

# Evolution and efficiency in color naming: The case of Nafaanra

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Many theories hold that languages acquire new color terms with time, resulting in finer-grained color naming systems (e.g. Berlin & Kay, 1969; MacLaury, 1997; Levinson, 2000). More recently, it has also been claimed (e.g. Lindsey et al., 2015; Regier et al., 2015; Gibson et al., 2017) that this historical evolutionary process, and color naming more generally, are shaped by the need for efficient communication — that is, the need to communicate accurately, with a simple lexicon. Zaslavsky et al. (2018) [henceforth ZKRT] showed that an independent information-theoretic principle of efficiency, the Information Bottleneck (IB) principle (Tishby et al., 1999), explains much cross-language variation in color naming, and they hypothesized that color naming systems evolve under pressure to remain near the theoretical limit of efficiency. However, most research concerning the evolution of color naming, including ZKRT, has been based on synchronic cross-language comparisons, rather than on diachronic data.

Here, we examine color naming evolution using diachronic data for a single language: Nafaanra, a Seno language spoken in Western Ghana. Color naming data for Nafaanra were first collected in 1978 in the village Banda Ahenkro, as part of the World Color Survey (WCS, Kay et al., 2009). The data revealed a 3-term system with terms for light/white, dark/black and red. ZKRT found that 93% of the WCS systems, including this one, are near-optimally efficient in the IB sense. Nafaanra data were collected again in Banda Ahenkro by one of us (K.G.) in summer 2017, and revealed a 7-term system. The three terms from 1978 are still used but they now name smaller categories, and there are also new terms for (roughly) yellow, green, blue and purple. These findings are consistent with the claim that languages add new color terms with time. To investigate whether Nafaanra had changed under pressure to remain efficient, we analyzed the 2017 system in the same way ZKRT had analyzed the 1978 system. We found that the 2017 Nafaanra system, like the 1978 system, lies near the theoretical limit of efficiency, and that this outcome would be unlikely without pressure

for efficiency. To our knowledge, this is the first evidence that directly supports the proposal that color naming evolves under pressure for efficient communication. How broadly this finding generalizes across languages and domains (Regier et al., 2015), and how efficiency interacts with other factors such as language contact, are questions for future research.

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