Variation in Spatial Language as a Form of Adaptation: An Evolutionary, Experimental Approach

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Why do languages differ so dramatically in grammatical and conceptual forms? Usually, linguistic diversity is attributed to random changes that accumulate and become conventionalized. However, over the past years an increasing amount of studies emerged suggesting that linguistic structure can additionally adapt to social, physical or technological aspects of the external environment (see Lupyan & Dale 2016 in press for a review). This includes climate or landscape, social factors like population size, language contact and even genetic predisposal due to ecological adaptation.

Spatial language is arguably one of the most fundamental domains of linguistic practice, as all humans inhabit a 3D space and therefore need to reference its qualities to interact successfully (e.g., locations, topology, relations between objects etc.). Different speech communities have found very different solutions to this problem leading to striking diversity in how motion, topological or distant relation (“Frames of Reference,” FoR) are expressed (Levinson & Wilkins 2006). This has often been cited as an argument for cultural evolution leading to diversity via conventionalization (Evans & Levinson 2009). However, since spatial language has also been used as prime argument for the claim that language restructuring general cognition, differences have usually been attributed to arbitrary conventions leading to language structure that, in turn, affects cognition (Haun et al. 2011). Accounts emphasizing the possibility of ecology-induced cognitive styles or the environment (e.g., urban vs. rural) affecting the choice in FoR have been criticized or accused of simplifying the issue (Levinson et al. 2002, Majid 2004). And yet, it remains counterintuitive that clearly geographically grounded systems should have emerged independently of the environment: Languages solely relying on the absolute FoR often directly integrate landmarks from the surrounding environment like slopes in Tzelatal (Levinson & Wilkins 2006) or rivers in Mian (Fedden & Boroditsky). Intuitively, a certain strategy should be more adaptive in a certain environment and get selected over time. Left/right may not be helpful in a desert where absolute directions seem more reliable. In a dense jungle or urban area, however, far sight is disabled; relative/intrinsic strategies might become adequate. Only recently, fieldwork has begun to crosslinguistically test for these relationships by comparing spatial language between related/same languages spoken in different environments and distant languages spoken in similar environments (Palmer 2015, Bohnemeyer 2015).

In order to test for relationships between spatial language and environment, I suggest to complement this recent correlational approach with experiments that attempt to model the evolution of spatial language per se, possibly uncovering mechanisms that contribute to the diversity we can observe. Recently, we conducted an experiment to test whether linguistic
conventions that emerge spontaneously in dialogue—the predominant mode of communication and arguably the starting point for most language change—are affected by the environment. We used Garrod and Doherty’s (1994) maze game, a collaborative task where dyads have to communicate about spatial locations in order to guide each other through virtual mazes. The original experiment showed that in this task-oriented dialogue, dyads automatically routinize a specific strategy to describe positions, which would even spread when partners were exchanged leading to “communities” that adhered to a specific convention. We introduced three conditions that systematically varied maze layouts (Fig. 1).

![Fig. 1. Mazes from the (a) regular, (b) irregular and (c) stratified condition.](image)

As predicted, different linguistic strategies became routinized in response to these environmental conditions. Players in the regular condition would rely more on the MATRIX strategy conceptualizing the maze as a coordinate system (“go to D2”), while players in the irregular and stratified conditions relied significantly more on figural shapes or horizontal displacements that were made salient (“Go to the head,” “The switch in the second row, left”). This suggests that linguistic interactions and routines are not only the result of automatic priming mechanisms, but also highly sensitive to factors of the shared task environment. Interaction in specific environments can influence how the very same coordination problem (in this case communicating spatial positions in the maze) is conceptualized and translated into linguistic conventions (outcompeting equally valid alternatives).

Following these results, an additional series of experiments is planned to test whether such mechanisms are not only at work in dialogue, but could constrain emerging communication systems as such (Nölle, in progress): Subject pairs have to describe spatial positions to each other to solve the same task in varying immersive, virtual environments, while the use of conventional language is restricted. They have to develop a novel, graphical communication system. Manipulating the environment, e.g. by contrasting flat vs. elevated, dense vs. sparse vegetation, or landmarks vs. none, allows testing whether such differences will systematically affect the “languages” that emerge and evolve in these settings. This work thus aims at showing that linguistic adaptation is a possible evolutionary mechanism that contributes to the diversity in spatial language that we can observe.

References


