

## Processing figures and grounds in nonlinguistic events

Tilbe Göksun (advisor: Kathy Hirsh-Pasek)  
4<sup>th</sup> year PhD student, Department of Psychology, Temple University

Relational terms (e.g., verbs and prepositions) are the cornerstone of language development, bringing together two distinct fields: linguistic theory and infants' event processing. To learn relational terms, infants initially perceive and conceptualize spatial components within events such as path and manner, and then uncover how their ambient language packages these spatial constructs. We propose that infants *trade spaces* as the language-general nonlinguistic constructs are gradually refined and tuned to the requirements of the particular native language (Göksun, Hirsh-Pasek, & Golinkoff, in press).

Previous research suggests that preverbal infants from different language environments possess a general set of spatial and event components (e.g., containment, support, degree of fit, path, manner, source, goal) that form bases for learning relational terms. Our studies offer a new area of research, exploring infants' processing of figures and grounds in dynamic events.

The *figure* in an event can follow any path or move from any source. The *ground* is a stationary setting with respect to a figure's movement. For example, in the sentence "John is walking across the street," John is the figure and the street is the ground. Importantly, languages encode *figure* and *ground* relations differently. Japanese *ground-path* verbs such as *wataru* "go across" or *koeru* "go over", incorporate constraints on the physical geometry of the ground along with the direction of motion. For example, *wataru* "go across" implies that there is both a starting point and a goal and the ground should be a flat extended surface. The typical grounds for *wataru* "go across" are railroad, road, or bridge. In contrast, when the ground does not contain a barrier between two sides (e.g., a tennis court, grassy field) the verb *tooru* "go through," rather than *wataru* "go across" is used (see Figure 1).



Figure 1. The grounds at the top panel (railroad track, street, road, and bridge) are encoded by the verb *wataru* "to cross" and grounds at the bottom panel (tennis court and grass) are not typically coded by the verb *wataru* "to cross," but encoded by the verb *tooru* "go through" in Japanese

In a series of studies, we examined how English-reared infants differentiate figures (e.g., a man or a woman crossing a railroad) and grounds (e.g., crossing a railroad vs. crossing a tennis court) in dynamic events. Results indicated that infants notice changes

in figures and grounds by 11 and 14 months of age, respectively. Notably, the same infants distinguish grounds *better* when the comparison is between a *wataru* “go across” (e.g., railroad) ground and a *tooru* “go through” ground (e.g., tennis court) according to Japanese (Göksun, Hirsh-Pasek, & Golinkoff, 2009). Thus, preverbal infants are sensitive to the subtle distinctions of grounds that are not lexicalized in English. In a control study, we tested a potential confound, the color of the ground, on infants’ differentiation of these grounds. One might argue that the “greenness” of the grassy field or tennis court drew infants’ attention to prefer looking at those sides at test trial. However, results replicated the original findings with colored scenes suggesting that color of the ground is not a strong perceptual cue for infants’ discrimination of grounds.

Our current studies address two lines of inquiry. First, we attempt to tease apart the role of spatial and temporal interaction in these events. Do children process static scenes of the same dynamic events similarly? Relational term learning demands perceiving the spatial-temporal interaction inherent in dynamic events. Verbs, for example, can label a moment in time (as in *kiss*) or they unfold across time (as in *run*), or can represent the completion of a particular time frame (as in *break*). Eliminating the temporal aspect of an event might enhance or reduce children’s ability to distinguish different figures and grounds.

Second, to test our hypothesis of *trading spaces* for figure-ground relations, we investigate how Japanese-reared infants from two age groups (14 and 20 months of age) differentiate grounds in the same nonlinguistic dynamic events. The comparison of these children to their English-reared counterparts will provide crucial information on how language exposure might influence the attention to language-specific distinctions in events.

Göksun, T., Hirsh-Pasek, K., & Golinkoff, R. M. (in press). Trading Spaces: Carving up events for learning language. *Perspectives on Psychological Science*.

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