Making sense of the abstract uses of the prepositions *in* and *on*

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Abstract

Prepositions name spatial relationships (e.g., book *on* a table), but also abstract, non-spatial relationships (e.g., Jordan is *on* a roll)—raising the question of how the abstract uses relate to the concrete spatial uses. The two most frequently extended prepositions are *in* and *on,* and there has been no consensus about what aspects of spatial meaning they retain when used abstractly. We propose that what is preserved is the relative degree of *control* between the located object (the figure) and the reference object (the ground). Building on previous work showing that this aspect of meaning can distinguish conventional abstract uses of *in* and *on* (Jamrozik & Gentner, 2011), we found that it is also extended to the comprehension and production of novel abstract uses. We discuss the application of the findings to second language instruction.

Keywords: prepositions; metaphor; spatial language; abstract language; semantics.

Introduction

Prepositions are used to name relationships between entities. Although we think of prepositions as naming spatial relationships (e.g., The cup is *on* the table), they also name abstract relationships, such as the relationship between a person and a state of mind (Mary is *in* a frenzy). These abstract uses are common, making up roughly 40% of preposition occurrences (Steen, Dorst, Herrmann, Kaal, Krennmayr, & Pasma, 2010). Understanding how these abstract uses arise, and how they relate to the concrete spatial senses of the terms, is important for theories of semantic structure and language change, for computational theories of language processing, and for applications such as machine translation and second language learning. For all these reasons, accounting for the abstract uses of prepositions has been an important endeavor.

There have been some key advances in understanding abstract extensions of prepositions. For example, metaphoric extensions of the preposition *over* have been explored within the conceptual metaphor framework (Brugman & Lakoff, 1988; Lakoff & Johnson, 1980). However, a significant gap in this body of knowledge is that there is no consensus account for the abstract uses of *in* and *on*— the most frequently extended prepositions in English (Cameron, 2003). In previous work (Jamrozik & Gentner, 2011) we proposed and tested such an account. The basic idea of our *continuum of control* account is that *in* and *on* differ in the distribution of control within the figure-ground relationship[1]. When used to name spatial relationships, *on* tends to convey relatively greater figure control of the relationship (e.g., a fly *on* the plate), and *in* tends to convey relatively greater ground control of the relationship (e.g., a fly *in* a hand). In prior work, we found that this distinction is extended to abstract uses: that is, abstract uses of *on* convey greater figure control than abstract uses of *in*.

Here we ask whether the continuum of control account extends to novel abstract uses of *in* and *on.* In Experiment 1, we ask whether this account applies to the comprehension of novel abstract uses (e.g., *in* a frive), improving on a prior study. In Experiment 2, we turn to production: we ask whether the continuum of control account predicts the production of novel abstract uses.

We first review accounts of spatial uses of *in* and *on*, and show that figure-ground control is important for these uses. We then describe our *continuum of control* account of abstract *in* and *on* use and present our studies.

Importance of relative control for spatial uses of prepositions

Early accounts of spatial uses of *in* and *on* (e.g., Bennett, 1975; Herskovits, 1986; Leech, 1969; Miller & Johnson-Laird, 1976) focused on the

[1] Following Talmy (1983), we use the terms *figure* and *ground* to describe the participants in the relationship named by a preposition (e.g., a figure is *in* a ground).

geometry of spatial relationships. Broadly, these accounts proposed that *in* names relationships that involve inclusion of the figure by the ground, and that *on* names relationships that involve contact between the figure and ground. However, more recent accounts (e.g., Coventry & Garrod, 2004; Garrod, Ferrier, & Campbell, 1999; Garrod & Sanford, 1989; Talmy, 1983) have stressed the importance of functional relations, which concern the current or possible interaction between a figure and ground.

Garrod and Sanford (1989) proposed the functional relations of containment and support for *in* and *on*, respectively. Based on their idea that both containment and support involve some degree of control of the figure by the ground, they named them *control relations*. More recent accounts have also highlighted the importance of control relations for uses of *in* and *on* (e.g., Coventry, Carmichael, & Garrod, 1994; Coventry & Garrod, 2004; Feist & Gentner, 1998, 2003; Garrod, Ferrier, & Campbell, 1999), but have differed slightly in the way that they characterize these relations. For example, Garrod and Sanford (1989) and Coventry (e.g., Coventry, Carmichael, & Garrod, 1994; Coventry & Garrod, 2004) proposed that both *in* and *on* involve greater ground than figure control, and that *in* involves greater ground control than does *on*. Feist and Gentner (2003) likewise proposed that *in* involves greater ground than figure control, but suggested that *on* involves a degree of figure control. Empirical research has provided evidence that both *in* and *on* involve a degree of ground control (e.g., Coventry, Carmichael, & Garrod, 1994; Garrod, Ferrier, & Campbell, 1999), but also that *on* involves some degree of figure control (e.g., Feist & Gentner, 1998, 2003). These findings can be integrated if control is conceptualized as a continuum that ranges from full ground control of the figure-ground relationship to full figure control of the relationship. Under this *continuum of control* view, *on* is closer to the figure control end of the continuum than *in*.

The *continuum of control* account of abstract uses of *in* and *on*

Our hypothesis is that abstract uses of *in* and *on* preserve the continuum of control dimension from the concrete spatial uses. Specifically, we propose that abstract uses of *in* involve relatively greater ground control and abstract uses of *on* involve relatively greater figure control. Although the continuum of control we propose is novel, the hypothesis is related to an early proposal by Garrod and Sanford (1989) that the functional control relations of containment and support might also be extended to non-spatial uses of *in* and *on,* respectively. This idea is also related to work on control in metaphorical extensions of other prepositions, such as *over* (e.g., Jane has a strange power *over* him) (e.g., Brugman & Lakoff, 1988; Tyler & Evans, 2001).

In earlier work (Jamrozik & Gentner, 2011), we found support for the continuum of control account. We found that, like spatial uses, conventional abstract uses of *on* (e.g., *on* a roll) convey greater figure control than uses of *in* (e.g., *in* a hurry). The same pattern also held for matched figure-ground pairs (e.g., a figure *in* time vs. *on* time). We also found preliminary evidence that the relative control aspect of preposition meaning may also extend to new abstract uses.

In the present studies, we ask whether the continuum of control account extends to *novel* abstract uses. In Experiment 1, we test the *comprehension* of novel abstract uses of *in* and *on*. In Experiment 2, we test the *production* of novel uses.

Experiment 1

In earlier work (Jamrozik & Gentner, 2011), we provided evidence that the idea of relative control extends to the comprehension of novel *in* and *on* uses. We asked participants to interpret novel uses of *in* and *on,* such as 'Kate is *on* a cipe', and found that figures *on* a novel ground were construed as having more control than figures *in* a novel ground. This could come about in two ways. One possibility is that participants interpret novel uses through local analogical extensions from particular conventional uses, as has been proposed for novel extensions of verb constructions (e.g., Bybee & Eddington, 2006). If this is the case, people should be more likely to

correctly interpret a novel use the more similar it is to a frequent familiar phrase.

Another possibility is that people have abstracted and stored a general relative-control schema (perhaps through repeated analogical extensions over varied uses of *in* and *on)*. In this case, people should be able to apply the relative control schema regardless of whether the novel uses are similar to frequent *in* and *on* phrases.

To test these two possibilities, in Experiment 1, we altered the novel phrases to render them less similar to common *in* and *on* phrases. We used phrases that included an adjective between the preposition and the ground (e.g., *on* an extreme grore), which are much less frequent[2], and should be less likely to remind participants of common familiar phrases.

If relative control is invoked in the comprehension of novel abstract uses of *in* and *on*, then participants should interpret novel figures *on* ground as having greater control than figures *in* ground, despite there being minimal similarity to conventional phrases.

Method

Participants Thirty-two participants received either partial course credit or payment for participation in this experiment. All were native speakers of English.

Materials and Procedure Participants were presented with 16 passages that involved activities that could be described with a novel "niche" vocabulary (adapted from those used by Jamrozik and Gentner, 2011). Each situation was described with an introductory paragraph that was followed by a target sentence describing a figure from the situation that included a novel word (a plausible non-word from the ARC Nonword Database; Rastle, Harrington, & Coltheart, 2002). There were eight experimental passages, whose key sentence included *in* or *on* paired with a novel ground. Each ground was modified by an adjective to form prepositional phrases of the form 'in/on a(n) modifier novel word' (e.g., It's the third day of the mixing process and Kate is in an absolute cipe). To disguise the purpose of the task, these passages were interspersed with eight filler passages, whose key sentence included a novel word playing the role of a verb, adjective, or noun, and also included a modifier before the novel word. The key design factor (within-subjects) was whether *in* or *on* was used in the figure description. All order and assignment factors were counterbalanced.

An example passage is presented below. The participants' task was to interpret the final sentence describing the figure.

> Context: Kate is a perfume maker who is very skilled at discovering new scent combinations. She works for a perfume company that creates unusual fragrances made from rare plant oils. Kate creates new scents for the company. The process of mixing the plant oils is very complicated. Kate has good days, when the scents she creates are subtle and intricate, and bad days, when her nose seems insensitive and the scents she creates are boring.
> Transcript from Tracy (a worker in the perfume company): *"It's the third day of the mixing process and Kate is in an absolute cipe."*
> What does the transcript sentence mean?

Participants' interpretations consisting of one word or uninterpretable fragments were excluded from coding (9 out of 256 interpretations were excluded). Two trained undergraduate research assistants, who were blind to condition, coded participants' interpretations for figure control. For each of the eight test items, the coders read the context descriptions (but not the transcript sentences containing the prepositions) and rated participants' interpretations for figure control on a scale from 1 (extremely low control of the situation by the person) to 5 (extremely high control of the situation by the person).

Results

As predicted, figures described as *on* a novel ground were construed as having more control than figures *in* a novel ground. For example, participants who read that Kate, a perfumer, was

[2] Based on data from COCA (Davies, 2008), the frequency of prepositional phrases made up of *in* or *on*, a determiner, and a noun phrase is eight times higher than that of phrases made up of *in* or *on*, a determiner, an adjective, and a noun phrase.

on a novel ground gave interpretations such as: "Kate has done a wonderful job mixing perfumes for the past three days," and "Kate is concentrating on a new concoction- a big breakthrough in scent," but participants who read that Kate was *in* a novel ground gave interpretations such as: "Kate is struggling with her own scents and the ability to create good new ones".

Participants' interpretations of figures *on* ground were rated as having more control (M = 3.34, SD = .63) than their interpretations of figures *in* a ground (M = 2.48, SD = .52), $t(31) = 5.29$, $p < .001$, $d = 1.47$, with inter-rater reliability of $r = .779$, $p < .001$. Item analyses revealed a similar pattern of results. Interpretations of figure *on* ground sentences were rated as having greater figure control (M = 3.38, SD = .56) than interpretations of the corresponding figure *in* ground sentences (M = 2.49, SD = .36), $t(7) = 4.28$, $p = .004$, $d = 1.88$.

Discussion

Extending earlier findings (Jamrozik & Gentner, 2011), we found that figures *on* a novel ground were construed as having more control than figures *in* a novel ground even when modifiers were added between the prepositions and the novel grounds. Thus it is unlikely that novel uses of *in* and *on* (e.g., *in* or *on* a cipe) are understood through their similarity to particular frequent conventional uses. Instead, this pattern suggests that the relative control aspect of preposition meaning are broadly extended to the comprehension of novel uses, regardless of local similarity to existing uses—consistent with there being a general abstract schema.

Experiment 2

In Experiment 2, we ask whether relative control is extended to the production of novel abstract uses of *in* and *on*. We ask whether people can use information about relative control in a novel figure-ground relationship to infer whether the relationship should be labeled *in* or *on*. To do this, we used novel words to name a situation (adapted from Experiment 1),

We gave participants descriptions of figures who were portrayed as having either low or high control of a situation (adapted from Experiment 1), and asked them to choose whether the figure would be best described as *in* or *on* a novel ground. We predicted that participants would describe high-control figures as *on* a ground and low-control figures as *in* a ground.

Method

Participants Thirty-two participants received either course credit or payment for participation in this experiment. All were native speakers of English.

Materials and Procedure The experimental materials were adapted from Experiment 1. For the eight test passages, each description of the situation was followed by a description of a figure that either had high or low control within that situation (high-control figure vs. low-control figure). Following this, a sentence described the figure as '_____ a novel ground', and participants were given a choice to fill in the blank with either *in* or *on*. An example of a high control and a low control figure description are presented below.

> [The introductory context paragraph was the same as in Experiment 1]
> [High control figure] Yesterday Kate was very well rested and her sense of smell was very sharp. She was easily discriminating between the different smells and picking up the subtle scents in the plant oils.
> [Low control figure] Yesterday Kate had a cold and she was sniffling throughout the day. She was having trouble discriminating between the different smells and picking up the subtle scents in the plant oils.
> Kate was _____ a tem during the mixing process.
> What word is missing? Circle one: in on

As in earlier studies, we included eight filler passages involving other word choices to disguise the purpose of the task. As in the test passages, the final sentence of the filler passages contained a novel word and a blank for participants to fill in with one of two words. Some of the filler sentences involved a choice between antonyms

(e.g., It was clear that Adam's new technique was very [inventive/commonplace] because he made plastic that could be strinched), but some did not.

The key design factor (within-subjects) was whether figures were portrayed as having high or low control of the situation. Again, all order and assignment factors were counterbalanced.

Results

As predicted, participants were more likely to describe high-control figures as *on* a ground and low-control figures as *in* a ground. A mixed-effects logistic model, which included random intercepts for participants and items, revealed a significant influence of figure description on preposition choice ($\beta = 1.49$, $SE = .28$, $p < .001$). Low control figures were 4.45 times more likely to be described as *in a ground* than high control figures.

Discussion

In Experiment 2, we tested whether relative control is carried forward to the production of novel abstract uses of *in* and *on*. We found that, as predicted, the extent to which a figure controls a situation influences whether the figure is labeled *in* or *on* a novel ground.

General Discussion

Building on our previous findings that relative control of the figure-ground relationship can distinguish conventional abstract uses of *in* and *on* (Jamrozik & Gentner, 2011), we asked whether this aspect of preposition meaning is extended to the comprehension and production of novel abstract uses. Our evidence indicates that the answer is yes. In Experiment 1, we found that the preposition used to connect a figure and a novel ground influenced participants' interpretations of control within the figure-ground relationship: figures described as *on* a novel ground were construed as having more control than figures *in* a novel ground. The novel figure-ground phrases included an adjective between the preposition and the ground (e.g., *on* an absolute cipe). Since prepositional phrases of this form are relatively rare, it is unlikely that people simply drew on similar conventional phrases to interpret the novel uses. In Experiment 2, we asked whether the continuum of control principle is likewise extended to the production of novel abstract uses. Specifically, given a novel word used in a rather novel situation, we asked whether people's choices of which preposition to use would be influenced by relative control. Indeed, we found that figures described as having high control were more likely to be described as *on* a novel ground than figures described as having low control. Together, the current findings support the idea that a continuum of control distinguishes abstract uses of *in* and *on*, and that this aspect of meaning can be extended to novel uses.

Application to second-language instruction

Learning the meanings of English prepositions is very challenging for non-native speakers (e.g., Ijaz, 1986). Students are often told that abstract uses of prepositions are idiomatic and are advised to memorize them on a case-by-case basis (e.g., Yates, 1999). Teacher feedback can also reinforce the idea that there are no patterns governing abstract uses of prepositions. Students' errors in the use of abstract prepositions are often considered 'untreatable' by educators, since they cannot be overcome by imparting a set of rules (Ferris, 2003). Instead, teachers often simply supply the correct form (Ferris, 2006), reinforcing the idea that case-by-case memorization is required.

Our findings suggest, on the contrary, that there is a general pattern underlying the diverse abstract uses of the prepositions. This offers hope that there may be an alternative way for students learning English to master uses of *in* and *on*. We are currently exploring whether teaching second-language learners the idea of continuum of control can help them acquire a productive understanding of these prepositions in diverse contexts (Tenbrink, Jamrozik, & Gentner, 2012).

Conclusions

Accounting for the many different uses of the prepositions *in* and *on* has been a challenge for accounts of language use. Our findings suggest that there is an important regularity governing their interpretations—the *continuum of control*

principle. This aspect of preposition meaning appears to be productively mapped from spatial contexts to abstract contexts. Like spatial uses of these prepositions, abstract uses of *in* involve relatively greater ground control of the figure-ground relationship, and uses of *on* involve relatively greater figure control of the relationship. This distinction holds for conventional abstract uses of *in* and *on,* and it is also carried forward to the comprehension and production of novel abstract uses.

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