

Colour Naming of Post-COVID Participants Hints to “Darkening” of Perceived Colour

Yulia A. Griber ^{1*} and Galina V. Paramei ²

1. Smolensk State University, Smolensk, Russia; y.griber@gmail.com
2. Liverpool Hope University, Liverpool, UK; parameg@hope.ac.uk

* Corresponding author: y.griber@gmail.com

Abstract

We investigated colour naming in individuals who have recovered from COVID-19. Data was collected from native Russian speakers in an online experiment (<http://colournaming.com>). An unconstrained colour-naming method was employed. The dataset included responses of 201 participants (147 women) aged between 19–65 years ($M = 33.4 \pm 13.2$), who had had coronavirus infection and the confirmed medical diagnosis. The data was compared with data collected pre-pandemic (2018–2019) from 2,457 respondents (1,402 women) aged between 16–98 years (henceforth termed “healthy”). For intergroup comparisons, we estimated frequency of Russian basic colour terms ($N=12$), frequent non-basic colour terms, and achromatic modifiers, as well as the number of words in colour descriptors and colour-naming patterns. In post-COVID respondents, we found an increase in ‘brown’-naming, along with an increase of frequency of achromatic modifiers. These naming pattern changes provide indirect evidence that colour vision of these respondents has been affected by coronavirus. If confirmed in a psychophysical examination of colour vision, the two phenomena might be indicative of an affected processing of spatial luminance contrast in post-COVID individuals.

Keywords: *Colour Naming, COVID-19, Colour Perception*

Introduction

There is increasing evidence that patients who have recovered from COVID-19 exhibit various symptoms of vision impairment, such as photophobia, blurry vision, and decreased visual acuity. Clinically these are associated with raised intraocular pressure (IOP), eye muscle spasms, and dilated retinal veins, the sign of retinopathy (e.g. Costa et al., 2021; Invernizzi et al., 2020). By now it is not known whether COVID-19 infection affects colour vision. However, post-COVID ocular changes, such as IOP and retinopathy, are likely to manifest as an impairment of blue-yellow discrimination, according to previous non-COVID studies (e.g. Castelo-Branco et al., 2004).

Based on the available data, we hypothesised that, compared to respondents who have not been affected by coronavirus, the affected colour perception in

post-COVID respondents will manifest as an altered pattern of colour naming. To test this hypothesis, we compared colour naming in individuals who have recovered from COVID-19 and in those whose responses had been obtained before the pandemic.

Materials and Methods

Participants

Data was collected from native Russian speakers in an online experiment (<http://colournaming.com>). The 2022 dataset included responses of 201 participants (147 women) aged between 19–65 years ($M = 33.4 \pm 13.2$), who had had various forms of coronavirus infection and the confirmed medical diagnosis. The 2022 data was compared with pre-pandemic data collected in 2018–2019 from 2,457 respondents (1,402 women) aged between 16–98 years (henceforth termed “healthy”).

Web-based psycholinguistic experiment

Participants were randomly presented with virtual colour cards selected by a computer program from 606 stimuli. Colour was described by coordinates in CIELAB colour space (for further details, see Griber et al., 2021). Respondents were asked to name each colour using the most appropriate colour descriptor – either a simple word, a modified or a compound term.

Analysis

For intergroup comparisons, we used several linguistic measures:

- (1) frequency of Russian basic colour terms (N=12) and recurring non-basic colour terms;
- (2) frequency of achromatic modifiers;
- (3) number of words in colour descriptors;
- (4) colour-naming patterns.

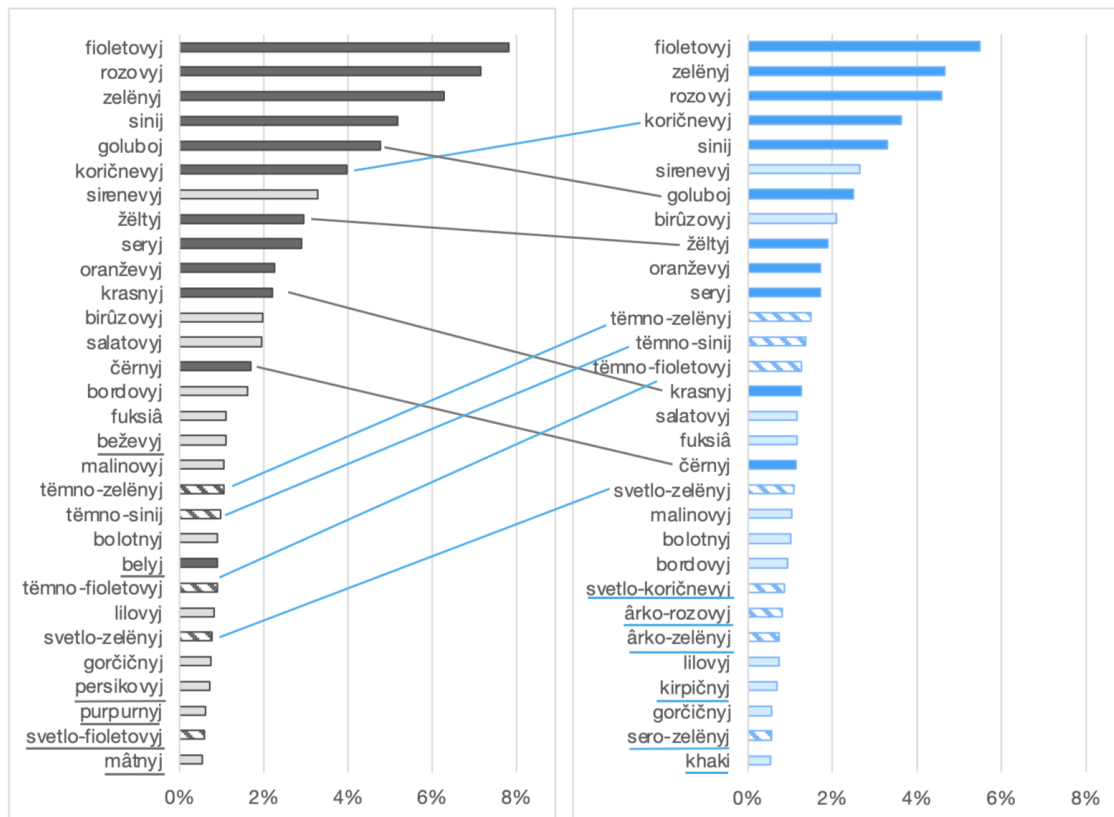


Figure 1. Most frequent colour names in non-COVID (left) and post-COVID (right) respondents. BCTs are indicated by solid bars, frequent non-BCTs by transparent bars, and modified or compounded terms are thatched. Colour names offered frequently by one group but not by the other are underlined.

Results and Discussion

Comparison of ranking of the most frequent colour names (Figure 1) showed that participants from both groups used basic colour terms (BCTs) more frequently than non-BCTs. Compared to the “healthy” respondents, post-COVID participants offered *koričnevij* ‘brown’ more frequently; conversely, percentage of the terms *oranževyj* ‘orange’ and *krasnyj* ‘red’ was lower; also, the terms for “light” colours – *želtij* ‘yellow’, *rozovyj* ‘pink’ or *goluboj* ‘light blue’ – were offered less frequently.

Notably, CTs with achromatic modifiers were much more prevalent in the post-COVID participants’ descriptors compared to “healthy” respondents (Figure 2): *tëmnyj* ‘dark’ (10.0% vs. 5.0% respectively), *svetlyj* ‘light’ (6.7% vs. 4.0%), *ârkij* ‘bright’ (4.1% vs. 1.7%), *blednyj* ‘pale’ (2.7% vs. 1.5%), *grãznyj* ‘dirty’ (2.4% vs. 0.9%), and *pastel’nyj* ‘pastel’ (1.1% vs. 0.2%). The ‘dark’-modifier was used particularly frequently in combination with *zelënyj* ‘green’, *sinij* ‘dark blue’, and *fioletovyj* ‘purple’, i.e. BCTs that in colour space denote colour categories of relatively low lightness, thus, prompting that this modifier conveyed further perceived dimming of the corresponding colours.

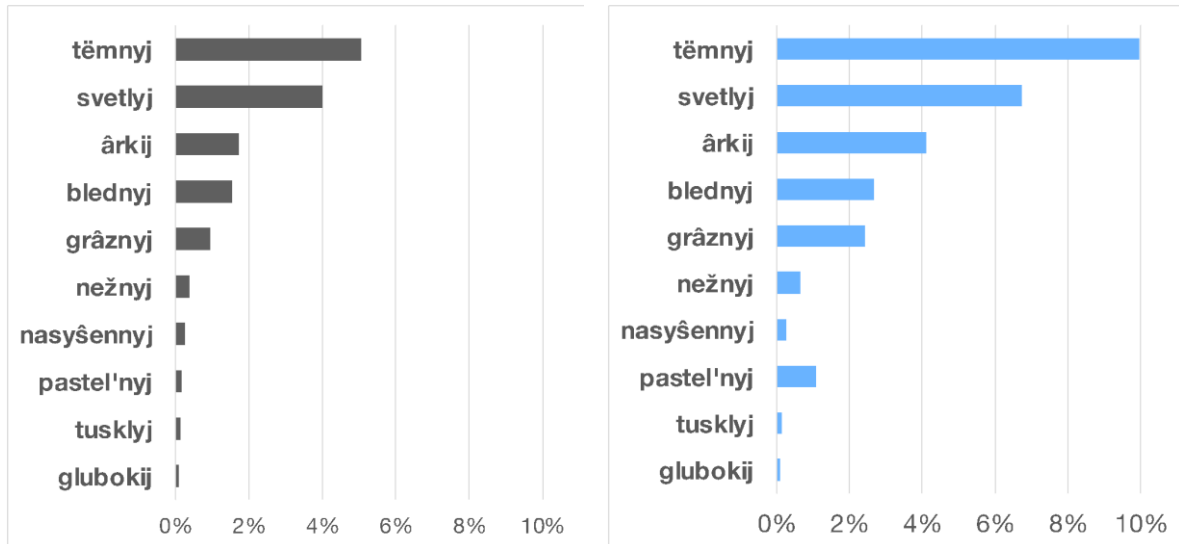


Figure 2. Frequency of achromatic modifiers in compounded colour names in non-COVID (left) and post-COVID (right) respondents

Colour-naming patterns differed significantly between the two groups, too (Figure 3): whereas the vast majority of “healthy” respondents’ colour descriptors were monolexemic (BCTs: 49%; non-BCTs: 30%), for post-COVID respondents the corresponding numbers were lower (BCTs: 32%; non-BCTs: 25%). Moreover, they frequently offered more elaborated, polylexemic descriptors, e.g. *tusklyj tëmno-krasnyj* ‘dull dark red’ or *blednyj rozovyj s fioletovym otlivom* ‘pale pink with a purple opalescence’.

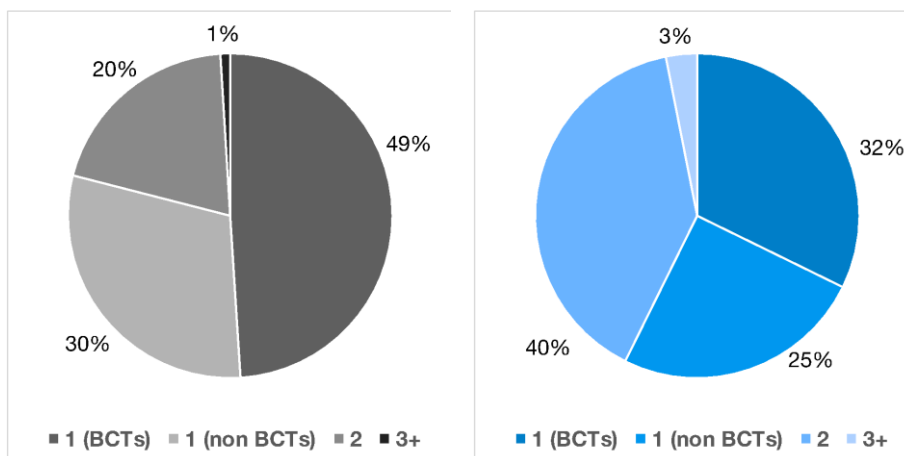


Figure 3. Number of words in colour descriptors in non-COVID (left) and post-COVID (right) respondents

Conclusions

The increase in 'brown'-naming, along with the increase of using achromatic modifiers in post-COVID respondents provide indirect evidence that their colour vision has been affected by coronavirus. The relatively high frequency of 'dark'- and 'dirty'-modifiers may signal a generally "darkened" appearance of colours. Furthermore, an increase in frequency of 'pale'-, 'dull'- and 'pastel'-modifiers hints to desaturation of perceived colours. If confirmed in a psychophysical examination of colour vision, the two phenomena might be indicative of an affected processing of spatial luminance contrast in post-COVID individuals (cf. Bimler et al., 2009).

Acknowledgements

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