Using virtual reality to study language evolution

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Why are there different languages and how arbitrary is their variation? It has been suggested that at least some of the cross-linguistic variation can be explained by language-external variables such as the social, physical or technological environment in which languages are embedded (Bentz et al. 2018; Lupyan & Dale, 2016). However, many proposed links (see, e.g., Lupyan & Dale, 2016) are purely correlational. In order to make causal claims and avoid 'spurious correlations' such findings have to be integrated with other methodologies such as experiments that can be used to test hypothesized causal links (Roberts, 2018). One approach is to use artificial languages in laboratory experiments to uncover cognitive biases or general mechanisms shaping the structure of languages as they are learned, used, and transmitted (see Tamariz, 2017 for a review). Some have shown that languages are indeed sensitive to the referential contexts or communicative situation in which they evolve, e.g., with regards to what meaning dimensions become specified or which category systems evolve (Winters et al. 2015; Nölle et al. 2018). One problem is that such experiments are usually extremely simplified and abstract 'communication games' or artificial learning situations (e.g., isolated pictures with labels presented on a screen), which therefore may lack 'ecological validity'. Here we present a new approach that tries to overcome this issue by providing participants with more naturalistic tasks in Virtual Reality (VR) that allow for higher ecological validity while still providing tight experimental control. We showcase a series of studies that demonstrate how VR can be used to test how languages adapt to the physical world: One case study addresses whether topographic features in the local environment (such as a slope or a dense forest) can motivate the use of competing spatial reference frames to describe spatial locations of objects. Linguistic fieldwork has suggested such a relationship, but a causal link is yet to be demonstrated (Majid et al., 2004; Palmer et al., 2017). VR tasks allows us a way to study spatial language use in large-scale environments under tightly controlled conditions that structurally resemble more abstract communication games, while at the same time providing more naturalistic viewpoints and communicative goals. This allows us to test whether changing environmental variables in otherwise identical tasks can motivate the use of different frames of reference (e.g., viewpoint-based vs. environment-based) as preferred by different speech communities. Beyond the obvious domain of space, we also discuss further research questions and manipulations afforded by VR. One exciting new avenue for language evolution research is the use of realistic environments that behave slightly differently from the real world to test the robustness of linguistic universals under different conditions. This could help us assess whether cognitive biases that seem to affect the distribution of universals are simply innate or rather result from learning inside and in interaction with a specific environment. In sum, VR experiments can overcome limits of traditional paradigms and give us a deeper perspective on how language relates to human cognition and situated behaviour.

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