

HOW THE STRUCTURES OF UMWELTS AND SIGNS ARE RELATED

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Why do humans use symbols more than any other animal (Deacon, 1998)? Here we argue that part of the explanation might lie in the effect certain properties of the human sensory world have on language.

Following Peirce (1955), semioticians usually distinguish three kinds of signs – indices, icons, and symbols – that are often treated as discrete, separate classes. However, analyzing the structure of sign types using conceptual blending theory (CBT: Fauconnier and Turner (2008)) allows us to establish a continuity between them. In CBT, mental spaces are integrated by a projection of those spaces as inputs onto an emergent blend space, which develops structure beyond the input spaces alone. Conceptual blends could be ordered on a cline based on how incongruous the structures of their input spaces are. Human thought frequently features blends with input mental spaces whose structures are in ‘fundamental conflict’ (Turner, 2014). Signs can be analyzed as blends of the signifier (symbol or other representation) and the signified (referent) (Peirce, 1955). Indexical and iconic signs have a relatively close match between the structures of the signifier and the signified. In symbols, however, the signifier and the signified are inherently discordant due to the arbitrary nature of the former. Importantly, the structural similarity of mental spaces is not an all-or-nothing property, allowing for an account of gradual emergence of symbols.

Furthermore, every sign includes an interpretant, i.e. the way it is interpreted by its receiver (Peirce, 1955). Because of this, communication should be analyzed relative to an animal’s Umwelt, i.e. the way the world presents itself to it (Uexküll, 1992). In this context the non-arbitrariness of indexical and iconic signs as precursors to more complex blending in symbols becomes especially important. If we look closely at Umwelts of other animals, iconicity and indexicality can be found much more readily than before. Perhaps most clearly it can be seen in the often overlooked case of olfaction, as behaviors like marking an object with alarm odor, sexual pheromone, or urine marks can be interpreted as indexical due to their deictic function of demarcating presence, location, dominance, and territory. Additionally, the smells of those marks bear resemblance to the organism

which produced it, suggesting an iconic relation as well (Parsons et al., 2018). A clear example is the urine marking of fire hydrants by dogs. McGuire, Olsen, Bemis, and Orantes (2018) suggest that small dogs lift their legs significantly higher than larger dogs for urine marking. The hydrant acts as a dominance display record, where the highest urine mark indexes the presence of a higher ranking individual. The suggestion is that dogs arriving at the fire hydrant interpret it as an iconic/indexical sign of their conspecifics in the area. The spatially arranged layout of the urine samples is interpreted as systematically mapping onto such properties of those individuals as size or dominance. Additionally, it might afford the perception of information about the temporal order of other dogs' visits to the hydrant or about their relative size. Such an understanding is not accessible to humans due to the different Umwelt we inhabit (Quignon et al., 2003).

Turning to humans, language can be viewed as a high level hyper-blend (Turner, 2014), i.e. a blend using other blends as input mental spaces: in language the linguistic conceptual space is blended with a production/perception modality, most typically audition. Importantly, the semantic space of human language has a higher dimensionality than that of audition, which, leaving aside timing and timbre, is often estimated to be 2D (Keller, 2017). Recent experimental evidence suggests that iconicity is harder to maintain the more conflicting the topologies of the meaning and the signal space are, e.g. if the meaning space has higher dimensionality (Little, Eryilmaz, & De Boer, 2017). In such cases, more compositional or combinatorial structure is likely to emerge¹, leading to the development of more symbolic signs. This is indirectly supported by the observation that sign languages typically exhibit higher levels of iconicity than spoken languages (Taub, 2001). Interestingly, olfaction is often argued to have a more highly dimensional psychophysical space compared to other senses (Mamlouk & Martinetz, 2004; Magnasco, Keller, & Vosshall, 2015). While human olfactory abilities are often underestimated (Majid, 2021), humans exhibit abundant variation in olfactory receptor protein genes (Hasin-Brumshtein, Lancet, & Oleder, 2009), which affect odor perception (Trimmer et al., 2019), and have many more nonfunctional olfactory receptor genes compared to other primates and other animals (Gilad, Man, Pääbo, & Lancet, 2003; Quignon et al., 2003). This could plausibly lead to more variability in Umwelt structure for smell compared to other senses between humans, and raises the possibility that olfaction – a high-dimensional perceptual modality affording more means for iconic communication – is less readily available for communication to us than to other animals.

Taken together, the arguments above could suggest that the uniquely high reliance on symbols in humans might be partially explained by the specifics of our perceptual and communicative Umwelt.

¹This can be seen as a way to increase the dimensionality of the signal space: each compositional/combinatorial element serves as a new temporally separated dimension.

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