

Unconscious effects of language-specific terminology on spatial concepts in bilinguals

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Keywords: categorization, linguistic relativity, spatial cognition, vMMN

Categorization is one of the most fundamental cognitive abilities of humans, however, different languages vary radically in how they partition and encode the surrounding physical world through lexical and grammatical devices (Malt & Majid, 2013). For example, despite shared biological constraints and life experiences, people coming from different language backgrounds carve up space in strikingly various ways (Bowerman & Choi, 2001). While English native speakers make an obligatory lexical distinction between support and non-support relationships (*on* for support; *over/above* for non-support), in Chinese, people use a common term '*shàng*' to indicate both relationships (Toh & Suárez, 2017). Learning an additional language usually entails internalizing novel categorical distinctions and restructuring existing ones, and such categorical boundary shift has been demonstrated in a variety of cognitive domains (Ameel, Malt, Storms, & Van Assche, 2009; Flecken, Athanasopoulos, Kuipers, & Thierry, 2015). However, for a long time, spatial concepts (especially support relationship) have been suggested to be so foundational to human experience as to be immune to the influence of language (Munnich, Landau, & Doshier, 2001). Therefore, in this study, we aim to investigate whether and how language knowledge shapes the spatial concepts of Chinese-English bilinguals. We recorded brain activity in three groups of participants (including English monolinguals, Chinese-English long-stay and short-stay bilinguals) while they were performing a visual change detection task in an oddball paradigm. That is, a visual presentation stream of stimuli occurring with different probabilities: standard (80%), deviant (10%) and target (10%). For example, in one block, support relationships would serve as standard stimuli while non-support relationships serve as deviant stimuli; in another block, the role of standard and deviant stimuli would be switched. Each participant would view 4 blocks of 540 stimuli in total, two blocks for between-category (support vs. non-support) comparison and another two blocks for within-category (non-support) comparison. Participants were instructed to pay attention to the shape of the located object instead of the relationship between two objects and to press the spacebar each time when they see the shape of the located object changes from a circle (for standard or deviant stimuli) to a square (for target stimuli). Their unconscious and automatic processing and categorization of visual spatial scenes would be indexed by the visual mismatch negativity (vMMN), a spontaneous and pre-attentive brain response which has been proved to be highly sensitive to category-related deviances relative to standards (Czigler, 2014). Even though there have been intensive studies related to spatial cognition, but it is the first time to investigate early visual stages of spatial categorization using the visual oddball paradigm, and the results will provide fundamental new insights into the plasticity of the bilingual conceptual system by establishing the neural correlates of categorical spatial perception when languages show different categorization patterns on spatial relationships.

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