Cognition 136 (2015) 196–203

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/COGNIT

Brief article

Why loose rings can be tight: The role of learned object knowledge in the development of Korean spatial fit terms

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ARTICLE INFO

Article history:
Received 23 August 2013
Revised 20 April 2014
Accepted 4 November 2014

Keywords:
Spatial relations
Korean
Language development
Cognitive development
Fit
Object knowledge

ABSTRACT

The Korean fit distinction has been at the center of a debate about whether language can influence spatial concepts. Most research on this issue has largely assumed that the concepts that support Korean fit terms are signaled by innate abstract visual cues (e.g., relative motion of objects), while linguistic studies in Korean suggest that fit terms are object-specific. To examine this issue, Korean-speaking three- to six year-old children and adults were asked to describe spatial scenes, which varied in object type/relations and visual cues for fit. Both groups relied on the prototypical relation between pairs of objects (e.g., rings tend to fit tightly on fingers) in selecting tight-fit terms, and this dependence increased with age. In contrast to Whorfian and Conceptual tuning accounts (Bowerman & Choi, 2003; Hespos & Spelke, 2004), these results suggest that Korean fit concepts are not entirely innate or abstract.

1. Introduction

The fit distinctions encoded by Korean spatial terms have played a significant role in debates about whether language can influence non-linguistic spatial relations (Whorfian hypothesis, Whorf, 1956). For example, Korean verbs distinguish tight-fit (e.g., *kkita* for a ring on a finger) from loose-fit support relations (e.g., *nohta* for a ring on a table), while both of these events are described by the same word *on* in English (for other examples see Bowerman & Choi, 2003). Several studies have demonstrated that pre-linguistic infants, regardless of the input language, distinguish tight from loose fit, but English adults do not maintain this distinction, unlike Korean adults (Casasola & Cohen, 2002; Choi, McDonough, Bowerman, & Mandler, 1999; Hespos & Spelke, 2004; McDonough, Choi, & Mandler, 2003). This developmental pattern has been explained by a *conceptual tuning* mechanism (Hespos & Spelke, 2004), which is similar to the mechanism that supports perceptual tuning for speech (Werker & Tees, 1984). That is, infants are initially sensitive to a universal set of innate spatial categories, but language experience tunes these categories and this causes some distinctions to be diminished.

What types of visual cues would support the detection of fit relations? Researchers have suggested cues such as *relative shapes of objects, relative motion*, and *friction along the path* (see Fig. 1). For instance, Hespos and Spelke's (2004) first two experiments manipulated *relative shape cues* by varying the diameter of cylinders in containment/support scenes. Their third experiment tested if infants would use *relative motion cues* by showing tight cylinders that moved together versus loose cylinders that moved independently. Kawachi (2007) proposed *friction along the path* as another cue for fit distinction because the same end state of a motion event can be considered tight or loose, depending on the friction or effort needed to reach that state (e.g., a battery in a clock could have been placed

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http://dx.doi.org/10.1016/j.cognition.2014.11.002
0010-0277/

easily or with some effort). Although these visual cues have been used to examine spatial representations of fit in infants and adults, there is a lack of evidence showing that these cues are directly linked to Korean fit terms (Kawachi, 2007). This is problematic for the conceptual tuning hypothesis, which assumes that early associations between Korean fit terms and visually-cued fit concepts are needed to maintain innate fit concepts.

If Korean fit terms are not selected by visual cues, then what could explain the divergent development in English and Korean learners? One type of information that could explain this divergence is learned object knowledge. For example, English speakers typically understand *in front of a painting* as being parallel to the widest surface, while *in front of a car* as the side that the driver faces. This understanding cannot depend on innate concepts, since one must learn about these artifacts and their prototypical interactions with other objects. Support for this change in object knowledge is found in Tanz's (1980) study, where 2-5-year-old English children became more adult-like in their use of *in front of* between two to five years. Similarly, Korean fit terms tend to correlate with particular pairs of objects and their relations (e.g., ring + finger → *kkita*; Bowerman & Choi, 2003). In this account, what changes over development is object knowledge (e.g., children learn that rings are defined as objects that typically fit tightly on fingers) and their links to the labels. Innate visual cues are also involved in identifying these spatial relations, but the object knowledge determines the nature of the relation/concept (e.g., a candle on a table is tightly attached if it has melted to the table). The conceptual tuning and *object knowledge* accounts both explain the developmental changes, but the object knowledge account predicts growth in object-specific fit term use over development. The present study is the first to contrast these accounts by examining the relationship between Korean *linguistic* choices and visual cues (as in the infant literature) across multiple objects in development.

2. The present study

To determine whether learned object knowledge or visual fit cues select Korean fit terms over development, we manipulated visual fit cues across multiple events with different object pairs and elicited descriptions from 3-, 4-, 5-, and 6-year-old children and adults. Object pairs were selected which had associations with particular Korean tight fit terms (e.g., *kkita*, *kkocta*), and their matching loose versions were created. If visual fit cues activate innate concepts that support fit term use, then tight events should elicit more tight-fit terms than the loose versions and this distinction should not vary across different object pairs. If object knowledge is critical for fit term selection, then fit term use should vary across object pairs but would be insensitive to visual cues. Furthermore, if this knowledge grows over development, then the use of the object-pair-specific tight-fit terms should increase with age.

It is difficult to identify the role of visual cues in fit term use because most studies used real physical events where multiple cues are conflated. For example, Hespos and Spelke's (2004) study manipulated relative shape, but the tight condition also had more friction and restricted motion due to real-world constraints. To examine the role of visual cues in isolation, we obtained descriptions for four single-cue spatial events, where a robot placed objects in a 3D computer-animated world. Three of these four artificial scenes independently manipulated a single visual cue for fit: relative motion, relative shape, and friction/effort along the path. The fourth scene only changed the type of object (flat block versus Lego block), while controlling for the other three visual cues.

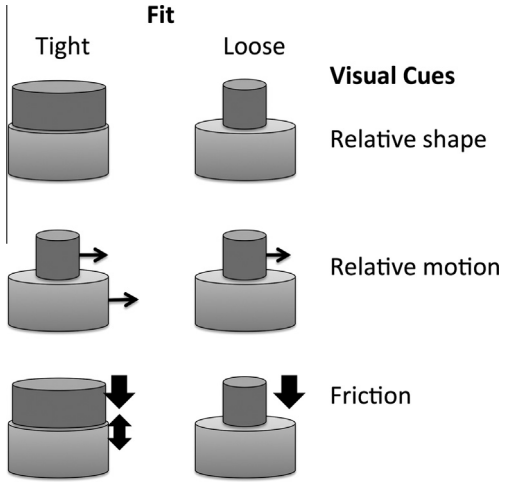

Fig. 1. Three visual cues used to distinguish tightness of fit.

3. Methods

3.1. Participants

Thirty-two monolingual Korean-speaking adults, 20 3-year-olds (M = 42 months, SD = 3.7, F = 10), 23 4-year-olds (M = 54 months, SD = 3.4, F = 12), 24 5-year-olds (M = 66 months, SD = 3.1, F = 13), and 20 6-year-olds (M = 78 months, SD = 2.6, F = 10) from the vicinity of Seoul, South Korea, participated in the study.

3.2. Materials

3.2.1. Real events

Support/containment tight events involved seven object pairs that typically occur together and that are encoded by tight-fit terms as depicted in Fig. 2. Tight events typically encode tightness in a unique way (Norbury, Waxman, & Song, 2008) and it is possible to create a loose version of tight event, but it is not possible to create a tight version of a loose event (e.g., apple on a table). Therefore, we created video stimuli that sampled a range of tight fit events and created matching loose versions. The videos were placed into four lists where the item order and fit condition were counterbalanced (fit condition alternated and participants only saw one version for each item).