a strong symbolic significance related to the moral, religious and political virtues. Being white symbol of honesty, nobility, truth and purity, governmental buildings and places of political power are often white, making white architecture often a symbol of political power. The most emblematic expression of this is the White House in Washington D.C., that devotes its color to the aesthetics of ideal white in American neoclassicism, but expresses the clear interpretation of white as a colour representation of the virtues related to political power. The same symbolic meaning can be assigned to the Russian White House in Moscow, designed by Dmitry Chechulin and built in 1981 to hold the Supreme Soviet of Russia (now House of the Government of the Russian Federation).

In different cultures, one of the virtues associated mainly with white is religious purity. The use of white plaster or white stones for church architecture (even if they are not a local construction material) is frequent in many historical traditions. In the modern movement, the aim to express purity in church design gave origin to interesting architectural experimental research with white plaster and light.

WHITE IN CONTEMPORARY ART

The symbol of the contemporary art zone is the white cube since Alfred Barr, director of the Museum of Modern Art (MoMA) in New York. In the exhibition “Emptiness” (1958) Yves Klein also turned to white, as a symbol of the exhibition space. So, the white color and cube form become an ideal neutral space, where history does not press and does not interfere with the art manifestations, researched in the theoretical works of the conceptual artist Brian O’Doherty (1986). But since the 1990s, contrary to the art market, fighting consumerism, curators have often turned from the white cube to the concept of site-specific space as a place for true communications, and participating art. One of its radical examples is the Antarctic, natural “white” world, used for Biennale too. In the history of contemporary art white seems to be used in art objects like a universal color, represented in every decade of the twentieth century, so in figurative compositions, and even in white metaphysical art of Moscow non-conformist painter Vladimir Weisberg, very near to Giorgio Morandi. Harmony is expressed through light, which makes objects colorless, in idealized mutual communication of things and the environment. A composition of things à la Cezanne of simple geometric shapes, historical time (columns, Venus) and present (white table cover) is the similar search for balance among the rhythm of things made of plaster and clay and voids between them. For sculptures of George Segal using white plaster for human figures means to show the typicality (Segal et al. 2016), as well as habituality for Emil Alzamora's sculptures on a cement base. For postmodernists, white becomes the ideal way to transcend the boundaries of both old art and modernism. Manzoni abandons color and painting on canvas in order to convey the transparency of the canvas, how light penetrates the surface and changes it, depriving it of boundaries and depth (Manzoni 1960). For the Russian artist Valery Orlov, the flatness of the paper sheet, on the contrary, acquires texture, tactility and relief, created by deformation of the paper and the play of light and shadow (Tesis 2012). If Manzoni hints conceptually at light, Orlov uses its physical qualities. White is usual to anti-art objects, so beloved by conceptualists. So, in the exhibition "Eternity cube" (2012) artist Leonid Tishkov realized his funny theory about the influence in Malevich's childhood of an unconscious love for white raffinate sugar cubes due to the work of his father in a sugar factory. Tishkov was impressed by Malevich's *architectons*, houses without windows and doors, top and bottom, models of new life in cosmic space, realized in white like a symbol of uselessness of colors in novelty and otherness. Even outstanding and unemotionality has criticized Olafur Eliasson replacing 30 blocks of glacial ice from Greenland to London for the public environment in 2018.

WHITE IN CONTEMPORARY DESIGN

Finally, how do people represent themselves using white? Besides different religious meanings of white in clothes, there are even social and political ones. Nowadays in Russia white ribbons symbolize disagreement with the public policy like in Russian Civil War headbands dressed by the White Guard symbolized disagreement with the Soviet regime. Social position is about white collars identified a belonging to the class of professional, desk, managerial and administrative "office" workers. Today we are considered to be living in a post-Fordist society with a creative economy, where white collars are replaced by casual style outdoors, so the symbol of creative or intellectual labor are white sneakers like, e.g., by Armani.

Last trends in fashion are about a turn towards being natural thanks to increasingly domestic lifestyle. Older models appeared in fashion, such as Russian Oldushka agency, American old model May Musk, etc., thanks to improving the quality of life and its expectancy. Carmen dell'Orefice or 99-year-old designer Iris Apfel are now legendary celebrities. White is associated with a concept of cleanliness often degenerating even in racist purism, which is why the brand "off white" deals with that gray zone between street culture and the high fashion world (Yotka 2020). American micro-trends in the marriage market show a new norm, at least 3 marriages per life (Penn and Zalesne 2007). This leads to the need for a variety of outfits for each new ceremony. White, a symbol of innocence, is no longer as important as the reusability of an outfit, which is why we see more and more light-colored non-white wedding dresses, easily reusable. Black and white, thanks to photography and cinema, dyeing technologies became universal in the twentieth century. When a new color trend begins, it is interesting how this color is usually described as a "new white", e.g., this yellow is the new white. The conception of total white, e.g., the last minimalistic Paris private apartment of Karl

Lagerfeld was reduced to three hygienic zones: bedroom, bathroom and kitchen. The increase in home filming has shown that white backgrounds are dazzling on the screen, so warm neutral shades (gray, beige, etc.) are gradually replacing white (Gronskiy 2018).

Another trend that we can observe in the last years, is a more sophisticated use of lighting technologies for characterizing spaces. With this trend, if colorizing happens with light and mapping effects, objects and space become pure form modelled by light, colored paints are less important, and white surfaces have a new meaning of perfect screens.

WHITE IN THE PANDEMIC CRISIS COVID-19

Today the use of white has returned to the idea of medical associations because of Covid-19. Since the nineteenth century white coats were dressed by medical doctors primarily for surgical operations. They had become an official uniform at the beginning of the 20th century, substituting the previously normally used black suits, symbol of reliability (Hochberg 2007). White coat has been used as a pure expression of cleanness, can be easily sanitized with high temperature, and has become a symbol of medical authority. White is used for the same reason even for many protective clothes for sanitation. Medical association of white has characterized the whole last century and with the actual pandemic becoming central. But today the sanitation costume means invisible illness, dangerous to be near and breathe. So medical white has turned from surgery to epidemic danger. Nowadays white symbolizes even tabula rasa as the beginning of new life. The totally white empty cover of the April issue of Vogue Italia, edited and published in the height of the pandemic health emergency, is emblematic. White means hope for the future, as it is made explicit in a second white cover of Vogue, this time of the September issue of Vogue Portugal. In the last months, a white fashion in dressing seems to confirm this trend.

CONCLUSION

The current pandemic crisis has renewed the importance of the association of white as the color of cleanliness, while at the same time the symbolism of white as concept of novelty, new beginning. This is clear by now in fashion design, while in the art world we can find some ironical interpretation of the wide use of white equipment to protect and to clean. In architecture, the reconsideration of the concepts of home, office, etc., with the transformation of our lifestyle with the enormous increase in remote working during pandemic have not involved directly new color trends. The trends of the last years seem, therefore, to be confirmed. The preference for shading and more natural color instead of a totally white environment and, on the other hand, the use of lighting technologies to emotionally characterize and colorize the ambience. With this “emotional tech” trend, white surfaces have a new meaning as perfect screens, pure form, open to total light. In this context, the duality of white walls with transparent and translucent architectural elements enabling light to penetrate into the interior remains actual.

ACKNOWLEDGEMENTS

We thank Natalia Osminina, Viola Hildebrandt-Schat, Maria Grazia Fiorin and Giuseppe Giuliano.

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A practical procedure for obtaining calibrated material colors for CAD Systems

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ABSTRACT

CAD systems for interior design often present 3D rendering photorealistic features for the project. It is possible to download accurate photometric data of luminaires from lighting manufacturers' websites, but the same cannot be said for the colors of materials and finishes. Excluding laboratory procedures for measuring the BRDF, which are not within the designer's reach, in this essay we are presenting a practical procedure based on the use of an SLR Camera.

The correct acquisition and virtualization of a sample according to a standard, reliable and repeatable procedure is the first step for an evaluation of the project materials based on faithful visualizations. This can be done through the Color Management, the use and the transformation of color profiles of each device used in the process.

We will see a possible and correct procedure to acquire a sample of material through a digital SLR Camera, how to set up the photographic set and the surrounding environment and how to create a color profile linked to the device and the lighting conditions of the shoot. Finally, we will show how to associate the color profile with the images taken by the camera and how to convert them into images that have a standard color profile recognized by the major CAD software, to provide a solid starting point for the subsequent steps that must be followed to obtain an as much as possible correct perception of the colors present in the project, regardless of the device used to display it.

Keywords: *color acquisition, colorspace, camera, sRGB, CAD*

INTRODUCTION AND THEORY

In the context of Interior Design, the designer is called upon to make design choices, not only about spaces and forms, but also lighting and materials. Regarding the first, nowadays it is possible to simulate with good accuracy the distribution of project light intensities through the use of particular IES or LDT files (Siniscalco and Guarini 2018), provided directly by companies through their websites and thus create photometrically correct predictive images.

Concerning materials and finishes, however, the correct simulation of real colors to be used in the project is not as refined and immediate. The procedure currently most commonly adopted by most professionals is to download a texture from the internet or to photograph a sample of the material via a smartphone. A fast and immediate approach, but which cannot return reliable predictive results. The textures downloaded from the Internet are generally in *.JPG format and nothing is known about how they were acquired, whether through cameras that were correctly calibrated or not calibrated at all, and in what lighting conditions. There is no information regarding the color profile of the camera that generated the images. Most smartphones on the market do not have color management functions, the same sample photographed by different devices could lead to images presenting different shades. Most of them cannot shoot in the *.RAW format, greatly reducing the possibility of post-production correction and calibration. On some glossy finishes a photo taken from a particular angle would show areas that are not uniformly illuminated or with unwanted reflections.

For the use of reference images in CAD systems for the creation of reliable textures, it is necessary to introduce the topic of color management (Rodney 2005), the transformations of color spaces between different acquisition and display devices, which must all be correctly calibrated, via software and with hardware supports. Furthermore, a procedure must be used that makes it possible to acquire the sample in lighting conditions that are as standard and replicable as possible.

A possible solution involves the use of a scanner, an excellent solution on samples of medium-small size and with smooth finishes or low roughness. The lighting conditions here are always the same, it is sufficient to cover the sample with a black cloth. In the case of larger samples, or with a very rough and uneven surface that could damage the glass of the scanner, the best solution is to use a reflex camera, if possible, in an environment prepared with a shooting set and controlled lighting. Here we will analyze this second case. To get true colors from a photo shot, it is essential to be able to shoot in *.RAW format and not *.JPG (Resnick and Spritzer 2009). Most SLR cameras have this feature. Smartphones capable of doing this are still few. The RAW format makes it possible to acquire color data in a “raw” way, i.e. acquiring all the information on RGB colors without any intervention by the processor in relation to corrections such as white balance, contrast or sharpness increase and change in saturation. In this way, the data can be edited more accurately at a later stage. When shooting in RAW format, the colors detected by the camera mainly depend on two factors: the characteristics of the sensor and the color temperature of the light sources (Kumar and Choudhury 2014). The first is related to the camera model. The second plays a crucial role, as real colors could turn to warm or cold tones if the camera is not properly balanced (Zhang et al. 2017). This is done through white balancing, which can be done in two ways: using a neutral reference during the shooting phase, the so-called “in camera” white balance, or in post-production using software.

With regard to the sensor, the representation of the colors acquired by it can only be corrected through the use of a physical instrument that, framed in the shot, portrays standard colors that can be recognized by the software and subsequently converted. This tool is called Color Checker, i.e. a palette containing these reference colors, through which it is possible to carry out the white balance, both in the camera and in post-production, and to create color profiles of the camera used, each linked to different lighting conditions at the time of a series of shots. X-Rite in 2009 released a small container with three color tablets called Color Checker Passport, now in the PHOTO 2 version (x-rite ColorChecker Passport Photo 2, s.d.), which contains an extra tablet, Mid Gray 18%. The four tablets measure approximately 12 x 9 cm. For our purposes, it is necessary to use the tablet containing 24 color samples, used in digital photography to generate DNG profiles (Digital Negative) (Triantaphillidou and Allen 2011) of cameras that shoot in * .RAW format. Inside there are also some samples of neutral colors used for white balance, both in the camera and in post-production, also useful for controlling the exposure to be used during shooting. Along with Color Checker Passport, X-Rite also provides proprietary software to generate DNG profiles, fully compatible with Adobe Photoshop's Camera Raw and also available as a plugin for Adobe Lightroom. The latest version also offers the possibility to generate ICC profiles (Johnson 2012).

In the Classic palette of 24 samples, produced and marketed in 1976, the colors are made of ametameric pigments (Setchell 2012). Among the colors there is also a row of gray scale samples used as a reference for white balancing in camera and in post-production, 6 primary colors and 12 common reference colors. Although already present since the 70s, the software for the creation of color profiles of cameras was only developed in 2009.

METHOD

The procedures for the acquisition and for profiling the Camera require to take at least one shot with the Color Checker inside, following some specific steps and respecting the particular conditions regarding the setting up of the environment and the photographic set, the positioning of the Color Checker, the settings of the camera and the white balance in the camera (optional but recommended, also to have a good view on the display). After the shot, it is necessary to carry out the white balancing in post-production and create the color profile. For this last step, there are two possible solutions.

In the first, Lightroom can be used together with the XRite Color Checker Plugin. The White balance is corrected in the software and the color profile is created. This will then be applied to the other photos of the sample taken under the same lighting conditions. In the second, it is necessary to convert the *.RAW shot into a *.DNG file using the Camera Raw software and then open the converted file using the proprietary software COLOR CHECKER CAMERA CALIBRATION and in this generate the DNG profile, or alternatively the ICC profile.

It is important that the acquisition of the material sample is done in a standard, controllable and replicable environment, for example in a laboratory where light from the sun and the sky can be completely excluded. The sample should be placed on a sufficiently large and evenly lit work surface with two lamps of the same type and age, the color temperature of which the user should know. These lamps should be placed on stands, symmetrically with respect to the table, one on the right and the other on the left. The light beam of the two devices should strike the center of the table with an inclination of 45° with respect to the normal at that point. In the case of non-Lambertian samples with a strong specular reflection component, to avoid points of maximum illumination and unwanted reflections in the final shot, it may be necessary to move the lamps away and raise them, thus keeping the beam of the lamps in the center of the table. To avoid unwanted color casts on the sample, it is best to avoid colored objects close to the set or clothing of the shooter with too light and saturated colors. To avoid light to be reflected on the sample, the acquisition plane should not be lighter than the white mark of the color checker. A gray background can be the best solution in most cases. The camera must be installed on a stand in order to perform a zenith view, perpendicular to the surface of the sample. The zoom of the camera must be in an intermediate position, avoiding the limit switch on both the wide-angle and telephoto side. To frame the sample, it is therefore preferable to adjust the height of the camera rather than adjusting the zoom. The aperture must be closed as much as possible to avoid vignetting phenomena, while sensitivity must be set to low values. As already said, the acquisition must be done in RAW mode to guarantee the maximum level of adjustment in the post-shooting phase and to manage in an optimal way the attribution of the color profile. The camera needs to be focused correctly. In the case of samples that are too uniform, if this operation is difficult, it is possible to temporarily position another object on top of the sample in order to adjust the focus on it, lock the setting and then take away the object before shooting. It is preferable to shoot in the best possible conditions, avoiding underexposure and overexposure. The same goes for white balance. This must be adjusted “in the camera” by entering a value in Kelvin degrees that corresponds to that of the correlated color temperature (CCT) of the two lamps. For more complete information on the characteristics of the illuminant, it would be better to have full spectral power distribution, but unfortunately this data is not considered by Adobe Lightroom and Camera Raw software, together with the proprietary Color Checker software.

The Color Checker must be illuminated by the same light source that illuminates the subject. Should the lighting conditions change, the specimen and the Color Checker should be photographed again. The tablet with the color samples should be oriented in front of the camera, then placed on the set’s table, next to the sample. If the sample is excessively large, the Color Checker can be positioned above it, and then a further shot can be taken of the sample of the material only. The tablet must occupy at least 10% of the frame, but it must not fill it completely or the vignetting effect could interfere with the color of the samples in the corners.

As already mentioned, the calibration can be done both with Adobe Lightroom and Camera Raw, together with the proprietary Color Checker software. Both cases will be discussed here.

The Color Checker Passport comes with software to be installed as a plugin in Adobe Lightroom, which in essence is an export preset, the final result of which is the creation of the DNG profile. After importing shots taken in Lightroom, in the photo with the Color Checker it is necessary to balance the white by entering the color temperature value of the lamps used. If this value is not known, it is always possible to set it using the eyedropper tool by clicking on the second sample of the gray scale present in the 24-color tablet. Once this is done, it is necessary to create the actual DNG profile, by choosing from the File menu the eXport Preset → Color Checker Camera Calibration, an item present only after installing the aforementioned plugin. The name of the exported profile should recall the Camera / lighting conditions pairing, for example Nikon - 4800K. To have the exported profile available in the program library, Lightroom must be restarted. At this point, it is possible to choose it from a drop-down list in the panel *Development* under *Profile, Browse Profile*. In this way, Lightroom can correctly interpret the Color Checker colors present in the photograph.

If the Color Checker has been placed next to the sample, the procedure ends here, after having cropped the frame to show only the material. If, on the other hand, the Color Checker has been positioned over the sample for reasons of space, it will be necessary to apply the same color profile and the same white balance also to subsequent shots, in which the sample was photographed without the Color Checker, and obtain from these the texture of the material. These other shots must be taken under the same lighting conditions. It is also possible to use a white balance and profile synchronization function on multiple photos. As the last step, in order to obtain the texture to be used in CAD systems, the image needs to be exported in the lossless *.TIF format, converting the color profile to sRGB (Nielsen and Stokes 1998), universally recognized by technical design software.

The other possible procedure involves using Camera RAW combined with the Color Checker Camera Calibration software. First, you need to convert the shot from the *.RAW to the *.DNG format, so that the second software can open it. To do this, the RAW file is imported into Photoshop's Camera Raw, then the white balance is corrected using the eyedropper tool by clicking on the second sample of the grayscale in the 24-color tablet. Once this is done, the file must be saved in the *.DNG format and then opened with the Color Checker Camera Calibration software supplied with the Color Checker Passport. This will automatically recognize the palette in the photo and will propose a manual readjustment of the area corresponding to the samples in case the user notices any misalignments. At this point, it will be possible to create the color profile, also in this case giving it a name that recalls the camera / lighting coupling, for example Canon - 2700K. Here, unlike the first method, the possibility of creating an ICC profile is also available, which is universal also outside Adobe software. The final step is to restart Photoshop and CameraRaw, which will now have the newly created profile available. Having reopened the initial image in RAW format, it will be necessary to correct the white balance again with the eyedropper tool on the second notch of the grayscale, and to choose the profile created using Camera Raw from the available options. As a last step, it will be necessary to save the file in *.TIF format after converting the color profile to sRGB.

EXPERIMENTS

As part of several editions of the Mono-disciplinary Theoretical *Strumenti e Metodi del Progetto 2*, held at the Politecnico di Milano, about a hundred students were asked to proceed with the acquisition of a sample of material of their choice using the equipment available at the *Laboratorio Immagine* Lab.

The Laboratory has prepared 3 photographic sets set up according to the procedure described in this paper. The machines made available were Nikon, the lamps used were halogen with a color temperature of about 2850 kelvin.

The students took two to three shots in RAW mode, with and without the Color Checker. For them, the greatest difficulty was finding the correct focus on some particularly uniform samples and finding the correct exposure. The white balance was set in advance in Camera with the same temperature as the lamps used. The students were then assigned the task to process the color profile of the shot taken with that specific camera and in those specific lighting conditions from the photo with the Color Checker, using the Lightroom software. Once the color profile was obtained, still using Lightroom they applied the profile and the correct white balance to the other shots taken. They have then exported the image with the sample and without the ColorChecker in *.tiff format and with sRGB color profile. Finally, they cut out the acquired image using Photoshop and made it seamless and ready for use in CAD systems.

RESULTS, DISCUSSION AND CONCLUSION

We are aware that for a correct description of materials and light-matter interaction in CAD systems, radiometric data would be needed, rather than colorimetric data, in a similar way to what is done for example in the open source software “Radiance Synthetic Imaging System” developed by Berkeley Lab. Unfortunately, this calculation engine is unknown in Design practice and ignored by most CAD software manufacturers who base their calculations on colorimetric quantities. But above all, the radiometric data of the light sources, and the BRDF of the materials used in the projects, are never available for designers in daily practice.

The acquisition of materials for their use in CAD systems is a topic often underestimated by professionals. The practice of downloading textures from the internet or taking photos with the smartphone in JPG format and without device calibration cannot provide reliable results. A more correct procedure would be using a scanner or a digital camera that stores images in RAW format.

In this article we have dealt with the second procedure, indicating specifically: what are the ideal spaces / environments for the acquisition; which lighting conditions are most appropriate; what are the best settings for the reflex camera; which physical tools and software to use to perform a correct calibration of the camera; how to apply the color profile of the camera to the shot images and finally how to export the images in the sRGB color profile, universally accepted by CAD systems.

Among the possible future developments, an interesting study could concern the integration of the acquired data with the spectral values of the BRDF, nowadays difficult to manage due to two main problems. The first relates to the feasibility of measuring BRDF values

(Shi et al. 2018) not on a homogenous material, but on one with motifs or textures. The second concerns entering the values, thus obtained, within commercial CAD applications offered on the market, which currently do not provide for this type of input.

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Effect of illuminant UV component on colorimetric attributes of eco-friendly dyed wool yarns

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ABSTRACT

Definitely, the colorimetric attributes of textile samples with fluorescent effects are achieved under the UV content of standard illuminant. There are some challenges for measuring the reflectance spectra of those samples that do not benefit from fluorescence effects while the applied solutions, i.e., dye solutions, mordanting solutions and so on, show very small amounts of fluorescent emissions. For example, the wool yarns dyed with natural dye and pre-mordanted by bio-mordant show no fluorescence effects while the Yellow myrobalan extraction which applied as pre-mordanting solution shows negligible degrees of fluorescent emissions.

In order to investigate the effect of illuminant's UV content on colorimetric attributes of pre-mordanted dyed wool yarns, their colorimetric characteristics were achieved under the D65 standard illuminant over the CIELAB color order system while the UV content of employed light source was set to be included and excluded, separately. Finally, the CIE1976 color difference formula (ΔE^*ab) was used to compute the color differences between the dyed wool yarns have been measured with and without the UV content of the light source while, both the CIE1964 as well as CIE1931 standard observers were considered to check the outcomes. Results showed that, regarding the proposed tolerance value for CIE1976 color difference formula ($\Delta E<1$), the color differences of wool yarns are not visually significant while the UV content of D65 standard illuminant is set to be included or excluded.

Keywords: *colorimetric attributes, illuminant UV content, color difference formula, eco-friendly dyeing, wool yarns*

INTRODUCTION

The advantages of producing the eco-friendly products via the eco-friendly methods are abundant. The Iranian handmade carpet is one of the most important of Iran's non-oil exports. In order to guaranty the eco-friendly production of handmade carpets, it is necessary to apply natural materials via a totally environmentally friendly method. In other words, all the treatment procedures, i.e., dyeing, mordanting, and so on, need to be done via the eco-friendly methods while all of the materials including fibers, dyes and additives must be in the class of natural and biomaterials.

Regarding the low affinity between natural dyes and natural fibers (Ashrafi et al. 2018, Adeel et al. 2020a), metal mordants are applied in the dyeing process via three different methods: pre-, meta-, and post-mordanting (Uddin 2014), conventionally. Considering their toxicity and environmental hazards (İşmal 2019, Zia et al. 2019), the application of bio-mordants has become of interest to achieve the same results (Ul-Islam et al. 2018, Khattab et al. 2020, Adeel et al. 2020b). In order to eco-friendly dyeing of wool yarns applied in Iranian handmade carpet, it is essential to apply bio-mordants instead of the metallic ones. In this paper, the Alum as metallic mordant is replaced by Yellow myrobalan as natural mordant to enhance the affinity between the wool fibers and the applied natural dye.

To achieve the colorimetric characteristics of opaque objects, their reflectance spectra are measured under the predefined conditions regarding the applied light source, standard observer, specular component of reflectance, and so on (Fairchild 2005, Hosseinnezhad et al. 2021). Obviously, the reflectance behavior of textile samples with fluorescence effects is measured by considering the UV content of standard illuminant. There are some challenges for achieving the colorimetric characteristics of those samples that do not benefit from some fluorescence effects while the applied solutions, i.e., dyes, pre-mordanting materials, and so on, show very small amounts of fluorescent emissions. For example, the wool yarns dyed with natural dye and pre-mordanted by bio-mordant show no fluorescence effects while the Yellow myrobalan extraction applied as pre-mordanting solution shows very negligible degrees of fluorescent emissions. The question is which condition should be applied for measuring the reflectance spectra of the final products? In fact, we are in doubt if measuring the samples with or without the UV content of the light source will result in different colorimetric attributes. The current research aims to answer this question.

EXPERIMENTAL

In order to enhance the affinity between the wool yarns and natural dye, the Yellow myrobalan was applied as bio-mordant. The finely powdered Yellow myrobalan (20 g) was extracted with a solution of water and methanol 1:1 (1 L) for one h at 60 ^{o}C in a shaker incubator (Heidolph Inkubator 1000). The extracted mixture was filtered, and the remaining residue was extracted three more times to complete the extraction. The achieved solution was directly used for measuring luminescence property in a Perkin Elmer L555 fluorescence spectrometer instrument. Next, the wool yarns were pre-mordanted in water keeping, M:L (Mass of substrate to Liquor) ratio of 1:40 with the achieved solutions of Yellow myrobalan extraction at 10, 20 and 40% concentrations on weight of fiber (o.w.f). Then, the pre-mordanted wool yarns were dyed in a dyeing machine using a L:R ratio (Liquor ratio) of 40:1 at 0, 5, 10, 20 and 40% (o.w.f) of Madder as natural dye. Finally, 15 pre-mordanted and dyed wool yarn samples were prepared. Table 1 shows the concentrations of applied natural dye and bio-mordant on weight of fibers.

In order to investigate the effect of illuminant's UV content on colorimetric attributes of dyed wool yarns, their reflectance spectra were measured using the Color Eye 7000 A Spectrophotometer from Gretag Macbeth over the visible wavelengths from 400 to 700 nm. The measurements were done with 10 nm intervals under the D65 standard illuminant and CIE1964 as well as CIE1931 standard observer while the specular component of reflectance spectra was included. The measurement geometry was d/8 and the UV content of the light source was set to be included and excluded, separately. Next, the colorimetric characteristics of wool yarns were computed over the CIELAB color order systems. Finally, the CIE1976 color difference formula (ΔE^*ab) was used to compute the color differences between the wool yarns have been measured with and without the UV content of the light source.

Materials	Application	Concentration (o.w.f)
Wool yarn	Natural fiber	-
Yellow myrobalan	Bio-mordant	10%, 20% and 40%
Madder	Natural dye	0%, 5%, 10%, 20% and 40%

Table 1: Natural materials applied for eco-friendly dyeing of wool yarns.

RESULTS AND DISCUSSION

As mentioned above, the luminescence property of the extracted Yellow myrobalan was investigated in a solution of water and methanol (1:1). Figure 1 shows that the extracted materials from Yellow myrobalan have weak fluorescence properties.

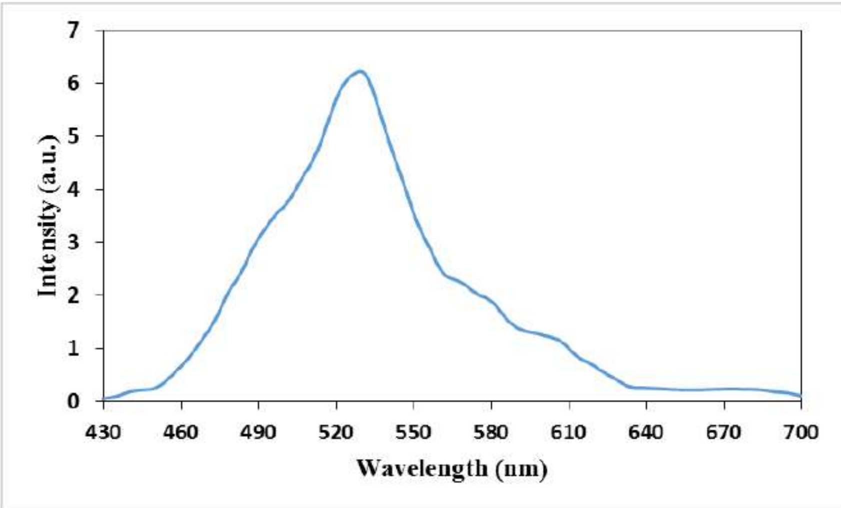

Figure 1: The luminescence property of the extracted bio-mordant over the visible wavelengths.

As mentioned before, in order to investigate the effects of small amount of fluorescence emission of applied bio-mordant on colorimetric attributes of final product, the colorimetric attributes of pre-mordanted dyed wool yarns were achieved over the CIELAB color space with and without the UV content of D65 standard illuminant. Table 2 shows the colorimetric characteristics of dyed wool yarns under the CIE1931 standard observer. The last column of Table 2 indicates the color difference values achieved between the wool yarns measured with and without the UV content of the applied light source. According to Table 2, all the computed color difference values are smaller than 1 ($\Delta E^*<1$).

In order to check the results, the color difference values between the dyed wool yarns measured with and without the UV content of the applied illuminant were computed under CIE1964 standard observer, once again. Table 3 shows the achieved color difference values as well as the colorimetric characteristics of pre-mordanted dyed wool yarns under D65 standard illuminant and CIE1964 standard observer over the CIELAB color order system. The last column of Table 3 indicates that all the computed color difference values are smaller than 1 ($\Delta E^*<1$), again.

Bio-mordant	**Natural dye**	**D65, UV included**			**D65, UV excluded**			
Yellow Myrobalan	**Madder**	**L***	**a***	**b***	**L***	**a***	**b***	**ΔE***
10%		68.508	1.804	23.708	68.227	1.895	23.895	**0.35**
20%	**0%**	66.874	1.796	27.67	66.674	1.867	27.722	**0.22**
40%		65.193	1.736	30.889	65.152	1.85	31.05	**0.20**
10%	**5%**	50.278	23.32	19.039	50.884	23.396	19.052	**0.61**
	10%	43.517	27.709	19.931	43.394	27.644	19.929	**0.14**
	20%	35.806	30.595	19.439	35.534	30.452	19.504	**0.31**
	40%	28.938	29.206	18.476	28.2	28.815	18.548	**0.84**
20%	**5%**	50.236	20.964	22.63	49.702	20.777	22.451	**0.59**
	10%	43.457	25.88	21.703	43.132	25.876	21.734	**0.33**
	20%	34.571	29.558	18.788	34.441	29.429	18.786	**0.18**
	40%	28.081	29.73	18.131	28.162	29.773	18.082	**0.10**
40%	**5%**	51.623	18.441	26.71	51.726	18.443	26.703	**0.10**
	10%	43.681	24.637	25.284	44.168	24.529	25.142	**0.52**
	20%	37.006	28.517	24.442	36.767	28.373	24.301	**0.31**
	40%	29.816	29.902	21.438	29.983	29.912	21.564	**0.21**

Table 2: The colorimetric characteristics of dyed wool yarns under the CIE1931 standard observer.

Mordant	**Dye**	**D65, UV included**			**D65, UV excluded**			
YM	**Madder**	**L***	**a***	**b***	**L***	**a***	**b***	**DE***
10%		67.9	2.997	23.841	67.615	3.1	24.007	**0.35**
20%	**0%**	66.208	2.976	28.106	66.007	3.052	28.14	**0.22**
40%		64.47	3.071	31.407	64.425	3.197	31.548	**0.19**
10%	**5%**	49.685	22.424	18.377	50.291	22.486	18.379	**0.61**
	10%	42.895	26.437	19.078	42.773	26.374	19.065	**0.14**
	20%	35.202	28.914	18.491	34.932	28.775	18.55	**0.31**
	40%	28.38	27.446	17.589	27.645	27.081	17.663	**0.82**
20%	**5%**	49.589	20.392	22.186	49.06	20.217	21.993	**0.59**
	10%	42.818	24.8	21.032	42.493	24.802	21.045	**0.33**
	20%	34.001	27.873	17.984	33.872	27.756	17.972	**0.17**
	40%	27.541	27.864	17.284	27.623	27.89	17.221	**0.11**
40%	**5%**	50.898	18.355	26.388	51.001	18.357	26.369	**0.10**
	10%	42.971	23.927	24.655	43.462	23.814	24.511	**0.52**
	20%	36.315	27.367	23.608	36.081	27.215	23.464	**0.31**
	40%	29.204	28.308	20.538	29.369	28.318	20.651	**0.20**

Table 3: The colorimetric characteristics of dyed wool yarns under the CIE1964 standard observer.

Comparing Tables 2 and 3 indicates that despite of applied standard observers, i.e., CIE1931 and CIE1964, all of the computed color difference values are smaller than 1 (ΔE*<1). In addition, except 4 samples in both Tables, the rest of achieved color difference values are even smaller than 0.5 (ΔE*<0.5). Regarding the proposed tolerance value for CIE1976 color difference formula (ΔE*<1), it is found that the achieved color differences between the dyed wool yarns with and without considering the UV content of the light source are not visually significant.

CONCLUSION

To investigate the effect of UV component of standard illuminant on color appearance of eco-friendly dyed wool yarns, the colorimetric attributes of pre-mordanted dyed wool yarns were achieved under the D65 standard illuminant while the UV content of the applied light source was set to be included and excluded, separately. The CIE1976 color difference formula was used to compute the color difference values between the dyed wool yarns measured with and without considering the UV content of the standard illuminant. Results showed that, all the achieved color difference values are smaller than 1. It means that the achieved color differences have little significance in terms of visual perception.

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Using coloured lights in physical and immersive VR environments as material for design

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ABSTRACT
Light and lighting in fashion and textile design generally relate to the viewing and production of a fashion or textile collection in daylight, or integrating LEDs, electro-luminescent wires, and optical fibres in the structures of fabrics to create a light-emitting fashion or textile collection. This ignores the potential that coloured light as material for design can bring into these disciplines. This paper aims to investigate coloured light as a material for design in relation both to physical environments and immersive virtual reality, and to develop design methods for fashion and textile design that could lead to a re-learning of coloured light as a material for design for developing novel artistic expressions. The first series of experiments focused on addressing the following questions in both physical and virtual reality: How do coloured surfaces and coloured light interact? How do interactions between coloured surfaces and coloured light influence the process of designing surface patterns? To critically examine the results of this research, textile and fashion design undergraduate students participated in a five-day workshop during which they experimented with, and reflected upon different types of interaction between coloured surfaces and coloured light in both physical and virtual reality. The students' designs showed that the design method provided them with an understanding of the use of coloured light in their design processes through experimentation and individual exploration, demonstrating that this approach can make a fundamental contribution to the development of coloured light usage in various design disciplines.

Keywords: *virtual, physical reality, coloured light, fashion and textile design, dynamic surface pattern*

BACKGROUND

Light and lighting in textile and fashion design generally relates to the viewing and production of a textile or fashion collection in daylight (McArthur 2017:150) or using LEDs (Layne n.d.), electro-luminescent wires (Persson and Worbin 2010), or optical fibres (Jansen 2015) in the structures of textiles to create a light-emitting textile or fashion collection. The *Rhythm exercise* (Jansen 2015) is a series of hand-braided structures, wherein each braid consists of thirteen optical fibres. Each fibre is connected to white LEDs, and programmed to emit white light through the use of a microcontroller and digital interface. Each string can be switched on or off to create a complex pattern of moving light patterns within the braided structures. These and other research projects are successful examples of artificial-light-emitting textile or fashion collections; however, in the opinion of the authors of this article, they do not fully utilise the potential that coloured light as a material for design could bring into textile and fashion design practice.

The increasing accessibility of immersive virtual reality (VR) technologies has led to rising interest from researchers in various disciplines, resulting in a variety of research projects. In the context of VR technologies, colour has primarily been investigated from technical and architectural perspectives within studies that have compared the appearance of colours in physical and virtual environments in terms of quality (Stahre and Billger 2006). This has been undertaken in order to develop virtual spaces in different colours to test the influence of colour on user behaviour (Zhang et al. 2017) or investigate improvements in colour representation in virtual environments (Pardo et al. 2018). While these research projects are successful examples showing how colour has been investigated in virtual environments, research of this kind does not investigate interactions with colour in virtual environments from an artistic research perspective. However, in a study conducted by Bachmann and Michel (2013), a virtual environment was developed to test colour perception from a design research perspective: users entered different rooms within a virtual exhibition, and assessed how the colour perception of objects and materials was affected by different colours of light. However, this virtual application was limited in its colour alteration possibilities due to the fact that it focused on altering colour perception in a manner similar to physical reality. Immersive three-dimensional sketching applications such as Google Tilt Brush and Gravity Sketch make it possible to design and prototype in ways that are not possible in physical reality, and therefore possess the potential to achieve creative expressions that are worthy of investigation within the context of fashion and textile design. Thus, the research presented in this paper aimed to investigate coloured light as a material for design in physical and virtual reality, and develop a design method for fashion and textile design processes that rethinks our understanding of coloured light as a material for developing novel artistic expressions.

EXPERIMENTAL PROCESS

For explorations in physical reality, four LED lamps were placed on the floor and one was attached to the ceiling of a 10m2 darkroom. The explorations in virtual reality used Oculus Quest VR headset in combination with Google Tilt Brush as 3D sketching application. Seven base colours in different shades were used: green, yellow, turquoise, blue, violet, vermilion red, and pink (Figure 1). In physical reality, the colours were printed on a white plain-weave fabric which was hung on a wall. Then, the coloured surfaces were illuminated with the LED lamps at full brightness in the following order: red, green, blue, cyan, magenta, and yellow. In virtual reality, the colours were applied to the virtual 'Flat' material in Google Tilt Brush. Then, the coloured surfaces were illuminated with different coloured lights at full brightness in the same order: red, green, blue, cyan, magenta and yellow. The results, in physical and virtual reality, showed how colour perception changes under influence of light. Subtractive colour combinations were created that cause colour hue shifts, changes in saturation, and greying. In details, the following phenomena were observed: i) Coloured surface illuminated with light of its complementary colour: the coloured surface appears grey or black; ii) Coloured surface illuminated with light of the same colour: the coloured surface appears to be highly saturated, and to some degree self-illuminating (Figure 1).

In addition, the results indicated that the subtractive combination of light and colour caused the colours of the printed surfaces to shift, and that the smooth colour transition of both the coloured surfaces and coloured light suggested a novel way of designing dynamic surface patterns. This finding highlighted a need for methods for using light and colours in the creation of dynamic patterns.

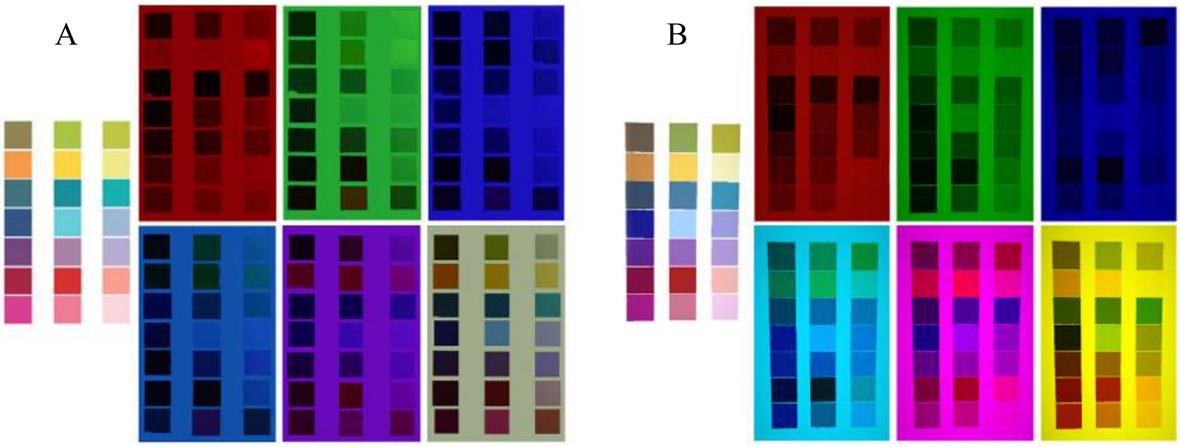

Figure 1: Image A shows the results that were achieved in physical reality. Image B shows the results that were achieved in virtual reality. In both images, the left-most picture shows the coloured surfaces exposed to white light. The six pictures to the right of both images show the coloured surfaces exposed to red, green, blue (RGB) and cyan, magenta, yellow (CMY) light.

In order to critically examine the results of the initial investigations, 15 undergraduate fashion and textile design students were recruited as workshops participants to test, experiment, and reflect upon different types of interaction between coloured surfaces and coloured lights in both physical and digital settings. The Colour and Light workshop had four stages. In Stage 1, the students began by using the coloured LED lamps in the darkened room to observe the effect of coloured lights, especially red, green, and blue light on various coloured surfaces that they had selected. The purpose of this stage was to provide the students with a setting in which they could explore how colour perception changes under the influence of coloured light. In Stage 2, the students were encouraged to work with the four available Oculus Quest devices and Google Tilt Brush. Just as in the previous stage the students were able to make use of the provided tools, which this time were digital in nature, to alter the perception of the colours of materials and objects placed in the virtual environment. In Stage 3, the students were asked to review their observations with regard to both physical and virtual reality and reflect on the differences and similarities they were able to identify. In the final stage, the students were encouraged to create a design work that displayed their understanding of coloured light as a material for design.

The design examples created by the students in the final stage demonstrated that the proposed pedagogical approach for teaching them about interactions between coloured surfaces and coloured lights shifted the students' understanding of coloured light – it changed from a passive tool that is used to improve the visual nature of design artifacts to a material for design in itself. It also created a unique set of fundamental skills for the students to learn in an easier and more profound way, and facilitated the design of dynamic patterns during the experimental workshop.

RESULTS

By observing the design processes and examining the design works produced by the students in both physical and virtual reality, it was determined that VR technologies provide more design possibilities for textile and fashion designers than physical reality with regard to the use of coloured light as a material for design. This logic was based on three conclusions: i) VR offers a wider range of visually perceptible light intensity (brightness); ii) VR offers the possibility of achieving different coloured surface behaviours in response to coloured lights; iii) VR provides the ability to work with digital materials that show either a high or low colour-alteration tendency when exposed to coloured light. This is supported both by coloured surface charts and the design examples.

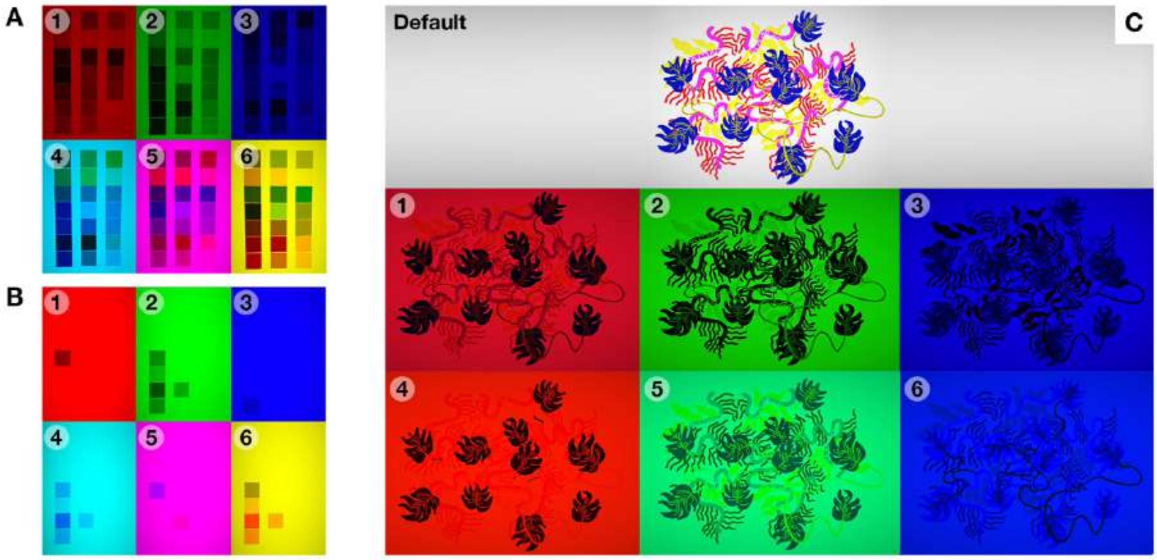

Figure 2: Group A shows the coloured surfaces after being illuminated by coloured lights in VR. Image group B shows the same coloured surfaces exposed to the same coloured lights with maximum brightness. Image group C shows how changing the brightness of coloured lights changes the design, e.g., changing the pattern to only leaves (C4) or no leaves (C6). Work by Bachelor's degree textile design student Luna Gil, Colour and Light workshop, 2020.

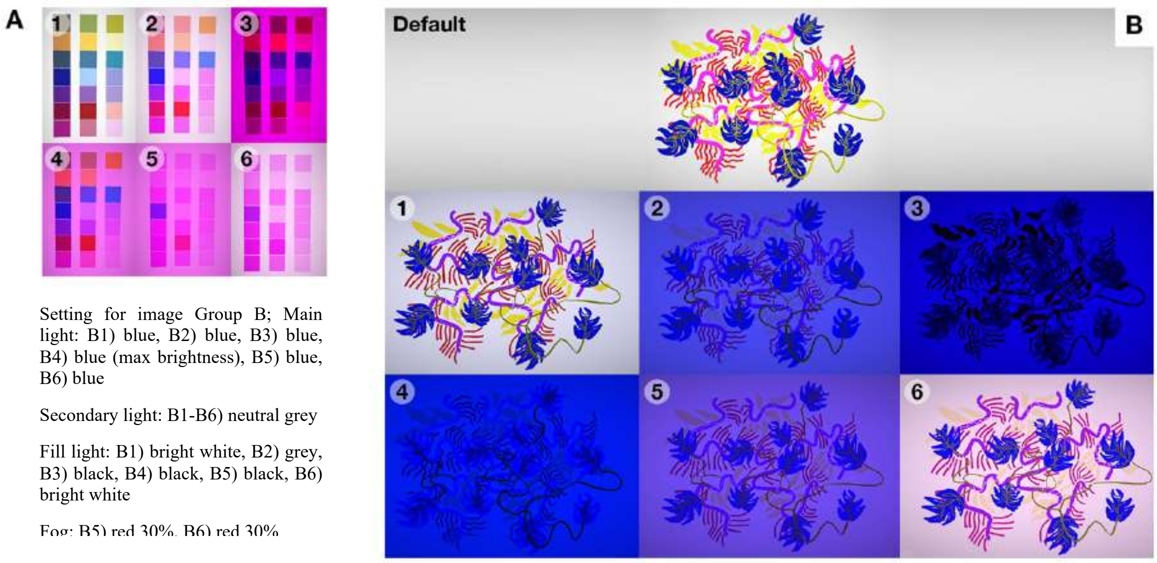

Figure 3: Image group A shows step by step light alteration that the coloured surfaces underwent as a result of exposure to coloured light, in this case magenta. Image group B shows the effect of subtle changes in fill light, fog, and level of brightness on colour appearance in VR. Work by Bachelor's degree textile design student Luna Gil, Colour and Light workshop, 2020.

Figure 2 shows that it is possible to change the brightness level of coloured light in VR in a way that is not possible in physical reality, resulting in more possibilities for altering the perception of coloured surfaces. The different coloured light settings shown in Figure 2 are identical to physical reality in case of the images A1 to A6. The images B1 to B6 in contrast show adjustments made to the coloured light settings, by setting them to maximum brightness, that were only possible in VR. This resulted in significant changes to the visibility of the coloured surfaces. For example, the coloured surfaces that were exposed to light of the same colour with the maximum brightness set to the highest possible level became invisible. This could be used as a novel design tool, enabling designers to make parts of their designs visible or invisible depending on the level of brightness of the light. While it is possible in physical reality to make parts of designs visible or invisible by changing the colour of the lights they are exposed to, in VR this can be undertaken on a much more ambitious scale and with more extensive customisation of parameters.

In images C1-C6, the pattern is shown when exposed to coloured light with parameters adjusted as follows: main light – RGB (C1-3) and RGB with maximum brightness (C4-6); secondary light – neutral grey (C1-6), fill light – black (C1-6). While the effect in the images C1 to C3 is similar to that of coloured light in physical reality, the images C4 to C5 show colour alterations with maximum colour brightness, which can only be achieved in VR (Figure 2).

The second conclusion indicated the possibility of achieving different coloured surface behaviours when exposing coloured surfaces to coloured lights in VR, which is not possible in physical reality. This suggested that changing the fill light from black, which was used in all of the other experiments, to bright white or grey and adding fog, as transparent coloured material, to the colour setting could offer a new colour palette (Figure 3). This was further elaborated on in the design work shown in the image group B of Figure 3. Here, blue light as main light, neutral grey as secondary light, and different kinds of fill light varied as shown in Figure 3 (B1-B6) were used. Comparing the different coloured light settings (Figure 3) demonstrated that it is possible to achieve different coloured surface behaviours with different coloured lights. The images B3 and B4 show parts of the design turned black, while the images B1, B2, B5 and B6 show that all of the colours were affected by the blue light without turning grey or black. The latter effect was not possible to recreate in physical reality with the coloured light systems used.

The third conclusion suggested that it is possible to combine different materials in VR that have either a high or low tendency for colour alteration when exposed to coloured light, using two different materials in VR. The Google Tilt Brush ‘Flat’ material was strongly affected by coloured light, while the ‘Marker’ material showed little to no effect in terms of perceived colour alteration when exposed to coloured light. Combining both materials in the design process would allow designers to create dynamic designs that are not possible to recreate in physical reality. This offers new possibilities for designing with coloured light and creates space for new artistic expressions that cannot be achieved in physical settings. In the design, the leaves did not change colour when exposed to different coloured lights as a result of being Marker material, while the other parts of the design work changed based on the colour of light used because these were made with the Flat material.

DISCUSSION

The significance of this research project is related to the development of a methodology to assist designers in seeing possibilities, making informed decisions, predicting colour shifts, and facilitating modifications to the colour brightness of coloured surfaces using coloured lights in the design of dynamic surface patterns.

The tremendous design potential of the complex relationship between coloured surfaces and coloured lights and differences between colour behaviour in physical and virtual reality suggest methods for creating novel dynamic surface patterns with smooth colour and pattern transitions in the textile and fashion design areas. Philippe Blanchard (n.d.), for example, created animated installations such as *Textile Animation 2019*, which used RGB lights to create movement in textiles. The research presented in this article, however, suggests methods and tools for creating smooth colour and pattern transitions using both RGB and CMY lights.

In addition, in design processes in which dynamic surface patterns are created, it is vital to not only select the hue with right value and saturation but to have knowledge and experience of how the different motifs of a surface pattern change when coloured light is used. The results of the experiments indicate that when coloured motifs are overlapped, colour and form transitions become smoother as they appear to be in dialogue with each other, in contrast to when coloured motifs are placed next to one another. The results also showed that when a surface pattern is designed using red, green, and blue colours, exposure to RGB lights creates movement rather than smooth transitions (as illustrated by the differences in Figure 2-A). The smooth colour and pattern transitions of dynamic surface patterns in both physical and VR suggest the value of adding storytelling to designs. Storytelling is a fundamental human experience that unites people and creates stronger, deeper connections and makes textiles more playful, and extends the lifecycles of textiles.

The results awaken curiosity and encourage designers to explore the design possibilities offered by other kinds of light, such as UV light, and tools for light alteration in VR. In this research project, the subtractive combination of coloured surfaces and coloured lights was in focus. Future research could explore additive colour combinations and shadows, together with subtractive combinations of coloured surfaces and coloured lights in both physical and virtual reality, in order to expand the range of methods of designing dynamic surface patterns.

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Depression to expression: color as visual language to communicate complex emotions

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ABSTRACT
This aim of this study is to explore the potency of graphic design as an opportunity to communicate complex emotions and depression using color as a design strategy. The distinctive color identity is formulated by adopting a three-step methodological approach. Firstly, an online survey was conducted focused on understanding individual's color preferences and color-emotion associations. The survey analysis helped to derive the color identity for six basic emotions. Secondly, mind-mapping of symptoms of each depression type was done to branch out the basic emotions involved and thus, derive its first color-emotion derivative. Next, the value-saturation scale was redefined wherein value represented the intensity of emotion and saturation represented the severity of depression. Lastly, the color symbolism of that particular emotion in Indian culture was cross-referenced and thus, giving the second derivatives. This combination of first and second derivatives give the resultant unique color identities for eleven types of depression solely based on the emotional dimension of color. It was aimed to further explore the innumerable possibilities that can be achieved by experimenting with variation of color attributes. Hence, the research work proposed a methodology, which is in the initial development phase, to define the complex emotional experiences of depression through visual communication.

Keywords: *depression, emotion, color association, color preference, communication*

INTRODUCTION

According to the American Psychiatric Association, depression is a common and serious medical illness that negatively affects the way we feel, the way we think and the way we act. For this research, eleven types of depression are considered (as identified by National Institute of Mental Health, NIMH) based on the level of emotional complexity/severity. In descending order of its severity, the classification is as follows: psychotic, bipolar, clinical, persistent, postpartum, seasonal, depression due to illness, premenstrual dysphoric, substance-induced, subsyndromal and grief.

The human reaction to a color, a color combination and to the environment is always initially a psychological one (Mahnke 1996:6). The research assessed the potential of color to effectively describe emotions of depression based on the theory of color preference. The more enjoyment and positive affect an individual receive from experiences with objects of a given color, the more the person will tend to like that color (Schloss and Palmer 2011). Studies have found that people with depression or anxiety were more likely to associate their mood with the color gray, while happier people preferred yellow (Carruthers et al. 2010).

The formulation of color codes highlighted the other significant part of the research that was to identify the symbolism in context to Indian culture. Colors are the most essential defining factors of Indian culture and traditions. The ancient Indian scriptures and Vedic science recognize colors as a vital source of energy – positive and negative, validating the reason to study Indian color symbolism. The Ayurvedic approach to mental disease rests on the premise that most mental illness is caused by imbalances leading to clouding of the perception and loss of understanding (Behere et al. 2013).

For color derivation, RGB color mode was chosen as it provides more options and better control to produce unique colors by interaction between color attributes. Another reason to work with the RGB was considering the fact that the target age group of 18–45 years is more approachable through digital media. Working with RGB color mode also provided a platform for future exploration of the research.

The uniqueness of color identity was achieved by adopting a three-step methodological approach. Hence, the research work intends to formulate a visual language of color to express the complex emotions of depression and influence the way we think towards mental illness. It is to be noted that the research is still in an exploratory phase and is yet to be tested and validated by the experts.

METHOD

In order to gauge the extent of awareness individuals have about depression, as well as to discern the societal perceptions and attitudes towards people suffering from depression, an anonymous online survey was conducted. The survey also aimed at identifying the importance of colors in everyday life of an individual. The survey was divided into two sections: section one tried to explore an individual's color preference and color – emotion association, whereas section two tried to reflect on an individual's understanding of depression.

The online survey gathered 148 responses from different nationalities, prominently from India (62 responses) and different European countries (76 responses). The analysis reflects how color preferences are changed based on gender, age and cultural differences supplemented by mood, emotional connectedness and fondness. The generic preference of shades for each color was further studied based on gender, age-group, and nationality.

These findings clearly support the fact that color preferences are not universal and can reflect variation depending upon many factors such as demographics, cultural differences, etc.

Another major aspect of this survey was to understand how individuals relate colors to different emotions. The participants were given 9 color options namely, red, purple, blue, green, yellow, orange, white, black and brown to choose from for the six emotions: happiness, trust, surprise, fear, anger and sadness. The analysis of responses project that the individuals identify color for happiness as yellow, trust as green, surprise as red and purple, fear as red, anger as red, and sadness as blue and black. The color-emotion analysis chart (Figure 1) supports the fact that emotional connect to a color changes based on the geographical location of an individual and then of its cultural essence.

India has always been wrapped in a myriad of colors. It is difficult to imagine any aspect of an individual's lives without colors when we talk about India. The Indian mythologies and scriptures define the sanctity of colors in their culture. Hence, the research focused on exploring the expressive potential of color theories cross-referenced with connotations to Indian culture.

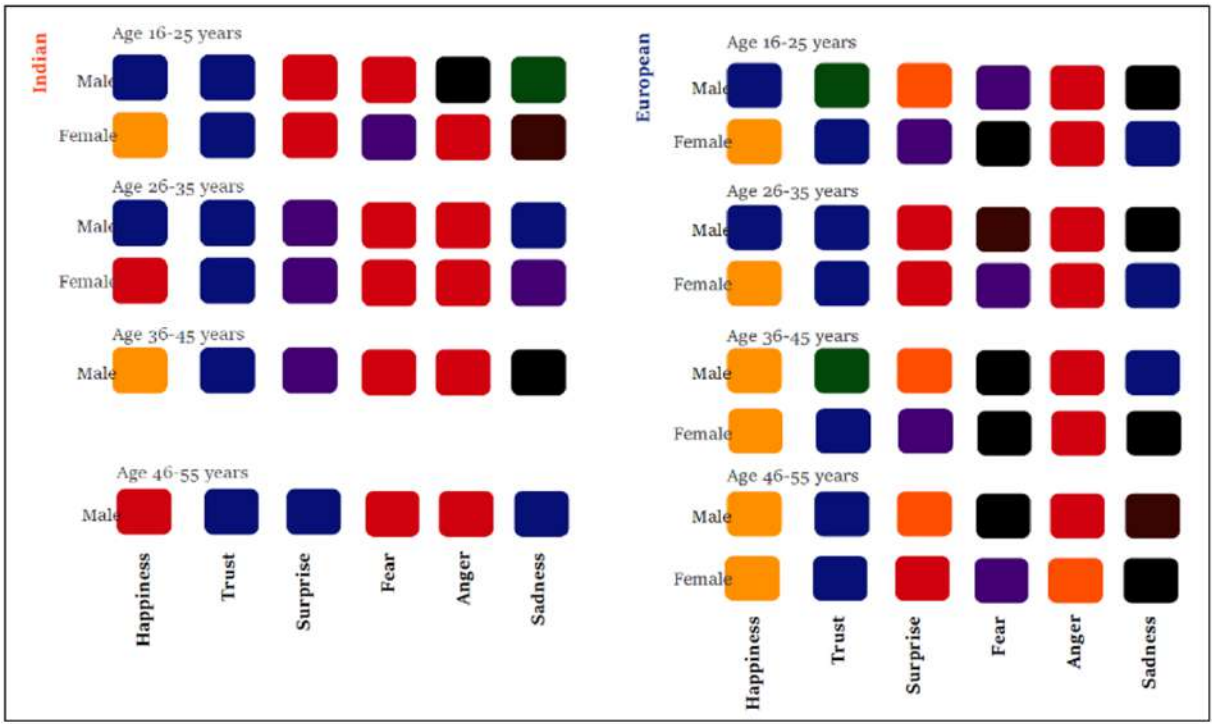

Figure 1: Color-emotion analysis categorized as per nationality, age-group, and gender used to derive the first results. Survey participants: Indian (left) and European (right). First two rows aged 16–25; subsequent two rows aged 26–35; aged 36–45; aged 46–55. Columns (left to right): Happiness, Trust, Surprise, Fear, Anger, and Sadness.

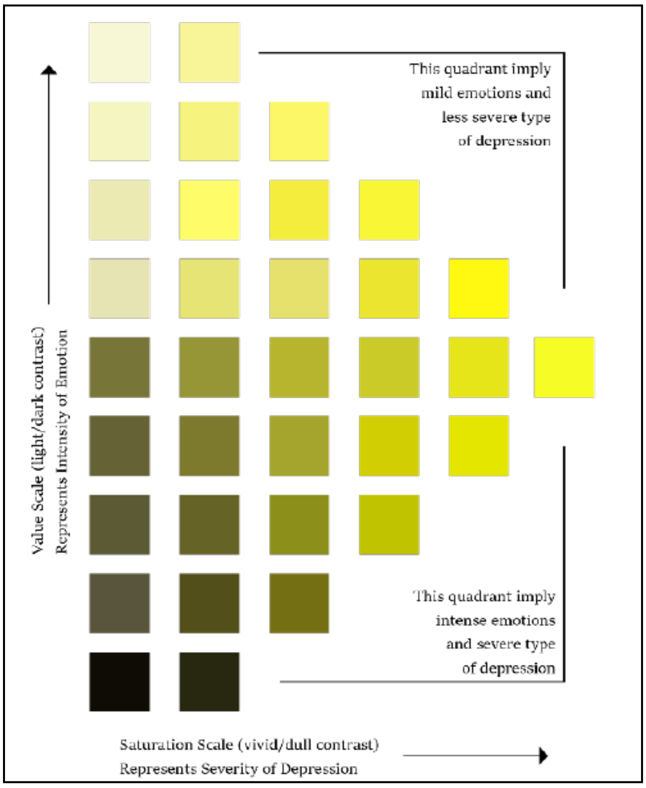

Figure 2: Value-saturation scale to extract second derivative based on intensity of emotion. Vertical axis represents the intensity of emotion (value scale, light-dark contrast); horizontal axis represents severity of depression (saturation scale, more or less saturated colors, vivid-dull contrast); top quadrant imply mild emotions and less severe type of depression; and, bottom quadrant imply intense emotions and severe type of depression.

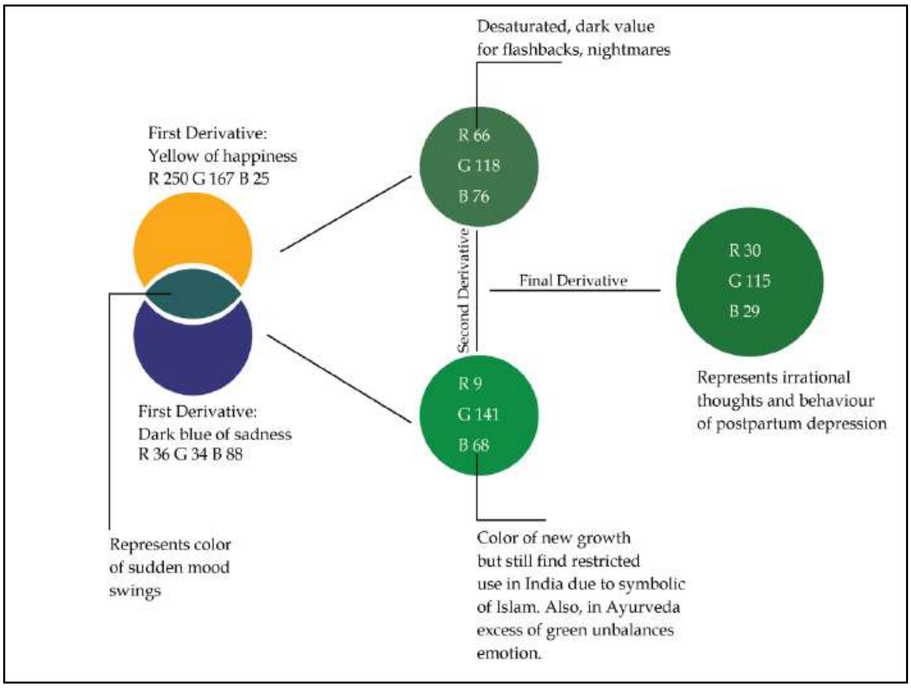

Figure 3: Three-step color derivation methodology for post-partum depression (experienced after child birth) (from left to right).

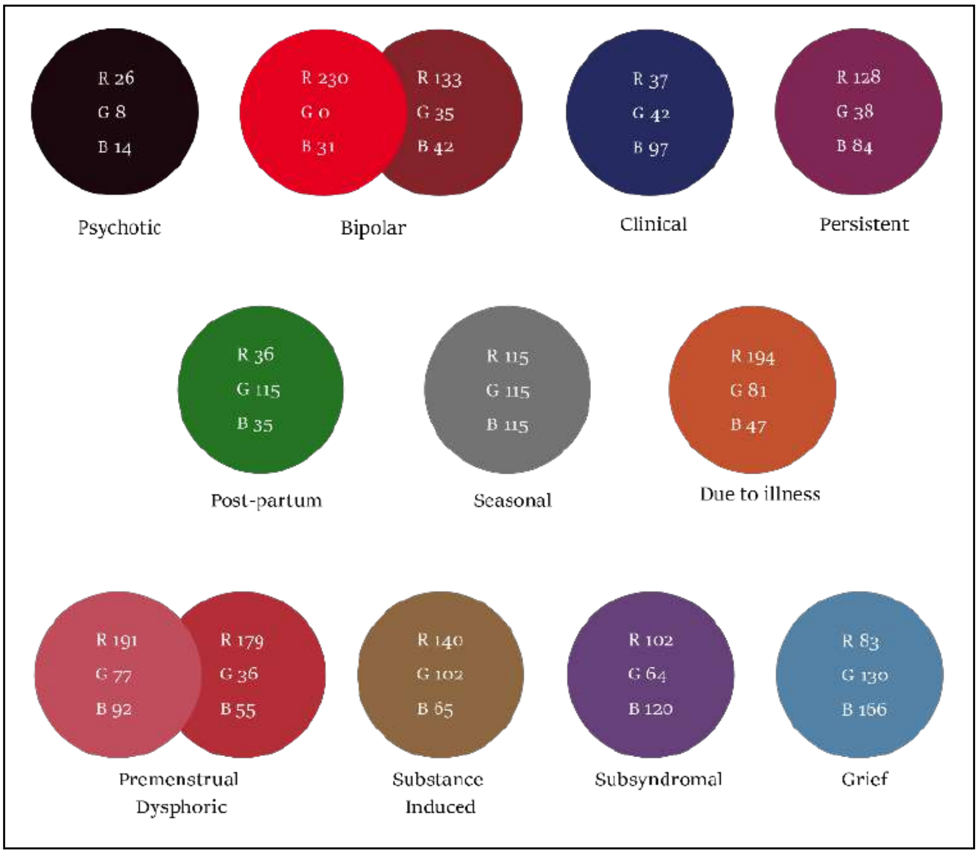

Figure 4: Distinctive color identity formulated for each depression type in descending order of severity (NIMH). Rows (left to right): psychotic, bipolar, clinical, persistent, post-partum, seasonal, due to illness, premenstrual dysphoric, substance induced, subsyndromal, and grief.

The next objective was to understand the willingness of people to talk about the topic of depression. In response to personal encounter with depression, individuals shared that either they had been through depression or someone they know suffered. However, the type of depression they suffered from was not disclosed in the survey. When individuals were asked to define depression, the majority identified depression as sadness or grief. Only 44.6% individuals identified depression as an illness. It denotes that a major segment of society does not see depression as a serious illness. Next, people were asked to show their agreement regarding statements related to depression which involved a mix of actual facts and myths about the illness. The responses reflected the amount of stigma surrounding depression.

Another important aspect to conduct this research work was to recognize that do individual's belief in the possibility of expressing emotions of depression through colors. The optimistic response by the majority of individuals strengthened the objective of this study.

The next step was to list down the symptoms of each depression type as identified by NIMH. Mind-mapping of symptoms helped to identify the basic emotion behind each depression type and derive the first hue to work on. The derived hue is further explored by working on other two-color parameters, value and saturation to define the intensity of emotion and severity of depression respectively (Figure 2). On the value scale, the relative degree of black and white varies depending upon the degree of an emotion in comparison to its basic emotion. Whereas saturation scale represented severity of depression where desaturated hue indicated the most severe form of depression whereas a saturated hue indicated the less severe form of depression. The point where no black nor white is added is pure hue representing that the equilibrium in balanced on value-saturation scale and is the state where only the basic emotion is experienced by the person. This point describes the normal mental state where basic emotions are felt as part of our daily life. Then, the hue derived from value-saturation scale and the hue significant or symbolic of that particular emotion in Indian culture is added to derive unique color identity (Figure 3).

RESULTS AND DISCUSSION

The survey analysis helped to derive hue for six emotions as first derivatives: yellow for happiness (R 255 G 168 B 4), bluish green for trust (R 11 G 144 B 158), pink for surprise (R 212 G 30 B 68), red for anger (R 237 G 29 B 39), dark red for fear (R 86 G 14 B 21) and dark blue for sadness (R 37 G 42 B 97). This first derivative hue combined with second derivatives (hue from value-saturation scale + hue with cultural connotation to India) gives the distinctive color identity to eleven types of depression taken into consideration for this study. Since the color derivation methodology is solely based on the emotional dimension, it is to be noted that only those symptoms of each depression type are taken into account that distinguishes it from the other, such as, hallucinations for psychotic depression, extreme ups and downs for bipolar and so on. Adopting the three-step methodology, the unique color code formulated are as shown in Figure 4.

CONCLUSION

In conclusive remarks, it can be said that the effect of colors on health, in general, has yet to be proven scientifically but the potential of emotional impact a color can have on an individual has been justified affirmatively with theoretical contextualization and analysis of survey results. The results establish color as a strong interactive visual tool to describe emotions and hence, giving each depression types its individuality.

The color code developed aims to act as a medium to spread awareness about depression and ultimately, recognize depression as worthy of deserving empathy. This is a future implication of the study that emphasizes that developed color code would encourage and initiate conversations about depression, and once people start accepting depression as a serious illness, the stigmas related to it will eventually be addressed and eliminated. In addition to above, the formulated color code may dispense a visual expressive tool to those going through depression. The color tool will prove to be the solution for the inability of people to put together words for their emotional experiences/ feelings when they are going through depression. It is noteworthy that color codes are formulated with a purpose to provide a tool for those suffering through depression to express their inner thoughts with near ones as well a medium for others as a part of society to understand about depression and the complex emotions involved so that they can extend their empathy to those suffering when required.

The uniqueness of color identities is based solely on the emotional symptoms. Thus, the research work established that color does follow the change of emotions. Any change in the intensity of emotion or severity of depression will eventually lead to change in hue and the new hue will convey a new emotion. Hence, the main motivation behind the research to develop an interactive visual medium to express complex emotion is fulfilled using color as the design strategy.

It is to be highlighted that the effectiveness of the color derivatives needs to be evaluated to study the reactions of the people. Also, the developed color codes need to be tested with people going through depression to study the practical application of color and emotion co-relationship.

Hence, the research work proposed a methodology, which is in the initial development phase, to define the complex emotional experiences of depression through visual language. This can be extrapolated further by addressing other contributing factors in occurrence of depression such as personality type, gender, etc., and thus study the proportional changes in color codes.

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Color as a visual language: exploring the chromatic palette in Suzan Pitt's animation

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ABSTRACT
The aim of this work was to extend current knowledge of color as a visual language in cinematography by analyzing the "Asparagus" animation done by Suzan Pitt, one of the most important feminine animators of the last decades, whose oneiric and introspective works are highly renowned all over the world. Her work "Asparagus" can surely be recognized as a mighty example where color is acting as the narrator and the narrative, helping the artist to communicate her story. This paper calls into question how the feminine world of dreams can be represented through color and artistic means by extensive study of "Asparagus", a true masterpiece with its brave plot, telling the story of a faceless woman with her sorrows and longings. Suzan Pitt invites to take a journey into the sphere of female dreamland and to get acquainted with its dynamics and vulnerabilities. An additional question that was thoroughly studied was if art could relieve the psychological pressure of the modern society. It is worth saying that color can be nominated as an independent Visual language that is certainly more potent than words. Contemporary studies connected to color constitutes a relatively new area which emerged on the intersection of humanities, social and natural sciences and should be subsequently considered by artists, wide range of professionals employed in the cinema and theatre production, designers, dressers, as well as psychologists, sociologists, and neurologists. Only due to shrewd analysis it is possible to bring about new findings in this scope of the disciplines.

Keywords: *communication, psychology, animation, visual language, color in film*

INTRODUCTION

The central idea of the following paper was to reveal what role color can play in the narration of the plot in a film. The following question is discussed using the example of an animated film made by a famous feminist artist Suzan Pitt. This paper is an overview of the cartoon animation "Asparagus", whose surrealistic and slow storytelling method helps immerse oneself in the world of feminine dream land. Even though Suzan Pitt can boast of various works that deserve scrupulous studying and consideration, it was decided to delve in her award-winning work "Asparagus" that first ran at the cinema in 1979. There are couple of reasons explaining the willingness to study the following work:

First of all, it is interesting to observe the way color is used in the film. The biggest peculiarity lies in the fact that color is playing double role: it is both the narrator and the narrative. Mixed with the skillful exploitation of the signs and symbols, it can be possible to conduct psychoanalytical analysis trough studying the color palettes of the artworks.

Secondly, in the current work Suzan Pitt approaches the topic of the complexity of feminine inner world, accepting the controversy of wishes and feelings that is communicated through visual images enhanced with the right choice of colors. The whole film is an adventurous trip without a strict logical sequence, though its impulsive dynamism proves incoherence and changeability within psychological foundations of a woman.

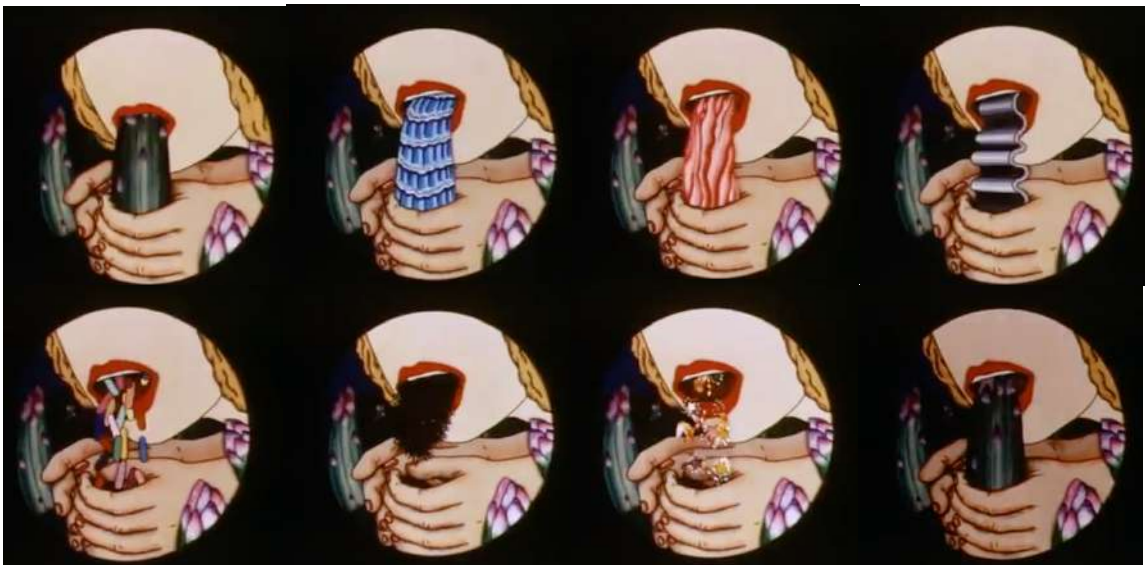

Figure 1: A final sequence representing allegorically asparagus through changing visual representation and its meaning while leaving the comprehension of the object constant. Asparagus resembles a phallic object due to its shape, so in this chronology, changes in representation and color palette, it acquires different meanings. The following sequence represents a story of the relation of the woman without face with a man, where man figure embodied in asparagus is perceived both as spring of joy and sorrow, exaltation and pain.

ANALYSIS

Cinema has been an appealing topic for philosophers and psychoanalysts since almost the very beginning of the cinema era, though it has been always analyzed from the strictly masculine point of view, as "femininity to be prohibited in classic Hollywood cinema" (Everett 2007). Feminist enquiry into the cinema practically started with the works of Laura Mulvey (1999), who had made the first attempts to rethink the principles of the masculine cinematographic society. Subsequently, feminist theorist Kaja Silverman drew attention to the peculiarities of performances that could be determined by the differences in the use of color and sound. As a result, further studies conducted by Patricia Mellencamp (1990) and Laura U. Marks appeared, putting the one who is watching in imaginary relation to dreamy manner of narration that is actually shaping the essence of cinematography. In this paper it is stated that color shapes complex structures of interactions and inertia that perform more intricate structures beyond the symbolism of a particular color.

The story of "Asparagus" is a depiction of the life of a faceless woman, a true magician and a dreamer, taking care of her wonderful asparagus garden. While the scenes are changing, the decoration and the color palettes are changing as well. As "Asparagus" is a silent animation, the overall effect of the color is enhanced by the music, creating specific atmosphere. It is a proven fact, that color and music can recall spatial and temporal feelings or, according to Sergei Eisenstein (1976:383), combined together, they can "most fully express or explain what must be conveyed, said, or elucidated at the given moment of the development of the action." That is how we find ourselves observing in a red room the main character from behind in silent immobilized posture. The only bright stripe of light emitted by the floor lamp appears as a connecting link between the room and the woman. The interaction of reds and the light casting shadows are acting as an invitation to the journey of the main character's inner world, engagement into her subconscious trip.

Due to the oneiric manner of narration, the animation resembles the way a wandering mind is traveling across the streets and rooms of one's anima, where the boundaries between reality and fiction are blurred to such an extent that a person cannot distinguish anymore in which world is meant "real", external, or internal, "unconscious". The film recalls to mind "Meshes of the Afternoon" (1943) by Maya Deren where by reoccurrence of moves within the time and almost ritualized repeated gestures, a woman continuously finds herself in a sequence of inter-nested miniature living rooms. In "Asparagus" we face a similar situation as it casts trans and altered state of mind reached by "rondo" effect, and subsequently "crescendo" effect (borrowed from the music), while traveling between red rooms full of red furniture and lights. It is shown in such a manner that the first room closes the sequence of interiors, resembling a vicious circle. Sergei Eisenstein stated in 1948 that a crescendo is obtained by moving color from one colored object to another, reflecting the "emotional shades" of what can be observed on screen (Eisenstein 1970:128). According to a French philosopher Gilles Deleuze, movement of shapes infused in a specific ambience, *l'espace quelconque* (the "any-space-whatever", translated literally), where "linkages can be made in an infinite number of ways. It is a space of virtual conjunction, grasped as pure locus of the possible" (Deleuze 1986:109). Deleuze additionally points out "locus of the possible" means "expressed state of things" and is indivisible from the "absorbent function" of color.

Once the sequence of the moving images is finished, the rooms turn out to form a baby doll house that inevitably evokes the feeling that this house is the secret "house" where unconscious resides. A parabole of detachment and retrieval, Asparagus follows this faceless woman's solemn passage through a dusty-sweet colored fiction world of elaborated interiors, seductive boudoirs, miserable streets of the city, and a mesmeric theatre scene. The right movement of the scenes is essential for cinematography, shaping in such a manner a space for "interaction" between the narration and the viewer. The color image has a potency to construct a particular space that is much similar to an invisible space that appears in psychotherapeutic sessions, where the analyst and a patient create a room in a room, meaning that the mental connection can evoke the feeling of existence in a specific intimate space between those two. The common thing happens while watching "Asparagus", where the color fused with red rooms either shown in a close-up or utterly distant creating a sense of dichotomy. Gilles Deleuze (1986:121) writes "[...] the colour-image does not refer to a particular object, but absorbs all that it can: it is the power which seizes all that happens within its range, or the quality common to completely different objects. There is a symbolism of colours, but it does not consist in a correspondence between a colour and an affect [...]. Colour is on the contrary an affect itself, that is, the virtual conjunction of all the objects which it picks up."

Starting from the opening scene so explicitly depicting the controversy of the society by a simple image of a pretty woman's leg in red high heels with a green Tempter serpent wrapping around, the viewer starts to experience the contradictory of feelings that is enhanced by strong visual contrast. The easiest interpretation would be to say that society awaits the beauty and a sort of seduction from a woman, this is something so desired and, finally, so frightening. Entering in a more theosophical discourse, we would state that femininity, in general, is hard thing to speak about, as well as about a color. So everything that is connected to human being cannot be analyzed in a direct and biased manner. The controversies of the color perception and the variety of its interpretation is similar to the self-expression of a human being.

An important feature to dwell on in "Asparagus" is the abundance of reds. Tendentially red is important color, especially connected to the femininity. In "Asparagus" Suzan Pitt frequently used red of slightly different saturation. In each case the use of red hue has strong hidden meaning. It is directly addressed to the most archaic understanding of the woman's world. The way the color is depicted through various objects and interiors, creates a feeling of attachment and detachment, passion and aggression, contemplation mixed with longing and sorrow, making us to be highly involved in the interchangeability of the states of the soul. It is interesting to mention how Luce Irigaray perceives the red hue. She writes, "Red, any colour, is more in the mode of participation than the solitary emergence of the concept" (Irigaray 1993:158). Paradoxically, color has the potency to take the guise of the flesh, it starts to be fully incorporated, conveying sensations of touch and feeling by the right interconnection with light and variations in hue. Sometimes in the film, red leaves an after effect of something soft, even bringing in velvet touch to the scene, instead in other times the lightness of reds creates the feeling of coldness and detachment, something icy and distant. According to Dufrenne (1973:284), the aesthetic presence of color and its sense interrelate building a world framed by means of its form, and its affect.

Thus, how is it possible to come to an understanding of the colored image and its aftereffect? The narration of the film is always enclosed in a movement image that shapes the perception of the story. The interconnection of image and color affect tremendously the way we discern the notion the artist wants to give to the story. Suzan Pitt resorts to using the constant object by adding various meanings to the changing colors and notions of the objects. As it can be noted with the red armchair taken from the red living-room, after an instant it becomes an asparagus armchair with the opposite meaning. The reverse transformation to the red one closes the circle, creating an ended structure, the object in itself. If the red armchair evokes the image of blood and flesh, then the green of the asparagus stands for something prolific and life-giving. Marco Zee-Jotti (2000:51) once said that "If the sensuality of colour comes from an intrinsic ambivalence, so the very arbitrariness of the relationship with which colour liaises with the other components will preserve a trace of a potential reversal. Colour, therefore, is naturally prone to be used as a counterpoint because it is in its nature to appear with a double face value". So every color is multifaceted, and its meaning changes by a slight variation in value, chroma, or hue.

This common disturbance effect is achieved at the last scene where Suzan Pitt portrays a sequence of images with a woman, trying to swallow asparagus. Through the series of images depicting various ways to represent the same object, a storytelling is organized around the object of asparagus but incorporated in different images and with different meanings. Something that is easy to perceive can be so complicated to be expressed by words. Inevitably comes to ones' mind a phrase of M. Merleau-Ponty claiming that "A movie is not a thought; it is perceived. […] The movies are peculiarly suited to make manifest the union of mind and body, mind and world, and the expression of one in the other (Merleau-Ponty 1982:58).

The complication of the relations of the sexes is a red string that passes throughout the animation movie. The artist achieves that level of expression where the right image brings to one's mind the exact message she is about to give. So we recognize the jealousy and pain that can be caused to a woman by a man. The main character is passing by the Dolls' shop looking at the window-case with the baby dolls of both sexes. These dolls are differentiated practically by the color of the cover on which they are lying. Undoubtedly, light blue and pink veils, making us immediately aware which sex belongs to which color. So for more than 150 years, we are bombarded with a socially accepted message that the proper color for a boy is blue, though the girl has to stick to more "feminine" reddish hues, including different gradations of pinks and reds. The whole message perceived by the observer evokes an utter feeling of injustice and ridiculousness, showing that the society, in a way, is fostering and encouraging sexist division, imposing, as on the example of the color use, behavioral patterns and "proper" social norms and standards related to a specific gender.

Thus, we approach a personal statement made by Suzan Pitt. Her art starts to be a personal story, the manner she was conveying the world and what she had suffered. Her other works, as "Joy Street" has an intimate subtext as well. It is a story of a depressed woman trying to find her way and to cope with unhappiness. Actually, the prolific connection between creativity, body, and soul can be found in works of C. G. Jung (1944), who was believing in the recuperative power of art aimed to heal soul and body. Jung was actively practicing art therapy with his patients, believing in the power of color. Once one of his patients brought a series of colored works, C.G. Jung had started to analyze the artworks of this patient. Lately he found out that it is possible to include art in the analytical process as it portrays the states of consciousness. Subsequently, Jung worked out a system of color symbolism with the tetradic representation of colors where each color – named as qualia – means something specific for the psyche – thinking, intuition, feeling, and sensation – mentioned in his theory of psychological types. He forms a color tetrad, consisting of blue, yellow, red, green, with subsequent meanings mentioned earlier.

CONCLUSION

Taken together these results, it is worth saying that Suzan Pitt made a sound statement in 1979 with the release of "Asparagus" when the topic of femininity was far more discreet than today. She brought to the public observation feelings, thoughts, and dreams of her own. She stated that there is nothing feminine or nothing only masculine in this world, and we are victims of the prejudices of the society that we still have to convey and obey.

This paper led to conclude that color plays a significant role in cinema and visual art, having the ability to convey mood, feelings, inner world of the hero. As a result, the color starts to be an independent hero that can communicate with the one who is watching the performance or film but also to tell the story, while enhancing or weakening the flow of the storytelling.

The study is one of the first steps in studying the strong correlation between possibilities of color used in cinematography and its strong interconnection with psychotherapy. Future academic works connected with art therapy, sociology, and philosophy will be a great support to discoveries linked to the current topic.

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Surface quality evaluation in cementitious mixtures: the grey color of mortars and concretes from a qualitative-quantitative point of view

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ABSTRACT

The precast concrete industry facilitates the design of structural elements that were traditionally limited by technological advances. Nowadays technologies have facilitated the evolution of aesthetic aspects and led to higher surface quality demands even with grey color. Architectural or Self-Compacting Concrete (SCC) allows building pieces with multiple and complex formats. For many decades, the grey color evaluation was limited to visual inspection studies and the CIB Report “Tolerances on blemishes of concrete”. It has seven pictures in grey scale from the light grey to black. They allow choosing one to compare with any cementitious mixtures surface, such that the evaluation is fulfilled from the qualitative point of view. Fortunately, according to this Report, both the visual inspection and the CIELAB color measurement bring this qualitative technique closer to quantification suggested BS EN 12878 Standard (2014), “Pigments for the colouring of building materials based on cement and/or lime.” However, it does not specify the equipment, therefore, rethinking new adjustments to the technique is important. This work presents the results of tests in which the mortars and SCCs surface quality was analyzed. The aesthetic criteria and evaluation methods are shown. The experimental part includes the qualitative-quantitative analysis of these mixtures in contact with different molds. The method adopted for data acquisition allowed to qualify the surface quality and show the influence of both the different treatments and the mixture type. The agreement between the results coming from different mortars and SCC levels reaffirms the significant importance of studying mortars to estimate the concretes surface quality.

Keywords: *surface quality, grey color, cementitious mixtures*

INTRODUCTION

The concrete surface quality depends on the materials, formwork (mold) and release agent used to obtain it. The concrete allows different surface finishes to be obtained either by using the formwork surface as a model or by performing some subsequent treatment such as, e.g., exposing the aggregates. In the first case, the material with which the formwork is built will influence the concrete surface, which in general is smooth or polished; while in the second, the finishes will depend on the removal depth and are classified as textured. In both cases, the surface finish will also depend on the constituent materials. The formwork permeability degree has a significant influence on the surface finish. When the material is non-absorbent, waterproof or with low permeability, the number and size of bubbles and other surface defects tend to increase, but on the other hand, clearer surfaces with greater color uniformity are achieved. In addition to metal formwork, a similar behavior is observed in plastic molds, veneered or covered with plastic films. Although the use of absorbent materials reduces the bubbles formation, it causes staining and aggravates the lack of color uniformity according to the variation of the surface absorption level. An absorbent material produces variations in surface humidity and dragging of the particles in contact with the mold; the bubbles are covered but the color can be modified and, in general, it is darker. Wooden formwork has these characteristics.

There is a variety of release agents according to the type of formwork, formulated in order to improve more color homogeneity. They may or may not contain solvents, leading to differences in odor and distribution ability. There are also aqueous emulsions (odorless and of minimal flammability). These products have a physical and chemical release effect, guaranteed by the oil component and the additives, respectively. Fatty acids or esters are the components that generally activate the separation. A chemical reaction between the COOH groups of fatty acids and calcium hydroxide produces the so-called “lime soap.” The latest innovations with vegetable emulsions further improve color uniformity and avoid blowouts, as well as not having harmful effects on people and the environment.

The variation of the surface concrete color could be a blemish. This could be due to change in materials composition, incomplete mixing, segregation during placing, variation in batching, stains or dyes on form face, rust from forms, insufficient curing and/or his workability (Mindess et al. 2003).

The CIB Report No. 24 (1973) writes, “this document presents a method whereby the quality of a surface can be expressed in quantitative terms.” The color variation analyzed by using sheets allows establishing a limit to the variation between one part of a surface and another. If a surface is special, elaborated, ordinary or rough, the separation (i.e., adjacent or distant) between the surfaces must be considered. Greater blemishes are allowed when the evaluated areas are located distant from each other. Table 1 presents the ranges allowed for each concrete quality depending on the distance between the observed surfaces and also the different grey scales (7 sheets). In those times, the color was not measured on mortars and concretes. This technic was applied by Pacios et al. (2008) after three decades. If there were spots, they could be identified by the grey level. Once the sheets have been selected for each area, the difference between their numbers is calculated to obtain a range (R: difference between sheets) indicating the surface quality. A higher value of R is related to lower surface quality or higher color variation. In addition, the results of the sheets color measurement obtained by Lemaire et al. (2005) is added. Fortunately, both the visual inspection according to this Report and the color measurement (CIELAB) bring this qualitative technique closer to quantification suggested in BS EN 12878 Standard (2014), “Pigments for the colouring of building materials based on cement and/or lime”. However, it does not specify the equipment; therefore, rethinking new adjustments to the technique is necessary.

This work presents an experimental research aimed to analyze the color-surface-finished on cementitious mixtures from qualitative and quantitative points of view.

Grey scale used when the color variation of concrete finishes is evaluated (Report N° 24)								
Classes	**Special**		**Elaborate**		**Ordinary**		**Rough**	
A: Adjacent D: Distant	A	D	A	D	A	D	A	D
Range (R)	2	2	2	3	3	4	NR[a]	
R: Maximum allowable difference using the enclosed “grey scale” viewed from at least 3 m from the surface.								
Grey scale	1	2	3	4	5	6	7	
Images JPG 7 level								
Lightness Values (L*)[b]								
	90	*80*	*70*	*68*	*57*	*48*	*35*	
[a] NR: No requirement. [b] nearby Lightness value of the grey scale ranging from a very light grey (level 1) to a dark grey (level 7).								

Table 1: The classification of the concrete finishes and approximate values of Lightness.

EXPERIMENTAL DETAILS

Micro Color II Dr. Lange colorimeter programmed to measure with the CIELAB color space was used. Lightness (L*), as well as the a* and b* coordinates of three mortar samples (M1, M2 and, M3) were acquired. Mortars were elaborated with a 0.50 water/cement ratio and they were combined with different cement/limestone powder ratio (c/lp). M1, M2 or M3 were elaborated with 0.90, 0.80 or, 0.70 c/lp ratio. Both mortars were elaborated with different superplasticizer amount and a silica natural sand was used according to the self-compatibility parameter. Each mortar was kept in an experimental mold manufactured with steel, wood or glass for 24 h. Then, the samples were removed from de molds and kept in a chamber conditioned to 23±2 °C and 70±5% of relative humidity for 24 h for visual inspection and color measurement. The surface was treated with 1 mL of release agent placed on 78 cm^2. Oleo-based release agent (ORA) recommended on steel surface was used while a water-based release agent (WRA) was used on wooden surface; glass surface was not treated. The visual inspection was carried out by an observer placed at least 50 cm from the surface, and the obtained value compared with the pictures of Report No. 24. The surface was illuminated with a fluorescence lamp. Twenty color measurements on each surface were made, and their results used to calculate the L*, a* and b* average values and the corresponding SL*, Sa* and Sb* standard deviations.

Two SCC samples (SCC1 and SCC2) were elaborated. SCC1 was elaborated with M1 while SCCC2 was elaborated with M2. There was an important difference between both since SCC1 was more viscous than SCC2 because SCC1 was prepared using crushed granite (maximum size 12 mm), and a steel fiber type hooked-end (35 mm length); for its part, the SCC2 was prepared with a bigger stone (20 mm) and synthetic fiber (50 mm length). Two samples of SCC (8x50x200 cm^3) using steel molds were elaborated. It was like a wall molding from an edge. The SCC1 was removed after 24 h in a mold with one side treated with ORA (ORA-SCC1) and the other with WRA (WRA-SCC1). The other concrete (SCC2) was removed in a mold with one side treated with ORA (SCC2-ORA), and the other with a synthetic film (SF-SCC2) for simulating a glass surface. The visual inspection was accomplished by one observer placed at least 3 m from the surface, and the results compared with the pictures of the Report No. 24. Illuminated with a fluorescence lamp, each concrete surface was subdivided into four parts ~ 50 x 50 cm^2. The first part was where the concrete was placed and the fourth part where the concrete stopped flowing.

RESULTS AND DISCUSSION

Table 2 shows the pictures for M1, M2 and M3 mortars (the JPG mortars images are only illustrative), the grey scale of mortar finishes and the color parameters of each surface (wood, steel or glass). Analyzing the surfaces in the visual inspection, differences between the surfaces were observed. Mortars in contact with steel (ORA) and wood (WRA) were less gloss than mortars in contact with glass (whose surface was specular). According to the adopted classification (differences in the grey scale), surfaces in contact with the steel mold did not show stains, however, there were rust stains attributed to defects in the formwork preparation.

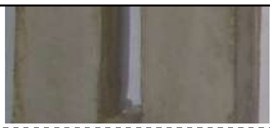
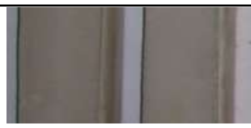
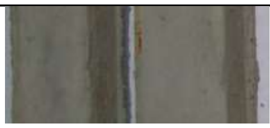
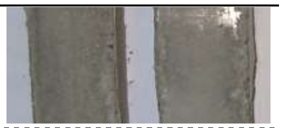
Mortars		Steel-ORA	Wood-WRA	Glass
M1	JGP Image			
	Grey Scale	2	1-3	2
	Color (L*, a*,b*)	(76.0, 1.3, 6.3)	(72.6, 1.5, 5.0)	(75.1, 0.8, 3.5)
	($S_{L^*}, S_{a^*}, S_{b^*}$)	*(0.5, 0.1, 0.3)*	*(1.7, 0.3, 0.7)*	*(0.7, 0.2, 0.2)*
M2	JGP Image			
	Grey Scale	2	1-3	2
	Color (L*, a*,b*)	(72.6, 1.4, 8.4)	(74.7, 1.6, 6.1)	(72.1, 0.6, 3.8)
	($S_{L^*}, S_{a^*}, S_{b^*}$)	*(1.0, 0.2, 1.2)*	*(1.6, 0.3, 1.1)*	*(1.2, 0.1, 0.4)*
M3	JGP Image			
	Grey Scale	2	3	2-3
	Color (L*, a*,b*)	(72.5, 1.0, 6.5)	(69.0, 0.7, 7.6)	(68.5, 0.5, 4.4)
	($S_{L^*}, S_{a^*}, S_{b^*}$)	*(0.6, 0.2, 0.7)*	*(1.4, 0.2, 0.3)*	*(0.9, 0.1, 0.2)*

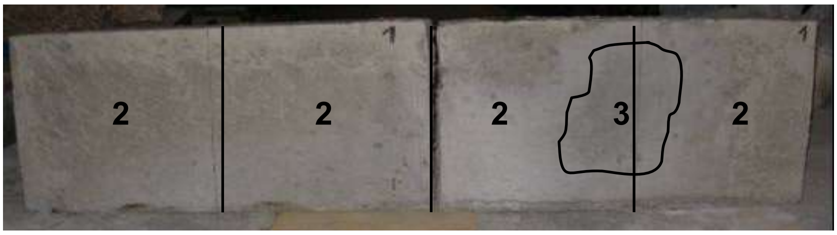
Table 2: Mortars JPG images, grey scale and color statistical values in mortars with different molds.

Surfaces in contact with the wood copied the veins of the mold and showed white spots typical of the release agent. It was found that stains can be removed with a simple surface cleaning. Considering the grey scale according to Report No. 24, the ORA treatments (steel) and glass corresponded to the grey scale No. 2. In the case of the WRA treatment (wood), greater differences were found, with grey scale No. 1, 2 and 3, probably due to excess release agent or the effect of mold absorption. A more heterogeneous color could be seen. For the mortars that responded to sheets No. 1 and 2, the Lightness (L*) values ranged between 72 and 76. When the mortar was adjusted to sheet No. 3, the L* decreased to 68. Finally, it should be noted that in the mortar with the lower filler content (M3) the lightness decreased for all the applied treatments.

In Table 2 can be seen how the sheet No. 2 was strongly related to the 72, 73, 75 and 76 lightness values while Lemaire has been reported 80 lightness value (Table 1); nevertheless, sheet No. 3 showed 69 lightness value, very equal. It could be able to influence the b* values, but the author did not analyze them as well as the illuminant characteristics. It suggests the importance of exhaustively defining the observer, the illuminant and the object because the Report and the standard are not specific for material buildings, if the surface quality evaluation was made.

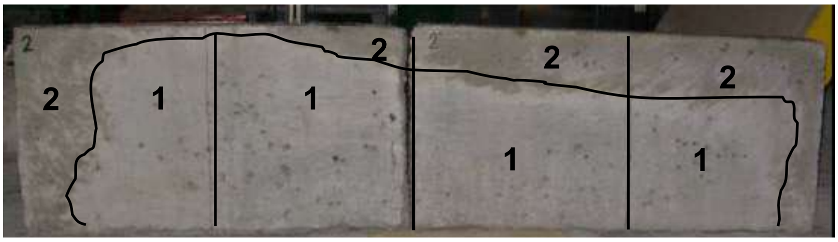
Figures 1 and 2 show the pictures for SCC1 and SCC2 concretes, respectively. The concretes JPG images are only illustrative, and they were drawn with curved lines that indicate the color variation viewed from at least 3 m according to the grey scale number.

Surface treated with ORA (ORA-SCC1)



A4 Part	A3 Part	A2 Part [a]	A1 Part [a]
Range (R) “Especial” Concrete. [a] Stains			
0	0	1	1

Surface treated with WRA (WRA-SCC1)



B1 Part [a]	B2 Part [a]	B3 Part [a]	B4 Part [a]
Range (R) “Especial” Concrete. [a] Stains			
1	1	1	1

Figure 1: The pictures for SCC1 Concrete and range analyzed according to the Report No. 24.

As SCC1 was more viscous and had more color variation than SCC2 when concretes were in contact with ORA. The SCC2 showed best quality or less color variation when ORA was used. It can be interpreted that there was less visual impact. Information related to the assessment of the concretes surface color variation according to the range (R) reached, the numbers of the corresponding color sheets, as well as the presence or absence of any stain is indicated. Each surface was of “especial” concrete. It could be seen how SCC1-ORA (No. 2 and 3) and SCC1-WRA (No. 1 and 2) were less homogenous than SCC2-ORA and SCC2-SF (No. 2).

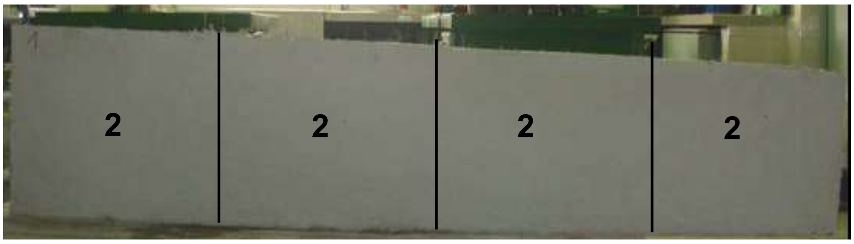
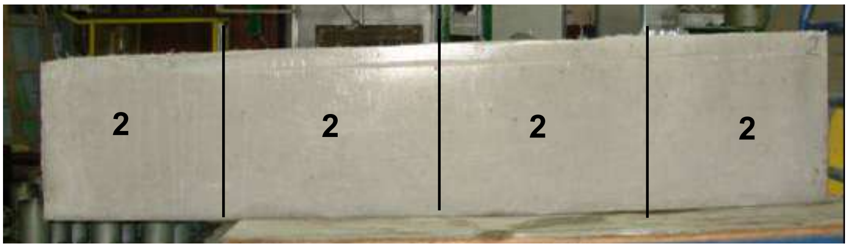
Surface treated with ORA (ORA-SCC2)			
			
A1 Part	A2 Part	A3 Part	A4 Part
Range (R) “Especial” Concrete			
0	0	0	0
Surface treated with synthetic film (SF-SCC2)			
			
B4 Part	B3 Part	B2 Part	B1 Part
Range (R) “Especial” Concrete			
0	0	0	0

Figure 2: The pictures for SCC2 Concrete and range analyzed according to the Report No. 24.

CONCLUSION

Experimental tests on mortars and concrete to evaluate surfaces obtained using molds of different materials treated with different release agents were carried out. The study method adopted allows to easily qualify the surface quality and show the influence of the material of the molds, of the different treatments applied to their walls as well as of the particular characteristics of each mixture. The treatment with an Oleo-based release agent has better color homogeneity if the concrete is less viscous. The agreement between the results coming from different mortars and SCC levels reaffirms the significant importance of studying mortars to estimate the concretes surface quality.

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Color as a way of communication in design education

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ABSTRACT
Color studies in design education should cover color theory, terminology, as well as visual research methods and color application projects. In interior design education, we practice how to identify the nature of spaces that depend on the judgement of their quality and status. Interior design studies consider several design elements at the same time, and one of them is color. The present paper is a discussion on the importance of color studies in interior design education. It covers relevant research studies; hence, the author has given the color course for several years. The methodology of the course is described and evaluated at three levels. The basic level includes a discussion on conceptual color in regard to emotional color. The intermediate level focus on the development of a personal color wheel and on defining personal color codes for color-mood associations. And the advanced level introduces 3D modelling for color application, color practice for interior design in line with color-mood associations, discussion and critique of aesthetics regarding subjective factors, and the development of three different color schemes for the same project. Each term, the course is taught to 35 to 40 students at basic, intermediate, and advanced levels from both the Department of Interior Architecture and the Department of Architecture. It was observed that the colour course is beneficial for design students.

Keywords: *color, communication, design education, interior design*

INTRODUCTION

In timeline, we see that color has always been an important part of architecture, the discussion dates back to Vitruvius. Hence, it has always been a way of conveying meaning while being a supportive element of architectural design. As suggested by Caivano (2006), in history, the sources related to color studies can be compiled into four categories: theorists and writers of architectural treatises, archeologists and historians of architecture, architects who have been relevant in the professional practice, and color theorists coming from the fields of architecture and design. However, there is a lack of knowledge in color among many graduated professionals from architectural design schools. In their study, Janssens and Mikellides (1998) investigated color in architectural education and concluded that, there was a lack of knowledge about color research among students of architecture. Since their study, very little has changed about the situation. As explained by Serra Lluch (2019), architects have difficulty with color design. Also, he claims that the topic is left unaddressed in many undergraduate curricula in architecture schools all over the world. In his book, Serra defines how color affects architecture; color and metrics, color and structural system, color and architectural composition, color and architectural function, where he also sheds light on how to integrate color into the architectural design phase.

The well-known professional authorities support the importance of color studies in undergraduate curriculum as well. According to the Council for Interior Design Accreditation Professional (CIDA) Standards (2020), color and light shall be included in interior design curricula. The Accreditation Standard indicates that any interior design program shall include color and light in education by means of Program Identity and Context, as well as Knowledge Acquisition and Application. In other words, two parts of the accreditation system are given credits for light-and-color-based courses, their outcomes as a special knowledge acquisition area. CIDA suggests that a students' work demonstrate color terminology, color principles, theories and systems, color in relation to materials, texture, light and form. Similarly, the objectives of the International Color Association (AIC, aic-color.org) are: to promote research and education in all aspects of colour, to disseminate color knowledge, and to encourage co-operation with industries.

Another important authority, the International Commission on Illumination (CIE), explains that the color research process includes social research, as well as quantitative data (Derefeldt et al. 2004). Hence, there should be a focus on cognitive aspects of color which represent subsequent processes of semantic and verbal classification of our perceptions. Cognitive aspects are important, because the extent to which an individual is visually aroused depends on the type and rate of imagery information embedded in the environment.

In the architectural context, as color can be employed to create a certain meaning (known as the sign function of color), emotional and conceptual color studies are very important. In their book Meerwein et al. (2007) explain the complex relation between humans and color. They state that, "Color is polyvalent, in designing the environment the actual effect of color depends on its materialization, associated with the remaining active role played by environmental factors." For example, a light blue colored iron-glass façade may be experienced as light in weight, on the contrary, a dark red iron-glass façade may be experienced as heavy. While a white colored parquet may invoke negative feelings such as insecurity, on the contrary, dark brown parquet may arise an impression of security. Similarly, as long as the hue is constant, brighter shades appear lighter than saturated ones (pink versus red; light versus heavy; orange versus brown; light versus heavy). All these concepts are related to color perception, whilst they are based on individual experiences.

It is also interesting to consider how color is represented psychologically in order to define color spaces. Here, "color spaces" help us to describe color representation in hierarchy, rather than only defining color intuitively. All through the process, cognitive aspects of color represent subsequent processes of semantic and verbal classification of our perceptions. Cognitive aspects are important, because they are related to how an individual is affected from the surrounding environment (Gao and Xin 2006, Yendrikhovskij et al. 1999). Although there is complexity in our visual environment, in the practice of color design, we generally prefer to use the sign function of color, color symbolism, and aesthetic quality. Described by Küller and Mikellides (2009), colors are important to stimulate environment, they help to make a relation to buildings and spatial functions as they are descriptive terms. In his study, the effects of color-mood associations in terms of visual complexity are examined.

All this relevant knowledge leads us to define why color is closely attached to "architectural space and design education". Referring to the authorities in the field and studies regarding color and design, this paper aims to discuss how color knowledge can be adapted to interior design education by improving self-awareness of color both personally and professionally.

COLOR STUDY IN THE COURSE

In interior design education we practice how to come up with the optimum solution for the given design problem. Interior design problem solving covers many issues, one of which is, designing color schemes in regard to emotional, conceptual and aesthetical factors. Coloring process focuses on developing the most suitable color palette and to design according to color-mood associations. Table 1 summarizes the breakdown of the color work (in a design process), starting from cognitive issues ending up with application.

COLOR	Emotion	How do you feel about this color?	Warm, cool, tiring, exciting, relaxed, annoying, No feeling…etc.
	Concept	To which space do you think this color suits well?	School, hospital, residence, hotel, etc.
	Design	Which color-mood associations fit best?	School-child friendly, warm, exciting, calm homey, warm, lovely, etc.
	Aesthetics	Considering user preferences, adopting it to the color philosophy	Subjective factors should be identified and adapted to the color philosophy
	Application	Developing color palettes (selecting color schemes and developing color models accordingly)	Monochromatic (Warm or cool), Analogous scheme, Complementary scheme/ split complementary, Achromatic color scheme, etc.

Table 1: Breakdown of the color work in a design process.

COURSE OBJECTIVES

The course aims to understand color with its implications in interior design. Also, it includes an exploration of color theories, color spaces, color applications in the field of design with a specific emphasis on color practice. The course is designed to explain color as an environmental design element, to understand the philosophy and practice, to introduce color spaces, color palettes, color measuring systems, also to experience color as an interdisciplinary field. It was an undergraduate course where the number of students were between 35 and 40 each term. It was given to the students from both the Department of Interior Architecture and the Department of Architecture.

METHODOLOGY

In line to the course objectives, the course is given at three inter-related parts; basic level, intermediate level and advanced level.

Basic level. Color theory is introduced, emotional and conceptual color practices are studied interactively. Critiques on color-mood associations are given in regard to various design projects. It is intended to develop a basic terminology of color. Students take photographs, bring them to class, and color effects are analyzed.

Intermediate level. Students are asked to develop their own color wheel. They define personal color codes and complete the color wheel with color-mood associations.

Advanced level. Students are asked to develop 3D interior color schemes either for a particular space and/or for their own design projects. While developing the color schemes they are asked (Table 1):

- to develop conceptual color in regard to emotional color;
- to practice on the color design in line to color-mood associations,
- to discuss the aesthetics regarding subjective factors (for example: “light blue is suitable for the walls because it creates a calm atmosphere, dark red is not suitable for the walls

because it makes the space uncomfortable, dark gray is not suitable for the ceiling because it makes the space darker and confined)

-to develop 3 different alternatives for the same Project (monochromatic scheme, achromatic scheme by adding hue(s) whenever it is necessary, and complementary color scheme);

-to add material and light effects to the Project, discuss verbally the application (wall / ceiling / floor / furniture / door / window, materials and their contribution to the interior atmosphere) and discuss their effects.

DISCUSSION ON COURSE OUTCOMES

Some of the outcomes of the students' work are shared in order to visualize the methodology. In a first stage, students defined their personal color codes and completed the color wheel. They were free to design their color wheels by means of computer programs, as well as to choose the graphic representation. They were asked to identify color mood associations on their color wheels and to write down the color associations. For example, some students associated red with love and excitement, while others with fire. Some students presented a color wheel in a two-dimensional way, while other students represented it in a three-dimensional way. One distinct example included the grayscale in the color wheel explaining so the three-dimensionality of the color wheel. Other examples of color wheels were more narrative in respect of the color-mood associations. It was observed that students exercised to define each color by several words. The students practiced several times to finalize their work, each time trying to improve the systematic approach. Each color wheel was unique in terms of graphic expression and color codes (Figure 1).

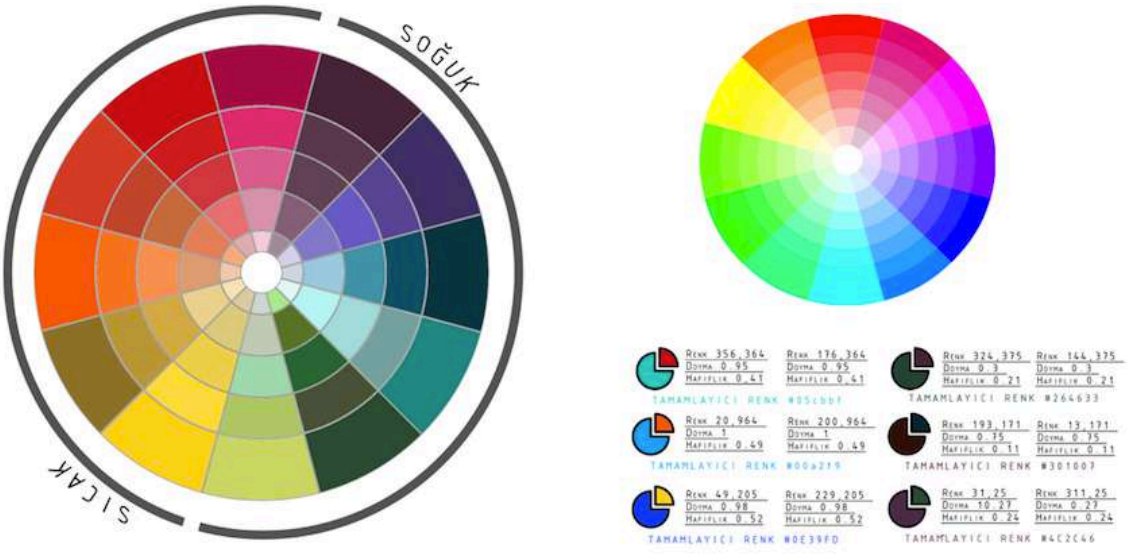

Figure 1: Color wheel by Handegül Özel (IAU, Dept. of Interior Design). The initial color wheel (right) is modified by the student for application in interior color design (left).

Students practiced to adapt the colors in their color wheel while modeling their interior design projects. As seen in Figure 2, firstly an achromatic scale was studied without a material list. The empty space was described as unnatural and monotonous, and warm colors were added to improve the mood of the interior. Meanwhile, the material selection was redesigned. Similarly, the design was developed in relation to each other with the following question, "How can we apply the color words of the personalized wheel to the interior design Project?" (monochromatic scheme and achromatic scheme are applied for the same interior space). For each trial, different material selections were identified, the change in mood was explained in detail.

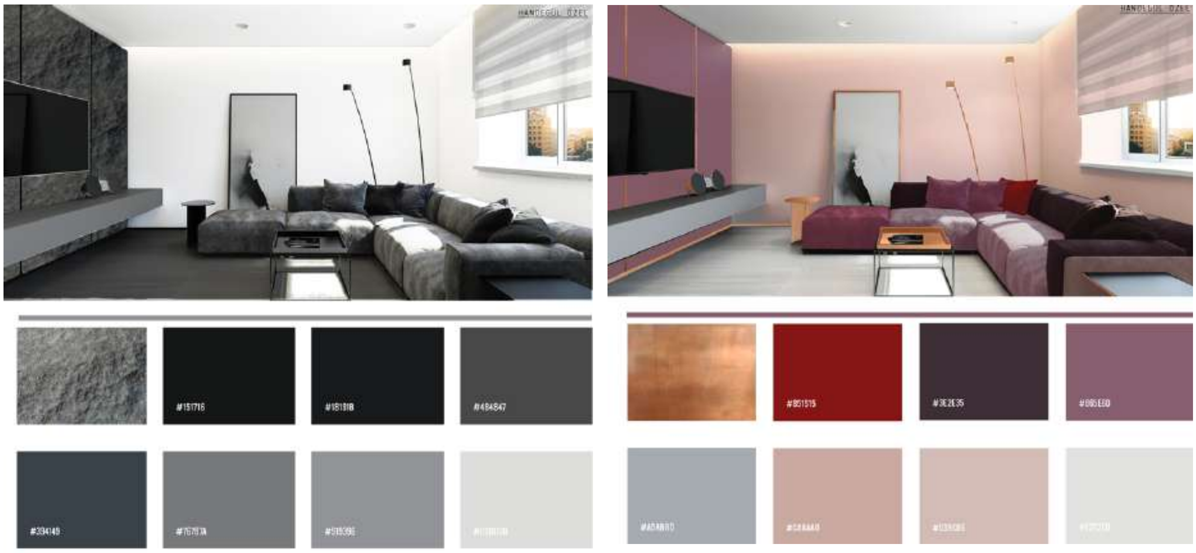

Figure 2: Interior design alternatives for achromatic (left) and monochromatic (right) schemes, by Handegül Özel (IAU, Dept. of Interior Design).

It was observed that, students generally preferred to start with the achromatic scheme. They had difficulties in developing complementary color schemes (especially split complementary). As the color choices increased, students had difficulties to determine where and how to use them (on the floor, on the wall, which furniture, etc.). It was the first time for both architecture and interior architecture students to do color exercises, to plan a color scheme and to think color at building-volume scale with a systematic approach. They had successes and failures many times and experienced the process. It was also observed that, students who were introverted preferred dark and low-chroma shades, while extroverted students preferred to use vivid and saturated colors. In the color wheels and their interior color schemes, extraverted students did not use color samples with low value and low saturation. On the contrary, introverted students did not prefer to use color on large surfaces such as walls. This argument is not reached by a statistical analysis, however, the author gave other courses to the same student group. It is suggested to study on this argument in a future research. Regarding the advances of the digital technology, students are more curious to use computer programs. Nearly all students preferred to use computer programs instead of making hand-made sketches. It might be practical and/or more enjoyable to work via computer programs in that age group. Actually, this year, we are all practicing every design course via digital platforms because of COVID-19.

CONCLUSION

The methodology of the course was beneficial as it provided a platform to discuss and investigate the importance of color application in interiors. As Janssens and Mikellides (1998) suggested, there is a gap between color research among students of architecture, depending on their experience, therefore the color course is essential to the interior design curriculum. The design of this course is also important. It should be introduced in interrelated parts; from basic to advanced. Similar to the suggestions of Weber and Kanthak (2017), moving from a basic to an advanced level, the color course had positive results when the outcomes are evaluated. At the end of each term, it is observed that the methodology can be discussed at three levels;

- Basic level (first to fourth week): discussion on conceptual color in regard to emotional color;
- Intermediate level (fifth to eighth week): development of a personal color wheel and definition of personal color words for color-mood associations;
- Advanced level (nineth to fourteenth week): 3D modeling of color application; practice in color for interior design in line with color-mood associations; discussions and critics on aesthetics regarding subjective factors; development of three different alternatives for the same project: monochromatic scheme, achromatic scheme, and complementary color scheme; discussion of material, lighting effects, and indoor finishing.

In the future, students can experience real-case studies in the course by making interviews with a client group and developing mood boards. Also, the issue of color choice with regard to personality (introverted-extroverted) can be tested statistically.

ACKNOWLEDGEMENTS

Special thanks go to the students whose works are used in this paper.

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Technology in the walk: experiential reading of color of urban landscape

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ABSTRACT
In the research project “City readings: landscape and color. Emerging technologies in public space,” developed in the Color Institute of the Faculty of Architecture, Urbanism and Design of National University of Córdoba in Argentina, the interaction of people with real urban scenes is enhanced using *in situ* the concept of experiential learning of public space as well as digital tools. We adopted the methodology of *Les Parcours commentés* by French sociologist Jean-Paul Thibaud, who considers the sensitive experience of the observer and allows perception in context and in movement, stimulating perceptual resources along the way. The objective of the research project is to develop a methodology for reading public space and for allowing those who manage the city to generate sustainable forms of inducing meaning to places.

As a case study, the town of Villa Allende in Córdoba Province has been selected, with its scenic sights, valuable heritage and environmental interest, where color is the protagonist. The focus is on the main street of the town, well known for the presence of historic architecture. As a tool for urban interpretation digital devices as emerging technologies were incorporated such as mobile phones and tablets with different applications. Several chromatic situations were recorded, evaluated and summarized describing different atmospheres as well as the generic colors of the landscape. The experiential learning of the city, based on situated cognition and interaction with the urban scene, will mark an advance in the concepts and practices carried out in the public space of a city.

Keywords: *urban color, landscape, experiential reading, emerging technologies*

INTRODUCTION
The focus of this paper is part of an on-going research project entitled “City readings: landscape and color. Emerging technologies in public space” developed within the framework of the Color Institute of the Faculty of Architecture, Urbanism and Design (FAUD) of the National University of Córdoba (UNC). It maintains a line of continuity with research projects carried out for the study and design of public space, including pedagogical practices.

In developing and incorporating the concept of experiential learning of urban space, the city’s recognition, based on the contemporary model of situated cognition, is of fundamental importance. This contemporary concept addressed by Frida Díaz Barriga Arceo (2003) accentuates the interaction of people with the urban scene. Experiencing public space in situ, in real urban contexts, and with views at different scales, allows one recover the critical historical memory of the places and territory, emphasizing the conscious apprehension of it (Petit 2015).

Using digital tools to promote the culture of commented tours of the city is an additional aid for the team to advance in this research area. The proposed concept of "Aprender a Ver" (Learning to See) developed by the team of the Experimental Workshop of the Urban Form (TEFU) at the Faculty of Architecture, Urbanism and Design since 2015, including the practice of progressive complexity, definitely is a relevant precedent. To provide a theoretical framework and address the reading and interpretation of the city's image, the approach on the perception of urban environments and method of the sociologist Jean-Paul Thibaud's *Les Parcours commentés* (2001) and Francesco Careri's *Walkscapes* (2002) were consulted, and laid the foundations for the research proposed by the team for designing and adopting new practices to the experiences developed.

THEORETICAL FRAMEWORK: GUIDED WALKING TOURS

Les Parcours Commentés developed by Thibaud (2007, 2013) for visits or guided walking tours, considers the sensitive experience of the observer that involves three simultaneous activities: walking, perceiving, and describing. This recognition method is about knowledge in motion that generates a dynamic in discovering, reading, recording and communicating about the urban reality. It allows perception in context and in movement, mobilizing perceptual resources along the way with experiences and practices in public space (Borja and Muxí 2001).

The sensitive observer's qualities are activated, which contributes to understanding the identity and image of a city (Petit et al. 2012). The plurality of perspectives is considered here, which requires a variability of the observer's points of view and positions. From this perspective, the landscape becomes a territory to be lived and experienced. Walking, then, becomes a privileged way of experiencing the city, due to the physical presence in space, sensory perception, and other dynamics that enable interaction with the landscape to become an active entity. This dynamic experience of urban space, as a reading, recording, and interpretation methodology, includes an approach to different scales, pedestrian, aerial, physical and temporal. Using further resources, such as digital tools, needs to be considered as an interaction in real urban contexts. It may involve urban landscape, design, shape and color, among other features. Likewise, it will allow those who manage and operate in the city to conceive alternative sustainable forms of territorialization and inducing different meanings to places, enabling the interpretation and understanding of mechanisms of construction of the urban image identity.

The team determined to engage in a different experience from the practices that had been carried out using emerging technologies in the urban public space explorations, i.e., using electronic devices to widen the scope and scale of the research approach, enabling and integrating the use of augmented reality. The incorporation of a drone, equipment acquired by the FAUD UNC, is proposed. To the usual experience at the pedestrian eye level, the challenge would be to add the gaze from an aerial perspective, a situation that led to the necessary updating and training of the team in the use of locative media, digital mapping, digital reading, and the science of the measurement of color or colorimetry. For its operation the drone required the regulations and legal framework of the air control agencies, a procedure unfortunately delayed in the official offices, which added to the times of mandatory isolation due to COVID-19. Therefore, the planned practices using the drone had to be rescheduled to 2021.

EXPERIENTIAL URBAN READING METHODOLOGY APPLIED

The theoretical framework was established so far, and guidelines were defined to design an experiential urban reading methodology, based on walking and technology. Criteria had to be specified for the recognition, assessment, and selection of the study´s object among potential urban locations nearby the city of Córdoba, taking into account the critical history and heritage of the location, and the relevance for registering the urban landscape and color.

Villa Allende, situated in the metropolitan area of the capital city of Córdoba, is the chosen site to apply the experiential reading methodology, enabling an approach by walking. With a low-density population and a residential character, the city of Villa Allende is located between the Sierras Chicas and the Sierras Pampeanas (Figure 1). It has a great environmental and heritage landscape value, and its urban morphology, expression, and color constitute a great contribution to the critical view of the subject, and the reasons for its selection.

Before immersing into the research activity, it is worthwhile describing in a brief summary the historical and patrimonial context of Villa Allende. The urban settlement began in 1889, in a ranch belonging to the Mercedes Goycochea de Allende's family, its founder. However, in its current jurisdiction there are testimonies dating back to 1770, such as the historic Casa and Nogal, declared a National Historic Monument, and the "Casona de los Allende", later on at Saldán road and river, respectively. At the end of the 19th century, the route of the railway from Córdoba and the construction of the first summerhouses gave it a strong building boost. Today, this important town has a rich cultural heritage from the first half of the 20th century, especially in the district starting from the main square with the Church Nuestra Señora del Carmen that extends towards the Saldán river with a series of picturesque residences by the renowned Italian architect Augusto César Ferrari (1871–1970). Neighboring the Villa Allende Golf Club, other sumptuous picturesque homes as well as valuable works from the second half of the 20th century by the main author of this paper, are immersed in magnificent gardens and parks.

METHODOLOGICAL PROCESS AND RESULTS

The methodological process for the experiential urban reading approached by the team, can be synthesized in the following actions:

1. Working meeting and proposal presentation. A working meeting was scheduled between team members of the project, and authorities from the City Hall, who supported the proposals for an experience of sensitive recognition of Villa Allende. The general ideas proposed were discussed and supported, and other topics of interest and vacancies in the locality were added to the dialogue for future consideration. The first exchange was very interesting. The research team includes a group of researchers dedicated to the study of urban heritage, working on the cataloging of architecture of local heritage value.

2. Delimitation of the micro intervention area. Antecedents addressed and the city map facilitated the understanding of the city insertion into the region, accessibilities, limits, geographical situation, points of interest, detection of environmental landscape areas, heritage, among other items, which guided the relevance for registering urban form, landscape and color.

Finally, an area of certain characteristics and extension, including a main axis with a great potential to be revalued, was determined. The delimited area is located between Avenida Goycochea, the main avenue of the town to the south, and Avenida Carlos Pellegrini to the north, bounded by the Saldán river to the east and west. The main axis stretches from Del Carmen street, passing through the main square of the town, to Avenida Goycochea until the avenue meets Saldán river, and another sector with the axis of Rivadavia street which is parallel to Del Carmen street.

Figure 1: General view of the City of Villa Allende (left), and its location between Sierras Chicas and Sierras Pampeanas, some 23 km from the city center of Córdoba (right)

Considering the collected information, the first partial results were made from reflections and evaluations reported in a summary sheet. Then, it was decided to carry out a first experience of experiential reading among the members of the team, from a pedestrian scale perspective and of objective and subjective characterization.

3. Perception and registration of public space in context and in motion. This stage began with a sensitive recognition of the public space on foot, focusing on the route of Del Carmen Street within the chosen area, explored and perceived in context and in movement. When walking, the site was perceived and described. Changes of positions and change of views were taken into account using the following resources:

A. Photographs recording general and detail views, with cameras, analog graphics, drawings, and sketches.

B. Recordings with emerging technologies using mobile cell phones, digital tablets, with different types of applications.

C. Recordings, exchange of comments, consultations on the spot with the inhabitants, users and different social actors.

4. Detection, analysis and interpretation. The actions at this point were synthesized: firstly, detection of place system, roads, areas, architectures, shapes, textures, greenery, and interesting visuals; secondly, understanding the detected architecture with cultural heritage value; and, thirdly, completing with the interpretation of uses, behaviors, and experiences.

During the tour, different systems of places were discovered that make up a true fabric of paths, areas, architectures, color compositions, interesting visuals, of different uses and behaviors. All these components interact with each other and create various atmospheres in the perception of the context and the construction of the image.

The work of the Italian architect Augusto César Ferrari, including residences of great cultural heritage value from the early 20th century implanted in large areas of gardens, stands out for the presence of color through the textures of their roofs, the work of materials, and the presence of a variety of green species in the landscape. The emphasis is on the richness of lived experiences, lived from the presence of color. Different components and chromatic situations were detected, recorded and evaluated, with a predominance of environmental colors that varied from yellowish ochers, reddish-browns and different ranges of green and that will change in the different seasons across the year, as well as with the variations of changing light during the day.

A street sequential color map was composed based on the main colors detected in the construction of the image of the city, where the approach of guided walking tours was applied. Polychromatic color palettes with contrasting arrangements of harmonic colors were generated from the reading of the various components of the Del Carmen Street, where the combination of cold and warm colors resulted in an interesting contribution to the lansdcape image (Figure 2).

Figure 2: Street sequential color map, with houses by Italian architect Augusto César Ferrari (1871–1970)

CONCLUSION

These are the results of the project's advance of applying the experiential urban reading methodology. It included different environmental colors perceived in the route of Del Carmen Street. In spite of the rescheduled actions due to the COVID-19, the first partial results of this reading information were transferred to a Street sequential color map (Figure 2) and will continue with the design of color cards including every single point of interest previously observed and detected.

The experiential learning of the city, based on situated cognition and interaction with the urban scene, marks an advance in the concepts and practices carried out on the city's public spaces. These experiences incorporating digital tools, as another way of reading and recording and at different scales of approach, allow the design of an experiential urban reading methodology that will be of importance to support those who manage and operate in the city, allowing them to:

• adopt foundations and intervention criteria in the reality of public space to reinforce or generate sustainable forms of territorialization and meanings of places.

• promote awareness and appreciation of the identity construction of the public space image.

• create through emerging technologies, e.g., augmented reality, a different experience of urban public space.

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Augmented reality in interactive color experience: commemorating Bauhaus 100

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ABSTRACT
In September 2019 a meeting was organized by the Faculty of Architecture, Urbanism and Design of the National University of Córdoba in Argentina, to celebrate one hundred years of the Bauhaus, with the intention of reconsidering the values of the German school and update its imprint in the educational context. In this framework, it was considered appropriate to re-signify its validity.

This work advances on practices of "*Aprender a ver*" (Learning to See), developed by the Research Team of the Institute of Color. As a different way of experiencing meaningful activities that enrich the ways of seeing and understanding reality, the team's objective is to generate practices that favor the development of different perceptions. These practices are proposed using emerging technologies as permanent study tools and incurred by the team in exercises of learning to see. These practices motivate intellectual interactivity and stimulate the exploration, observation, and collective reflection. The Bauhaus coloristic proposal was approached by the team, linking the chromo-syntactic schemes of one of its main representatives, the artist Paul Klee, with the work of Córdoba's contemporary painter Rosa Ana Tinti. In her artistic process some similarities in the use of color can be appreciated. The purpose was to reveal the relationship in the way color is used by both artists in a space of micro experimentation. This was possible through the use of digital applications and mobile devices, interacting with Augmented Reality (AR) and combining the real world with virtual elements.

Keywords: *color schemes, painting, emerging technologies, digital photomontage, pedagogy*

INTRODUCTION

This work arises as a pedagogical project and advances in the practices of "Learning to See". The Research Team (Experimental Workshop of the Urban Form, TEFU), of the Institute of Color of the Faculty of Architecture, Urbanism and Design at the National University of Córdoba, Córdoba, Argentina, has been developing this pedagogical methodology.

The team promotes and generates practices that favor the development of perceptions, either within the teaching environment, or aimed at the entire community in university extension tasks as a different way of experiencing meaningful activities that enrich the ways of seeing and understanding reality. These practices are proposed using emerging technologies as permanent study tools and incurred by the team in exercises of learning to see and look, motivating intellectual interactivity, stimulating exploration, observation, and collective reflection (Veletsianos 2010).

The proposal of the Bauhaus School of Design, with its innovations in the teaching and learning of design, became a founding experience of European Modernity and a point of reference for institutions of architecture and design since the beginning of the 20th century and in different parts of the world. (Droste 1991)

In September 2019 a meeting was organized at the Faculty to celebrate one hundred years since the Bauhaus foundation, with the intention of reconsidering the values of the German school and updating its imprint in the educational context, both from the teaching practice and from the collective and individual research projects of students, designers, and researchers. In this framework, it was considered appropriate to re-signify its validity.

COLOR AT THE BAUHAUS AND THE PROPOSAL FROM THE RESEARCH TEAM (TEFU)

From the performance space of the Institute of Color and interested in the study of color in architecture and the city, two of its research teams approached the characteristic color schemes of the Bauhaus School of Design, constituted by the attitudes towards the color of its main pictorial "masters". Their works present in common the poetics of geometry and a new orientation dominated by technique and rationality, transcending history. According to Juan Carlos Sanz (2001:159), these colors determine the expressive mode of an artist and are characterized “by their functionalism (...) and, almost always, by their synesthetic connotation.”

The Bauhaus coloristic proposal by the team was approached linking the chromo-syntactic schemes of one of its main representative artists, Paul Klee, with the work of Córdoba’s contemporary painter Rosa Ana Tinti (1927–2016) who considered Klee's works as her initial inspiration. In her artistic process she has represented some of Klee's attitudes and similarities, and these can be appreciated for the use of forms and mainly the use of color. Because of this, her work was selected to be analyzed.

The painter Paul Klee, who has become a reference for the Bauhaus and his contemporaries, is also a reference for current researchers who inquire into the subject of color, (re)discovering in his work the values that reflect rhythm and poetry, serving as a source of inspiration to other artists. This is the case of Rosa Ana Tinti, a painter from Córdoba, Argentina, inspired by Klee’s work in the use of color and shapes.

COLOR AND PAUL KLEE

Klee drew inspiration from everything around him. He was a lover of nature and music, and found a way of representing them in an abstract way, as well as poetry, dreams and travels reflect in his work. He presumed abstraction as an instrument to find parallel worlds he suspected were hidden behind the so-called reality.

His pedagogical legacy consists of a set of texts derived from his teaching and studies at the Bauhaus with theoretical and practical investigations, full of diagrams, tables, color scales and drawings about form, geometry, plane, rhythm, movement, and reflections on the structures of Nature. His theories of color were based on the color wheel designed by Goethe, where color red was opposed to green, orange to blue, and yellow to violet. In addition to his famous notebooks, he also wrote essays on art. In his investigations on modern theories of color, he experimented with the superposition of tones, considering grey as the center of the color system.

Klee added a new dimension to Goethe’s diagram, turning it into a sphere, with white at the top and black at the bottom. This framework should cover all the aspects of color, including hue, lightness, and saturation. The colored rectangle became the main basic geometric shape and building element of his paintings. Klee used color in the manner of a musical note, combined with other colored rectangles and squares, which allowed him to create harmonies analogous to a musical composition. In selecting a color palette, he used complementary pairs, and sometimes dissonant colors, again reflecting his connection to musicality (Partsch 1994).

COLOR AND ROSA ANA TINTI

Rosa Ana Tinti graduated at the School of Fine Arts of the National University of Córdoba, Argentina. She investigated into Klee's work and experimented in her paintings mainly with the use of color.

Studying her work and reading her story in the local newspaper of Córdoba *La Voz del interior*, Tinti's paintings evoke wide interest for her series of floral themes, landscapes of the local mountains, human figures, although her favorite subject was the urban landscape. Magical realism is expressed in her work which stands out for a poetic vision and a marked religious tinge to the urban landscape of Córdoba. She manages to install a candid atmosphere, contradictory to the aggressiveness of urban reality, and with an apparently naive celebration of color. She works with grids, where the images of churches and carousels are repeated, as a characteristic feature of her paintings. Shapes and colors in contact with the sky balance the compositions with great dynamism, defining interesting skylines of the urban landscape.

At times she focuses on a small area of her painting, which can be perceived as a distinct, small scene by itself, like a painting within a painting orienting the gaze to diverse places of interest.

The scenes and atmospheres are composed by the use of palettes with earthy colors, reddish browns and greenish blues, and also by using complementary colors, creating arrangements of great balance with subtle variations of hue, lightness and saturation.

RESULTS OF THE INTERACTIVE CROMATIC EXPERIENCE

The purpose of the team was to reveal the relationships regarding the use of the color of the chosen pictorial artists in a space of micro-experimentation with the idea of rediscovering the values of the German school and updating its imprint in the present historic context to re-signify it. This was possible using digital applications and mobile devices interacting with Augmented Reality (AR) and combining the real world with virtual elements.

Augmented reality, as its name suggests, is a type of emerging technology that "augments" reality, this is, it allows the real world to be combined with elements of the virtual world adding physical information.

The bibliographic search was first mobilized to begin the process of selecting and defining the works to be presented. The selection criteria were ruled by taking into account both the use of shapes and color, specially observing the handling of color palettes considered by both artists, as the syntax achieved in the composition of the works.

The presentation of this project to the public included paintings by the two artists as well as photomontages and further images, with which visitors could interact (Figure 3).

In order to activate augmented reality in the reading of the presented works, the *Wallame* application downloaded for free from the digital store of devices, due to its ease of use and technological availability.

Previously, the team members had to digitally intervene in the editing process, creating virtual photomontages on the image of the original painting, transposing from one artist's image to the other each of the components of each painting: shapes, people, objects, colors, details, plans and even spatialities.

Figure 1: Example of a virtual photomontage (right) using the RA Wallame App that arranges motifs and elements from Paul Klee's paintings onto Rosa Ana TInti's painting *Sin Nombre*, c 2000 (left).

Figure 2: Example of a virtual photomontage (right) using the RA Wallame App that arranges motifs and elements from Rosa Ana Tinti's paintings onto Paul Klee's painting *Red and white domes*, 1914 (left).

Thus, with this disaggregation of components, the graphic foundations and the common colors could be easily evidenced, based on the similarities of the works of the two artists (Figures 1 and 2).

From there, visitors were asked to read the paintings of both artists with the use of mobile devices and smart phones provided by the work team. They were motivated to explore images to achieve interaction from augmented reality, stimulating perception, imaginary, suggesting superpositions and relationships, among them, at times with logical or predictable results and at times with fantasy, of indescribable richness in the use of shapes, colors, textures.

Figure 3: Interaction of visitors searching for relationships between Klee’s and Tinti’s paintings by focusing with the digital device on the paintings.

FINAL CONSIDERATIONS

From the pedagogical context of university education searching collective and individual teaching practices for students and designers, this interactive and innovative experience of re-creating pictorial images gave room to rethink the legacy of the Bauhaus, its concepts and proposals that allow solving questions, ideas and uncertainties of today.

It contributed to the enrichment of the perception and cognition mechanisms of the temporal space, with a different approach to the understanding of the chromatic phenomenon, relating artists from different historic times.

In this particular artistic project, the team appreciated that visitors acquired an active role of curiosity in the observation of a wide production of photomontages achieved with the use of technologies (Figure 3).

At this point, it should be noted that the visitors to the space of micro-experimentation were not specialists nor connoisseurs of color from the academic point of view. The intention was to motivate their gaze toward the discovery of relationships between the two artists as a way of promoting an affective and intellectual interactivity and awakening collective reflection. It made it possible to rethink, highlight and discover in a clear and dynamic transfer exercise the relationships of the application of color and the artworks of Paul Klee and Rosa Ana Tinti.

From the technological point of view, the use of emerging technologies for the development of learning processes also raises the need to reconfigure teaching practices including the diversification of technological devices, such as mobile media, which are constantly renewed and offer ways to experiment with information and communication.

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Rethinking the role of technologies in teaching colour design

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ABSTRACT
The rapid evolution of education technologies during the last decade provides both opportunities and challenges for design education. The agenda for Education 4.0 also requires rethinking of the role of emerging technologies in the development and delivery of engaging content in diverse subject areas, including colour design. To implement authentic learning experiences and opportunities for subsequent knowledge tests in blended and online colour lessons, design educators can explore the potential of immersive technologies that support augmented (AR) and virtual realities (VR). This paper aims to stimulate discussion on the use of these technologies in innovative teaching of colour design to architectural and interior design students. An assumption that AR and VR can change conceptualisation of colour design teaching and learning underlies the proposed discussion.

Based on the extensive review of literature, this paper analyses the trends and perspectives in the use of virtual reality in architectural and interior design programs. Further, it develops a rationale for the utilisation of immersive technologies in colour design curriculum. Finally, this paper reflects on the role of immersive educational technologies in the development and delivery of the future-oriented and authentic colour design training. The paper contributes to a better understanding of how blended and online colour design programs can utilise immersive technologies in innovative teaching and learning.

Keywords: *colour design education, educational technologies, immersive virtual realities*

INTRODUCTION

The rapid evolution of education technologies during the last decade provides both opportunities and challenges for design education. The agenda for Education 4.0 initiative also requires rethinking the role of emerging technologies in the development and delivery of engaging content in diverse subject areas, including colour design. Education 4.0 initiative is the vision of the future education that aligns with the development of the World Wide Web and the emerging fourth industrial revolution (Fisk 2017, Salmon 2019).

Emerging technologies have a profound impact on future-oriented teaching and learning (Horizon Report 2019). Veletsianos (2016: 7) describes the main characteristics of emerging technologies as not defined by newness; coming into being; not-yetness; and, unfulfilled but promising potential. The modes of learning associated with Education 4.0 involve the optimal use of technologies for innovative and effective teaching, active learning engagement and collaboration (Admiraal et al. 2019, Salmon 2019). Emerging technologies promote agility and adaptability. Application of these technologies can be contextualised for specific educational needs. The two most common technologies in the design field are augmented reality (AR) and virtual reality (VR). Whereas AR overlays physical objects and places with virtual content, VR is typically a more immersive experience, that involves the manipulation of and interaction with virtual objects within an entirely virtual environment. The AR applications are available on mobile devices, including smartphones. The VR experiences are commonly delivered by means of an Head Mounted Display (HMD) or within an immersive space.

AR and VR applications have been used in spatial design disciplines during the last two decades. Numerous academic and secondary sources provided examples of both advanced and limited use of these technologies in architecture and interior design (Milovanovic et al. 2017, Schnabel et al. 2001). However, a search for similar experiences in teaching colour design has been fruitless. There are a plethora of online colour courses for designers, but little evidence of optimisation for innovative teaching based on the synthesis of pedagogical and technological perspectives. Arguably, there is a gap in knowledge, or the relevant information has not been reported.

This paper aims to stimulate discussion on the use of these technologies in innovative teaching of colour design to architectural and interior design students. An underlying argument is that the augmented and immersive virtual environments offer alternatives to colour design teaching and learning in the context of Education 4.0.

The paper starts with an analysis of the most significant trends in and perspectives on the use of augmented and immersive virtual reality in architectural and interior design programs. Further, it develops a rationale for the utilisation of AR and VR technologies in colour design curriculum. Finally, this paper reflects on the role of immersive educational technologies in the development and delivery of the future-oriented authentic colour design training.

BACKGROUND

The growing agenda for Education 4.0 is one of the main drives of the transformation for professional education in general. Education 4.0 aims to change teaching-learning methodologies to prepare students for future challenges. It deploys the emerging digital technologies, open-sourced content, personalised data and promotes continuous life-long learning (Fisk 2017).

From a pedagogical perspective, Education 4.0 is learner-centred. Therefore, it is vitally important to understand the nature of future learners. Prensky (2014) argues that our current and future learners belong to a generation of “digital natives”. For instance, it is asserted that digital natives learn differently to past generations of students. They are described as active, experiential learners, proficient in multi-tasking, and dependent on communications technologies for accessing information and for interacting with others (Oblinger and Oblinger 2005, Prensky 2014). Reporters claim that these characteristics raise fundamental questions about whether education is capable of meeting the needs of this new cohort of learners. The emerging technologies and practices evolved over the last decade have been preceded by opportunities to meet the needs of the “digital natives”.

However, most leading educators agree that technologies should not guide education. According to Horizon Report (2019: 13), “technology by itself does not yield the greatest impact on learning; it does so when it is embedded in a scaffolding of support for learners and instructors”. Indeed, there is always a subject expert and great teacher or instructor behind any successful teaching and learning model. The experienced educators are accountable for teaching and learning effectiveness, as well as selection and appropriation of innovative technologies for specific learning objectives. At the same time, to achieve the fruitful integration of digital tools, educators have to possess specific technological and pedagogical competencies.

So, how to achieve a balance between design pedagogy and technology to frame innovative learning models? TPACK (Technological, Pedagogical and Content Knowledge) framework helps to understand how technological and educational perspectives can be synthesised to innovate the pedagogical approaches and learning experiences (Mishra and Koehler 2006).

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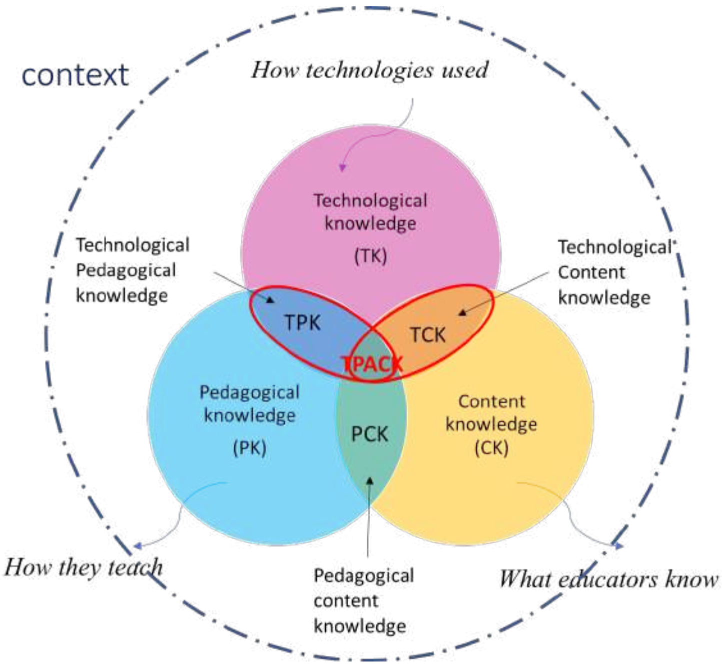

Figure 1. TPACK model (adopted from Mishra and Koehler 2006). This approach considers three main areas of knowledge including: Content knowledge (CK) that defines subject area expertise and depth of knowledge of the relevant theories, concepts; Pedagogical knowledge (PK) that refers to an understanding of teaching-learning theories, instructional design models and principles of assessment; Technological knowledge (TK) that indicates an educator's competence in the use of technologies in teaching and learning. Decoding the intersection areas: Pedagogical content knowledge (PCK) refers to the strategic approaches to representing and explaining the subject matter clearly and effectively; Technological pedagogical knowledge (TPK) guides the selection and utilisation of technologies to innovate teaching methods; Technological content knowledge (TCK) refers to the use of technologies in curriculum innovation and development of multimedia and interactive educational contents.

Contextual application of the TPACK framework guides evaluation of the use of digital technologies in the teaching and learning process within different subject areas, including colour design. A preliminary analysis of six Vocational Education and Training (VET) programs in colour design offered online, and an academic unit "Colour Studies" offered by Queensland University of Technologies (QUT) suggested a lack of rigour in TPK and TCK area of colour education (Figure 1). While several online courses had developed multimedia contents, the potential of 3D simulations and applications of AR and VR in teaching colour design principles remains overlooked. The Colour Study course offered to spatial design students by QUT has been initially created for the face-to-face studio mode. This course integrated live lectures, face-to-face studios, visual and oral presentations of colour design projects. The use of AR and VR for the course improvement was discussed but not yet implemented.

Despite the limitations of this analysis and need for further research, it is reasonable to argue that contemporary colour design teaching lacks synthesis between professional, pedagogical and technological perspectives. Meaningful integration of emerging technologies involves innovative pedagogical approaches to content development and delivery. To harness the pedagogical benefits of AR and VR, educators and learning designers need to comprehend both their affordances and related issues. For example, AR applications earn credits for opportunities to co-design and sharing conceptual ideas between the users on the site (Wang 2007). Tangible ARs provide a link between tactile action and visualisation and facilitates more profound learning. Integration of VR in spatial design training associated with numerous benefits. The core VR affordances include:

- Detailed visualisations. VR simulations can stimulate visual learning by taking multiple perspectives of the same scenario (Bailenson et al. 2008).
- Presence and immersion. An immersive virtual environment (IVE) perceptually surrounds learners, increasing their sense of presence. An IVE allows learners to interact with the complex information and might reduce the cognitive load in the procession this information (Cousin 2005).
- Social VR software, such as rumii, allows embodying an avatar to enhance students' engagement and learning by doing (Hand 2008, Gossett 2020). Social VR software also supports collaborative learning and exchange of information.

Limitations of AR and VR are predominantly related to the coast of development, and coast and access to equipment. The effective use of these technologies in a studio environment requires some specific skills of learners and instructors.

GENERAL DISCUSSION

This discussion focuses on the role of AR and VR in future-oriented colour design education and professional training. However, it commences with a review of trends in the use of these technologies in architecture and interior design.

AR applications in the spatial design field overlay real environments with virtual information using diverse techniques by implementing HMD AR, Tangible AR, Smart Device AR (SDAR) or Spatial Augmented Reality (SAR). The development of applications for mobile devices stimulates the use of on-site AR for interior design purposes, building renovation or restoration (Milovanovic et al. 2017). SAR gives an opportunity to visualise virtual building elements (such as floor, walls, windows or furniture) within the real space on 1:1 scale.

The current trends in the use of VR in architectural education and interior design education are:

1. Visualisation that relates to converting a 3D file (such as a Revit or SketchUp file) into a VR experience.
2. Presence and immersion that allows students to design within the VR space, without needing to go back and forth between different software.
3. Virtual design collaboration / virtual design studio.

The increasing interest in the use of VR visualisation in teaching spatial design allies with the transformation of professional practice, as more architects and interior designers utilise VR in their project presentation. Even mobile VR architecture solutions for a smartphone becomes increasingly popular. Kim Bauman Larsen (cited in O'Connell 2017) suggests that "the architect can render stereo 360 panoramic images directly from the BIM software such as Revit or using a visualisation tool like 3ds Max with V-Ray, and publish the images to the web using third-party services like VRto.me or IrisVR Scope". Skills in the creation of detailed virtual visualisation in high demand in the design practice.

However, to optimise the use of VR technologies, educators need to consider not only the industry interests but also the authentic and personalised student experience. The virtual architectural visit is one of the emerging trends focused on interactive learning. In this case, VR simulation allows learners to visit an interior or an urban place without travelling to a specific location. A guide can use tools to modify an augmented reality experience drawing learner's attention to significant elements or features. This type of learning experience is impressive, memorable and exceptionally engaging (Bliss 2019).

Milovanovic et al. (2017) scrutinise AR and VR applications in architecture and interior design presented in 122 research papers. The authors concluded that VR shows great potential for enhancing conceptualisation, the quality of students' design product and evaluation. Virtual design studio and the shared virtual environments support remote synchronous design collaboration. Augmentations of tangible mock-up are proven to be useful in design critique and discussion.

Undoubtedly, AR and VR applications have relevance to colour design teaching at the tertiary level and for vocational training. The appropriate use of AR and VR can contribute to development in TCK (curriculum innovation) and TPK (teaching innovation) areas in the context of the future-oriented colour design education. VR has the potential to create a fully immersive experience enhancing comprehension of the interplay between colour, materials, lighting and spatial elements within the interior or urban settings. Immersive VR may involve visual, audio, haptic and olfactory simulations to create the ambient sensation of an embodied spacial experience (Bailenson et al. 2008).

Virtual architectural visits show an exciting way to learn about the historical application and symbolic meaning of colours. A virtual visit is also a powerful tool for on-site observation, analysis of existing colour palettes and impacts of light on colour appearance. Virtual simulations can be integrated with augmented functions, providing opportunities to experiment with material or applied colour and their distribution within a 3D setting.

Trends in the use of VR support the multi-modal structure of blended and flipped programs. For instance, learning modules focused on specific areas of colour knowledge can be delivered as a whole course or integrated into formal architectural/interior/urban design subjects. For example, a group of 3rd-year architectural students in QUT used immersive VR to explore impacts of colour on perception of the multistorey facades aesthetic. The 4th-year students employed a similar approach to analyse the role of interior colour on the perception of space in small residential apartments.

The above speculation about the possible use of AR and VR in colour design studies neither grounded in empirical data or counterintuitive. However, it is underpinned by decades of critical reflection on teaching architecture, interior and colour design at tertiary levels; and search for opportunities to shift the value of colour knowledge for academic and professional design education. Upon critical reflection, to provide coherent guidance in innovative approaches to colour design education, more formal research is needed.

CONCLUSION

For colour design education to evolve and become profitable in the digital learning environment, educators need to recognise the vital role educational technologies play in the future-oriented pedagogy. Integration of AR, VR and Mixed Realities applications offer immense possibilities to design high-quality, engaging content and optimise teaching and learning in colour design. The use of innovative IVEs might alter the social dynamics of learning environments through alternative social interaction. Despite current limitations, such as the cost of equipment and time necessary to create content, emerging technologies create opportunities to bridge the gap between the core values of professional colour education and the needs of the future learners.

Effective teaching with emerging technologies requires new skills of instructors. At the same time, VR technologies provide opportunities to unite efforts of educators passioned about colour design at the global scale. In the post-COVID context, they provide safe environments for discussing and co-designing internationally accredited colour design programs.

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Quantifying colors of traditional academic gowns in Spain

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ABSTRACT
We propose a quantitative specification of colors of academic gowns currently used in Spain to distinguish different academic disciplines. Our proposal is based on the 16 categories (color names) suggested in 2010 by protocol experts from universities in Spain, and spectrophotometric color measurements we performed for 83 fabric samples provided by 3 tailor shops specialized in making academic gowns in the city of Madrid. We also investigate the meaning of colors employed for some of most traditional academic disciplines: white (theology), sky blue (philosophy), yellow (medicine), red (law), and green (canon law). We propose specific color coordinates for 15 of the 16 categories, with a tolerance of 5 CIELAB units, based on variability of measured fabric samples. No samples were provided by the tailor shops for 1 category (mauve color, assigned to speech therapy). We found a very high variability (23 CIELAB units) for the category green (#15), suggesting that protocol experts should reconsider the numerous disciplines currently associated to this category: canon law, librarianship, documentation, veterinarian, etc. We propose to increase the color difference between the grey (#7) and light grey (#8) categories, which is now 9 CIELAB units. Considering the color gamut of real objects, it is possible to produce colors which may be assigned to future academic disciplines.

Keywords: *academic gown, protocol, textile, CIELAB*

INTRODUCTION

Color is an important tool for communication in many symbols like flags, uniforms, commercial logos, etc. (Melgosa 2006). In 2006, the 7th International Symposium of the Slovenian Colorists Association focused on “Color of National Symbols”. Certainly, the academic gown is one of the oldest and most traditional university symbols in Spain. It has been stated that perhaps the use of colors as distinctive for academic disciplines is as old as the first universities, as we can see in some paintings from the 15th to 17th centuries with scenes from academic life (Darías Príncipe 1999). The origin of the academic gown dates back to robes used in the Roman culture and also to clerical habits used in the church, under whose protection universities were born. In Spain, the initial configuration and colors of academic gowns were regulated by Decrees signed by the Queen Isabella II in 1850. In 2010, a team of experts in protocol from universities in Spain proposed 16 color names as distinctive of academic disciplines at university (Galindo Mateos et al. 2010). Currently, the academic gown is only worn by academics in most solemn ceremonies, like the opening of the academic year or the investment of new doctors '*honoris causa'* (Figure 1).

Figure 1: Academics from different disciplines in a ceremony held in 2005 at the University of Alcalá de Henares

The current paper is about the colors currently used in academic gowns in Spain to distinguish academic disciplines. Our specific goals are: 1) to make a quantitative proposal of colors and tolerances for the categories (color names) indicated by protocol experts from universities in Spain (Galindo Mateos et al. 2010); 2) to explore the meaning of the colors assigned to most traditional academic disciplines; 3) to report on problems the human eye may have to distinguish colors of any two intentionally different academic gowns; 4) to consider available colors for future new academic disciplines. This paper only considers real object colors (fabric samples), not images of academic gowns in visual displays. In summary, we try to divulgate and preserve an old and beautiful tradition, providing a quantitative reference for tailor shops and academic gowns used in other countries.

METHODOLOGY

Table 1 shows 15 of the 16 categories (color names) proposed by experts in protocol of universities in Spain for the academic gowns of different disciplines (Galindo Mateos et al. 2010). For more than a decade 3 tailor shops specialized in making academic gowns in Madrid provided us samples (satin fabric) for 15 categories. No samples were provided for the category #9, mauve color, assigned to speech therapy, which has been omitted in Table 1. Overall, we collected 83 samples (3-8 samples per category), which were measured using a Konica Minolta CM2600-d spectrophotometer (8 mm aperture, de:8°, UV=100%, specular component excluded). Our samples were considerably uniform in color and therefore we averaged the results of three non-consecutive measurements on each sample. Because of the small size of the samples, for spectrophotometric measurements the fabrics were put without any fold on a standard white (RS50 StellarNet Inc.). The gloss of the samples was low (average of 2.9 GU measured at 60°). From spectrophotometric measurements color coordinates were computed assuming the CIE standard illuminant D65 and CIE 1964 standard colorimetric observer (CIE 2018). The variability of measured samples within each category was assessed by the mean color difference with respect to the mean (MCDM) in CIELAB units (Berns 2000)

	ID #	Color Name	Main Academic Disciplines
	1	Yellow	Medicine
	2	Sky blue	Humanities (Philosophy, Philology, Geography, History, Pedagogy,…)
	3	Cobalt blue	Experimental Sciences (Physics, Chemistry, Biology, Mathematics,…)
	4	White	Theology, Fine Arts
	5	Dark red	Food Science
	6	Fuchsia	Odontology
	7	Grey	Information Sciences (Journalism, Communication, Public Relations,..)
	8	Light grey	Health Sciences (Nursing, Physical Therapy, Chiropody, Nutrition,…)
	10	Violet	Psychology
	11	Brown	Engineering and Architecture
	12	Dark Purple	Pharmacy
	13	Orange	Economic and Business Sciences, Politics Sciences and Sociology, etc.
	14	Red	Law
	15	Green	Canon Law, Librarianship and Documentation, Veterinary, etc.
	16	Light green	Sport Sciences

Table 1: Colors proposed for different academic disciplines by protocol experts of universities in Spain (Galindo Mateos et al. 2010). The colors shown in the first column of this Table are only approximate.

RESULTS AND DISCUSSION

	ID #	Color name	Number of Samples	$\overline{X_{10}}$	$\overline{Y_{10}}$	$\overline{Z_{10}}$	$MCDM$ ($\Delta E^*_{ab,10}$)	ID Nearest Neig. ($\Delta E^*_{ab,10}$)
	1	Yellow	6	53	50	8	7	14 (35)
	2	Sky blue	7	32	38	57	10	7 (17)
	3	Cobalt blue	7	8	9	24	5	12 (22)
	4	White	5	87	91	107	4	8 (26)
	5	Dark red	3	9	6	4	6	11 (23)
	6	Fuchsia	6	25	15	19	9	5 (31)
	7	Grey	5	30	33	39	3	8 (9)
	8	Light grey	3	39	42	44	3	7 (9)
	10	Violet	5	33	31	42	3	7 (19)
	11	Brown	5	12	10	4	3	5 (23)
	12	Purple	8	7	6	17	3	3 (22)
	13	Orange	6	45	36	11	2	1 (35)
	14	Red	6	18	10	4	6	5 (25)
	15	Green	8	9	14	11	23	16 (32)
	16	Light green	3	37	44	36	5	8 (18)

Table 2: Colorimetric results for the categories shown in Table 1. The colors shown in the first column of this Table are only approximate.

Table 2 shows the results found for each category in Table 1: Number of measured samples (column 4), average tristimulus values (columns 5-7), variability of measured samples (MCDM) in CIELAB units (column 8), and nearest neighbor category with its color difference in CIELAB units (column 9).

Figure 2 shows an example of the variability of the 7 measured samples in the category sky blue (#2). In this case we have a variability (MCDM) of 10 CIELAB units, the second highest in Table 2.

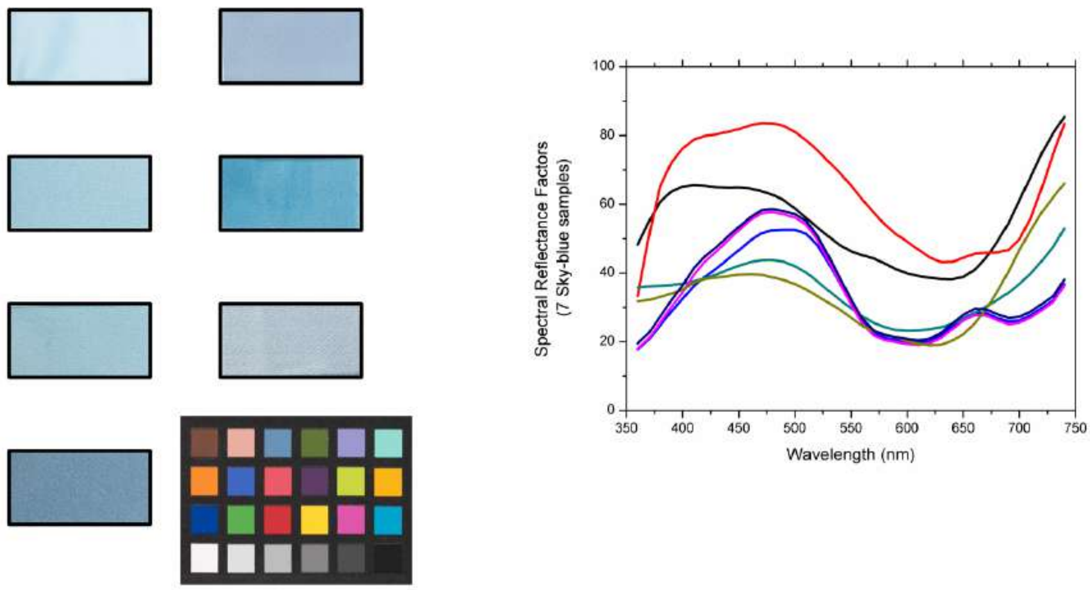

Figure 2: (Left) Photograph of the 7 samples in the sky blue category (#2), together with a Gretag-Macbeth ColorChecker. (Right) Average measured spectral reflectance factors of these 7 samples.

From Table 2, the color variability (average MCDM) of the 3-8 samples measured for each category was 5 CIELAB units, excluding category #15 (green) which has a very high MCDM of 23 CIELAB units. Probably, the reason for this last high variability is that there are many disciplines within the category #15 (canon law, librarianship, documentation, veterinarian, environment sciences, etc.) under the same color name 'green', which has induced tailor shops to use very different arbitrary green colors for these disciplines. From current results, we feel reasonable to propose a tolerance of 5 CIELAB units for average color coordinates shown in columns 5-7 in Table 2. Color tolerances of 5-10 CIELAB units have been proposed for colors in the standard flags of regions of Spain (Gómez Robledo et al. 2019). On the other hand, the nearest categories in Table 2 were grey (#7) and light grey (#8), with a distance of 9 CIELAB units. In our opinion, this last color difference could be easily increased making the academic gowns of these two categories more easily discernible for the human eye, as desirable.

Figure 3 shows the positions of proposed average colors (columns 5-7 in Table 2) in CIELAB color space, distinguishing the hue-angle/lightness and hue-angle/chroma planes (CIE 2018). As we can see, the hue-angle scale is covered reasonably well by the proposed colors, and it should be easy to increase the distance between the grey (#7) and light grey (#8) categories. It is also interesting to know whether it should be possible to choose new colors different to those shown in Figure 3, for example, as options for academic gowns of future new academic disciplines. In this sense, Figure 4 plots the colors of the 83 samples measured in this work, together with a color gamut for real object colors (Pointer 1980), distinguishing six CIELAB hue-angle intervals from 280°-340° to 220°-280°. We can note in some plots of Figure 4 a few samples outside the color gamut, which is attributable to the fact we have plotted in Figure 4 just the gamuts for the intermediate hue-angles in each interval, which are not the hue-angles of plotted samples. Figure 4 also shows that, in particular in the 100°-160° and 160°-220° hue-angle ranges (i.e., around green tonalities), there is enough free space, which means that we can choose colors for academic gowns in these regions. As mentioned before, we think that the green colors of academic gowns (category #15) must be reconsidered by protocol experts.

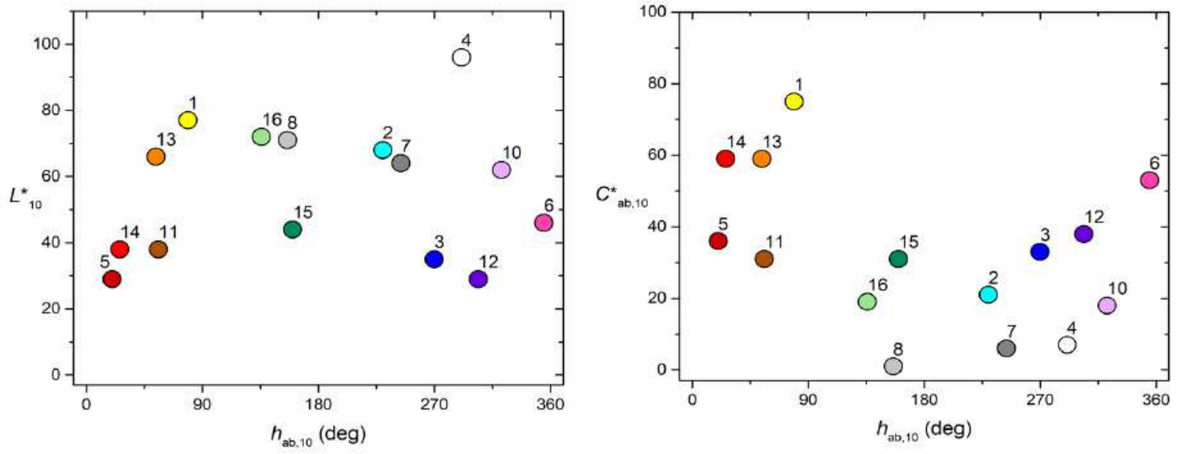

Figure 3: CIELAB cylindrical coordinates (left: lightness vs. hue-angle; right: chroma vs. hue-angle) for the 15 colors of academic gowns proposed in Table 2.

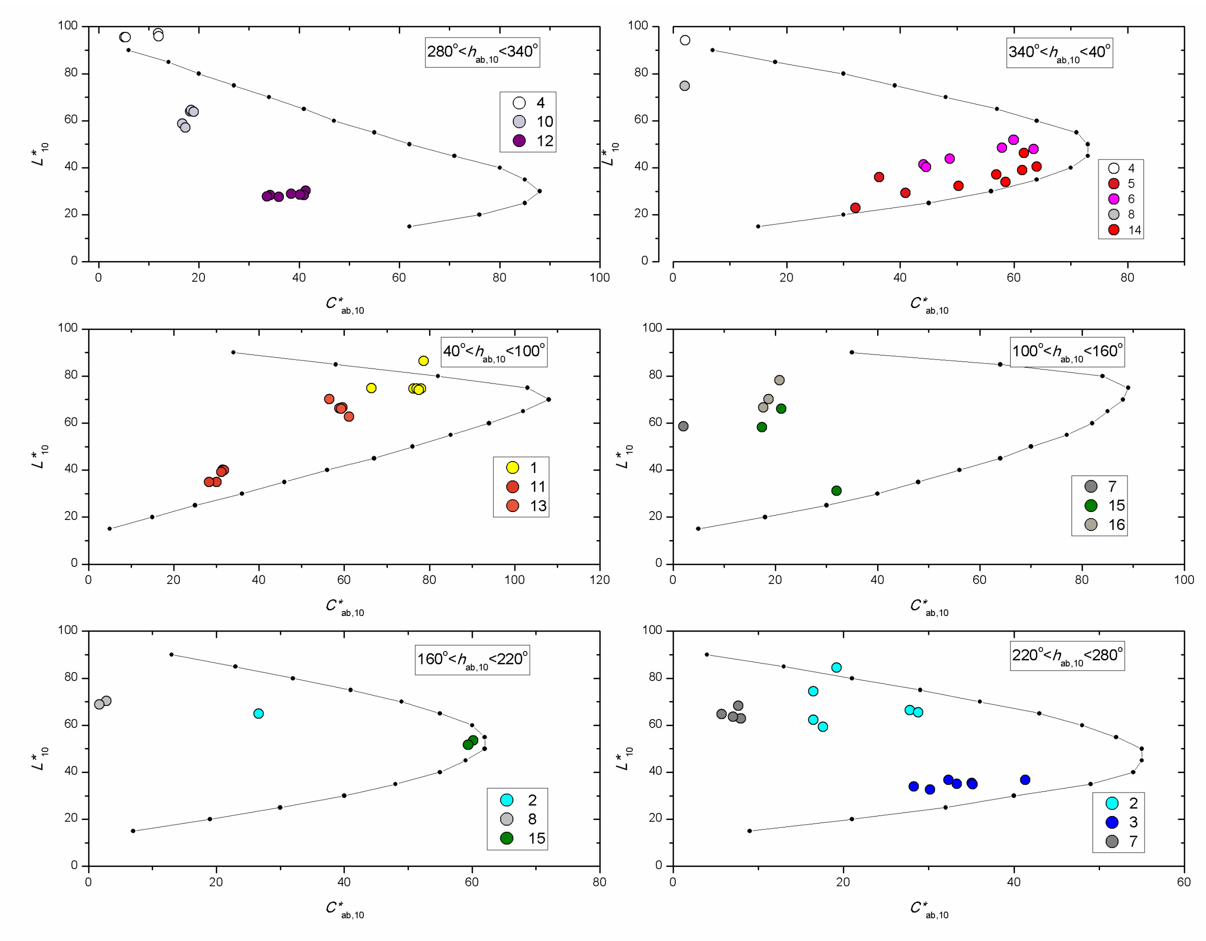

Figure 4: CIELAB coordinates of the 83 measured samples in six different hue-angle intervals. The numbers in the insets of the plots correspond to the categories in the second column of Tables 1 and 2, and their associated colors are only approximate. The continuous line is a color gamut (Pointer 1980) for the intermediate hue-angle.

Finally, we also investigated the potential meaning of colors in academic gowns of most old disciplines. Originally, color represented a specific feature, a quality that characterized the

Faculty that carried it. Curiously, we owe to a Peruvian trained at the University of Salamanca (Spain) the first written testimony about the symbolism of colors in the oldest university disciplines (León Pinelo 1608). White represented the purity of theology, the science of sciences; green, the hope of canons, the science of God's decrees; yellow, the charity of medicine, the science of life; red, the strength of law, the science of the legislative power; blue, the contemplation of the highest, of arts and philosophy, the science of the heavens.

CONCLUSION

Current quantitative proposal of colors of academic gowns in Spain may be useful for tailor shops and for protocol experts in order to have a more accurate reference, allowing to properly preserve this old university tradition.

ACKNOWLEDGEMENTS

Ministry of Economy and Competitiveness of the National Government of Spain, research project FIS2016-80983-P, with support from the European Regional Development Fund (ERDF). Ministry of Science and Innovation of the Government of Spain (PID2019-107816GB-I00 / SRA / 10.13039/501100011033). Detailed comments from anonymous reviewers are acknowledged.

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Color tectonics: enhancing and modifying form and space with color

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ABSTRACT
Tectonics in architecture is 'poetics of construction' according to Kenneth Frampton. Color, as a complement to architectural form and space, has the ability to define, enhance, and modify the expressive power of architecture. Color, then, becomes a visual tool that, like form and space, has its own expressive power. This contribution to the poetry of construction is Color Tectonics. My aim is to show how color tectonics can be integrated into a three-phase design process for architectural design. These phases are: 1) Concept – where the generative idea stated verbally is represented visually and in color as a diagram. 2) Development – defining form and space three dimensionally, where the hierarchical relationship of the parts to the whole are established and represented in color through figure/ground juxtaposition. 3) Final Design – the embodiment of the conceptual idea and the relationship of the parts to the whole in built form with real materials in an environmental context, where color expression defines the parts and their hierarchical relationships based on the conceptual idea. The methodology for using color tectonics will be described for each of the phases of this design process and highlighted with examples from student projects in my architectural design studio, my Color and Light class, and from real projects in the built environment.

Keywords: *design process, color education, interior architecture*

INTRODUCTION

The design of an object, a building, a city, or work of art begins with an idea. In most cases this idea will be stated verbally, and range from the philosophical to the pragmatic with a multitude of conceptual possibilities in-between. In the conceptual phase of the design process in architecture, drawings are used to represent relationships of the essential parts of the building. These parts can be described formally or metaphorically, and the relationship of these parts to one another creates the generative idea that is the point of departure for the design. These are often expressed as a dialogue between oppositions such as public/private or active/passive. They can also represent events in the experience of architecture such as hierarchy, separation, connection, transition, and assimilation. These ideas all become represented visually by form and space, but they can be enhanced with color. Color has expressive power through an emphasis given by color contrast and figure/ground juxtapositions, and when combined with the physical embodiment of form and space, the idea becomes more distinct as architectural expression (Minah 2008).

Tectonics in architecture is defined as the science or art of making, both in relation to use and artistic design. Tectonics in contemporary architectural theory has been addressed from a number of points of view, but most refer, as in Kenneth Frampton's definition, to the poetics of construction (Frampton 1995). Color tectonics is the visual enhancement of this expressive potential through the process of using color to enhance or modify form and space by giving emphasis to form. The aim of this paper is to describe how color can be used as a tool to represent ideas conceptually, and to enhance the expressive possibilities of form and space through the degree of emphasis in color juxtapositions in all phases of the design process.

The process of using color as a tool in architectural design involves its incorporation in the three major steps of the design process: 1) CONCEPT – where the initial idea stated verbally is represented visually as a diagram. This diagram will define the major parts of a building and indicate the dynamics in the relationship of these parts and how they interact with one another. The differences, similarities, and hierarchy of these parts and their relationships can be enhanced with color juxtapositions defined by contrast and degree of emphasis. 2) DEVELOPMENT – defining form and space where the hierarchical relationship of the parts to the whole are established three dimensionally. It is here where the structure and space defining elements are determined. Models are used in this phase. These begin with abstract representations of the parts to the whole and become refined throughout the process. The color of these parts will represent the emphasis determined in the conceptual phase and become further defined as the materiality of the project is established. 3) FINAL DESIGN – the initial conceptual idea that defines the parts of the building, their dynamic relationships, and their hierarchies will remain. The form and space will be enhanced with the color decisions from the Development Phase, but modified by materials and an external physical context that will determine its visual presence.

METHODOLOGY

The methodology described here is used in my architectural design studio at the University of Washington. This design process can also be used in practice. In practice, however, the Final Design phase is more rigorous and will address issues related to budget, codes, and construction documents as well as color decisions.

The student or the practitioner will be asked to use color in all phases of the design process and to justify every color decision with a rationale. In the Concept Phase an example of how a diagram is enhanced with color might be a modification of Louis Kahn's concept drawing for the Goldenberg House near Philadelphia. The concept was to design a house around a square courtyard that was the focal element in the design. The functional parts of the house would then begin with the geometry of this courtyard and a structural system that would allow the parts of the house to grow independently from each of the four sides of the square courtyard. This was drawn as a square figure with diagonal lines projecting from the four corners defining four quadrants. Each quadrant would contain the activity spaces for a part of the house, but each having one side connected to the courtyard. This diagram defined the major parts of the house and their relationships in black and white (Ronner and Jhaveri 1987:146–149). With the addition of color, however, a number of interpretations might occur. The status of the central courtyard might be enhanced or diminished by the degree of contrast between it and the surrounding activity spaces. The relationship of the activity spaces to one another as similar or different could be defined by color, and a hierarchical order of the whole could be represented as a color juxtaposition. The rationale associated with these colors will continue into the Development Phase, and the Final Design, but may be modified as the project progresses, however, the color emphasis or perceptual weight (Smith 2009) defining the relationship of the parts will remain.

In the Development Phase the task is to give form to the parts of the building. The parts will consist of structural elements defining spaces that support the various functions and activities. The initial conceptual idea will guide this development, and the resulting form and space will express these ideas in three-dimension. Models and schematic drawings are used here. The parts will have differing status in the relationship to one another. It is here where color tectonics will play an important role through the visual emphasis given to these parts.

The Development Phase will begin with study models. Digital models will be used but cardboard models are still the preferred medium. In the early stages, color in these models may be exaggerated to emphasize the primary parts or to clarify their differences. Subtle changes in cardboard color or value can be very effective in communicating these relationships and the conceptual ideas.

In the Final Design Phase colors used as tools in the Development Phase may still be present but modified by materials and the limitations of a physical context that will determine whether the project has a figural presence in this context, or serves as background architecture. An example would be Herzog and de Meuron's Elbphilharmonie in Hamburg. In Development, the parts consisted of a translucent sculptural form containing an auditorium on top of a dark masonry base consisting of commercial activities. The final design had the same parts, but the translucent sculptural form became a textured glass façade, and the base became a color in harmony with the masonry buildings adjacent to the site.

Many well-publicized buildings that are notable examples of color in architecture rely on the building skin to convey the visual imagery. Sometimes this imagery is integrated with the conceptual goals for the building as a whole and sometimes the building serves simply as a prop or billboard for the display of color. Often color decisions are made in the Final Design Phase as an ornamental application where the color imagery is an idea that has no relationship to the conceptual goals of the building. In this methodology, the Final Design color decisions build upon the visual emphasis given to the parts of the building but may add additional layers of visual expression. These will be defined here as Color Imagery. Color imagery in the Final Design Phase is therefore an enhancement of the expressive potential of the building. Color in this phase will not only represent relationships and hierarchies, but add another layer of purpose and meaning to the built project. Color imagery may involve some of the following categories.

<u>Association</u>. Another term is mimesis – the representation or imitation of the real world in art or literature. These associations will range from literal to metaphorical or symbolic associations. An example is Herzog and de Meuron's Winter Olympic Stadium ('bird's nest') in Beijing.

<u>Materiality</u>. The Modern Movement in architecture stressed honesty in the visual appearance of the building. When the presence and essence of a material becomes the primary idea for expression, the color choice for the material becomes a major factor in color imagery. An example is Fay Jones's Thorncrown Chapel in Eureka Springs, Arkansas.

<u>Cultural Expression</u>. The color of a building may conform to traditional values of a place associated with a particular cultural milieu. An example is the Forbidden City in Beijing.

<u>Symbolism.</u> The colors associated with symbolism may also be related to cultural traditions, or they may relate to more literal associations such as red for fire trucks and fire stations (Fehrman and Fehrman 2004:160–165).

<u>Figural Status</u>. The importance of a building in a particular context may dictate a foreground presence in an environment where high visibility is the goal. An example is the Duomo di Siena.

<u>Color Composition and Artist Expression</u>. This is often experienced when multiple buildings are designed as a group or complex and the colors are part of the form in a sculptural array. An example is Luis Barragan's House and Studio.

Personal Expression. The primary goal is to call attention to the project as a unique design and signature expression of the architect. These projects will usually be figural in any context. An example is Will Alsop's Sharp Centre in Toronto.

TOOLS

Color tectonics in the Concept and Development Phases will be primarily concerned with the perceptual characteristics of color juxtapositions and color effect rather than the more subjective characteristics of color preference. In studio and in Color and Light class, students will use examples and do projects that focus on issues where color makes a difference in the perception of built form. These exercises provide a background for understanding the degree to which color becomes a factor in the visual emphasis of the parts of the design. Some of these are:

Figure/Ground. This is the primary tool for creating a color effect that will highlight an element in the design, and give the degree of emphasis based upon the designer's intentions. The juxtaposition of figure and ground is a focus in all design projects and poster presentations and will be a component in all of the tools described here.

Figural Color. When colors are juxtaposed, some have the ability to stand out more powerfully than others. This may be a consideration at any scale, but a particular focus is on the role of figural color in the urban environment. The atmospheric conditions will be a factor is these observations. In Seattle, Washington, which is similar in color to many modern cities, the most figural colors are those at the apexes of the NCS triangle – white, black, and highly saturated hues. In the Seattle region the atmosphere is often overcast and the colors that become figural and appear more saturated in these conditions are blues and yellows. White will remain figural in this light, but black becomes more muted and neutral (Minah 2003).

Color Contrasts. As an introduction to color theory, students do a number of projects using color contrasts. There is a focus on color contrast when lighting is introduced as a color tectonic in the design of interior architecture. Color contrasts also become a factor when the design becomes compositional and color strategies are employed where color harmony is a goal.

Background Color and Camouflage. Designing background architecture is usually a low priority for most architecture students. Architects that get the most attention are usually recognized for their highly visible structures that are often figural objects in the built environment. All cities have background buildings that contribute to an urban fabric that define parts of the city, streets, and neighborhoods. This fabric also provides the background for buildings that are recognized as figural. Color is still important in the design of the individual buildings that make up this urban fabric, but the degree of emphasis in color effect is the challenge. Exercises in camouflage and visual illusion at a building and urban scale are some of the projects in studio and Color and Light class, and these become a basis for the design of background in architecture and urban design.

Color and Form Interactions. A variations of Lois Swirnoff's cube projects are used to show how effective color is at creating and deconstructing 3-dimensional form (Swirnoff 1989). Examples of color and form interactions are evident in case studies in the built environment, and these become examples for reference in the design studio.

Color Unity. There are numerous case studies of color used to create architectural unity, unity of urban fabric in the city as a whole, and in distinct neighborhoods and districts as well. Some of these examples are accomplished with natural materials as in Lima, Peru, and

Jaisalmer, India. Other cities, such as Rome, have created unity by decree using paint and materials of a specified color.

Color and Detail. An architectural detail can represent a smaller version of the larger design. This will be generated by the original conceptual idea and follow the same process in development as described here. In the Final Design the selection of material, the selection of color, and, most importantly, the degree of emphasis given to its visual appearance will be established.

INTERIOR ARCHITECTURE

The design of interior space will follow the methodology described above. Defined space is an essential part of the whole in the building project, and its form will evolve from the initial conceptual idea. Color decisions for interior design differ from those used in exterior design. Color in interior architecture is dependent not only upon the color of materials and surfaces, but upon the color of light, and this presents a wide range of possibilities for color tectonics. Also, interior space does not have the physical context to which an exterior form must respond, and this allows a creative freedom that may not be appropriate for the exterior.

The color of surfaces defining interior space, like form, will employ the tools of color tectonics described above with the addition of color in lighting. In most cases the nuance in daylighting is the primary consideration in exterior design, but the color experience and design of both daylighting and artificial light increase the creative possibilities for interior architecture. The design of space may be compositional where color harmony is a goal, and color strategies based upon color combinations, i.e., monochromatic, analogous, complementary and a variety of color contrasts may be used (Rompilla 2005:165–174).

Students are given projects that focus upon composition and harmony with a black box model of an interior space that allows a variety of color surfaces and lighting through external openings. These are used for exercises in color contrast, compositional harmony, and experiments with color in lighting. One project involves a model of an interior cubic space with an object of their choosing placed in this space. A projecting shaft from one side of this space for photography is part of this model. Students will design openings for lighting that illuminate this space in a variety of ways. Color paper is used for the interior surfaces. The exercise is one of color composition with all of the elements described, but with a clear strategy as the conceptual focus, such as creating a color harmony with the color of the selected object. Other projects involve using photoshop to improve an existing poorly designed space on campus. One of these took an arcaded entry to a large lecture hall built in rough concrete and transformed it into an inviting rhythmic procession using contrasting colors on the structural elements in this arcade.

URBAN DESIGN

Color tectonics is an important tool for urban design, and a subject for study in my studio and Color and Light class. This is a topic that involves much of my research interests, but will have to be the subject of another paper.

CONCLUSION

Since student involvement in the design process described here is a part of this subject, a conclusion will be the analysis and critique of student projects that use this methodology and produce a final design with a color rationale for all phases of the process. Student projects are not built and do have limitations, however, the final design for this work will represent a building approaching reality with three-dimensional drawings and models in color showing materials, details, and interior spaces and surfaces in color and light. Here is a description of a successful project using color tectonics and the design process described here.

The project was the Slow Food Institute for Rome. The rectangular site was at the northwest corner of the Mattatoio (old slaughter house complex) in Testaccio, across from the new covered market. The long sides of the site faced north and south. The concept was the division and expression of the public and private spheres. The building involved two major parts; spaces for public events, and spaces for private activities, i.e., administration, research, housing, etc. The public spaces were to be open, inviting, and flooded with light. The in-house activities were to be private, separate, but with views to the public areas and the market.

The concept diagram was simple – the long rectangle was divided into two adjoining rectangles, rendered in blue and red. The red part defined the public sphere and throughout the development phase, the focus was to bring warm southern light into the public spaces through clerestory windows and a section that allowed the light to reach all of the public spaces. This produced the form for the public part of the diagram. Materials were warm colors bathed in this southern light. The blue part or the private sphere contained smaller spaces with views into the public areas and to the market. Windows were designed primarily for admitting northern light and these had views of the new market. Northern light is cool light and the colors of materials and surfaces were in cool hues. The part of the building where the private sphere and the public sphere intersected became a combination of warm and cool surfaces and details, illuminated with both the northern and southern light.

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The role of color training in industrial environments

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ABSTRACT
A Color Educational Approach is proposed for Industry and Institutional application which will include permanent inbuilt questioning of the instruction process. Several aspects of color education will be considered regarding color material and how to apply color knowledge, including: A) The artistic application and practice of color design as a discipline isolated from notions of productivity and mass application, providing aesthetic practices and theories designed to open minds to new creative possibilities; B) Color trainings in professional areas where color classes are given and attempts made to identify their main opportunities for color use and any corresponding liabilities, hindrances or difficulties arising from such use; C) Finally, a focus on understanding political, cultural and social contexts of color application and color training that may exist in industry either locally, regionally or globally. In the industrial world, color training has commercial objectives: it has to promote products, but it is not the only objective. The approach emphasizes educational benefits of color and design knowledge in order to promote products and the companies themselves. The benefits that result from a color training provide essential advantages in every area of the industrial creation and the building sector. Nevertheless, step by step, numerous stakes appear as color design training makes it possible to question, on a regular basis, the creation process as well as the production process and gives the opportunity to discover constant innovation in this area.

Keywords: *color, industrial environments, knowledge, color language, practice*

INTRODUCTION

The objective of this paper is to question and put into perspective different methods of teaching *couleur* (color, in French) within the academic world or professional environment. The aim is to describe the approaches used to better identify the issues at stake. The three examples describe the approaches that my associates and I, at the company Nacarat, have undertaken with industrial companies, professional city planners and at the University ISCID – Higher Institute of Couleur Image Design in Montauban (University Toulouse 2 Jean Jaurès), France.

We teach *couleur* to creative artisans and trade pros (from product design to architecture, but also within the trades of the city), and aim to train professionals or future professionals to use *couleur* as a tool for their projects. We believe that by mastering *couleur* in its most varied environments allows, not only to accompany projects using *couleuration*, but also as a beautiful tool for creation and imagination, as well as a tool of mediation and/or a political tool. We will attempt to demonstrate hereafter. We defend the rightful place of highlighting this expertise which consists in understanding how to use *couleur*, compose with it, create ranges and master its application in industrial projects. We also defend its capacity to be an artistic discipline in its own right, taking its autonomy and isolating itself from the problems of production and productivity, proposing *aesthetic theories and practices designed to open minds leading to new creative possibilities.* We underline the role of *couleur* as a "political and cultural tool", in urban spaces and industrial environments: The choice of a *couleur* often conveys a history, a symbol or messages and is never insignificant and so it's preferable to master all aspects. In the industrial world, *couleur* training has commercial objectives as well: it must promote products, but that's not all. It's a channel of exchange between disciplines, including non-artistic ones.

Our approach emphasizes this plurality. Through three very different examples, this demonstration will bring a fresh look, rich in ideas on *couleur* training as we conceive it. Each of these training sessions required the contribution of fundamental knowledge, transversal in different domains that was taught in a wide variety of ways and adapted to target audiences.

The three experiences are: a) Instruction in *couleur* models, atlases and codifications; b) Understanding the language of couleur, the symbolic, linguistic or alpha-numeric codes; c) Experiential learning of models and *couleur* harmonies and the knowledge of how to manipulate *couleur*. The trainings were adapted to different needs.

CASE STUDY NUMBER 1

Up against the wall, Immersion training. The first example was an immersive training with city hall employees in the city of Nantes. It consisted in coaching the anti-graffiti team. For those being trained, the main goal was to identify tagged walls and to create a mixture of *couleurs* on the spot and in their trucks, that could replicate the original *couleur* and create a *couleured* mask to cover the wall. Most of the trainees had an academic level equivalent to secondary school, and no training in *couleur*.

a. *Couleur* Theory, to aid in better field practice

The training consisted first of all, in working from *couleur* models, learning and understanding them through simple exercises and creating bridges by mixing these *couleurs* at the foot of the wall. The challenge was to facilitate the work of the field teams as much as possible. The proposed exercises allowed them, step by step, to understand and experiment the three parameters of *couleur*, Hue / Saturation / Brightness. From samples that had been provided, the trainees composed chromatic circles of different clarity. They had to delimit one chromatic space from another (for some, the limits were not very obvious). There were three circles: one saturated, one pastel and one dark circle. Sorting the *couleurs* into three sets was not an easy exercise for some and a few participants began organizing the chromatic elements differently. We saw a progression from one exercise to another, a better understanding and therefore a better adaptation. We then got them to recompose a *couleur* triangle to show the relationship between hue and saturation. We chose yellow – not easy! – but it is close to the chromatic *couleurs* they use every day in the field. This was very beneficial to complete the training. A typical question was, “What do I add to this *couleur* to get to this other *couleur*?” Finally, an exercise dealing with the simultaneous contrast of *couleurs*. This made them aware of the phenomenon, an indispensable knowledge when dealing with *couleur* on a daily basis: we also advised them to wear a white gown or apron, so as not to interfere with their vision of *couleurs* against the fluorescent orange of their field clothing.

b. Creation of adequate tools for everyday life

The second part of the training consisted in the preparation of their own *couleur* chart, made with their paint. This *couleur* chart will serve as a base in their daily work. Some were surprised at what could be achieved with such a *couleurant*, for others this experience confirmed the situation identified in the field. Strangely enough, it was something they had never done before, although they have been working in the field for many years. In order to understand the degree of *couleur* modification when drying and before working on the wall itself, this practice starts with a piece of cardboard on which they were asked to put *couleur*.

Learning the NCS coding system, and equipping each agent with a *couleur* wheel gave them a new base: reading and understanding the coding to analyze what basis to start with, and what *couleurant* to add, and in what quantity. The paint mixtures were stored with the street name and number and usually kept in jars: we suggested that they add the NCS code, so that it would be easier to use in other places. In the afternoon, the practical application was tested in the field. This proved to be essential for a good understanding of the *couleur* process, and the teachers were able to adapt to this operating mode to promote improvement based on the exercises and skills learned in the morning workshop.

c. Knowledge of the practitioner

When we conducted the training, we knew that we couldn't make "perfect" mixes the first time around. It requires time to really understand each medium and their specific particularities. And it's not only an intellectual understanding. It is this humility that we should have as "intellectual" or "thinking" *couleurists*, in front of the practitioner who has other knowledge taken from experiments and know-how acquired over time. To succeed in working with *couleur*, the practitioner has "refined" the intellectual tools (It happens in the brain). Even if these are not verbalized or conceptualized, they are a form of knowledge, or a form of work, which can often be tiring but, they are important to understand.

Figure 1: Immersion program in Nantes. Photo: Nacarat Color Design.

CASE STUDY NUMBER 2

Exploration in applied research: the Lexichromatic Notebook

In France, the only professional Master's Degree, specializing in color is at the ISCID – Institut Supérieur Couleur Image Design, at the Toulouse Jean-Jaurès University in Montauban, France. Courses are available in color theory but also in project practice. Color is taught with an objective to give access and add expertise to design projects in many disciplines (spatial design, object design, scenography, trends and style). The students adopt both a poetic posture (they question the close relationship between doing and knowing), and a posture as a future professional in the world of color, from perception to conception and conception to realization. They learn how to talk about color, but above all, to communicate with and around color: they use the color-coding systems made available by manufacturers (ACC, NCS, RAL, etc.), and also create tools for project communication.

a. The derivative term, putting color into action

The *Lexichromatic Notebook* course invites the student to put color in action, in creation, in words and in projects. The approach, co-constructed with Céline Caumon (2016), university professor at ISCID, and then applied and tested with students, allows the novice color researcher to explore the active and potential qualities of a color. Using a triple analytical method (countertyping, reproduction, classification) to enrich it through lexical, imaginary and poetic exploration, and finally, to give birth to a project or an action that is in the process of being carried out.

Figure 2: Lexicographic Notebook. Photo: Nacarat Color Design.

The student's leitmotiv? Starting from a term and its derivatives, color is put into action or color in motion. Green, Greenish, Greening, Verdigris, …, then moving little by little, in the course of creative and experimental thinking, towards an evolution and exploration of new terms like greenish blue or golden green. In this approach, color is at the source of the creative project, and it is put into action by choosing a real or a derived term that best qualifies the thought process behind the project. Project as a noun but also in a primary sense of the term, to project or “cast out, far ahead”. They choose colors and make one or more countertypes, in painting, and then a standardized countertype using color charts. The next step: the linguistic approach – exploration in the words of colors; the poetic approach – creating imaginary countertypes; the dimension of the project – it gives birth to a project, born out of color. The aim of the *Lexichromatic Notebook* is to train students in applied arts and future designers in an approach to color as the genesis of the project. Exploring the dictionaries of Annie Mollard-Desfour (2008), linguist and lexicographer at the CNRS and author of the *Dictionnaire de la couleur. Mots et expressions d'aujourd'hui (XXe-XXIe siècles)* [Color Dictionary. Today’s Words and Expressions, 20th and 21st centuries], the students must enhance their work from this research around the names of colors. Little by little, the colored material chosen at the outset will be enriched with chromatic, linguistic and standardized references, which will feed into the creative imagination and lead to a project created from color (Mollard-Desfour and Pauliac 2017).

CASE STUDY NUMBER 3

The intra-company workshop

a. A co-construction workshop. The third example was a mission to support the redesign and launch of a collection of architectural textiles for an international company. The "workshop" formula replaced the consulting service that could have been entrusted to the agency in the form of an order. We emphasized the importance of shared work and its efficiency to address trends, the colors of future collections, stories (or story telling) and a deployment strategy in different European countries. We should also underline the multidisciplinary nature of the group: designers, marketing communications management and marketing managers were brought together to work together, which raises the question of sharing expertise and exchanging ideas: mutual listening and understanding, joint formulation of solutions. Therefore, we conducted the workshop during these two days as a co-construction working session. Co-construction uses the asymmetry of knowledge, the plurality of practices and takes a gamble on the regularity of interactions to gradually arrive at a formulation for a solution that satisfies everyone. It allows everyone to build on experience and common knowledge. It is also necessary to consider that the members of a co-construction workshop are not in the position of an “apprentice” or a student, they are the actors.

b. Color as a key facilitator for exchanges

In this context, how do we pass on the knowledge about color? Through guided exercises, by working in small groups to encourage individual appropriation of questions and, by relying on group restitution sessions to consolidate a global approach. In this specific case, color plays the role of mediator or facilitator of exchanges: of course, color is the main subject and object of the workshop, but we quickly notice that we communicate around and with color first. The common language is defined by and with color. An "object" of exchange that we manipulate, that we use in the context of trends, then in the context of the collection: valor, philosophy, narrative, imaginary. Color is the vehicle of a trend, of a collection's story and the starting point for the creation of a tool.

c. Content of the workshop (presentation of the first three steps)

Stage 1 – representations. We first positioned our roles as expert colorist designers by restoring our vision of the product, our analysis of color trends in the world of architecture and life style by proposing some of the raw material for the workshop. This material consists of trend boards divided into four unique design universes, each with a chosen iconography, accompanied by color samples and materials from our color and raw materials and textiles library. The presentation serves as a demonstration “model” of the work of a colorist-designer: trend monitoring, aesthetic and chromatic analysis, creative appropriation, re-transcribing in colors, raw materials and fabric.

Stage 2 – presentation. We invited the design department of the company we were working for to present their trends and their first selection of colors for the future collection: 3 universes / 3 imaginary worlds defined by iconography and key words. 3 specific color schemes. Even though our trend analyses show very different methods and sensitivities, it should be noted that our global visual culture resulted in proposals of color ranges with similarities in nuances, even though descriptions and points of reference varied. From the outset, color has played a mediating role in fostering the meeting of distinct creative cultures.

Stage 3 – crossroads for manipulation and creation: defining the universe of colors for the future collection. In iterative development mode, multidisciplinary groups of three to four people worked on the 3 universes to enrich them progressively. There were three designers: each of them was responsible for a universe and reported on the work from each group. This research gave rise to adjustments in color which gradually lead to renaming the universes. The initial undetermined finality did not allow a sufficient projection to lead to the color ranges of the future collection. Words and lexicons of color were as important as the color itself, even more so when it comes to achieving a creation based on color.

CONCLUSION

To conclude, it seems important to point out that the posture of the trainer(s) in each of the learning situations was different. During the work with the graffiti removal team, the colorists used applied pedagogical program techniques, step-by-step teaching and an exchange of knowledge, from theoretical to technical knowledge. In the intra-company workshop, the colorists chose not to place themselves as trainers, but in the role of advisers or resource persons and organizers who manage time, synthesize, animate, inform and disseminate knowledge at every key moment. Positioning themselves as expertise partners, they dialogued with the designers, marketing services and management without trying to take over, by disseminating knowledge step by step, so as to enable them to overcome the hierarchical relations between them by working together in a common way. Within this framework, color has also become a political tool for dialogue and co-construction.

There are indeed ways of passing on knowledge and savoir-faire, according to our posture and logic of how we pass them on through practice and methodology. They are the teacher, the trainer, the adviser, the resource person and the researcher. In the context of the *Lexichromatic Notebook* project, the colorist became an associate researcher. She invited her students to undertake the work, as one would in applied research. Offering the essential tools for research by transmitting learned knowledge of the prerequisites, she then invited the students to invent, innovate and explore the creative potential of color. Every student was able to explore color, based on their own sensitivity and personal experience, to create a project, a recipe or a concept. Color then became the driving force behind creation: sensitive color, educational color, mediator color, political color, creative color, innovative color.

ACKNOWLEDGEMENTS

Soizic Boucault, Mathilde Laval, Lina Perdomo, (Nacarat Color Design), Celine Caumon, Annie Mollard Desfour.

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Characterization of the full-scale of browning degrees in liquid food models

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ABSTRACT
During food processing, an adequate level of browning, caused by non-enzymatic reactions, may provide desirable sensations, leading to set the end point of cooking in bakery products, meat roasting or caramel candies. Outside the optimum brown range may indicate not adequate cooking, loss of nutritional value or off-flavors. Thus, brown color is psychologically associated to everyday events, such as meal preparation, gastronomic satiety and gratification, and also serves as a factor for food identification and acceptance. Surprisingly, the color of what is perceived as "brown" remains poorly defined, e.g., in the Merriam-Webster Dictionary: "any of a group of colors between red and yellow in hue, of medium to low lightness, and of moderate to low saturation". Due to the meaningfulness of brown color in food systems, many approaches are employed to follow its development. Frequently, absorbance at a single wavelength, 2D diagrams, a browning index (BI), or just L^*, are employed to describe color in the browning processes in many types of food systems. The defined BI was employed in many research papers quite successfully. However, it was defined up to the point in which the samples have light/medium brown colors. In this work, we examine the limitations of 2D chromatic diagrams, describe the time evolution of BI and other selected color functions, and the limits for the appropriate use of the different indexes of browning. We also analyze the behavior of the dilution by water of brown pigments in the chromaticity diagram, in comparison with other water-soluble colorants.

Keywords: *foods, browning index, browning development, color spaces*

INTRODUCTION

Brown is a widespread color in foods. It could be used as indicator of thermal processing degree (Hutchings et al. 2012). Brown color is also psychologically associated to everyday events, such as meal preparation, gastronomic satiety and gratification and also serves as a factor for food identification and acceptance (Color Marketing Group 2015). However, despite the importance of this color in food chemistry, color remains poorly defined in colorimetric terms.

The non-enzymatic Maillard reaction was first reported by Camille Louis Maillard in 1912 (De Bry 2005), and takes place when sugars and amino acids or proteins (common components of foods), are in contact. The rate of this complex reaction is affected by several intrinsic (water content, type and amount of reactants, salts, pH) and extrinsic factors (temperature, relative humidity, time of exposure) (Delgado-Andrade et al. 2010). The final products are brown soluble polymers called melanoidins (Lund and Ray 2017).

Colour development and aroma formation are desirable sensorial aspects of the Maillard reaction, but it may also cause undesirable effects, such as excessive browning, toxic product formation, such as acrylamide, furans (Rannou et al. 2016), loss of nutritional value and off-flavors (Delgado-Andrade et al. 2010). In this way, browning is a marker of food quality during industrial processing. Due to the meaningfulness of brown colour in food systems, many approaches are usually employed to follow its development: a) visual scales, which are subject to subjective aspects; b) absorbance of liquid samples at a fixed wavelength (between 420 and 490 nm). In this case, only light intensity attenuation is analyzed, but no color characterization is possible; c) colorimetric instrumental measurements, involving only one or two-color coordinates, luminosity most of the times (Pepa et al. 2020).

The first definition of Browning Index ($BI = (x - 0.130)/0.172$, where x is the chromatic coordinate; (Buera et al. 1986) includes only the x chromatic coordinate in a specific range and comprise samples which are light/medium brown, up to a purity value of 90%, but it fails to represent the darkest products (such as dark beers, soy sauce or balsamic vinegar). This index has been widely spread in food chemistry and technology for over 30 years (Hirschler 2012). Most food researchers use it without checking whether the studied colour range is within the correct limits.

The objectives of this research work were, a) to challenge two-dimensional chromatic diagrams in the evaluation of the full range of brown color and establish their limitations and b) to propose adequate descriptors for each browning stage. Also, to characterize the effects of dilution by water in comparison with colorants of other colorations.

EXPERIMENTS

In order to study browning evolution due to Maillard reaction, 10% (w/v) glucose (sugar, source of carbonyl groups) and 1% (w/v) glycine (amino acid, source of amino groups) solutions were prepared, resembling the concentrations typical of fresh fruits. As well, six different salts, which are known to affect browning kinetics, were added: sodium citrate (NaCit), sodium malate (NaMal), sodium and potassium tartrate (NaKTart), sodium bicarbonate ($NaHCO_3$), sodium monoacid phosphate (Na_2HPO_4), and sodium tetraborate (borax). These salts (with the exception of borax) are common components of fruits and vegetables. Thus, six different solutions were prepared.

In order to optimize reaction kinetics, the pH of the solutions was set at a pH of 7.30 and thermal treatment was conducted at 100 °C. Different aliquots were removed at different time intervals.

In a dilution experiment, different colorant solutions were prepared in high concentration and sequentially diluted to almost transparent color.

Spectrophotometric transmittance curves were obtained in a Shimadzu UV-Vis 1203 (Kyoto, Japan) spectrophotometer of samples placed in a 10mm cuvette and tristimulus X, Y and Z values in the CIE space were calculated employing ten selected wavelengths for Illuminant C, 2° standard observer (Lozano 1978). Illuminant C was chosen as the most employed in food science.

RESULTS AND DISCUSSION

As heating time increased, samples changed visually from transparent through yellow, reddish and finally dark brown colors. In the two-dimensional chromatic diagram, all six browning curves followed the same path, changing only in the rate and browning degree achieved: all six curves initially overlapped. As shown in Figure 1, as heating time increased, different colour stages were defined: at stage 1 systems become yellow, increasing saturation, at stage 2 hue shifted from yellow to red, saturation remaining constant at about 90%, and at stage 3 they achieved dark brown color, while the chromatic variables decreased.

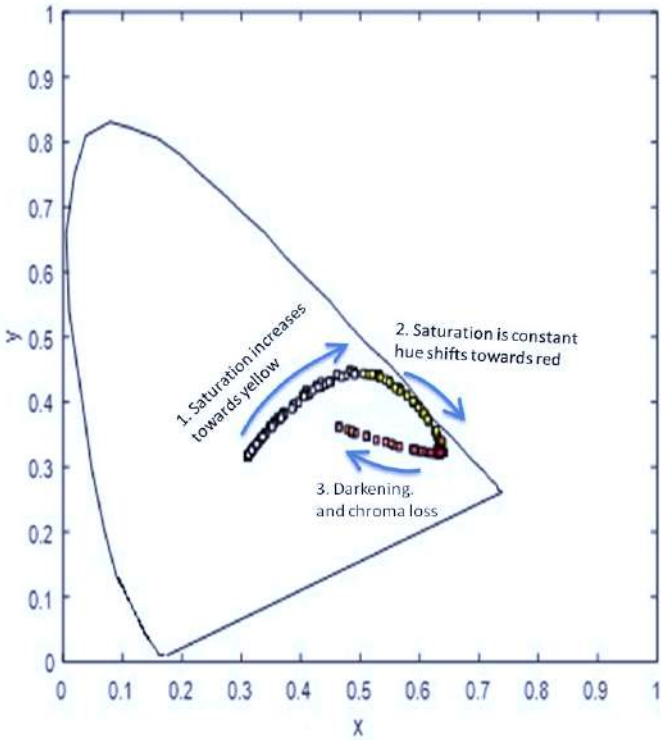

Figure 1: Chromatic displacement of samples undergoing the browning process onto a chromaticity plane (x,y), into the perspective projection of the CIE space in the x, y plane. All formulations followed the same path throughout the heating time (blue arrows). Error bars lay below the symbols.

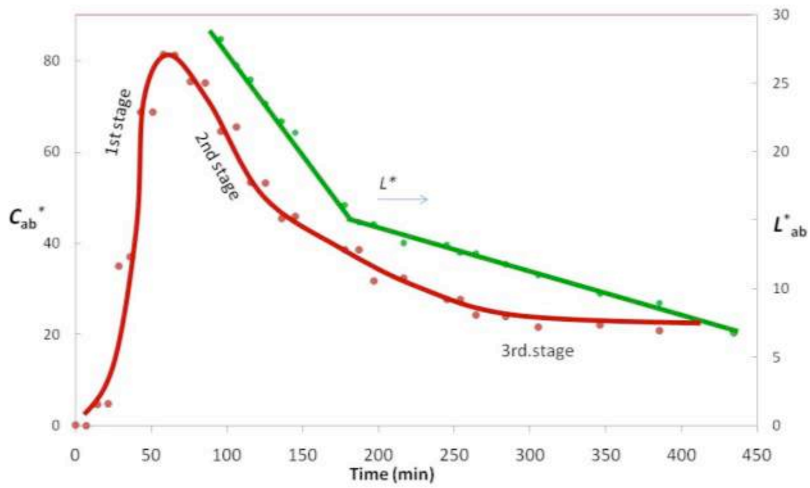

Figure 2: Chroma (C^*_{ab}) and luminosity (L^*_{ab}) for the phosphate buffer samples as a function of time, showing the luminosity decrease and constant chroma value in the third browning stage.

In the third browning stage the browning development path in the CIE 1931 (*x, y*) plane seemed to approach the white achromatic point (Figure 1) (Pepa et al. 2020). However, it was actually heading to the black achromatic point. Some commercial products, such as coffee, cola beverages, soy sauce, dark beers, balsamic vinegar and other drinks are located in this region of the diagram.

As time of thermal treatment increased, in the two-dimensional projections of color spaces of CIELAB or CIELUV in (a^*, b^*) or (u^*, v^*) planes, an initial increase of both b^* and v^* values was observed, indicating a yellow coloration. Then, there was a displacement towards red (manifested by increasing a^* and u^* values). Finally, there was an apparent return of sample color towards the white achromatic point, although the color corresponded to an approximation to the black achromatic point, in a different plane of lower luminosity value.

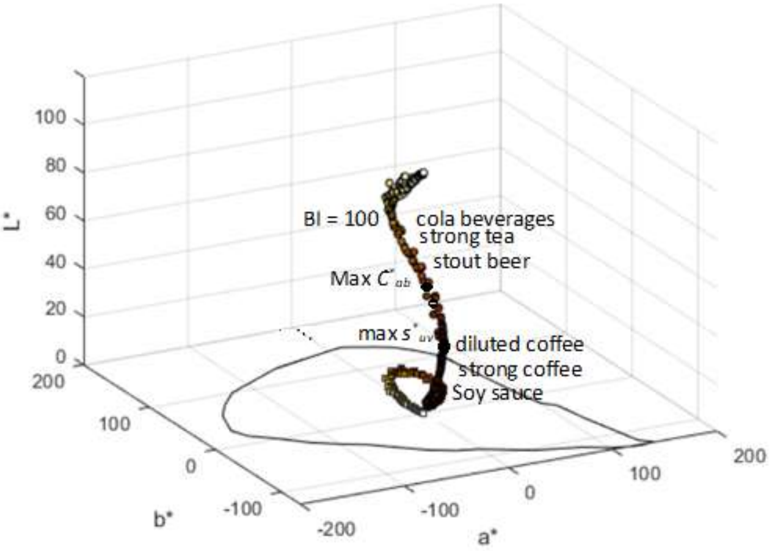

Figure 3: Representation of the browning development path the in the CIELAB space and its projection on the (a^*, b^*) plane. The L^*, a^*, b^* values corresponding to brown liquid foods and the maximum attained values of BI, C^*_{ab} and s^*_{uv} were also located in the space as a reference.

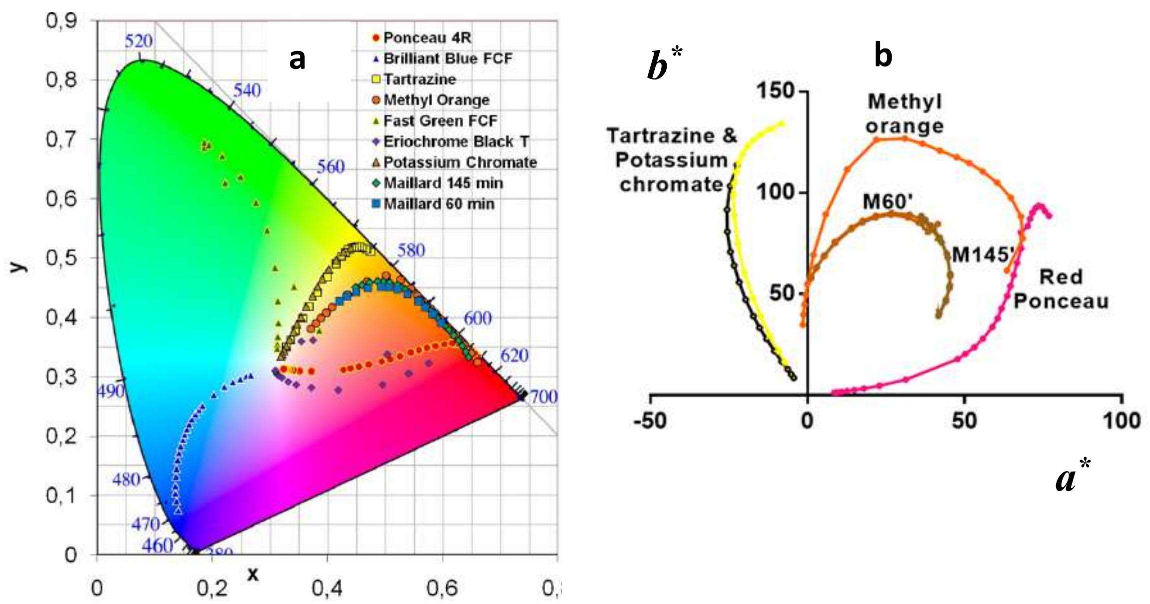

Figure 4: Chromatic coordinates (a) and (a^*, b^*) values (b) corresponding to the sequential dilution of water-soluble colorants (indicated in the graph) and brown melanoidins (Maillard). M60 and M145 represent the values for the melanoidins from Maillard reaction at 60 and 145 minutes of heat treatment.

It is to be noted that in the third browning stage, the chromatic coordinates decreased to very low values as heating time increased beyond that stage and only the luminosity values could be used to follow the progress of the reaction for the darkest brown shades. From the analyzed samples, those containing borax, hydrogen carbonate and hydrogen phosphate achieved these dark colors in the time-frame of the experiments. Figure 2 shows the behavior of chroma, C^*_{ab} and luminosity, L^*, as a function of time. C^*_{ab} reflects the initial increase of the a^* and b^* values and their decrease after achieving a maximum value, up to a point at which C^*_{ab} remained constant, while L^* decreased continuously even in the third stage of constant C^*_{ab}.

The full description of the browning phenomenon was only possible in three-dimensional graphs, as shown in Figure 3, in which typical dark-brown liquid foods were also included as reference. In the first stage, luminosity decreased slightly, while saturation increased towards the yellow zone, *BI* achieved the value 100. The *x* chromatic coordinate was the only parameter which changed significantly. Thus, in this stage, traditional Browning Index was an adequate descriptor. In the second stage, saturation remained high (90%) and the coloration was reddish. There was a luminosity decrease as well and C^*_{ab} reached the maximum value.

Browning trajectory presented a wide amplitude in the chromatic planes at intermediate luminosity values, narrowing as luminosity decreased further, approaching the black achromatic point. Thus, in the third stage, when C^*_{ab} attained its lowest value, the variations in chromatic attributes of color were negligible and L^* was the only color attribute useful to discriminate samples. *BI* and C^*_{ab} represented the browning phenomenon up to luminosity values around 70%, while s^*_{uv} (saturation in the CIELUV space) could be employed even for lower L^* values. Finally, L^*could be employed to detect color changes for those samples which reach the darkest brown colors.

Since in many definitions brown colour is described as the dark colour counterpart of yellow, orange or red: “an orange of low brightness and saturation” (WordNet Search 3.1., Merriam-Webster Dictionary), it was analyzed if the dilution of brown samples followed the pattern of the yellow, orange or red pigments dilutions. Concentrated solutions of water soluble yellow, orange or red colorants and melanoidins at two browning stages (at 60 and 140 minutes of heat treatment) were prepared and diluted, measured and plotted in CIE (x, y) and (a^*,b^*) planes (Figure 4, a and b).

In the chromaticity diagram (Figure 4a) the dilution of the brown melanoidins seemed to follow the dilution pattern of the orange colorant. However, in the (a^*, b^*) plane (Figure 4b) systems of melanoidin brown pigments followed a specific dilution path, which was different from yellow, orange or red colorant solutions. In most of the colorants the hue was maintained through dilution, but diluted brown systems showed not only increased luminosity, but the hue changed. The brown dilutions followed the same path that the samples during browning development (Figure 1). This indicates that the brown pigments do not change during the progress of the reaction, but only their concentration. If brown were indeed a “darker red, yellow or orange”, dilutions should lead to the same path for all samples.

CONCLUSION

Evaluation of brown color development in foods by using either lightness (1D) or chroma (2D) are adequate to define partially the process, but they fail to properly characterize the brown color quality. Single functions: *BI*, C^*_{ab} and s^*_{uv} provide accurate color analysis in light/medium-brown samples. The commonly employed indexes are not suitable to describe color at the later stages of browning, important for many commercial products, which can be characterized by *L**, since the chromatic parameters are not sensitive in this region.

Brown color shows a specific behavior upon dilution: the tendency is different from yellow, orange or red colors, not only in luminosity value, but also in chromatic features. Therefore, brown is a more complex and unique color than merely “dark red, orange or yellow” colors.

ACKNOWLEDGEMENTS

The authors acknowledge financial support from Agencia Nacional de Promoción Científica y Tecnológica (PICT 2018-01822) and Universidad de Buenos Aires (UBACYT 20020170100459BA).

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Blue in *Alentejo*: authenticity and sustainability

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ABSTRACT
The aim is to identify the use of "blue" in Alentejo's architecture, as it does not come from any pigment of that region. This color also exists in the Mediterranean culture, even though its application in architecture is differentiated. The visual verification of the constancy of the blue color's application in Alentejo's architecture combines with local pigments such as ochre, red, grey which are cheaper. However, the social, economic and environmental sustainability of blue, involves its use in religious buildings, the belief of scaring away the bad spirits of houses, protection against insects and capacity of reflecting heat. The identification of zones and the different tones of blue, with a big visual presence of the ultramarine blue, is a result of the prevalence of economic, technical, symbolic and metaphorical aspects in the maintenance of buildings that are painted every year. The pigments have been modified and substituted by paint, albeit the market still commercializes a few types of pigments. The microscopic analysis and the technical aspects that result from them, identify marks of time and variations of its application that are necessary to crosscheck with information in terms of authenticity, as there is a cultural constant that characterizes the use of color in Alentejo.

Keywords: *authenticity, sustainability, blue*

INTRODUCTION
Alentejo is a vast region of Arabic influence in the south of Portugal, where there is the tradition of using lime to paint the houses white every year (Figure 1). The architectural elements – corners, wainscots, walls, and stairs – are painted in color, using pigments or paints such as ochre or blue. Doors can also be painted blue (Figure 2).

The yearly painting of the houses, apart from its maintenance and cleaning, its sanitation and sustainability criteria, acts as a reflector of sun radiation and also possesses insect repellent effects.

Being humans rational, metaphorical and symbolic creatures, it is natural that in architecture these domains are conjugated, as the rational corresponds to the technical field. They are transversal to time, even though sometimes their memory and reason of being get lost. Nevertheless, a ritualization lingers in the transitions that are signed in multiple ways, such as the case of the door that emphasizes the relation between the profane and the sacred. We can mention that, in Alentejo, blue is the noblest color; it was also used to highlight the places where the royal party went, since the King of Portugal had hunting grounds and a Palace in Vila Viçosa. The houses were cleaned for the king's visit. Authenticity corresponds to everything that has been added throughout the time and that becomes part of collective and cultural memory, unifying the territory.

METHODOLOGY

The methodology equates the purposes of the use of blue, aiming to identify unifying cultural patterns of a territory that presents main sets of ocher or blue. The approximation that is made in technical, authentic, sustainable and meaningful order, intends to deepen the reasons why color works as a support in a more profound narrative. This way, we try to understand the identity factors of blue, the reasons for its dominance that persist in collective memory and research of historic facts and factors.

According to the Nara Document on Authenticity (ICOMOS 1994), we can compare these values with those of other civilizations and their diverse frameworks, to bring out the application of blue in technical terms, characterization of the environment and symbolic meaning. Color also involves phenomenology and the creation of moods. The lack of reference to colors in vernacular architecture in Portugal is a critique that can be made to the "Survey of Popular Architecture in Portugal", from the end of the 19th century to the 1950s. Despite being in black and white, the survey omits, for ideological reasons, programmatic and constructive prognoses, an application of color that is frequent in Alentejo and Algarve. There is a greater correspondence to the architecture of the Mediterranean regions than to the architecture of the North of Portugal. This debate still exists today in the country creating a rivalry, on a theoretical level, between the Architecture Schools of Porto and Lisbon.

When equating the question of authenticity, we emphasize what has been added over time and what is in accordance with the way of being of communities, forming part of their collective and cultural memory, unifying the territory. In this sense, the "Nara Document on Authenticity" (ICOMOS 1994), reveals the desire to apply the concept of authenticity to contexts that respect the social and cultural values of all societies, deepening the spirit of the Venice Charter (1964), and meeting current concerns about the concept of cultural heritage. In terms of authenticity, one can consider the cultural aspect with the adequacy (of its time and place, the collective memory and tradition), the material aspect (pigments and paints), and its relationship with the qualities of the support (textures).

The question that arises regarding the use of pigments is that blue is rare and its application appears as a counterpoint to ocher, reddish and grey, poorer colors that mix with lime or just water. When blue became a noble color, its use in architecture represented an elevation of status. Thus, it was also used in Alentejo in the paintings of architectural elements of the areas where the king passed, sacralizing the route and representing an immaculate architecture painted in white and blue. The cartography of blue crossed with the routes of the royal delegations, could establish zones of influence, associated with local, environmental and symbolic characteristics.

The creation of an architectural identity, where color plays a relevant role, leads us to an anthropological aspect that is linked to construction systems resulting from the materiality of the places. The "blue of Saint Susana" characterizes the color of a small village near Alcácer do Sal, which is completely painted in blue and white. This blue is the reference of the predominant blue in Alentejo. This village is part of the European Genuineland Network that aggregates rural cultural tourism in several European countries (Rodrigues and Rodrigues 2009).

Figure 1: Estremoz (left). Glória (right). Photos: RBD, 2020.

Figure 2: Vila Viçosa (left). Areias (center). Estremoz (right). Photos: RBD, 2020.

Figure 3: Areias (left). Vila Viçosa (center). Estremoz (right). Photos: RBD, 2020.

THEORY

The oldest blue (known to be) used in Alentejo is the "Indigo of Almodôvar" (13th century). It was used in whitewash with a high degree of degradation due to adverse weather conditions, so its original records are more difficult to find. One of the oldest references is the "Blue of Aljustrel" (16th century). The other shades of blue are more recent, dated from the 19th century, such as the case of ultramarine blue, a noble color introduced in the country according to registers of 1828 and that became part of Alentejo's architecture (Figure 3).

Also, cobalt blue, indigo and other blue dyes were used precariously in the whitewash due to their small duration. Natural pigments have mineral origins, obtained from nature through the process of purification, to separate all the other elements associated with it. In ochres, the color is given by iron dioxide. There are variations in the blues used, but the ultramarine blue has a dominant presence (Gil et al. 2009). Ultramarine blue came from lapis lazuli from the Badakhshan region, in Afghanistan (Ball 2012). Currently, Chile is also a big producer of this color.

Figure 4: Elvas (left). Terena (center). Glória (right). Photos: RBD, 2020.

Figure 5: Estremoz (left). Photo: RBD, 2020. Ericeira, a coastal village north of Lisbon (left center). Photo: RBD, 2016. Santorini (center right) Photo: Maria Rebelo, 2015. Sidi Bou Said (right). Photo: RBD.

Figure 6: Estremoz (left). Vila Viçosa (right). Photos: RBD, 2020.

Historically, there were changes in the status of blue, as the techniques used by the Egyptians produced an ancestral color obtained from the fusion of copper, silica and limestone that was probably the first synthetic blue pigment (Anon. n.d.).

The Maya invented a paint that is at the base of all the pigments we use today. In 1931, scientists discovered very bright blues in the ruins of Chichén Itzá, Mexico. This blue, resistant to the passage of time, erosion and biodegradation, is considered the precursor of hybrid pigments. These are created using a mixture of organic and inorganic compounds, where the color is due to a very efficient organic compound, but unstable in the light. To overcome the deficiency, it is used an inorganic stabilizer that works as a pigment coating, avoiding discoloration over time. Researchers from Francisco Verdú's team, from the University of Alicante in Spain, inspired by the Mayan principles, developed a new method for the production of a new type of blue nano-pigment that combines the best of organic and inorganic (Chiari et al. 2008).

In the Mediterranean cultural matrix, these aspects reveal a constructive pragmatism and the need to respond to the ambient temperature. Lime, as well as blue, is a reflective product that reduces the temperature of building materials.

Recently, the discovery of the Y(In,Mn)O3 blue reinforces this characteristic because, in addition of being non-toxic, the blue pigment is more durable and reflects heat, keeping buildings colder (Li and Subramanian 2019).

The symbolic and meaningful aspects of blue derive from another order of magnitude: identification with the sky, the intangible and indefinite. With changes in society's values market, pigments were replaced by paint.

The construction followed new paradigms but there is still a market segment that maintains the tradition, which functions as a deposit of time in space. The overlapping of lime layers and paint with pigments create a vibration effect under the light that is incompatible with the paints on the market. It is a quality that is aesthetically valued in painting and architecture, where the interaction between light and color on the support material is highlighted. Vibration and variability accentuate the texture of architectural surfaces under the sun.

The visual verification of the constancy of the blue's application in Alentejo's architecture includes cheaper local pigments, such as ochre, red, and grey (Figure 5, left). Also, military architecture is related with colors like ochre (Figure 4, left).

In architecture, there is a combination of technical, metaphorical and symbolic domains that are transversal to time and through which there has been a loss of memory and reason of being. However, the ritualization in transitions that are signed in multiple ways remains, as it is the case of the door that has three scopes in architecture: the relationship between inside and outside, private and public, profane and sacred (Figure 4). By analogy, one can enunciate a principle that takes root in a previous tradition of marking the natural hazards in caves or the human body, as it is the case of the eye or mouth paintings. It is in this domain that color acquires a deeper meaning and symbolism.

This way of signaling the entrances and windows of the houses with blue, to expel the evil, is rooted in a sacralization of the private space that must be maintained. As well, they are painted blue in response to natural conditions – reducing temperature and as a mosquito repellent (Figure 4, right). This seems to be a common belief (Lenclos and Lenclos 2016:241), however, more research has to be done to learn how to use color based on knowledge about the insects' perception of color and their behavior towards it. Sometimes color is specifically mentioned in the administrative regulations, e.g., whitewash for the façades and blue for doors and wooden lattice of the windows, as ordered by Baron Rodolphe d'Erlanger in 1915 in Sidi Bou Said in Tunisia (Lenclos and Lenclos 2016:220).

This dominant characteristic in the region grants it its cultural identity that is extended to some coastal areas in Portugal (Figure 5, left center).

In Mediterranean zones, such as Greece or Tunisia, mainly on the islands of Myknos and Santorini (Figure 5, center right) and at Sidi Bou Said (Figure 5, right), other shades of blue are used, but the context is different. The doors, windows and shutters are painted blue, as well as some domes, balustrades and railings.

Nevertheless, we can highlight that the ancient Greeks never used blue – besides the Minoans – as it was intangible, since this color only existed in the sky or the sea.

CONCLUSION

The status of blue has changed throughout time. Its metaphorical and symbolic meaning, combined with technical qualities, made its application in architecture emblematic: cultural appropriation of blue regarding technical aspects (temperature control), environmental (protection against the heat and the mosquitos), of representation (identification with the ennoblement of houses), cultural (expelling of evil and spirits). This ability to reflect heat, to drive away insects, to create protection and ennobling, leads to blue color's wide range of applications, in addition to being a practically consensual, phenomenologically pleasant color (Figure 6).

Ultramarine blue has a more relevant status due to its provenance – the lapis lazuli – but the ancient uses of Egyptian blue or Maya blue are also worth mentioning. Today, it is a domain of nano-technological research.

In Alentejo, architectural references are used to create a cultural identity of Mediterranean characteristics.

This narrative is missing from the reference literature on vernacular architecture in Portugal that needs to be studied, restoring its cultural importance.

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Color as a distinctive quality in visual identity: analysis of dominant color in brand identity in relation to the perception of the recipient

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ABSTRACT
The impact that colors have on our emotions and feelings is widely recognized. For example, the color red has been associated with anxiety, orange is perceived as a de-stressor, violet as dignity, yellow as a giver of encouragement, and blue with safety and comfort. However, some colors are associated with different emotions and some emotions are associated with more than one color, which is explained because although the capture of color occurs in a first stage in a common way for all individuals, the processing of this stimulus varies in each person and the associations that arise from it become subjective, unique and particular. Individuals perceive according to the context in which they are and under the filter of previous knowledge and sensations they have experienced, which are activated in their minds when they come into contact with a certain color. Starting from this premise we can study the colors and perform this investigation. The research, then, proposes to carry out a journey on the theory of colors, their perception, the importance they have in design, the phenomenon of perception and particularly the perception of colors, the foundations of visual identity and the thread identification of a brand. In this way, starting in general and approaching the specificities of the research, we will be able to understand the fundamentals of the study of colors when creating a brand, the potential of color as an identifying sign, and the need to understand the public and their experience with color.

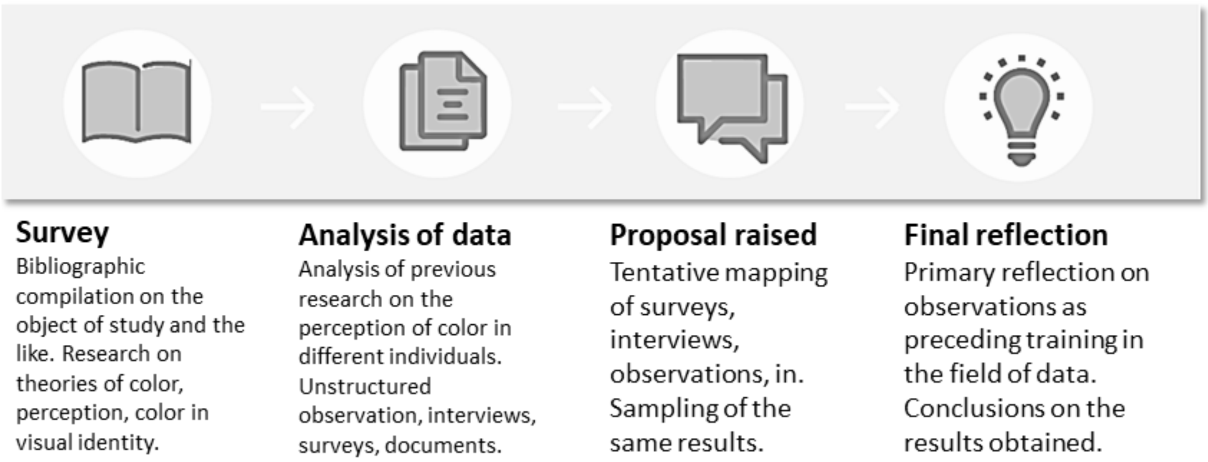
Keywords: *color, language, emotions, identity*

INTRODUCTION

The present work seeks to understand the importance of color as a distinctive quality in visual identity based on the analysis of the dominant color in various brand identities and its color range in relation to the perception of the recipient. The project aims to approach color as a sign loaded with meaning capable of communicating the underlying values behind a graphic brand. Currently there are many studies and research on color as meaning and the sensations caused by the same phenomenon. What we propose here is to analyze whether the recipients to whom the visual messages of the identifying signs are addressed perceive the values and feelings that the brands wish to communicate. To understand this operation of the influence of color, this work is developed in three parts. The first dedicated to the theories of color. A second stage based on the study and analysis of color as a perceptual sign and, finally, an approach based exclusively on the link between color and brand identity (Figure 1).

The methodology includes a survey, data analysis, a proposal and final reflections, and the objectives are stated as general and specific.

METHODOLOGY



OBJETIVES

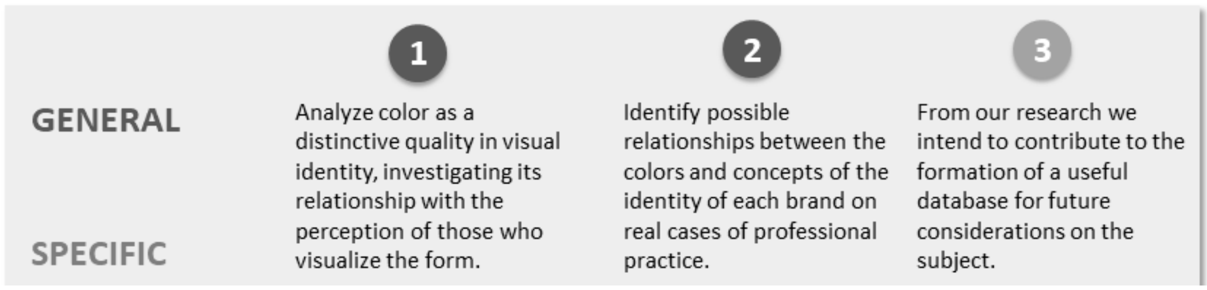


Figure 1: Schematic graphics of the methodological process and research objectives.

COLOR AS MEANING

Talking about color presupposes talking about its sensation, the feelings it suggests, its harmonies and symbols, mainly the role it plays in visual communication. We speak of color as a perceptual and communicative sign since, perhaps more than shape, colors have the ability to penetrate deep into our brain. It is one of the visual elements that best informs about the state in which we are. This information is usually faster and easier to decode than a linguistic sign (Figure 2).

Color, as a visual form, has as much articulation capacity as a word and as a sign, it is the most valuable medium for transmitting sensations and communicating what we want to communicate. The language of color is one whose signs is chromatic and just like all signs is made up of a signifier – the expression of the color itself – and a meaning or content.

Color is about a psychic perceptual sign, composed of a chromatic image and a concept, attributed by each individual in particular. Although this correspondence is subjective – for the same signifier there may be different concepts – they all have the same value. This is what enables us to think of a possible general guide to color perception (Heller 2004).

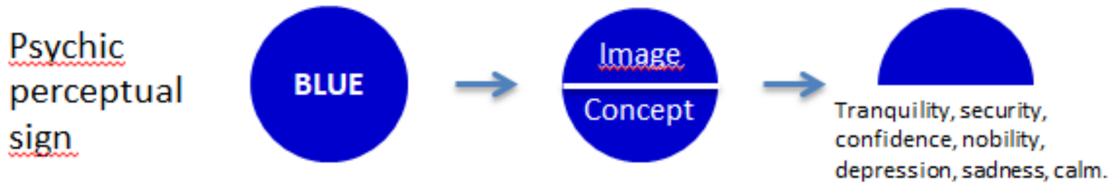


Figure 2: Color scheme as a perceptual sign (blue), image or concept, and associations.

COLOR AND BRAND IDENTITY

The process of "construction" of the brand identity can be thought from a methodological scheme where the identifying characteristics are established through three conceptual lines, which come from the name, form and qualities of the subject of visual identification. The intention is to establish nominal, formal and qualitative references (Prause 2004) (Figure 3). Within this last line are the chromatic referents as attributes of an identifying subject, in an associative unit of name, shape and color.

Like visual forms, colors have a very high level of communicability, insofar as associations with visual and verbal forms can be produced to complete the identification chain (Capriotti 2009).

On the other hand, the recognition of brand signs is developed according to an "identification chain" (Chávez 2007) according to the following sequence: linguistic sign, shape, color (Figure 4).

	IDENTITY OF THE SUBJECT	
NAME	FORM	COLOR
	REFERENTS	
VERBALS	ICONIC	CHROMATIC
	TRANSFERS	
LOGOGRAPHIC	ICONOGRAPHIC	QUALIGRAPH
	VISUAL IDENTITY	

Figure 3: Verbal-chromatic model in visual identity management.

Figure 4: Construction of brand identity.

We know that with color, sensations and mental presuppositions become that color represents and communicates, adding an emotional charge, connotative to identity and a notable aesthetic force, therefore a color cannot be arbitrarily attributed to the construction of a visual identity.

Color must always accompany the feeling that the entity represented by its own name and form successfully completes its identification.

ANALYSIS LEVELS

In order to generate meaning, this methodology proposes the journey through three levels of structuring:

Axiological: it constitutes the deepest level, in which the fundamental values that form the structure of society are involved. In this way, its foundations cement a certain construction of meaning.

Narrative: refers to the intermediate level, where these values are articulated in a more or less structured story or narrative: At this level there are different possible types of narrative that must always respect the basic principles of narrative grammar.

Discursive / superficial: it responds to the superficial level, where both the values and the narrative structures become enriched by the contextual elements of the real and concrete world that allow their identification.

ANALYZED ENTITIES

The analysis was carried out on six entities of three different categories (Figure 5):

Figure 5: Fast food (left), TV cable and Internet (center), financial institutions, banks (right).

AUDIENCE AND SURVEY

In the selection of the case studies, the brands chosen were brands present in the city of Santa Fe and known to all citizens. The objective of this part was to determine if the feelings and associations that Eva Heller (2004) had assigned to colors on the basis of a survey carried out in Germany and published in her book *The Psychology of Color* coincide with those of people in Santa Fe.

Finally, the colors and brand "entities" of each of the identities analyzed in the previous chapter were recovered and a survey was carried out on which colors the audience believed were most relevant to represent and identify a group of brands (banks, entertainment and fast food).

The following general questions were first raised:

1) Do you consider that colors convey feelings or emotions?

2) How important are colors for brands?

With the following result:

In this first instance, the survey concluded that out of a total of 219 participants, 83% answered that colors effectively convey feelings or emotions, and 16% answered that they do sometimes. In this way, only 0.9% of the participants maintained that colors do not convey feelings or emotions. The first general hypothesis sustained in the research is corroborated that colors effectively convey emotions and feelings. This is a reason why designers should take into account that a large percentage of the public is aware of this quality when thinking about the colors of a sign of visual identity.

Regarding the second question about the importance of colors for commercial brands, 69.9% of the survey participants stated (on a scale from 1 to 5; 1 being none and 5 extremely important) that colors are extremely important in the construction of a brand identity

(5=extremely important). 25.1% said colors are important (4=very important) and only 4% said colors are moderately important (3=moderately important). In this second instance, it can be concluded that the participants not only recognize the ability to identify and transmit concepts that colors have independently of brands, but also recognize that colors are very important for the creation of a brand and the identification of a company.

In this second stage, we proceeded to verify the sensations that colors can cause, offering three options, within which the group of sensations offered by Eva Heller (2000) for each color was given. For reasons of space, it is not possible to display the graphs, but the survey confirmed that between 50% and 80% of the respondents coincide in the same group of feelings and emotions transmitted by a certain color present in the questionnaire. It allows a first and incipient conclusion that, indeed, generalities can be established about the feelings that each color transmits.

In a final stage, the participants surveyed replied in particular to the case studies analyzed (banks, fast food, entertainment). The colors that the analyzed brands use for their identities were given as options, thus they were asked what would be the colors that they would choose to represent these companies. With this, it was sought to know if the participants can relate a certain color to an entity, if it is perceived even though it cannot be theorized, or if there is no real link between the brands and the way the participants perceive the colors. The participants were faced with the questions, what colors would you choose to represent the brand (visual image) of an entertainment, internet and cable TV company? In all cases, although the results are not as clear as in the selection of a group of feelings that are transmitted by a color, it can be recognized that clearly a majority of respondent support the choice of certain colors for each case study.

In the first case, when surveying the visual representation of the species “banks”, 39.7% responded that they would choose dark blue, while 26% variations of the same hue (blue), confirming indeed that those who do not know about design understand that the color blue conveys security and legitimacy characteristics expected of a banking company. In this case we can say that for those who do not belong to the world of design, it is clear that colors must be applied to brands that effectively convey the sensations that color independently transmits.

In the second case, where the question was asked about choosing a color for the identity of an entertainment, internet and cable video company, the answer was more varied. In the first place, the Orange color was chosen as the one indicated to make an entertainment brand, which although it does not correspond to the colors that were analyzed in the brand identities of the case studies, it has a logical and easily interpretable basis. In the previous stage of the survey, 80% of those surveyed affirmed that the color orange represents dynamism, joy, fun and activity for them.

Qualities easily attributable to a company that is responsible for offering entertainment services. Second, the color chosen by 21.5% of those surveyed was red, which is positively verified with the colors analyzed in the entertainment brands of the case studies. Within this choice, we can see how again people who do not know about design perceive the sensations that colors convey; they chose red because for them in an earlier stage it represented speed, something they expect from the company that they order their internet and cable services from.

In the third case, when asked about the color that should be used to represent the brand of a fast food company that was analyzed in the case studies, the results of the survey are: Yellow = 40.6%; Red = 27.4%; Green = 11.4%; Violet red = 13.2%; Others = 7.4%. It was verified positively that red and yellow are the colors chosen by the respondents.

What is surprising is that contrary to what is held about red as the color par excellence and the one most used by fast food places, yellow would be the color that those who do not know about design, held more pertinent to identify a fast food place. In this way, the audience might prefer that the food place and the company be sincere, friendly, and close to the public, rather than fast, and hasty.

SOME CONCLUSIONS

Something that was the problematic situation that gave rise and founded the choice of the topic, was that according to a previous hypothesis, colors are not used correctly according to the sensations they transmit since it is indeed verifiable that colors are powerful signs of identification and significance. This point is the one that corresponds to the first great conclusion: indeed, all the audience to which designers are targeting their productions is aware of the impact of colors in relation to their own sensations and their own psyche. This is a conclusion that I consider extremely important, since the audience you are speaking to can be reinterpreted; an audience that leaves aside the merely intuitive interpretation to be able to recognize the use of color that they expect from certain brands. Through this investigation, this research can conclude that it is undoubtedly due to take into account that the audience gives a high degree of importance to the colors in the brands they decide to buy from and on the other hand, everyone recognizes that colors convey sensations and they associate them directly with the values that the brand seeks to express. Regarding more particular conclusions about colors, I can establish that although I have corroborated that colors and the sensations that they transmit are still a highly subjective area, it is possible to observe that between 60% and 90% of those surveyed have chosen the same group of sensations assigned to a certain color.

ACKNOWLEDGEMENTS

Special thanks go to Designer Agustina Bolatti, who participated with a graduate thesis in the research project making an important contribution to field work (surveys) in Germany and Argentina.

My eternal thanks to the Faculty of Architecture, Design and Urbanism of the Universidad Nacional del Litoral, which has financed all my research projects on color and form.

My considerations to the Argentine Group of Color (GAC), the International Color Association (AIC) and the Society of Morphological Studies of Argentina (SEMA) that has allowed me to make the product of my research known, as well as to the funding agencies and anyone who has helped me in the research and is not listed as a co-author.

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Unveiling the potentials of colored light in relation to other sensory stimuli for atmosphere design

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ABSTRACT
Contemporary dwelling aesthetics progressed in the past decades under the influence of reemerging interest in the phenomenon of atmosphere. Theoreticians and practitioners related to artistic disciplines have been opening paths for establishing new aesthetic foundations, such as the "atmospheric perception" and the "thingness of light". Along this new path we find theories of the expanded understanding of the human senses. This research looks at ways that the diversity of sensory stimuli of a spatial setting, more specifically the visual stimuli of colored light, impact human emotional states, since atmospheres happen through the interaction between the surroundings and the observer. The practice-based experiments, set through the immersive micro-spatial situations, rely on the hybrid methodological tools of participant observation, group discussions, and feedback collection through questionnaires. The two experiments presented in this paper aimed to explore and capture responses to a spectrum of sensory stimuli. The main outcomes take the form of the visual representations and the documentation of individual accounts, which demonstrate the potentials of combining or not combining the colored light with other stimuli in a spatial setting. This research informs design practices, willing to integrate multiple aspects of sensory reality, and hence atmospheres. In terms of further research, it could focus on the tools that help designers to name and integrate diverse sensory stimuli and better understand how colored light takes part amongst other stimuli in atmosphere design.

Keywords: *atmosphere, senses, colored light, experience*

INTRODUCTION

Contemporary dwelling aesthetics progressed in the past decades under the influence of reemerging interest in the phenomenon of the atmosphere. A key figure in the aesthetics of atmospheres, the philosopher Gernot Böhme (2017) played a crucial role in defining atmosphere, including light as "belong[ing] to new aesthetics" and opened a path for practitioners from different artistic fields to embrace the phenomenon easier in their work, in terms of production and reception of atmosphere. The architect Juhani Pallasmaa's theoretical work expanded the understanding of spatial perception from visual to multisensory, or atmospheric perception. The architect Peter Zumthor, for his part, took an essential practice and material-based approach on the singularity of the atmospheric experience.

In terms of the practical artistic examples, visual artist James Turrell's colored light installations and architecture can be said to incorporate all of the above-described concerns through a particular work with light and color. His work reveals the new aesthetic categories, the multisensory nature of perception, and the physicality of light. Art historian and theorist

Amanda Boetzkes (2010: 106) quotes Turrell in order to define his focus: “My interest in the perception of light is in giving it thingness. It exists just as a physical object has a presence.” His work expands the ways in which space, light, and color are experienced by creating spatial setups of experimental colored light hues, gradients, and intensity. Turrell’s work has greatly influenced the visual culture, be it the film industry, advertising, photography, marketing industries, or pop culture in general, in attempts to convey spatial atmospheres. However, these attempts often ignore the multiple aspects of the sensory reality and thus reduce the role of colored light as a solely stylistic concern. The first part of the research described in this paper was done while the author was a MA Lighting Design student at Edinburgh Napier University, Edinburgh, UK.

THEORETICAL POSITIONS

As Böhme (2017:15) suggests, atmosphere fully depends on the perceiver: “The atmosphere is something in between subject and object. […] Atmospheres are not beings like things; they are nothing without the subject feeling them.” This aspect encloses a fundamental core of the phenomenon: „the mood of space“ does not exist by itself, it needs somebody who would perceive and experience it through their presence. The research focus put on the materiality aspects essentially, would be unproductive, because atmosphere „happens“ through the interaction between the surroundings and the observer. In a similar tone, the philosopher Tonino Griffero (2014) points out that “[a]rchitecture does not produce atmospheres, but only evokes them in the users.” Thus, this research looks at ways that the diversity of sensory stimuli of a spatial setting, more specifically the visual stimuli of colored light, impact human emotional states.

What are the basics of human perception: the process of interaction between sensory stimuli, sensory receptors, human interpretation? According to the knowledge from cognitive psychology, when a sensory stimulus such as smell, sound, or light and color, encounters our sensory receptors, such as the eye or the ear, it is called exposure (Figure 1). Receptors send impulses to our brain and it activates certain parts of brain attention. It leads to an interpretation of this signal and reaction to it.

Most commonly we refer to the five basic human senses: sight, hearing, touch, smell, and taste. When looking at the theories on human senses more in-depth, we encounter much wider perspectives. Under the influence of Rudolf Steiner’s philosophy, Albert Soesman in his book *Our Twelve Senses* (1999), in addition to the five basic senses, names seven additional ones: a sense of balance, sense of movement, sense of temperature, sense of speech, sense of thought, sense of life and sense of ego. These senses are of high value when it comes to the atmospheric experience, which goes way beyond the five senses. In this case, it is relevant to add to the list of senses (Figure 2) the “sense of space” – a notion theorized by the philosopher David Morris in his book *The Sense of Space* (1997). The concept of the sense of space encompasses the ability to situate oneself in space through different types of corporeal interactions, such as proximity and habit. The two experiments presented in this paper aimed to explore and capture responses to a spectrum of sensory stimuli.

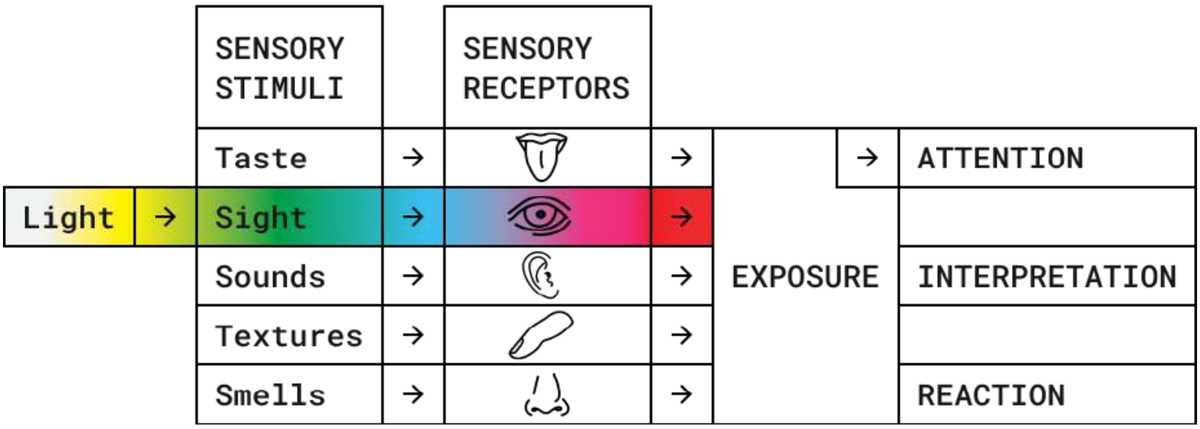

Figure 1: Sensory perception scheme.

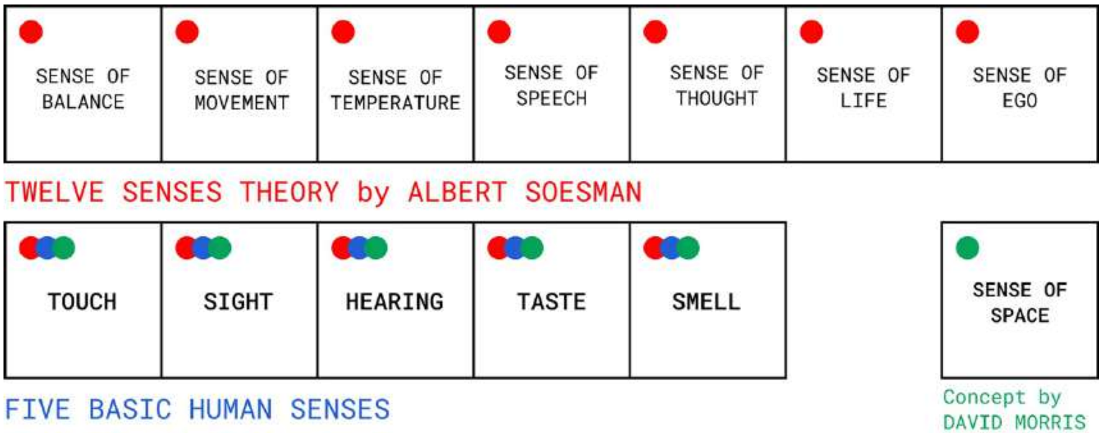

Figure 2: Illustration showing the extended view on human senses.

FIRST EXPERIMENT: WORKSHOP "THE LABORATORY OF IMMERSION"

The goal of the workshop "The Laboratory of Immersion" was to explore atmospheric experiences through micro-spatial situations designed to stimulate a particular combination of senses. This interactive experiment was conceived as an exhibition that took place in The White Space Gallery, in Edinburgh in 2018. "The Laboratory of Immersion" consisted of four interactive light installations (Figure 3) designed by the cross-disciplinary creative team: the music composer Michael Williamson; the exhibition architect Anant Basudev Shadangi; the mechatronics engineer Nicolae Preda; and, the author of this paper as workshop leader and light artist and designer. The methodology was based on the qualitative and quantitative data collection through questionnaires and participant observation. The questionnaire was based on the gauge of participant stress levels, which is typically used by the psychological analysis method, that aims to capture the change in emotional states. Participants were asked to mark their stress level from 0 to 10, before and after experiencing every installation. This research and data analysis were done in consultation with two clinical psychologists, Dr. Molly Bruce and Canan Bekas, at Edinburgh University.

A. "The Bubble" was designed to stimulate the sense of space and the visual sense. The installation consisted of a 1-meter diameter bubble shape; RGB LIGHT controller, adjustable by the user. Participants had the opportunity to put their head through an opening to the inside to experience being surrounded by color.

B. "The Sphere" was dedicated to the sense of balance, vision, and hearing. The installation design consisted of an inflatable mat to stand on the ground in order to experience the instability and to become more aware of the balance sense. The moving light patterns were projected on the convex shape and played in synchrony with the set of composed sounds.

C. “Projections” addressed the sense of movement in space, vision, and sound. Participants were given a ball with an integrated sensor, which allowed them to move the ball while moving in space and in consequence to change the colored light projections and sounds.

D. “The Cylinder” was designed to stimulate peripheral vision, hearing, and the sense of place. The installation had a curved shape, so to cover the peripheral vision and to simulate the sensation of being in space. The moving colored light patterns were projected on the shape and played in asynchrony with the set of composed sounds.

A B C D

Figure 3: “The Laboratory of Immersion” consisted of four interactive light installations: “The Bubble” (A), “The Sphere” (B), “Projections” (C), ”The Cylinder” (D).

RESULTS OF “THE LABORATORY OF IMMERSION”

The results of this workshop are two-fold: the gauge of the participants’ stress level and the descriptions of their behavior and reactions under the influence of different sensory stimulation.

1. The most radical change of stress level was after experiencing “The Bubble” addressing the sense of space and visual sense: the average stress level dropped down 2.8 points, from 4.9 to 2.1. Participants identified “The Bubble” as “the most immersive and relaxing experience.” The average of participants’ stress level after experiencing the installation “The Cylinder,” addressing vision, hearing, and sense of place, dropped down 1.6 points, from 3.8 to 2.2 (Figure 4). As a general remark, the data showed that participants' stress levels dropped down by at least 2 points after the workshop. Participants were the most relaxed after experiencing the sense of space associated with the visual and hearing senses. They found this particular combination the most impacting, as well as the interactive aspects of the installation the most engaging. These results showed a noticeable impact on stress reduction.

2. Participants tended to repeat the interaction with their favorite installation and were sharing their experiences and feelings with curiosity. Their involvement made the event last longer than planned: the exhibition space was said to make them feel relaxed and inspired, and thus making them stay and explore their senses. Some participants’ feedback include statements such as the following. “I feel more relaxed and really enjoyed the experience, it was immersive and relaxing. It gave me shivers at some point.” “Loved the show. It was a constant curiosity that got me thinking about all sorts and nothing. I could escape for a moment, which would sound short, but it was ages and just enough to create an impact.” “It is very immersing thanks to the design of lights.” In summary, both quantitative and

qualitative results show that sensory stimulation of colored light in combination with other senses generally had a more positive impact on the participants' emotional states.

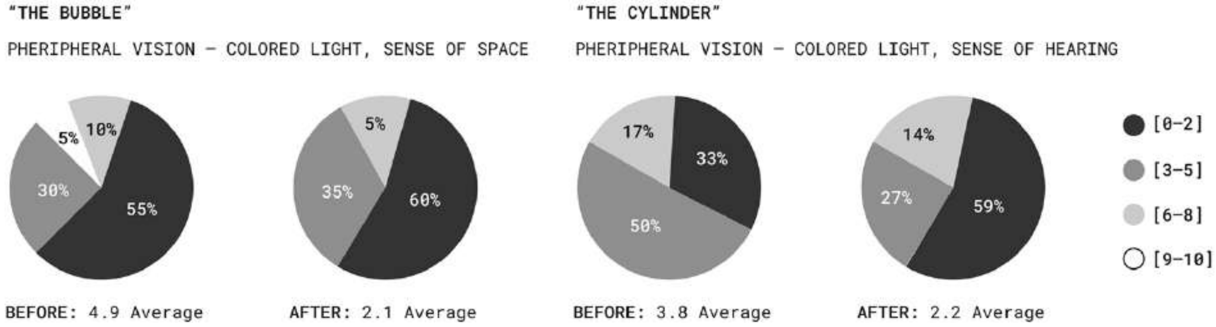

Figure 4: Diagrams showing the results of average stress level before and after experiencing: "The Bubble" (left pair): 4.9 and 2.1; "The Cylinder" (right pair): 3.8 and 2.2 points.

SECOND EXPERIMENT: WORKSHOP "THE COLOR SENSE LAB"

The goal of the experiment "The Color Sense LAB" was to capture how visual senses stimulation by colored light affect observers' emotions. The workshop took place at the Vilnius Academy of Art (Lithuania) in 2019, and consisted of two sessions with 18 participants in total. Participants were exposed to seven colored lights (in a following order: black, white, purple, red, yellow, green, blue) projected one by one on a big screen for one minute each (Figure 5). At the end of the session participants had an open discussion to share insights. The methodology for this capturing thus relied on the gathering of participants' individual accounts on the emotional impact of the colored light, which later were categorized as either negative, positive or neutral associations.

Figure 5: Workshop photographs showing participants exposed to purple light (left), red light (center) and green light (right), projected on a big screen.

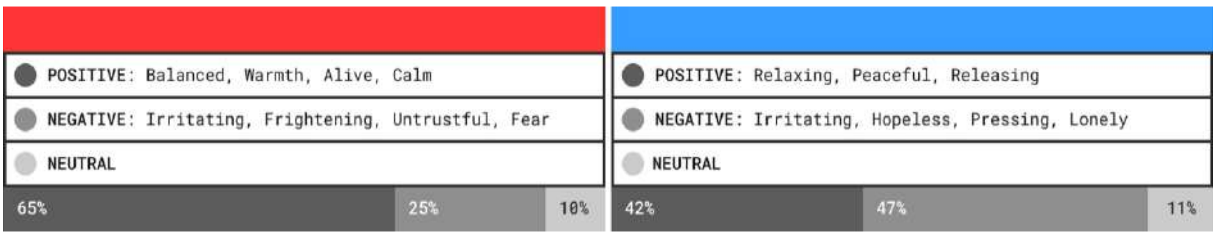

Figure 6: Reactions to red (left): 65% positive (balanced, warmth, alive, calm); 25% negative (irritating, frightening, untrustful, fear); 10 % neutral. Reactions to blue (right): 42% positive (relaxing, peaceful, releasing); 47% negative (irritating, hopeless, pressing, lonely); 11% neutral.

RESULTS OF "THE COLOR SENSE LAB"

The results of this workshop rely on the visual representation of the gathered individual accounts with both qualitative and quantitative data (Figure 6). The visual demonstrates the selected warm (red) and the cold (blue) hues and the words assigned to each projected color arranged according to the three categories (positive, neutral, negative).

The most recurring descriptions categorized as positive associations to the red hue were: clean, warmth, alive, calm; as to the negative associations: irritating, frightening, aggressive. Words used to describe the positive association to the blue hue were: relaxing, releasing, peace; the negative association: irritating, hopeless, pressing. From the warm hues, the red color got the maximum of negative reactions (58%). From the range of cold hues, blue had the most negative reactions (47 %). The most unexpected discovery of this experiment was several accounts on the memories provoked by the projected colored light that could be observed through both strong psychosomatic reactions and qualitative descriptions. This can be exemplified through the two insights in regard to the green hue: "I feel horror. Green color associated with radioactivity" (Diana, age 24); "The green light reminded me of an abandoned swimming pool and evoked a disgusting feeling" (Simonas, age 31).

CONCLUSION

This research looked at ways that the diversity of sensory stimuli of a spatial setting impact human emotional states, more specifically the visual stimuli of colored light. Both of the experiments aimed to explore and capture responses to particular sensory stimuli, based on the expanded understanding of human senses. The main outcomes take the form of visual representations and documentation of individual accounts and participant behavior. The first workshop's results showed mostly positive reactions to the combined sensory stimuli and thus led to the assumption that the colored light installations created during the second workshop would provide a similar, rather relaxing effect. What happened was the opposite. The reactions were far more diverse and, in some cases, reported by participants as extremely unpleasant. The comparison of the results of the presented experiments unveils that the subjective reception of the colored light in combination with other senses (balance or sound) has more potential to provoke a generally positive, relaxing effect, whereas participants, exposed to the colored light only, experienced very contrasting feelings.

It is necessary for designers to be able to name and integrate the diversity of sensory stimuli which participate in the atmospheric experience and to understand how colored light could take part in this experience amongst other stimuli, such as sound or smell. This research informs design practices, willing to integrate multiple aspects of sensory reality, and hence atmospheres.

ACKNOWLEDGEMENTS

The writing of this paper was funded by an individual scholarship from the Lithuanian Council for Culture. Huge thanks to Justė Pečiulytė for mentorship and inspiration in this research, also big thanks to Matija Vojvodic for infographics of this paper.

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Basic parameters for color education: a proposition of concepts on color theory for Brazilian elementary and middle schools

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ABSTRACT
This paper is part of a Doctoral thesis that aimed to evaluate the color education in Art textbooks for Brazilian Elementary and Middle Schools. From the analysis of the questionnaire answered by 193 Brazilian Art teachers, the 55 Art textbooks selected for the research, and the interview with an Art textbook author, we observed that some factors are important and determinant for the perpetuation of conceptual problems on color education. They are: (i) deficiencies in Art undergraduate courses, specifically on color theory; (ii) the low quality and/or high cost of materials for color education; (iii) the lack of physical space for Art classes in most of Brazilian public schools; (iv) and Art textbooks that have no color theory content or, when they include color theory content, in the vast majority of cases the content is very superficial, outdated or with conceptual problems. As well, they do not propose a clear didactic sequence on color education. The results from the data collected, the teaching experience in Art Education, and the teaching practice regarding specifically the color education in graduate and postgraduate Arts and Design programs, include: (i) the selection and proposition of concepts of color theory; (ii) a proposal of teaching strategies and didactic sequence on color education called Basic Parameters for Color Education, BPCE; and, (iii) a proposal for the organization and application of BPCE in Elementary and Middle Schools to promote color literacy in contemporary society.

Keywords: *color education, art textbook, color theory*

INTRODUCTION

The school life, the contact with other teachers, the experience to supervise Arts interns, as well as the research undertaken for the Doctoral thesis (Quattrer 2019) made it possible to observe that the main difficulties in color education are shared by many Art teachers of Brazilian Elementary and Middle Schools. At varying levels, teachers claim to have difficulties about color education that mainly involve: deficiencies in Art undergraduate courses, specifically on color theory; difficulties in teaching color in an interdisciplinary way; and,the lack of physical space and appropriate materials for color education.

Based on ethical guidelines and protocols during the Doctoral research, we developed and applied a questionnaire in Portuguese entitled “The color and the Art teacher”. The questionnaire was conducted in order to understand the color education in Brazilian Elementary and Middle Schools and verify if Art teachers use Art textbooks in their classes as a support for color theory and/or color practical exercises.

We also carried out a survey of Art textbooks published between 1970 and 2016 from our personal collection and also from public collections such as the Brazilian Textbooks Library, at the University of São Paulo, USP (São Paulo, Brazil) and the Brazilian National Library (Rio de Janeiro, Brazil). In addition to the teacher questionnaire and textbook survey, we opted to interview an author in order to understand how the concepts of color theory are selected by a Brazilian author in the process of writing an Art textbook and how the inclusion of Art in the National Textbook Program (Programa Nacional do Livro Didático, PNLD, in Portuguese) in 2015 has influenced the process of writing a textbook. We also called attention to the fact that primary colors, secondary colors and subtractive mixture were pointed out as the contents most taught by Art teachers who answered the questionnaire. Specifically, regarding the analysis of the basic concepts of color theory presented by textbooks published between 2006 and 2016, we observed that only 5 books outof the 13 collections of textbooks analyzed referenced concepts such as light, electromagnetic spectrum, and visible spectrum. However, we can find such Science concepts more easily in color books for Design and Architecture published in Brazil. Many of the Art textbooks analyzed teach that the primary colors of subtractive mixture are red, yellow and blue. It should be noted that the primary colors of additive synthesis are red, green and blue, and the primary colors of subtractive mixture for inks aremagenta, yellow and cyan (Frova 2008:148).

The difficulty of teaching color is aggravated by the variety of definitions and terminology in Portuguese for color theory concepts, resulting from inadequate translations and/or misunderstandings, which contributes to the perpetuation of conceptual problems. In Table 1 we have some examples in Portuguese of terms used to name the color attributes. The variety of terms in Portuguese becomes a problem when the concept behind the term is unknown to Art teachers.

Munsell (EN)	**Munsell (PT)**	**Aumont**	**Varela**	**Pope**	**V-Domingues**	**Others**
hue	matiz	matiz	croma	matiz	matiz	tom
value	valor	luminosidade	brilho	obscuridade	valor de luminosidade	brilho
chroma	croma	saturação	saturação	intensidade	grau de cromicidade	saturação

Table 1: Some examples of terms used in Portuguese to name the color attributes, adapted from Guimarães (2004:55). We opted to present the color attributes in English proposed by Munsell to help understand this issue.

For example, during the analysis of Art textbooks we identified a textbook that uses the terms in Portuguese: *tonalidade* to refer to the attribute hue (spectral position) and *tom* to refer to value (lightness of a color). In Portuguese, when these terms are used to refer to color attributes, they generally are used as follows: *tom* to denote hue and *tonalidade* to denote value. Without a standard glossary of terms, some teachers do not feel confident and choose not to teach color deeply.

As a result of the analysis of the teacher questionnaire and textbook survey and based on our teaching practice, we believe it is necessary to propose a new approach to the teaching of color for the curricular component Art of Elementary Education, which can be adopted by textbook authors in improving their works. By doing so, we hope to assist the Art teachers in the study and planning of their classes, in the development of color teaching-learning procedures with their students, and to stimulate the interdisciplinary work between the Art teacher and other curricular components of Elementary Education.To support our research and proposal, we studied the National Curriculum Parameters, PCN, (Brasil 1997), the National Common Curricular Base, BNCC, (Brasil2018), the Triangular Approach systematized by

Barbosa (2012) and color book in Arts and Design: Frova (2008), Monzeglio (1972), Gage (2000), Albers (2009), Guimarães (2004), Livingstone (2014) and Berns (2016). From these standards, we defined the following important criteria to guide our research and proposal: (i) fundamental concepts for understanding the interdisciplinary character of color; (ii) basic concepts of color theory for the development of color education strategies in Arts to increase artistic manifestations of people and cultures from different eras, including contemporaneity; (iii) concepts compatible with the reality of Art education in Brazil.

BASIC PARAMETER FOR COLOR EDUCATION, BPCE

From the data collected in the Doctoral research, and from the teaching experience in Art Education in Elementary and Middle Schools and, specifically, in color education for graduate and postgraduate students in Arts and Design, we created the Basic Parameters for Color Education, BPCE. Theparameters are composed of: (i) basic concepts on color theory; (ii) basic color nomenclature in Portuguese; (iii) suggestions of color education strategies, based on the Brazilian educational system; (iv) bibliography of books on color that can contribute to teacher training on color theory; (v) and a proposal for the organization and application of the BPCE in Brazilian Elementary and Middle Schools, in order to assist Art teachers and Art textbooks authors.

To promote the development and improvement of color education, a didactic sequence was organized into 22 topics. It is important to note that the topics were adapted to this paper from the nomenclature originally proposed in Portuguese in the Doctoral thesis. They are: Color (*cor*); Light (*luz*); Electromagnetic Spectrum (*espectroeletromagnético*); Visible Spectrum (*espectrovisível*); Photoreceptors (*fotorreceptores*); Additive Synthesis (*sínteseaditiva*); Primary Colors (*coresprimárias*); Secondary Colors (*coressecundárias*); Subtractive Mixing (*misturasubtrativa*); Color Wheel (*círculocromático*); Tertiary Colors (*coresterciárias*); Hue (matiz);Luminance (*luminosidade*[7]);Value (*claridade*); Monochrome Values (valores *monocromáticos*); Achromatic Values (*valoresacromáticos*); Chroma (*saturação*[8]);Analogous Hues (*matizesanálogos*); Complementary Hues (*matizescomplementares*); Simultaneous Contrast (*contrastesimultâneo*); Color Harmony (*harmoniadas cores*); Warm and Cool Colors (*cores quentes e cores frias*). The 22 topics are presented, detailed and justified in the Doctoral thesis. Unfortunately, it will not be possible to detail all the 22 topics in this paper. So, we will briefly introduce just some concepts and strategies.

Due to its interdisciplinary character, color involves important issues in Arts, Physics, Chemistry, Biology, Psychology, Linguistics and Philosophy. In this sense, we take the position that color education can and should be treated from an interdisciplinary perspective in order to enable the strengthening of autonomy and creativity in its use in Arts. In this way, we started the BPCE with the definition of color (*cor*), which, by itself, gives us indications of the basic and interdisciplinary concepts necessary for its understanding.

In our daily life the term color can have many meanings, definitions and applications depending on the area. In addition, according to Guimarães (2004:12), the term color can also

[7] For didactic purposes, we have adopted the term *luminosidade* in Portuguese to name the inherent characteristic of a saturated hue, i.e., how much it impresses the observer by its chromatic strength.

[8]Instead of Munsell chroma (*croma*), we use *saturação* in Portuguese to denote the third attribute of color, together with hue (*matiz*) and value (*claridade*). The Merriam-Webster Dictionary points at the difference that exists between chroma and saturation, when defining chroma as “a quality of color combining hue and saturation” (Accessed 6 December 2020). However, throughout the twentieth century, especially the first half, books in the original language were not easily accessible in Brazil and import was expensive, therefore *saturação* is commonly used today.

be used as “a quality of discrimination of objects” when color is understood as a percentage of their property, even if it is not. For this to be clear, it is essential to teach some basic concepts about the perceptual and cognitive processes of color phenomena that involve questions of physics and biology. After defining what is color, we present the nature of the physical stimulus and how the vision process occurs. We can show a red object to the students under a white light, for example, and invite the students to observe it. Then turn off the lights in the room, close the curtains, to keep the room as dark as possible and ask students to verbalize the perceived changes in relation to the color of the chosen object. Is it possible to perceive the color of the object in the dark? After that, if it is possible, put the same red object under a different light, such as yellow light, for example. Has anything changed? Do we still perceive red? This type of exercise is an interesting resource for provoking reflection about color definitions and for stating that the physical stimulus, perceived by the eyes and decoded by the brain, is light (*luz*). Which, in turn, can be defined as a type of the electromagnetic spectrum capable of stimulating nervous impulses or signals transmitted to the brain through the retina. This concept is very important and, to be clear, we must also present the concepts of electromagnetic spectrum (*espectro eletromagnético*) and visible spectrum (*espectro visível*).

Although we are surrounded by electromagnetic waves and constantly discuss its effects on our health, such as, for example, exposure to UV rays or X-rays, it is not uncommon that students of high school, undergraduate and professional courses in Arts and Design claim to ignore the concepts of electromagneticspectrum andvisible spectrum.Tofacilitate the discussion about light, electromagnetic spectrum and visible spectrum, we suggest the use of infographics and photographic images with the help of printed material, multimedia equipment and/or draw it directly on the blackboard. In the case of decomposition of white light, for example, we recommend, when possible, a practical demonstration with laser light or flashlight and glass prism or with sunlight, mirror, and basin with water.

For the presentation of concepts involving photoreceptors (*fotorreceptores*) to students, in addition to the use of infographics, we also recommend the use of analogies such as, for example, sunburn. As with photoreceptors that react to the wavelengths of the visible spectrum, cells present in the superficial layer of our skin (epidermis) also react to electromagnetic waves such as ultraviolet. Excessive exposure to ultraviolet wavelengths causes the release of substances that cause pain, swelling and redness in our skin. Teaching practice has shown us that this type of analogy can be a very important resource for understanding concepts involving photoreceptors.

It is worth mentioning here that in some literature photoreceptors are presented in a very simplified way, which can generate conceptual errors or doubts. Some authors claim that we do not have cones sensitive to cyan and yellow wavelengths and this is wrong. We use Berns (2016:37) to present and discuss the apex of the sensitivity of cones. To make this clear to students, we suggest that the teachers again use some analogy, for example, with soccer or a similar situation involving passionate fans. Just as each cone is highly sensitive to one portion of wavelengths and less sensitive to another, a soccer fan is highly sensitive to goals scored by his favorite soccer team and less sensitive to goals scored by other teams. We emphasize that it is important to assimilate these introductory concepts so that the following concepts are well understood. However, we observed in the analysis that only 20% of Art teachers affirmed to teach photoreceptors.

Thus, we continue the discussions and introduce the concept of additive synthesis (*síntese aditiva*). We indicate the use of RGB Digital LED reflector, red, green and blue light which greatly facilitate the exploration and discussion of additive synthesis.Also, we can use printed reproductions of illustrations and infographics of additive synthesis. From this, we can present and discuss the concept of primary colors (*cores primárias*) and secondary colors (*cores secundárias*) in additive mixing.

We then move on to the concept of subtractive mixing (*mistura subtrativa*). Still, according to the analyses, a large part of Art teachers introduces color wheels (*círculo cromático*). In Arts, one of the most common types of color wheels represents the subtractive mixture and the results obtained from the physical mixture of pigments or dyes. We suggest that, at first, teachers present students a representation of the color wheel with multimedia equipment or printed material. The presentation of the color wheel is followed by the discussion on color attributes.

It is common for students to use some terms such as 'pure', 'bright' and 'dark' to describe certain colors. Thus, we believe that it is important to present concepts about color attributes. We call hue (*matiz*) the attribute of color that refers to its position in the color wheel or electromagnetic spectrum. At this point, it is important to note that hue is color, but not every color can be called a hue. The luminance(*luminosidade*) is an inherent characteristic of the saturated hue, how much it impresses the observer by its chromatic strength. When comparing the colors of the visible spectrum, we will notice that yellow is the most luminous color, while blue is the least luminous color. Our teaching practice on color education has shown that the elaboration of a color wheel based on subtractive mixture(cyan, magenta and yellow)contributes to understanding concepts and characteristics of hue.

To make the color wheel, we use professional gouaches that are proven to achieve the expected color results and, thus, we can explore the mixtures that originate, the secondary colors and the tertiary colors (*cores terciárias*), obtained from the mixture of a primary color and a secondary color. The color surfaces (~3 × 3 cm2), here called "modules" are elaborated without a limit on quantity, which allows a perceptive development of the chromatic thresholds of the students already in this first phase of the exercise. The participation of the teacher is essential when comparing one color module to another, in order to point out to the students the color nuances, an important step in the selection of values. Also explained are the essential procedures for this selection, such as the removal of external objects from the visual field exercise where the values are selected, the placement of modules on the table within the visual field (60-degree cone) so that they are not perceived by the memory but simultaneously, and the activation of the chromatic perceptive threshold with greater emphasis, if the modules are superimposed. In the last case, the analogous values are better perceived, as are small variations invalue and saturation (Quattrer and Gouveia 2018:2).

This practical exercise of investigation and chromatic analysis is a simplification of the Munsell System, orrather, parts of its structure. Value (*claridade*) is the color attribute related to the variation of lightening and darkening of color (Monzeglio 1972:69). Teaching practice has shown us that the use of the term *claridade*, in Portuguese, is suitable for teaching purposes, since it is already used by teachers and students in everyday school life. It also helps us to differentiate this attribute from *luminosidade* as defined above. We use an exercise with gouaches for the elaboration of two specific scales: one of monochromatic values (*valores monocromáticos*) with variation of values of only one hue; and another of achromatic values (*valores acromáticos*) that, in theory, are white, black and gray, obtained from the mixture of white and black, as well as all its variations(Quattrer and Gouveia 2018:3).Chroma (*saturação*) is the color attribute that refers to its chromatic strength or purity.It is a concept that students have more difficulty in understanding and differentiating in practice. To facilitatethe understanding of these concepts, we make a chromascale with gouache: the students choose a hue from the color wheel (with the exception of the yellow hues) and, after tests and comparisons, they choose its gray equivalent obtained from the mixture between white and black (Quattrer and Gouveia 2018:4). This gray is mixed in different proportions with the hue in order to obtain a scale that starts from the pure hue until it becomes neutral gray.

In 2018, during the ‘ISCC Munsell Centennial Symposium’, we participated in the color game session in which we had the opportunity to try out educational resources like Breakthrough Color Cards and Kolormondo Globe and get in touch with their developers. We can use these educational resources to present color attributes and to explore the interaction of colors, for example. As the BPCE are directedto color education in Art, it is important to highlight examples of color concepts in works of Art. When direct interaction with artworks is not possible, which is unfortunatelyquite common, we can use digital or printed reproductions of works of Art.

CONCLUSION

The Doctoral thesis and the teaching experience have shown that the BPCE can be used successfully in different levels of education, including undergraduate, postgraduate and professional courses in Arts and Design. The most important step is to adapt the BPCE to the learning objectives and keep it aligned to students' interests and daily life. In this way, the BPCE has proven to be an important resource for promoting color education in Brazil. We intend to continue the research by proposing the Basic Parameters for Color Education based on deaf culture and identity, and in Brazilian Sign Language – LIBRAS, which is used by Brazilian deaf communities. The COVID-19 pandemic challenged our projects with deaf students, but we are resilient; we adapt!

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Unique experiential benefits that multispectral lighting may provide

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ABSTRACT
Light Emitting Diodes (LEDs) are well suited to deliver chromatic light of extraordinary quality – very pure and very colorful. In the domain of cinematography and film LED sources are expected to fulfill all demands concerning color reproduction. Multispectral LED light sources are an excellent choice for applications where color rendition is important and scenic support for theatrical design is appreciated. The usage of multispectral lights makes one group of users very enthusiastic, others only recognize mainly a higher level of complexity.

LEDs can be switched on and off at very high pace. This characteristic is used for time-multiplexing light. An informed view on a performance in which color multiplexed lights are applied reveals that an observer seeing the live performance will have an impression of all lights merged in a sequence. Cameras that are synchronized to the light sources are able to catch individual moments and may serve additional experience settings.

The opportunity to mix spectra from different spectral components enables experiments with different strategies to fuse these components. In theatre lighting these effects are used to stimulate moods and express emotions. Benefits why multispectral light mixtures are utilized include melanoptic effects, medical and aesthetical treatment, as well as entertaining optical and theatrical effects.

Keywords: *LED lighting, visual appearance, visual experience*

INTRODUCTION

Light Emitting Diodes (LEDs) caused many changes. Previously realizations of color variations in theatre lighting were described by gel numbers – a global language to filter light. This way of communication was very efficient as everyone had learned to associate with these numbers very similar experiences. Chromatic LEDs are narrow band emitters that produce very pure colors, combined they may provide extraordinary rich color variations.

LEDs are a good choice for optical wireless communication using visible light. With the so-called Metameric Modulation (MM), a method exists that encodes data in the visible spectrum while maintaining a defined colorimetric color point (Butala et al. 2012). With a careful choice of LED combinations excellent color rendering properties can be realized and the achievable data rates scale with different LED types applied. For Metameric Modulation multispectral sources with at least four different types of chromatic LED sources are required.

Systems with multi-primaries are not only evaluated for Visual Light Communication (Singh et al. 2017, Singh et al. 2019), but also for Displays (Allen et al. 2018). An increase of LED-types of multispectral systems or of primaries in displays causes an increased count of metamers that can be produced. Benefits that multispectral light mixtures may provide include melanoptic effects, medical and aesthetical treatment, as well as entertaining optical and theatrical effects. Ongoing are evaluations for colorimetric descriptions, circadian performance, and temporal characteristics. The applications discussed in this paper do not cover mid- or long-term perspectives for multispectral lights but focus on two applications that provide astonishing effects already today: Color multiplexed LED lights and metameric lights.

COLOR MULTIPLEXED LED LIGHTS

LEDSs can act at extreme speed, hence sequences can be formed that are not visible to the eye, but can be recorded by cameras. This requires a synchronized camera setup. Such multiplexed illumination may feed synchronously, live performance and online presence with different content, and additionally, providing all data for relighting scenes in the postproduction process (Figure 1). The audience watching the performance in the theatre experiences the visual impressions produced by the sum of all lights, the audience of the streamed version can switch between their preferred illumination components. The final product of the recording might include a finetuned version with individually relit scenes and all options for an optimized show in specific viewing environments.

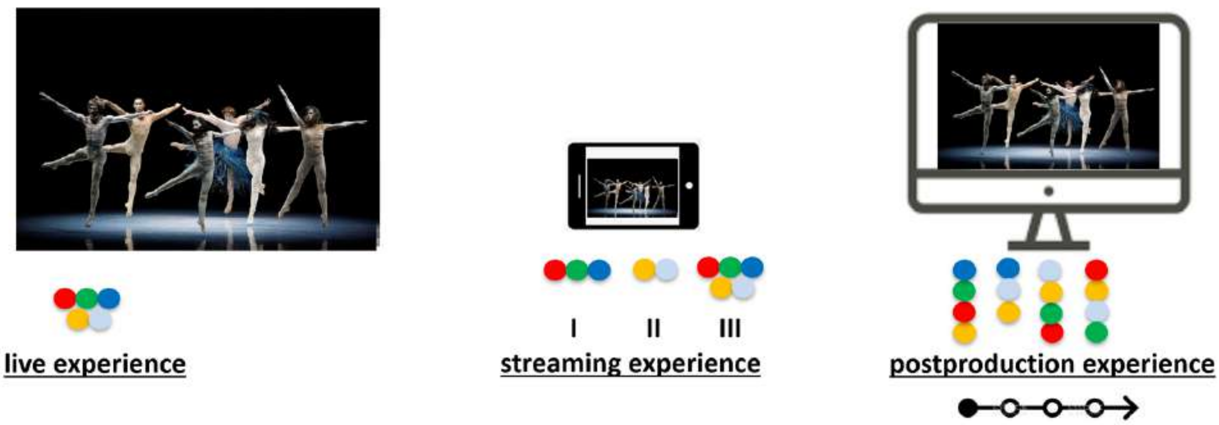

Figure 1: Options for different lighting experiences as multiplexed light is applied live, streamed live and consumed as final recording after postproduction.

To record multiplexed scenes camera shutter and light scene must align synchronously. To minimize typical demosaicing errors the use of a monochrome camera may be preferred (Shrestha and Hardeberg 2014). Color rendering or more general color quality is an important factor for lighting movie scenes. To describe characteristics of a source and compare different sources the IES TM-30 procedure is nowadays the preferred method. The fidelity index Rf is analogous to CIE Ra (CRI) and characterize the overall level of similarity between test source and reference. A unique feature are the color vector graphics that provide visual representations of hue and saturation changes based on the average rendering in a hue bin. The graphic provides a quick understanding of how different hues are rendered. Especially designers can benefit from informations contained in these graphics.

METAMERIC LIGHTS

We may expect that in natural situations metameric lights are very rare. In nature most probably metameric lights are even less frequent than metameric pairs of surfaces. The general audience has recognized the potential to surprise when lights or objects that appeared identical show up in distinctly different form. Although calculation methods for predicting metameric appearance exist (Finlayson et al. 2014), for evaluation purposes visual examination is recommended.

In the domain of stage lighting fixtures with five to seven LED types are rather widespread, some even feature eight or more types. These stage lighting products can easily generate many variations of scenes that appear identical, but are composed of light with different wavelength. In artistic Installations in Graz (2015) and Florence (2016) the author explored a specific set of metameric light situations. In contrast to other combinations these turquoise stimuli were able to evoke aftersensations in the center of the visual field. The visual pattern that appeared are distorted perception, as its shape is not present in the physical stimulus, but induced by the human visual system. Maxwell was the first one to describe the phenomenon. The so-called Maxwell spot was also observed in multi-primary displays that included cyan primaries (Gardasevic et al. 2019). Both examples illustrate that despite all what is known about metameric lights, colorimetric calculations and color space there are effects that reach beyond this. It is to expect that while we learn more about ways to apply and optimize effects of metameric settings, we will discover more of these yet unknown opportunities.

The limitation to consider only metameric effects that could be observed in an achromatic space was introduced to limit complexity. Considering effects of light and surfaces is challenging. The following theoretical experiment offers some insights about it. Jan Koenderink refers to it as spectrum-folding (Koenderink 2018). Therein bins of the radiant power spectrum are split in two equal halves. In the next step only the first half of each bin is used and the value doubled. This makes the situation identical to the previous. Now the second halves can be filled with a fully independent illuminant. If reflectance of a surface is folded the same way the first illuminant bin may align with the first or the second reflectance bin. Hence a grey surface may appear grey, white or black under illuminants that appear the same. As Koenderink points out this exercise of thought does not violate rules of physics, but there are specific restrictions. As justification he names that Schrödinger optimal colors do not admit metamers.

CONCLUSIONS

LEDs can act at extreme speed, hence they are well suited to generate multiplexed light scenes. LEDs as emitters of chromatic light are available for several wavelength of the visible spectrum. Due to manipulation of temporal or spectral characteristics a huge set of light scenes may be realized. To multiplex light scenes is a mean to enable relighting during the postproduction process. This technique has its biggest potential in fields where live experience, streamed experience or production results asks for dedicated light settings.

The amount of stage lighting fixtures that feature multispectral engines increased quickly during the last years. As a result, we have now in many spaces the ability to show metameric scenes. For stage lighting a great benefit to feature the metameric setting that is most expressive and fits best the emotional content. For other applications research activities contributed essential insights to develop optimization strategies. According them are settings tuned to minimize damage of artworks (Mayorga Pinilla et al. 2016), or minimize melatonin suppression for better sleep (Aderneuer et al. 2019). The mentioned art installations point out that not for all effects that metameric lights may cause are straight forward explanations available. The fact that lighting settings that are rather easy to produce can challenge current knowledge about perception processes is good motivation to continue to explore metameric effects.

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A color performance comparison of LCD and CRT monitors: considering black offset, white point, and linearity

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ABSTRACT
Monitors are counted as the essential and vital tools in a digital textiles printing product's color appearance design. Therefore, two sets of monitors with LCD and CRT technology are always focused. Although the LCDs benefit from a newer technology, CRT monitors are still used in the digital design. CRT is old technology and is employed as standard display devices, whereas LCD is a modern one with more modern technology. This work aimed to consider and compare the performance of color imaging by LCD and CRT monitors. For this purpose, we tried to compare three characteristics of the two widely used CRT and LCD monitors: black offset, white point, and linearity. The results showed that the black offset in both monitors was slightly different but not zero in either. The black offset on the LCD was about 36 times the black offset on the CRT. Therefore, it is necessary to consider this black offset level to correctly achieve acceptable colors in color management characterization and monitor calibration. The white point measuring showed that the CRT monitor could considerably simulate the D65 standard illuminant behavior. The CRT monitor linearization performs more linearly and somewhat better demonstrates a gray sample as input five signal levels, which was measured its corresponding spectral radiance. However, it was observed that the LCD has lower linearity than CRT.

Keywords: *LCD, CRT, black offset, white point, linearity*

INTRODUCTION

The digital printing industry is developing in all areas, especially in the textile industry. One of its main goals is to achieve the right color. To achieve that goal, a process chain including design, display, software, printer, etc., must be controlled and calibrated (Korger et al. 2015, Collis and Wilson 2012). Monitors are one of the essential tools in design. The designer depicts his mental idea with the display's facilities and capabilities and finally prepares it for decision-making and any subsequent operations, including printing. Of course, the represented image's quality is also highly dependent on the display characteristics (Li et al. 2011).

The expansion of displays in new and accurate applications has made the need to control the color transferred between different color imaging devices. The accuracy of their operation is critical. While large changes in color balance are acceptable on TVs, on color monitors used in the design, performing color calibration operations will affect the display's acceptability. Accurate description and calibration of a display affect the color and uniformity of the image screen, the output of the measuring equipment, and the color temperature selected for the white point (Vrhel et al. 1999).

Display characteristics could be considered as follow:
1. Temporal stability (existence of the same color properties over time);
2. Spatial uniformity (existence of the same color properties in different areas on the screen);
3. Channel independence (the presence of a channel at a pixel point does not depend on the presence of other channels at that point);
4. Phosphorus constancy (the color of each phosphorus is independent of the voltage applied to the channels).

Many technologies have been introduced in the manufacture of displays, including CRT, VFD, FED, LCD, PDP, EL, and OLED (Garg and Singh 2014). The competition between different technologies is for better features in terms of image sharpness, brightness, viewing angle, color gamut, contrast, portability and size, energy consumption, and price.

Despite the advent of advanced technologies, CRTs are still in some cases competing with LCDs. Studies have been performed to compare these two technologies' performance, color calibration efficiency, and a color gamut produced by them (Fairchild et al. 1998). LCDs are smaller in size than CRTs. It makes it easy to carry around. They also benefit from a higher resolution in image quality. However, CRT monitors are still considered and used by designers due to some features such as contrast and shade independence from the viewing angle of the observer (Garg and Singh 2014, Florin and Mastorakis 2009).

This study aimed to compare the performance of two different monitor technologies, namely LCD and CRT. For this purpose, the three characteristics of black offset, white point, and linearity were compared.

EXPERIMENTS

Figure 1: LCD and CRT monitors.

A SyncMaster T1900P LCD with the Samsung brand and a 720ED CRT monitor with the Hansol brand was used in this research (Figure 1). To determine the monitors' spectral and color characteristics, the CS2000 spectroradiometer from Konica Minolta of Japan was used which comes with a technology that enables it to sync with flashing lights. Its software named (CS-10W) has an option to enter the refresh rate of the light source. We adjusted this parameter to 60 which was exactly our screen refresh rate. The instrument is also equipped with a coaxial external port to physically sync with the light sources with unknown flashing rates and measuring these lights. Integration time was adjusted to “Auto” at CS-10W to ensure adequate measurement time for dark samples. This let us make sure not to have noisy measurements due to the lack of required exposure.

The spectral radiance distribution was measured in the range of 380-780 at intervals of 5 nm in W / m2-sr. The spectroradiometer was set perpendicular to the monitor screen and centered on a middle point to measure the spectral radiance. All conditions were set to be constant for comparison, including lighting conditions, monitor warm-up time, etc.

RESULTS AND DISCUSSION

Black offset

The following figure (Figure 2) shows the spectral radiance distribution of both monitors on an equal scale when the level of all three channels is set to zero (black offset mode).

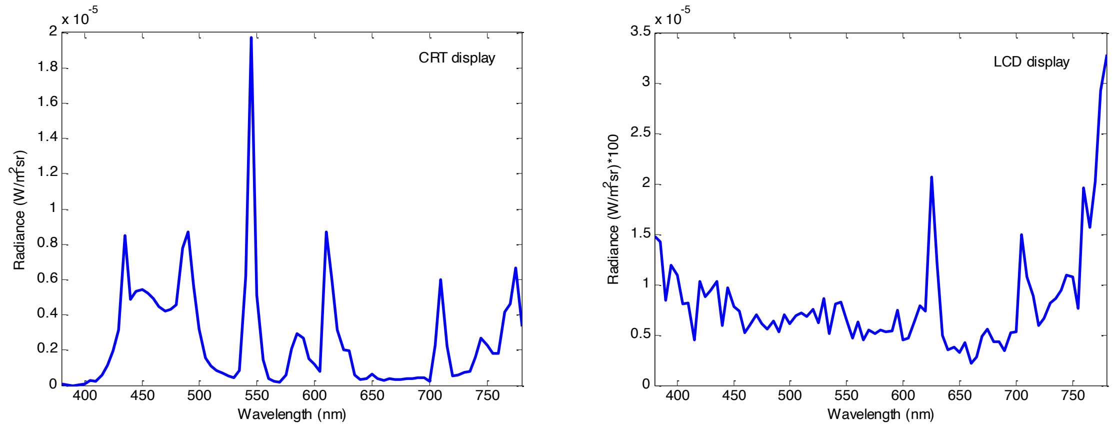

Figure 2: Black offset investigation by determining and plotting the spectral radiance distribution at zero levels for all channels.

Ideally, the amount of radiance in the black offset mode is expected to be zero. But for both monitors, it can be seen that this feature is not zero and allocates some value throughout the visible spectrum. As you can see from Figure 2, the LCD monitor's black image is always accompanied by a red tint (-reddish) compared to the CRT monitor. This was also confirmed by ocular observation. Although this behavior is derived from the technology used in monitor design, it can affect the image's quality. In other words, it seems that the higher black offset level, the less independent the color channels are. The black offset level and luminance of the black point on the LCD monitor was about 36 times that of the CRT monitor.

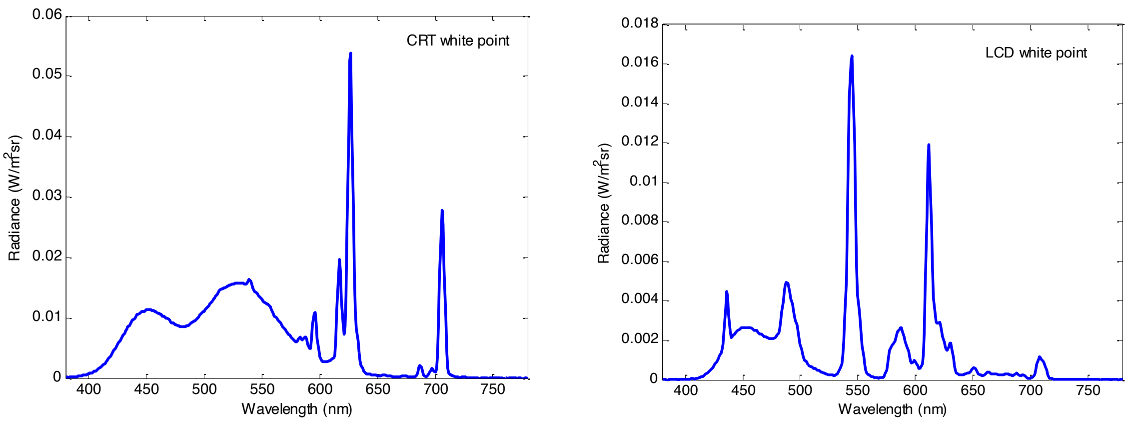

Figure 3: The spectral radiance of the white point.

White point

Figures 3 and 4 show the white point's spectral radiance and the color coordinates for both monitors in the spectral locus. The white point representation was achieved through software settings with Matlab software and by placing all three channels at their maximum emission.

As it is known, the spectral power distribution function for LCD is spiky or sharp. Therefore, compared to CRT, this may lead to that the LCD monitor for any accurate color imaging needs to shade correction through corrections such as applying the white balance algorithm. Moreover, both monitors' correlated color temperature was 5804 K for LCD and 6543 K for CRT, respectively. This amount of correlated color temperature in the CRT monitor design seems to simulate the D65 light source somewhat.

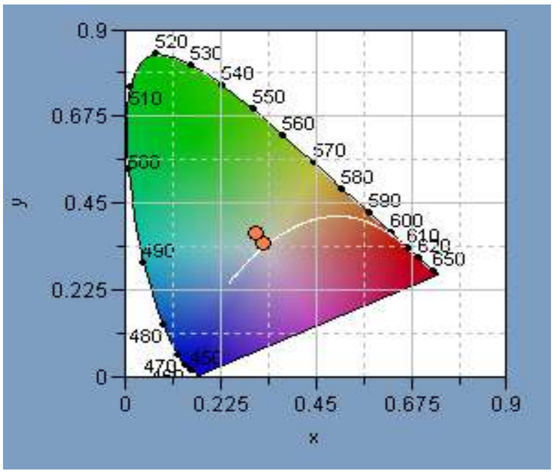

Figure 4: The white point location for two monitors in the spectral locus (CRT coordinates are closer to the Planckian locus).

The white point's luminance on the LCD monitor was about 2.2 times that of the CRT monitor. On the other hand, the results of figures 2-4 show that for an LCD monitor, the black offset and white point properties are much more similar than those in a CRT monitor.

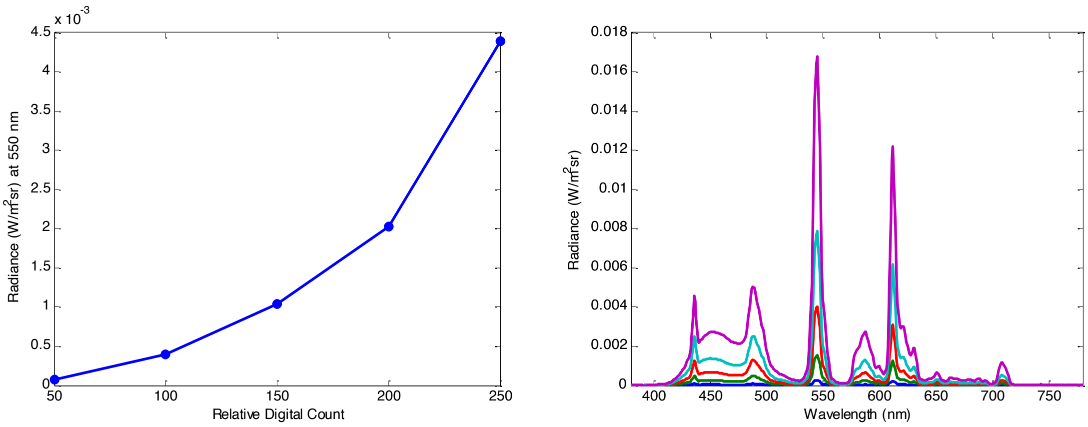

Figure 5: Linearity of the LCD monitor.

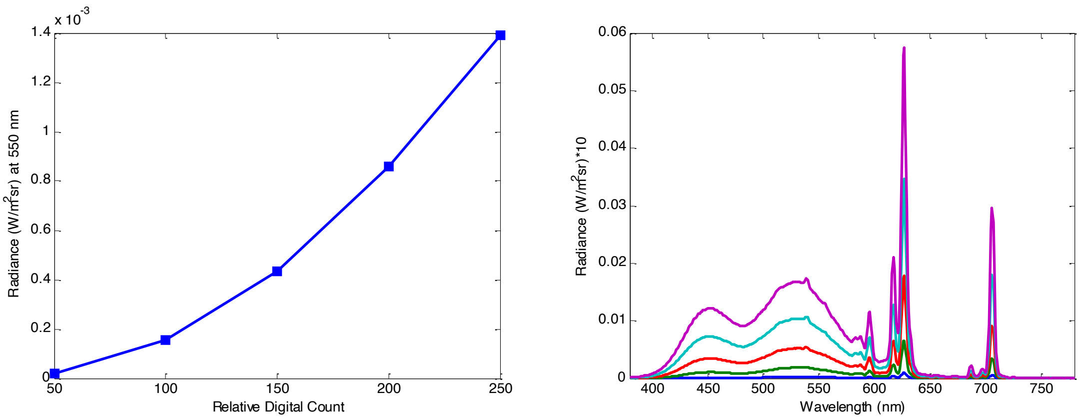

Figure 6: Linearity of the CRT monitor.

Linearity

In Figures 5 and 6, a gray sample's spectral radiance was measured at five different levels for both monitors. For both monitors, the results show a specific nonlinear behavior. In other words, the results show by increasing the input signal level (voltage); the response received from the monitors is not linear. For the CRT monitor, it behaves somewhat more linear. The nonlinear behaviors in monitors can be improved by gamma correction models (Garg and Singh 2014).

CONCLUSION

In the present study, we tried to compare the three characteristics of black offset, white balance, and linearity of two widely used monitors, i.e., CRT and LCD. This study showed that the black offset in the two monitors is somewhat different, but neither is zero. Therefore, it is necessary to consider this amount of black offset to obtain accurate color in color management and monitor calibration. The white point test also showed that the CRT monitor remarkably simulates the D65 standard light source's behavior. Besides, from the results of linear behavior, it was observed that the CRT monitor works better and more linearly to display a gray sample at the input signal levels. Finally, the above can be considered in some way in the color management process.

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The philosophy of colour in the French period of environmental colour design

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ABSTRACT
For the research project on the French period of environmental colour design oral history was used as a qualitative method to collect the experiential knowledge of French colour designers and consultants who began their careers in the 1950s and 1960s. In anthropological and social science field research the oral history method has proven to be an effective means of collecting data concerning, e.g., personal experience, accounts of events, etc. It has also been established by historians using it for historical documentation. The qualitative data-gathering technique employed in this research used semi-structured interviews conducted in French with six colour designers and consultants living in Paris who have been working in the field for decades: Michel Albert-Vanel, Yves Charnay, Victor Cherubin Grillo, Bernard Lassus, André Lemonnier, and Jean-Philippe Lenclos. To gain in-depth knowledge these main interviewees were asked five questions. This paper focusses on the results of one of the questions: *Comment aimez-vous pratiquer la couleur?* The question has been translated in English as: "How do you prefer to practice colour?" This research aims to document and record historical data from the personal perspective of each interviewee as a starting point to understand colour practice within a larger cultural context. The objective is to relate micro-history on a personal level to macro-history on a socio-cultural level. The philosophical and ontological question is whether there is an environmental colour design culture that exists independently of individual experience.

Keywords: *experiential knowledge, colour practice, environmental colour design, French colour designers, semi-structured interviews*

INTRODUCTION

This project is an on-going research project about the French period of environmental colour design. Some findings have already been published (Griber et al. 2019, Schindler et al. 2019). In these previous publications, it has been noted that two of the research project interviewees refer to Jacques Fillacier as their teacher, e.g., André Lemonnier speaks of him highly saying that he is a great pedagogue. The artist, colour designer, and colour theorist Jacques Fillacier (1913–1986), who was also a professor at École Nationale Supérieure des Arts Décoratifs (EnsAD), was a highly charismatic professional and an influential protagonist in the early development of French environmental colour design of the twentieth century. After studying at the École des Beaux-Arts in Paris, in 1960 Fillacier founded the *Association française des coloristes conseils* (AFCC) [French Association of Colour Consultants], becoming the association's first president and with Bernard Lassus as the first vice president. An incentive for launching this organization may have been the earlier creation in 1957 of the International Association of Color Consultants IACC in Hilversum (NL). In addition to artworks exhibited in galleries, murals in such diverse spaces as cafeterias, restaurants, and schools, and colour design for industry and architecture, in 1942 Fillacier not only conceived a mural but also a colour concept for a psychiatric clinic, engaging psychiatrists to debate about the societal role of colour (Charnay 2019:148). He worked as a colour consultant for hospitals, clinics, and senior housing and founded the Atelier Fillacier in 1947 (Pitiot 2017:12). André Lemonnier joined Fillacier's studio in 1960 and collaborated with him for ten years until 1970. During this time they worked together on "architectural polychromy" projects and developing theoretical colour tools (Lemonnier 2011). In 1971 Lemonnier opened his own studio with Monique Dudret. In 1972 Victor Grillo joined Fillacier, who was both his mentor and friend. In 1975 they founded the Atelier Fillacier-Grillo and worked together until 1985. Albert-Vanel and Fillacier collaborated on colour design projects for industry and architecture while Charnay's collaboration concerned colour theory. In his publication that appeared shortly after his death, Fillacier writes about the profession of the colour consultant (Fillacier 1986:162). In this work he states that the colour consultant is foremost an artist who must command an aggregate of knowledge essential to the practice. He claims further that the colour consultant must also be a humanist with solid experiential knowledge of social environments, e.g., work, transportation, leisure, entertainment, education, and health. Each environment requires specific analysis, and constraints and restrictions have to be thoroughly considered. To achieve greater efficiency, the colour consultant has to adapt to multi-disciplinary collaboration processes, which are sometimes confining. Fillacier concludes that the practice of the colour consultant (or the "colourist" as the French call it) oscillates between total creativity and restrictions due to colour standardization. In essence, he asserts that social environments benefit from the work of the colour consultant and colour contributes to the improvement of factory spaces and the well-being of workers.

METHODOLOGICAL FRAMEWORK

The methodological framework of research usually relies on written sources such as books and articles published in journals. Using a qualitative oral history approach means to consider the subjective experience of selected persons as a valid source of data. Researchers then use this material as the basis for extracting concepts and patterns and generating their own theories and further concepts related to specific cultural, social, and philosophical contexts. In anthropology and social sciences field research, the oral history method has been proven to be an effective means for collecting narratives related to, e.g., accounts of personal experience and details about events. Oral history has also been established by historians using it for historical documentation (Leavy 2011:6–7). There are meta-levels to be considered in using oral history as a method in qualitative research. Not only is it necessary to determine how the gathered material is to be analysed and interpreted, but also the underlying basis of the contextual framework needs to be examined. In this sense the underlying philosophical and ontological question of this research project on the French period of environmental colour design is whether there is an environmental colour design culture that exists independently of personal experience.

In applying a qualitative oral history method for this research project, after defining guidelines of the main topic, data-gathering entailed semi-structured interviews in French with six colour consultants and colour designers. This approach provided access to the personal experiential knowledge and contexts of the interviewees. To gain in-depth knowledge through the interviews, five groups of exploratory, open-ended questions were employed. This paper focusses on findings related to one of the questions: *Comment aimez-vous pratiquer la couleur?* Translated into English the question is: "How do you prefer to practice colour?" The relatively unstructured interviews gave the participants enough leeway to answer freely, but were also conducted within a defined framework ensuring the possibility of cross-comparisons (Edwards and Holland 2013).

Before starting the process of selecting and recruiting interviewees, French colour designers and colour consultants were considered who had already made a substantial contribution to the history of environmental colour design. Part of the criteria was to focus on protagonists living and working in Paris. Other preliminary tasks included establishing the interest of the potential subjects in actually participating in the project, making them aware of the purpose of the research, and also verifying that they agreed to having the interview videotaped. Each interview lasted from forty to ninety minutes per individual.

Ultimately the main interviewees included Michel Albert-Vanel, Yves Charnay, Victor Cherubin Grillo, Bernard Lassus, André Lemonnier, and Jean-Philippe Lenclos with the interviews being conducted in May 2019. All six of these colour consultants and designers started their careers after World War II in the mid-twentieth century. This research project aims to collect historical data from the personal perspective of the subjects. The material gathered in this way serves as the springboard for deducing an understanding of colour practices within a larger cultural context. An underlying objective is to use micro-history on a personal level to formulate macro-history on a socio-cultural level.

RESULTS AND DISCUSSION

Before beginning analysis and interpretation of the data, the videotaped interviews that had been conducted in French were transcribed by the researchers, then edited, and finally translated into English. As the project progressed, this edited and translated material was further transformed through the analytical identification of concepts and themes and development and consideration of relevant theoretical deductions, etc. (Berg 2007:34–35). To date, the analysis and interpretation process is still ongoing. It is presumed that further stages remain to be conducted, which will be defined according to existing literature. As expected by the researchers at the outset of the project, each of the interviews resulted in unique answers.

This paper discusses findings related to one of the interview questions: *Comment aimez-vous pratiquer la couleur?* or, in English, "How do you prefer to practice colour?"

Bernard Lassus (b. 1929), who is a landscape architect, visual artist, and professor emeritus of the École Nationale Supérieure de Paysage (ENSP) in Versailles, paused some seconds to think before responding that this question is a very difficult one. He maintains that he first aims to understand how other people use colour. As he is primarily interested in exploring how people use colour in their gardens, in 1965 Lassus investigated gardens across France distinguished by a category that he calls by *habitants-paysagistes*, which in English can be literally translated as by "residents-landscapers." His study focusses on practical aesthetics of the working class living in small, single-family houses surrounded by a small garden that were mostly built between the 1890s and 1930s and are located in the outskirts of big cities (Conan 1989:207). As the individual expression of the inhabitant's personality and taste, each garden is uniquely different. One objective of Lassus' colour practice is to reinstall a relationship between modern architecture and its inhabitants, who often consider new housing blocks to be too massive and ugly. His approach also includes blending buildings into the environment with the ultimate goal of transforming a housing development into an inhabited landscape.

Looking more intently at one of the interviewers, Lassus states, “So, in order to be able to work in social settings, it seems important to me to understand what people themselves are doing. It was also like that with Lucius Burkhardt [and] whereby [through this mutual understanding] we became great comrades, not to say close friends. And that’s how we met and worked together for years.” The key topics of the widely-published Swiss sociologist Lucius Burkhardt (1925–2003), who served at one point in his career as professor at the University of Kassel in Germany, include landscape, nature, aesthetics, and urban planning. In the 1980s Burkhardt developed the “science of strolling” or strollology (in German, *Spaziergangswissenschaft*), a socio-cultural methodology for perceiving/experiencing and reflecting/discussing processes and results concerning planned urban and landscape environments as well as everyday urban and rural space.

Lassus’ social approach is one of the key features and success of his “colouring” (in French, *coloration*). In Lorraine, an industrial region located in northeastern France, Lassus practiced colour on a large scale. In the interview he describes the dimensions and extent of his work: “For me, there is no one scale that is more important than another. I had the chance to work on some very large projects. Well, I mentioned the work I did in Lorraine, 15,000 housing units, which is a substantial number. For fifteen years I worked in several cities in Lorraine.” Indeed, from 1978 to 1987, he conceived colour design projects for such cities as Hagondange, Fameck, Villerupt, Amnéville, Thionville, Uckange, and many more.

Lassus also mentions a project near Dijon: “In the early 1960s, Quétigny was a village with about 315 inhabitants. Today it is a small city with 10,000 residents. I’ve done 4,000 dwellings there, in colour, in *pâte de verre*.” In practicing colour on a large scale, an additional problem emerges. French artist Fernand Léger imagines the utopian polychrome city as “one of the most curious revolutions in peaceful times” (Léger 1997:261). The meaning and connotation of this notion has changed with time: “Paint was a cheap way to improve the home. Colour was rapidly adopted for social housing for economic reasons and thereby social housing took on a symbolic image of poor for the poor. So, after that, I didn’t want to use paint anymore.”

Having studied at the École des Beaux-Arts in Paris and completed his training at Fernand Léger’s studio, Lassus specifies that practicing colour also means expanding the existing colour ranges proposed by industrialists in the 1950s that were very limited (Lassus 2017:88). “We had to find another material and that’s why I worked with *pâte de verre*, which although it was more expensive, I found extremely generous architects and authorities who were interested [in its application]. We were able to work with *pâte de verre* and for me, Quétigny is an experience where we show that we too have invented ranges of colours and materials. It’s part of our work. It’s not just about using colours. It’s also about inventing colours. Because at that time in France, in the 1950s, there were twelve colours on the industrial market. The manufacturers didn’t want to have stocks [of colours] because such stocks are expensive. So they limited the number of colours to twelve. Today we can pretty much do whatever colours we want. I am telling you about the situation fifty years ago.” Working with industrialists on their own material and colour collections has become a field of research of the colour designer and consultant. During the researchers’ visit to Lassus’ studio, by an amazing coincidence all sorts of plans, elevations, and colour ranges of his project carried out in Quétigny from 1967 to 1974 were hanging on the walls. He was about to give a talk on his projects and donate the archive material to the small town as a source of reference materials for current building restoration and renovation. He also showed the researchers his marvellous collection of the colour ranges of *pâte de verre*, small pieces of glass that he specially commissioned in the 1960s at one of Venice’s famous glass manufacturers.

Michel Albert-Vanel (b. 1935), colour designer, inventor of the Planetary Colour System, author, and professor emeritus of the École Nationale Supérieure des Arts Décoratifs (EnsAD) answered the question “How do you prefer to practice colour?” by saying that this is a broad question. He then focusses on one example of how he had experienced colour practice in the past: “There is one experience that I found particularly interesting: the oil refinery work that I undertook in collaboration with my colleague Jacques Fillacier.” Industry became a major client in which the foremost role of colour was functional in ensuring the safety of the workplace. Albert-Vanel further explains: “At first it seemed to us to be a very complex problem because we realized that in the oil refinery industry there are different stakeholders who can leave their mark on the terrain. So, there are the economists [investors or business managers] who just let everything rust away. That’s the presiding factor and this obviously leads to quite a desolate condition. Then there are advertisers/marketing experts who try to brand everywhere. Then there is the greedy ambition of the director or the director's wife, who will sometimes introduce proposals with a lot of violets and purples or things like that. Then there are also conservationists who want to establish a relationship with the environment. And, in fact, we were able to find a solution on the basis of there being different scales, i.e., at a very reduced scale, we have to know about standards, e.g., what fluids are circulating in the pipes, etc.”

Here it can be deduced that rigorous colour standardization became the rule and working on different levels was essential for large projects. This can also be surmised from Albert-Vanel, who continues this argument: “All you need is a very small scale, just a pipe with a valve, a tap, with a distinct colour. That's enough. Then there is a second level, that of the workers. There are safety standards. Then there is the fact that extensive distances must be covered relatively quickly at refineries, which are generally huge. Specific colours are used to distinguish different areas. And then the third level is the environment. With Fillacier, we chose to make bars a bit like the cliffs at the Pays de Caux. Through greenery, amber tones, things like that, we succeeded in combining these three levels. It is an answer, I guess, to the problem.” The undulating formations of eroded high cliffs exposed to wind and sea located in an area of the Normandy that had attracted artists such as Gustave Courbet, Claude Monet, and Pierre-Auguste Renoir now served as the inspiration for colour design for industry.

The second example shared by Albert-Vanel of how he experiences colour practice stems from a completely different context related to textiles. The interviewee enthusiastically recalls the “quite fabulous” endeavour at the MFTC (Manufacture Française de Tapis et Couvertures), a French firm in Beauvais producing carpets and blankets. At the time of Albert-Vanel’s intervention the company was struggling financially. He was surprised to be introduced to forty workers wearing white coats leaning over their drawing tables and was astonished to learn that they were working on colourless eighteenth-century motives. By chance they showed him a laboratory space where he discovered a storage cabinet containing absolutely marvellous colours that were actually dye samples. The interviewee told the researchers how he put an idea into practice by saying to the workers: “’This is the right thing to do!’ Ah-ha! They were a little surprised and said, ‘Well, yeah, we hadn't thought of that and what should we do?’ I said, ‘It's simple. We're going to choose a range of colours.’” Albert-Vanel further explains that the workers were really interested in arranging the colours themselves because it was the first time in their careers that they had dealt with colours in such a creative way. He said that a few weaves worked very well with ornate yet still harmonizing colour combinations. Some had a “warm heart,” others, a “cold heart.” For example, the centre was either red, blue, or yellow. Albert-Vanel recalls this experience as a very positive one.

Another “fabulous” experience concerns his various publications on colour. As he states, “I started from a somewhat scientific or scholarly field, but very quickly moved into other fields which seem to me to be richer and less exploited.” Important sources of inspiration for Albert-Vanel are also Buddha and Buddhism (Schindler et al. 2019). He then told the researchers about the set of tarot cards he created which is based solely on colour combinations. According to the interviewee, it can be used not only for personal divination, but also as an object of meditation or as a pedagogical tool (Albert-Vanel 2005). He then concludes, “A pretty important thing is that I deeply believe that currently we make too much of a distinction between what is the scientific field and what is the field we could call spiritual or cultural thought in general.”

André Lemonnier (b. 1937), who is a visual artist, colour designer, colour researcher, and inventor of a patented set of colour tools and an atlas, responded to the question “How do you prefer to practice colour?” as follows: “From my theoretical work, I extend my research to artistic variations in collages and paintings.” Studying at the Gobelins Manufacture (Manufacture nationale de tapisserie des Gobelins) in Paris, Lemonnier discovered the work of Michel-Eugène Chevreul (1839, 1864) which fuelled his specific interest in colour. In the 1970s, he created a colour system containing 1,555 equidistant colours (without counting black and white). His colour solid represents a double cone with an axis of twenty-one values ranging from white to black. The colour circle at the base of the cones is divided into twenty-four hues. With one side along the axis and the tip coinciding with a hue, each triangle contains sixty-four colours. The 1,555 colours are the starting point of a series of collages entitled *Tableaux théoriques* representing different arrangements of the colours. During his career as an artist his artworks have not only been exhibited at several museums in Paris including the Musée d’Art Moderne, Musée des Arts Décoratifs, Palais du Louvre, Centre Georges Pompidou, but also in Roubaix and at the Kunstgewerbemuseum der Stadt Zürich [Applied Arts Museum] in Zurich (CH) and at the Landesmuseum in Stuttgart (DE).

Jean-Philippe Lenclos (b. 1938), colour designer, visual artist, colour researcher–who developed the methodology he calls The Geography of Colour–, and professor emeritus of the École Nationale Supérieure des Arts Décoratifs (EnsAD) responded in an unexpected way to the question “How do you prefer to practice colour?” “I must say that I practice colour daily through my activities as a designer in the fields of industrial product design, architecture, and urban environment” (Lenclos 2021). “However, what truly nourishes my practice, i.e., is my source of inspiration in applying colour is what happens in a completely personal setting: my secret garden, where I practice colour through painting. Every morning I devote some time for doing my colour ranges with watercolour and when I'm on holidays outside of Paris, I practice oil painting. But for me, what serves as the most substantial sustenance is the sensitive, experimental discovery of colour that I pursue through my own painting. It’s my daily nourishment.”

The artist Lenclos explores properties of colours in his drawings, watercolours, and oil paintings. His artistic work creates vibrant optical patterns that capture light, rhythm, and movement similar to reflections on the surface of water with, as one of his former students Professor Jianming Song (2017) at the China Academy of Arts in Hangzhou says, the intention of “making colours sing.” For the past twenty years Lenclos has produced watercolours and oil paintings dealing with fluid, unpredictable, uncertain, and fragile qualities. His artworks capture the silent poetry of light falling on surfaces, objects, fruits, flowers, trees, and landscapes. Through their infallible chromatic transformation over time, the work of this artist reveals fascinating secrets of nature. His endless, inventive search for chromatic vibrations seizes the whiff and spirit of his subjects. Unknown to the general public, his unique artistic production encompasses more than 3,000 individual artworks in private collections.

Yves Charnay (b. 1942), light installation artist, painter, creator of a patented colour-light device, author, and professor emeritus of the École Nationale Supérieure des Arts Décoratifs (EnsAD) responds to the question “How do you prefer to practice colour?” with reflections about how and where colour practice takes place: “It depends on where this practice is, it depends on the recipients, it depends on the materials, and it also depends on whether it is an object with small dimensions or one constructed at a very large scale.” Charnay then talks about a colour design project he was commissioned for the Tanggu District in China. His process included exploring aesthetic and philosophical issues related to how to create diversity through colour without generating chaos, how to simultaneously create order and disorder. Speaking reassuringly, he says, “It was a very beautiful problem.” While working with Chinese architects, there were some communication problems. In France (Charnay 2017), the usual procedure is to develop a regulated system with an occasional exception.

An immaterial way of practicing colour is working with light, which is “very pleasant.” Charnay has conceived several light installations that consist of using light and filters. Symmetrically projecting light onto surfaces with protrusions, the cast shadows appear to be coloured. *Les couleurs de l’esprit* [Colours of the Mind] is one such light installation. He says, “I have much fun working with coloured shadows.”

Victor Cherubin Grillo (b. 1944), who is a visual artist, colour designer for architecture and industry, and professor emeritus of the École Nationale Supérieure d'Arts de Paris-Cergy (ENSAPC) reacts quite differently to the question “How do you prefer to practice colour?” He answers: “In the morning I open my eyes at my window and observe the atmosphere, the light on the plants, flowers, passers-by, and so on; all these are sources of stimulation for the project. It is the colour of the day.” Having studied at the École Nationale Supérieure des Arts Décoratifs (EnsAD), he claims: “Everything becomes a source of interest and can become a new artistic project.” Pointing to the materiality of colour, he continues in saying, “Photography occupies an important place in my work, but the material experience of the coloured surface is an indispensable complement. Of course, digital palettes and computers make it possible to digitize colours, but in facing this virtual reality, material reality regains value and consistency!”

CONCLUDING REMARKS

The six interviewees of this research project revealed their own ways of practicing colour, their personal stories from individual points of view. Nonetheless, some patterns can be observed. Jacques Fillacier was a pivotal figure who founded his colour consultancy studio in 1947. After World War II, his aim was to introduce colour in different environments to further human well-being. He describes his motivation and vocation as follows: “From the start of my career, I was struck by the spectacle of buildings devoted to work or community life: factories seem to be doomed to rust, hospitals and schools to grey, and barracks to brown. I then tried to convince a few manufacturers and industrialists to colour the factories, but in vain” (Charnay and Simonot 2017:6). As time passed, not only manufacturers and industrialists but also administrators and other professionals in chief positions became interested in colour.

Working as a colour consultant means conceiving colour studies not only for workplaces such as industrial sites, factories, and offices, but also for public buildings such as hospitals, schools, public administration facilities, public transportation stations, and public roadways. Further activities of a colour consultant include conceiving colour concepts for emerging new towns, housing developments, and the restoration of city centres as well as creating colour ranges for industrial products such as finishing materials, textiles, machines, etc. Fillacier describes the new profession as a challenging expansion of the work of the artist: “Between the artist and the engineer, we had to find the most effective level of information for both. An arduous task because there is no doubt that for the artist leaving the subjective universe of creation requires a great effort and, for the scientist, entering the universe of taking sensitive risks poses a severe test” (Charnay and Simonot 2017:4).

The various colour practice approaches, however, differ largely from each other. As revealed through the interviews carried out in May 2019, if it were necessary to summarize each of the six responses to the question “How do you prefer to practice colour?” in one word, the results might be expressed as follows: sociological-scenic (Lassus), spatial-functional (Albert-Vanel), theoretical-creative (Lemonnier), artistic-sensitive (Lenclos), immaterial-optical (Charnay), and material-digital (Grillo). In general, the attempt to classify colour practice in such a way appears reductive and further in-depth research has to be conducted to fully capture the large field of activities of the individuals and their seminal contribution to the history of environmental colour design. Gathering first-hand information from living witnesses via a qualitative research method explores narratives that are mostly missing in mainstream historical accounts. These new insights reveal diversity within the field of colour practice. Including colour practice in the histories of design, architecture, and urban planning would mean re-writing these histories. The answer to the initial underlying question as to whether there is an environmental colour design culture that exists independently of individual personal experience can thus far be answered positively.

ACKNOWLEDGEMENTS
The conducted interviews are part of a broader project that aims to examine the French period in the history of environmental colour design and has been funded by the Mechnikov Program of the Embassy of France in Moscow.

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Yellow color in European architecture and the built environment: traditions and contemporary applications

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ABSTRACT
This paper aims to summarize the most important facts concerning the use of the yellow color in architecture and the built environment, considering its symbolic, functional, and decorative aspects, with particular emphasis on Europe. To understand the diverse impact of yellow in space, its rich semantic layers and various issues of preferences, two main research questions were formulated:
1) Does the ambivalence of yellow in European culture affect its present use in architecture?
2) What functions has yellow hue performed in architecture over the years?

This research paper is divided into two main sections. The first part is dedicated to yellow in traditional architecture, while the second deals with its use in the contemporary built environment. The results conclude that although over the centuries the rationale and ways for using yellow in architecture were diverse; it was always present in many varieties, due to its positive connotations with sun, light, gold, and popularity of ochre pigments. Overcoming the role of visual stigma of some socially marginalized people, yellow could signify loyalty to governmental power and later a kind of symbol of social status, e.g., in the Habsburg Dynasty. In contemporary built environments, yellow plays an important role in the city visual communication system and corporate identity. It is also the common color of mailboxes, taxis and tramways. Thanks to new materials and technologies yellow as a visual attractor appears at a large scale both in buildings and public spaces, being modern and an intriguing color in architecture.

Keywords: *yellow color in architecture, yellow ochre, color traditions, yellow color ambivalence*

INTRODUCTION

Compared with the other primary colors, pure yellow occurs only in a narrow band of the spectrum (Lancaster 1996:63). In the environment many yellowish tones exist, as it “can tend toward green on the one hand and toward orange on the other,” being described as the color of gold, lemon, sulfur and saffron (Pastoureau 2019:173,174). Yellow color has as many positive connotations as negative ones, thus being the color with a characteristic dualism of meanings. Inseparable from the sun, it is often associated with joy, energy, serenity, optimism and happiness. It is also the color of communication, intellect and knowledge (Varichon 2006:53). In antiquity, yellow was a symbol of light, warmth, prosperity and abundance. But in Medieval Europe it became highly ambivalent and negative associations began to dominate. While warm yellow tending to orange still hosted positive associations with honey and gold, greenish yellow experienced as “cold”, however, became the color of “envy, jealousy, lying, dishonor and treason” (Pastoureau 2019:64). The duality of yellow is also visible in the analysis of the color preferences. According to the list of general preferences, since the 19th century yellow occupies the last, sixth place among primary hues, throughout western Europe (Pastoureau 2019:218). At the same time YR, Y and GY hues, according to Natural Color System, are the preferred ones for residential building facades in many European countries (Janssens and Küller 2009).

THEORY AND METHOD

The main goal of this paper is to summarize the most important facts concerning the use of the yellow hue in the built environment, considering its symbolic, functional and decorative aspects with particular emphasis on European countries.

Color in architecture is a result of the complex relationship between form, context and culture, seen in time. Therefore, to understand the diverse impact of yellow color in space, all its shades and nuances, as well as its rich semantic layers and varied preferences should be taken into account. So, two main research questions were formulated:

1) Does the ambivalence of yellow in European culture affect its present use in architecture?

2) What functions yellow hue performed in European architecture over the years?

The analysis of the yellow color use in traditional architecture has been conducted based on the available references, documenting the colors of traditional facilities in different regions of Europe, and the author's examinations. The research of contemporary usage of yellow in the built environment was based mostly on a detailed survey of the most popular websites, covering architectural news and projects from around the world, especially: Archdaily (www.archdaily.com), Divisare (www.divisare.com) and Dezeen (www.dezeen.com). The rich collection of yellow-colored objects obtained in this way became the basis for the analysis and determination of various ways of using yellow in contemporary architecture and the built environment (Figure 1).

RESULTS AND DISCUSSION

The results are divided into two main sections. The first part is devoted to the color yellow in traditional architecture, while the second deals with yellow in the contemporary built environment.

YELLOW AS TRADITIONAL COLOR

There are many different ways of yellow application in traditional architecture, with both positive and negative associations to the color itself.

Yellow pigments derived from clay soils rich in ochre owe their color to an iron hydroxide natural mineral goethite (Douma 2008). **Yellow ochre** is not only the oldest yellow pigment but also one of the first pigments used by humans (Varichon 2006:54). It was already applied as early as 45.000 BCE, for decorating human bodies and later for cave walls (Pastoureau 2019:20). Yellow ochre, present in human life since Paleolithic times, built the colorscape of many European cities, just to mention the French Aix-en-Provence, known as the “golden city” or Menton with its “yellow streets”. Thanks to the universal availability of ocher pigments, warm, orangey yellows have spread throughout Europe, shaping the chromatic perception of many towns and villages to this day.

But **over the centuries yellow has also been used to visually stigmatize** some socially marginalized groups and people. There are several such applications of that color in architecture. Michel Pastoureau describes the peculiar custom of painting yellow the residences, especially its windows and doors, of prominent persons, who were guilty of forgery, treason, heresy or the crime of lèse-majesté, that lasted from the late Middle Ages until the early modern period. This ritual, at first practiced in France, then in Italy and Germany, around the 16th century was already quite widespread throughout much of Europe (Pastoureau 2019:116). Yellow in a negative sense was also often connected with madness and mental illness. In some Central European countries lunatic and mental asylums were painted yellow or called "yellow houses", for example, in Hungary (sárga ház) and Russia (желтый дом), as recently as in the 1920s (Pastoureau 2019:189).

At the same time, **golden yellow** always hosted positive associations to the precious metal itself. Due to perceptual similarity to gold, yellow was often used to resemble and symbolize it, being used as its equivalent or even a much cheaper substitute. As well, in the language of heraldry "or" means both yellow and gold. Yellow ochre and orpiment pigments were used to represent gold for the color of skin already in Egyptian tombs, then in the murals of Roman villas, e.g., in Pompeii (Varichon 2006:54, Zennaro 2019). Golden yellow in form of gold sheets or yellow paint was also widely used in domes of many Orthodox churches, especially in Eastern Europe. For example, Kyiv (Ukraine) is known as "the city of golden domes" for the dominant golden yellow color of onion-shaped cupolas.

In the second half of the 18th century many castles, palaces and other buildings around Europe were colored yellow ochre (e.g., Mikhailovsky Palace (The State Russian Museum) in St. Petersburg, Russia, or Drottningholm Palace in Stockholm, Sweden). As **the favorite color of the Habsburg Dynasty**, yellow became also the main color of Austrian Empire baroque architecture, with Schönbrunn Palace in Vienna being the most significant building to be painted in this color. Hence, this yellow is called *Schönbrunner Gelb* (Schönbrunn yellow). The present color scheme for the palace was established in the middle of the 19th century, during the reign of Franz Joseph. But the term **"Schönbrunn yellow"** cannot be defined with a simple color code. In the second half of the 19th century, it became **a symbol of a certain form of political expression and signaled loyalty to the emperor.** Thus, many Wilhelminian style villas, the Marchfeld castles and other buildings of both the nobility and the bourgeoisie were colored yellow. Over time, yellow began to be also used by commoners and farmers in an attempt to visually raise their social position (BDA 2004). Similar usage of yellow can be observed, e.g., in traditional Swedish housing, where the fashion for walls painted in this color was inspired by golden brick or yellowish sandstone facades of Italian baroque palaces. However, as yellow paint required a more expensive linseed oil binder, it was mostly used by nobility and those, who could afford it, thus becoming **a kind of a symbol of social status** (Fridell Anter 2009:60). But **yellow was also present in common architecture with no particular significance** – as the color of thatch, new shingle and wooden beams, as well as painted façade wooden boards, yellow brick, or simply plaster. Of these ordinary yellow houses, the one from Van Gogh's painting is perhaps the most famous. The oil painting "Yellow house (Vincent Haus)" from 1888, shows the small, yellow house in the French city of Arles, where Van Gogh rented two rooms and painted there, among others, his popular series "Sunflowers" (1888) (Pastoureau 2019:197). However, the house itself doesn't exist anymore, it can serve as a universal symbol of all houses with yellow facades, seen everywhere in Europe, both in big cities as well as in small villages.

Of course, **remarkable, iconic buildings** cannot be missing in this article, buildings recognizable, among others, for their unique color – yellow. The first one is Berlin Philharmonic, designed by architect Hans Scharoun in 1963 in Berlin, Germany, with characteristic yellow metal facades. A second one is Kubuswoningen, a residential complex built in Rotterdam, The Netherlands in 1984 by architect Piet Blom. It is a specific architectural experiment of cubic housing colored yellow. The third project is Renault Distribution Centre, designed by Sir Norman Foster in Swindon, UK, in 1982. It is recognizable mostly due to 59 bright-yellow masts and arched steel-beams that support the roof. By using the bright yellow of the Renault brand, the building succeeded in constructing a visual identity for the French car company for many years. The fourth project, however, is not widely known. It belongs to the category of local importance and an exceptional use of the yellow color. The steel bridge in Gdansk, Poland, built in 1907, was painted yellow during one night in 1979, by Grzegorz Boros and a group of students from the Academy of Fine Arts, in an act of protest against the then government, just before the martial law period and further events that finally led to the fall of communism in Poland and other East European countries. However, the yellow color of the bridge was not chosen intentionally but simply because it was the only available paint. Due to its bright yellow, it stands out in the gray surroundings and soon became associated with the Solidarity movement. After its complete renovation in 2012, the bridge is still painted yellow (Abramowicz 2013).

Figure 1: Different yellow color applications in the built environment. Collage by the author.

YELLOW IN CONTEMPORARY ARCHITECTURE AND THE BUILT ENVIRONMENT

Nowadays, when the possibilities of dyeing finishing materials are practically unlimited, architects are increasingly turning to yellow, for its **remarkable capacity to attract the observers' attention**. It seems, that today this is one of the most important factors governing the choice of saturated yellow as the dominant color for buildings and public spaces. As the most reflective of colors after the achromatic white (Lancaster 1996:63), highly contrasting with the blue of the sky, yellow plays an important and still **growing role in the European city visual communication system**. Due to its powerful optical impact, it is a prevailing color for caution traffic signage, safety railings for handicapped persons and in factories, hazard tapes, etc. Yellow is also the **common color of mailboxes, taxis and tramways** in many European countries. It is worth mentioning that the tradition of yellow mailboxes originated in the 15th century, together with the creation of the European postal services system by the German-Italian Thurn and Taxis family, whose emblematic color was yellow. The same origin is attributed to the yellow color of taxis; their forerunners were horse-drawn carriages introduced by the same family (Pastoreau 2019:213). **New materials and technologies** create new ways of experiencing the color yellow in architecture. Golden metal sheets on facades always evoke the association of yellow with metallic gold. In Ragnarock Museum of Pop, Rock and Youth Culture by COBE + MVRDV, (2016, Roskilde, DK), the enormous golden overhang defies gravity and welcomes visitors into the museum. Yellow TECU®-Gold metal tubes were used to distinguish the new extension designed by Foster + Partners in 2013 of Lenbachhaus Museum built in 1891 (Munich, DE). Yellow raw concrete facades usually give a clear identity to buildings. Warm ochre shades used by AIR architects in the Apprentice Formation Center (2009, Saint-Maur-des-Fossés, FR) create a special, almost monochromatic image of the building, while uniform creamy yellow color of stamped concrete gives lightness to the blind walls of the Gymnastics building by Heams et Michel (2011, Tourrette Levens, FR). Steel panels in "Harvest Yellow" color used in the residential housing estate called Fjärilen by Belachew architects (2017, Uppsala, SE), not only make it possible to unite roof and façades with the monochromatic yellow, but also guarantee uniformity and durability of color for a long time. But the monochromatic appearance of the building can be also achieved by cheaper means of expression, e.g., in the low-budget project of the social housing complex Flur20, designed by INNOCAD (2012, Graz, AU), finished in plaster simply painted bright yellow.

Yellow color also serves as **a visual identification of many brands**. Present in logos, it is often incorporated into the buildings, which house corporate centers, headquarters, and factories. One of the most recognizable examples is Enzo Ferrari Museum, designed by Future Systems + Shiro Studio in Modena, Italy (2012). The yellow color of the sculpted aluminum roof is called "Giallo di Modena" (Modena yellow), being not only Ferrari's corporate identity color, but also the official hue of Modena city itself. Other examples of yellow color used in buildings as corporate identity are: INPEK Company Building, design by Enrico Massagrande (2006, Wiesen near Vipiteno, IT); ÖAMTC Service Centers, design by PAUAT Architects in Austria (2013), and the renovation of Southbank Centre Hayward Gallery by Feilden-Clegg-Bradley (2018, London, UK).

Yellow is a color that is seen, stands out, and spreads. That is why it is frequently reserved for those objects, that must enliven the view and surprise the observer (Pastoureau 2019:193). Thus, **saturated yellow as a visual attractor** appears on a large scale both in buildings and public spaces, as well as in temporary art installations and architectural sculptures. An iconic example of installations is for sure Bellevue-Das Gelbe Haus, designed by Fattinger Orso Rieper (2009, Linz, AU). Beautiful installation HE YAPMAXXI2013 by bam (2013, Rome, IT) can also be mentioned in this category, as well as Simulacrum Installation by Pedro Henrique (2019, Santa Maria da Feira, PT). Among meeting places and pavilions with the dominant monochromatic yellow appearance, it is worth mentioning: Festarch by 2A+P and A. Gianfranco Bombaci and Matteo Costanzo (2011, Terni, IT), The Yellow Pavilion by Architecture for Humans (2019 Prishtina, XK) and Bookgarden by Kune Office (2019, Madrid, ES).

Yellow differs from ordinary implements, adds a pleasant, playful, sometimes comic, and cheerful dimension (Pastoureau 2019:193). This is true in the case of yellow giant urban sculptures designed by Dutch artist and performer Florentijn Hofman, e.g., Rubber Duck, which since 2007 has entered harbors all over the world, or Big Yellow Rabbit (2011, Orebro, SE). Yellow gives also a distinctive look to linear elements in space, e.g., roads, pathways and bridges. Two such temporary installations are The Floating Piers by Christo and Jeanne-Claude (2014–16, Lake Iseo, IT) and Florentijn Hofman's Yellow Street (2003, Schiedam, NL). A permanent yellow structure is Luchtsingel by ZUS (2015, Rotterdam, NL).

Yellow is a stimulating and energetic color, thus it is often linked with the intellect and knowledge, being used by architects in buildings designed for education purposes, e.g., CCM Music School by Aurora-Arquitectos (2020, Artave, PT); IJburg College 2 by Atelier PRO (2018, Amsterdam, NL), and Lycée Georges-Cormier by Ateliers O-S (2014, Coulommiers, FR). Yellow in kindergartens represents fun and joy, e.g., Tellus Nursery School by Tham and Videgård Arkitekter (2010, Hagersten, SE), and Ecopolis Plaza by Ecosistema Urbano (2010, Rivas-Vaciamadrid, ES).

Most of the examples of yellow contemporary applications discussed above, usually show highly saturated tones, which seem to carry all the characteristics and associations of the color. But varieties of yellow may differ in hue, lightness and chroma, or two or three of these attributes. Commonly, residential architecture yellows were and are widely used, especially as primary hue for facades, but usually tones, with high lightness, or as earthy browns. As in most cases, very dark or very pale tones do not appear yellow anymore (Lancaster 1996:63). The question arises **whether a “yellow house” really is "yellow".** However, this is to be answered in a future paper.

CONCLUSIONS

For ages the rationale and ways for using the yellow hue in architecture were diverse, but it was always present in many varieties due to its positive connotations with sun, light and metal gold, as well as the popularity and availability of ochre pigments. Overcoming its role of visual stigma of some socially marginalized people, as favorite color of the Habsburg Dynasty in 19th century, it signaled loyalty to the emperor and later became a kind of a symbol of social status. Today yellow is a modern and intriguing color in architecture. Yellow is important in the city visual communication system and corporate identities, popular for mailboxes, taxis and tramways. It is often used for the unordinary look of a building and as a visual attractor in space. Buildings finished in saturated yellow, complementary to the blue of the sky, usually are mostly remembered due to their color, not for their form nor their function, and often nicknamed “yellow”. The negative associations with yellow in the past slowly faded and disappeared. It seems that despite the complexity of the immemorial “love-hate” relationship, the future of the yellow color in European architecture looks bright.

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Color as a sign in minimalist architecture

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ABSTRACT
Semiotics is a method to study the meaning of signs and therefore represents an interesting approach to analyzing sign systems like architecture. The semantic dimension raises awareness for the colored building as sign and what it stands for. According to the conception of Charles S. Peirce, signs are three-place relations that consist of an object, a sign-vehicle, and an interpretant. Semiotic tools help to explore the origins of architectural work on the basis of color as a medium for generating an atmosphere. In addition to the functional aspect of visibility, color conveys a meaning. We know that minimalist architecture is often called a contemporary architecture of simplicity, as well as the fact that minimalist architecture is searching for the minimum as essence. Accordingly, we can set up the components to determine the color in minimalist architecture as follows: white – as simplicity of minimalism and chromatic colors – as the essence of minimalism. Looking at case studies, semiotics can help to identify systems of how colors can be applied and the generated image and user experience combined. There are processes in which colors signify different things, as colors are effectively functioning as signs. Through the case studies we verify the starting hypothesis on minimalist architecture whereby color gives the architecture properties of semantic flow.

Keywords: *color, white, sign, semiotics, minimalist architecture*

INTRODUCTION: COLOR IN ARCHITECTURE

Semiotics is a method of studying the meaning of signs and therefore represents an interesting approach to analyze sign systems like architecture. Color can be used to create spaces inspired by minimalism, which seek to maintain its essence and purist form. Calm, tranquillity and harmony (Lleonart 2009:13) of this aesthetic current, are often associated with the color white as well as chromatic colors. Accordingly, the colors that emphasizes its character become a part of coloristic patterns of minimal architecture.

The application of color in the field of architecture implies addressing the multitude of color in the direction of architectural volume and its detail (Van Leeuwen 2011, Wong 1997). Colour is fundamental to the quality of architecture, having effects on the perception of the built environment. It has its own language (Figure 1). Although colors, in themselves, are not a shape in the literal sense of the word, they are nevertheless an important factor in the character of a shape (Lleonart 2009).

In architecture, some well-known architects paid special attention to color. For example, in his work Luis Barragan's color demonstrates spatial purity as an element that evokes emotions; Álvaro Siza Vieira uses the achromatism of surfaces; Bruno Taut is well known for his experience of colored space and space filled with colored light (Brenne 2013:23); Lina Bo Bardi adheres to red in some architectural elements; Ricardo Legorreta adopts lush colors inspired by Mexican culture; and, Steven Holl works with color reflections and projections, experimenting the spatial and surface effects of color (Figure 2). As well, some cities are well known for their colorful neighborhoods, for example, Nyhavn (New Harbor) in Copenhagen, and La Boca in Buenos Aires.

COLOUR SEMIOTICS

The science that deals with the study of signs is semiotics. It is the research of how meaning is created and how meaning is transmitted. Colors as words serve as symbols and thus represent cultural ideas (Caivano 1998). The main feature of the symbolism of color is its universality, not only geographical, but also at all levels of being and cognition: cosmological, psychological, mystical, and more. According to Herodotus, the city of EHBATAN, colored in seven planets, was conceived as a microcosm (Chevalier and Gheerbrant 2009:77). In the analytical conception (according to C.G. Jung), color expresses the main human psychic functions: thought, feeling, intuition and senses (Chevalier and Gheerbrant 2009:80). Like symbols, each color represents something and they can even have different meanings from one culture to another. Cultural study of colors is a complex and fascinating topic. Among the old Muslims in Spain, white was the color of mourning (Chevalier and Gheerbrant 2009:80), as in South Africa, where white was the magical value of the color of death. In Christian art, white belongs to faith, specifically to the Father. In Masonic symbolism, white corresponds to Wisdom, Mercy and Victory (Chevalier and Gheerbrant 2009:78).

COLOR AS A SIGN

A sign is a form or shape that contains certain often hidden content. Any entity (thing or phenomenon), regardless of its complexity, can be considered as a sign from the moment the process of semiosis begins. Within a culture, signs act in very subtle and sophisticated ways, because a sign is not a previously defined thing, but a consequence of various factors and the context in which it is taken as such. According to Charles S. Peirce's theory, a sign is something that signifies something other than itself and that is understandable to have some meaning (Figure 3). Unlike Saussure, he does not define a sign as the smallest unit of meaning, but marks it as simple or complex (Peirce 1931). In one of his many definitions of a sign, Peirce writes (Atkin 2013), "I define a sign as anything which is so determined by something else, called its Object, and so determines an effect upon a person, which effect I call its interpretant, that the latter is thereby mediately determined by the former (EP2, 478)". Color can be considered a sign, including its various aspects, in the process of semiosis through the triad relationship between:

- REPRESENTAMEN or a sign - verbal, visual, mathematical, embodied.
- OBJECT or the referent in the world – can be a physical object or an experience.
- INTERPRETANT or meaning – is the sense made by sign, concept, idea, explanation.

MINIMALIST ARCHITECTURE: IDENTITY THROUGH COLOR

The possibilities with colors are countless within the minimalist current. Accordingly, the application and treatment of color becomes a fundamental and even determining element. Vitality, energy and vigor are some of the feelings we get when many colors are combined in the same (minimal) space (Lleonart 2009:241). We know that minimalist architecture is often called a contemporary architecture of simplicity (Bertoni 2003, Asensio Cerver 1997), as well as the fact that minimalist architecture is searching for the minimum as essence. Accordingly, we can set up the components to determine the identity through color in minimalist architecture as follows: white color – as simplicity of minimalism and chromatic colors – as essence of minimalism or minimum (Figure 4).

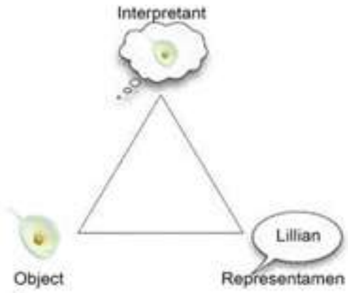

Figure 1: Sauerbruch Hutton, Brandhorst Museum in Munich, Germany (left); Figure 2: Steven Holl, Sarphatistraat Offices, Amsterdam (center); Figure 3: Sign in Peirce's semiotics – Representamen / Interpretant / Object (right).

WHITE COLOR

Great painters used white color to represent light, to materialize it. White color in architecture, much clearer than in painting, represents something more, much more than a complete abstraction. It is a solid, safe, effective base for solving the problem of light: to direct the light, cast a shadow, engrave with it, change it. White color in minimalism is present as the facade color, as with Alberto Campo Baeza, Eduardo Souto de Moura, Manuel Aires Mateus, Takura Yamamoto (Figures 5, 6, 7). Accordingly, within the minimalist current, the application and treatment of white color becomes a fundamental and even determining element. It involves the sum or synthesis of all the colors and is the one most light sensitive, as stated by John Pawson, "one finds that there are 50 different colors of white" (Pawson 1996:13).

In case studies, semiotics can help to identify systems of how white color can be applied and the generated image and user experience combined (Table 1).

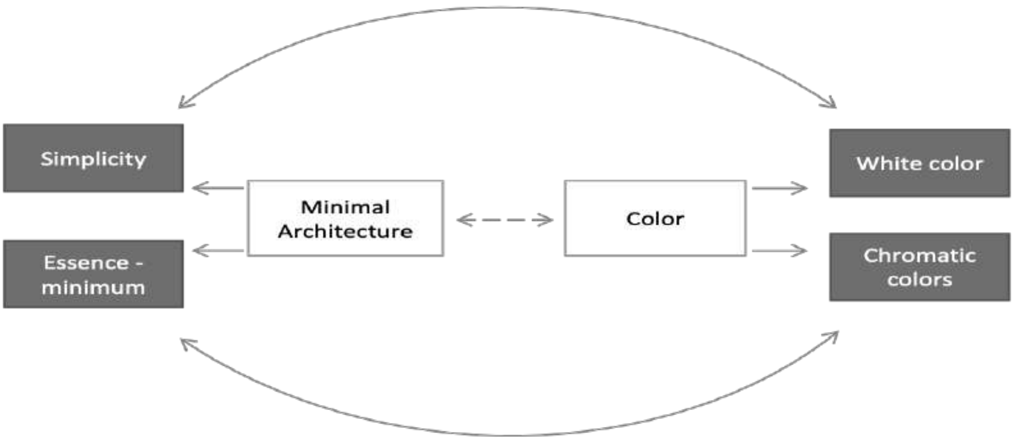

Figure 4: The components to determine the color in minimalistic architecture.

Representamen (sign vehicle)	**Interpretant (meaning)**	**Object (referent)**
White (color)	Innocence – White is the beginning of everything	Futuristic – Symbolizing a clean slate, we can envisage anything with white
	Purity – Its simplicity untainted by any other hue	Timeless, universal
	Clean slate – helping us through times of stress, and allowing us put the past behind us	Efficient – White is clean and clinical, giving an impression of efficiency and organization
	Preparing us to move on	New beginnings
	Unity – represents the positive as well as the negative aspects of all colors	Impartial – suggests fairness
	Equality – It contains an equal balance of all the colors of the spectrum	Neutrality
	Stands for everything good and right	Symbolically, in opposition to black
	The color of certainty, of illumination, and of insight	Knowledge and learning
White & other color	Detail	Personality
White & black	Symbolic duality	Aesthetic purity

Table 1: Sign analysis of white color taken from the sign triangle based on the theory of Pierce (Chevalier and Gheerbrant, 2009, Taft 1997, Holtzschue 2006).

In the most dogmatic version, minimalism should go hand in hand with absolute *monochromatic* use and only white color. The combination of white and other colors, as a detail, will determine the sensory perception of the space. If we want to maintain the principle that white is simplicity within minimalism, but want to add new elements that don't look dominant, the best way is to use accents with striking colors, such as any warm color. Each color and type of combination can endow a space with a distinct personality (Lleonart 2009). If we use a very toned-down color, a pale one, with white as well, the final atmosphere will be serene, gentle and very relaxing, but using a highly saturated and much denser tone, it will convey brightness and energy, and become the focal point of the color (Lleonart 2009:183). The contrast between black and white, as this combination presents a symbolic duality, results in a noticeable sobriety and aesthetic purity.

Figure 5: Alberto Campo Baeza: Domus Aurea (left); Figure 6: Manuel Aires Mateus: House in Leiria, Portugal, 2010. (center); Figure 7: Takura Yamamoto: Little House with big terrasse, Tokyo (right).

CHROMATIC COLORS

Colour harmony is one of the highlight research topics (Serra et al. 2015, O'Connor 2015). Contemporary colour theories have the roots in the work of Michel-Eugène Chevreul, who has distinguished six color harmonies, such as harmonies of scale, of hue, of a dominant color, and of their contrast of scale, of hue, and of a dominant color (Chevreul 1987). Associated with other minimal design elements, the chromatic scheme in minimal architecture takes over the visual dominance of the design to make it more attractive, and easy to understand. Accordingly, monochromatic color schemes emphasize accents, rather than attract attention.

Representamen (sign vehicle)	Interpretant (meaning)	Object (referent)
Gray (color)	Impartial and dispassionate.	Neutrality
	It is the transition between two non-colors, neither black nor white. It takes the middle ground, not making a decision either way.	Compromise Indecision
	Reserved, quiet and conservative color, it has a steadying effect on other colors around it.	Control
	Being non-emotional, gray can appear indifferent, uncaring, cold and aloof.	Detached
	Gray can be the stable base from which the new and positive can come.	Introduction
	Gray can appear neutral, disinterested, objective or impartial.	Unemotional
Gray & other color	Detail	Personality

Table 2: Sign analysis of gray color taken from the sign triangle based on the theory of Pierce (Chevalier and Gheerbrant 2009, Taft 1997, Holtzschue 2006).

From the fusion of the absence of color, i.e., black, and the synthesis of them all, i.e., white, we obtain the color gray, its tone and intensity depend on the proportions of the mix (Table 2). It can be a perfect union between the elegance of black and the luminosity of white. As it is a neutral tone, all other colors and tones could be used as a detail, to reinforce the purity and sobriety of minimalist lines.

CONCLUSION

In this paper, the starting hypothesis whereby color gives to the minimalist architecture the semantic flow properties is verified through case studies. White as well as chromatic colors, emphasize its character, become a part of coloristic patterns of minimal architecture. There are processes in which colors signify different things, as the fact that colors are effectively functioning as signs. Colors can highlight the main features of minimal architecture, despite any patterns, each color can be used. As stated by Wittgenstein, "There is no such thing as the pure color concept" (Wittgenstein 1977:26e,73).

The use of color could be the fundamental problem of how minimal architecture is observed today. It is observed with two polarities; the first is opinion as sublimity, and the second is an adverse opinion (as an aesthetically cold and sterile design). Depending on the positive or negative effect of the color that is used, the experience of the observer also will be positive or negative. The deciding factor for the observation, as positive or negative effect of color, could be the way of a light implementation, but that is another topic for another time.

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МЕЖДУНАРОДНАЯ НАУЧНАЯ КОНФЕРЕНЦИЯ
РОССИЙСКОГО ОБЩЕСТВА ЦВЕТА

Сборник статей
Под редакцией Ю. А. Грибер, В. М. Шиндлер

Издательство Смоленского государственного университета

Выпускающий редактор *Л. В. Пузырева*
Графические редакторы *Ю. А. Устименко, В. В. Устименко*
Переводчик *А. В. Ларченко*

Подписано к печати 27.12.2020. Формат 60x84 1/16.
Бумага офсетная.
Печать ризографическая.
Усл. п. л. 21. Уч.-изд. л. 22,5.
Тираж 300 экз.
Заказ № 149.