THE COLOUR LEXICON IS SHAPED BY ENVIRONMENT AND BIOLOGY: COMPARING HIMBA AND FRENCH COLOUR PERCEPTION

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The evolution and diversification of language is driven by evolutionary pressures, and by its repeated use, learning, and transmission across generations. One aspect of this process is the amplification of weak biases, potentially up to a whole language and beyond, in large-scale cross-linguistic patterns. For example, differences in subsistence mode (Blasi et al, 2019), in the anatomy of the vocal tract (Dediu et al, 2019), or in climate (Everett et al., 2015) may influence the phonemic repertoires of languages. We show here that the lexicons of languages can be influenced by weak biases due to environmental factors. UV radiations affect the eye physiology by causing the lens to opacify, and this may reduce the ability to perceive the blue part of the colour spectrum (Davies et al, 1998). As a consequence, people living in areas with high levels of UV incidence may be less likely to possess a specific term for blue in their vocabulary (Lindsey & Brown, 2002). However, the causes underlying the evolution of colour lexicons are complex and likely involve multiple factors, including variation in other cultural and physical factors. To investigate whether Lindsey and Brown's physiological hypothesis still holds when these other factors are considered, Josserand et al. (2021) conducted a large-scale statistical study on 142 populations, and found that populations living in areas with high levels of UV incidence are more likely to merge 'green' and 'blue' colours under a single (*'grue'*) term.

Here, we wished to complement these results by investigating the relationship between colour perception and UV incidence in two representative populations

living in markedly different environmental conditions. Specifically, we compared French participants (who are exposed to a medium amount of UV radiation) to Himba participants (a population of Northern Namibia, living mostly outdoor under high UV incidence). While French speakers have a specific term for 'blue', the Himba historically do not (Roberson et al., 2004; but see Mylonas et al., 2022). Here, we present new preliminary results from 76 Himba and 42 French participants. We used the Farnsworth Munsell test, which evaluates and ranks colour acuity for a broad range of colours and can reveal both inherited and acquired colour vision deficiencies. In addition, we used the JND (just noticeable differences) task for blue and red colours. Here, participants performed a binary forced choice stimulus task using a computerized adaptive testing design. Two coloured rectangles were presented on the screen with a colour difference magnitude ranging from 0 to 10 CIELAB units and applied differently per colour and per axis (L, a and b). For both experiments, luminosity settings and screen calibration were carefully controlled.

The results showed that older French participants were less able to discriminate close colours in the blue range (only). This finding is consistent with the cumulative nature of the exposure to UV radiation throughout lifespan. Second, older Himba participants were less able to discriminate close colours *both* in blue and red ranges. Surprisingly, while we expected that the difference between Himba and French participants would be the strongest in the blue range, on the contrary, Himba participants had greater difficulty discriminating close colours through the whole range of colours. However, a careful analysis is in progress to account for potential confounding factors, for instance related to the inadequacy of the tasks themselves.

These preliminary results may suggest that the effect of UV radiations on colour perception occurs for all hues. If so, it may be one factor explaining the relatively low number of colour terms used by the Himba people, by limiting the hues individualized in the speakers' perceptual space, in addition to other cultural and environmental factors. Indeed, recent computational work suggests that both perceptual structure and communicative needs shape colour naming (Zavlasky et al, 2019), and injecting variation in the initial perceptual space of these models is an avenue we plan to explore in the future. Our contrastive study between two populations contributes to unravelling the role of colour perception in mediating physical/environmental factors on lexical characteristics of languages. Overall, this work suggests that language is deeply intertwined with its surroundings, thus highlighting the relevance of considering weak biases related to the socio-cultural system, the features of the environment, or the biology of its speaker.

Acknowledgements

We thank our two guides and translators Fanny Kavary and Chinho Lopez for their great professionalism and help with the experiments, as well as for sharing their knowledge on Himba culture. We also want to acknowledge Esther Boissin for her resourceful advice and emotional support in this fieldwork. Most importantly, we are immensely grateful to the Namibians who welcomed us and our project with openness, benevolence, and generosity.

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