Is It Better to Be in Shape or on Top of It? The Impact of Control, Valence, and Expectedness on Non-Spatial Uses of *in* and *on*

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Abstract

Using the prepositions *in* and *on*, Jamrozik and Gentner (2015; 2014; 2011) explored a particular factor of meaning that was hypothesized to serve as a metaphorical link between spatial and abstract concepts. Across several studies, these researchers have provided evidence for the idea that there is a "continuum of control" that exists for both spatial and abstract uses of *in* and *on*. Our research explores other potential meaning factors that might play a role in non-spatial uses of *in* and *on*. Our results replicate and extend Jamrozik and Gentner's (2011) findings. We advocate using a multi-componential approach as research involving indirect metaphors continues moving forward.

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

Introduction

A popular assumption in cognitive linguistics is that metaphors are extremely common in both language and thought (e.g., Lakoff & Johnson, 1980). Historically, the evidence provided for this assumption has been primarily linguistic in nature. For example, a conceptual metaphor such as LOVE IS A CONTAINER is proposed to exist in the minds of speakers because it is natural to talk about people being in love or people falling out of love regardless of containment being a spatial concept and love being an abstract concept. One question, which arises from this assumption, is the nature of the connection between the spatial and the abstract. In other words, how might the spatial and abstract concepts activated by a conceptual metaphor be connected?

The potential for this type of metaphorical connection is most apparent when people talk about abstract concepts, such as time, thoughts, and emotions, using terms drawn from physically-based domains, such as space, force, and motion. Jamrozik and Gentner (2015; 2014; 2011) have explored the possibility of such connections using the prepositions *in* and *on*. Steen (2010) refers to these as indirect metaphors. Across several studies, these researchers present evidence suggesting that control is an important concept not only for spatial uses of *in* and *on* but also for abstract uses of *in* and *on*. For example, consider the scenario of a marble in a jar that has been secured with a lid. The marble is considered the figure and the jar is the ground. Even if you were to shake the jar or turn it upside down, the marble has very little control over where it can be at any given moment in time. In other words, the ground has more control than the figure in this situation. Alternatively, consider the scenario of a marble on a plate. The marble is still the figure, but this time the plate is the ground. If you were to move the plate, the marble might easily roll right off. In this example, the figure has more control than the figure. Borrowing from Beitel, Gibbs, and Sanders' (2001) terminology, the plate does not constrain the movement of the marble as well as the closed jar.

Jamrozik and Gentner's (2015) research suggests that this difference in the amount of control associated with *in* as compared to *on*—what they refer to as a "continuum of control"—also exists for abstract uses of *in* and *on*. Again, consider an example. If someone was described as being *in trouble*, participants in Jamrozik and Gentner's (2015) studies thought that the figure had a low degree of control over their situation. If someone was described as being *on a roll*, participants in Jamrozik and Gentner's (2013) studies thought that the figure had a higher degree of control over their situation.

Jamrozik and Gentner (2015) selected control as their factor of interest because previous researchers (Coventry, Carmichael, & Garrod, 1994) have considered control to be the most likely candidate for extension to abstract contexts. Our goal is to extend Jamrozik and Gentner's (2015) research by considering other factors that might be useful in differentiating between abstract uses of *in* and *on*. If control is not the only candidate for extension, then one place to look for other potential candidates is in literature involving the spatial semantics of the locative prepositions *in* and *on*.

Early research on the spatial meaning of *in* and *on* tended to focus on the role of geometric constructs such as inclusion and contact (e.g., Bennett, 1975; Herskovits, 1986; Leech, 1969; Miller & Johnson-Laird, 1976); however, these approaches cannot account for cases in which the necessary geometric constructs are present but the lexical item in question is dispreferred (e.g., a pear on a counter that is being covered by an overturned bowl is not considered *in* the bowl) as well as cases in which the necessary geometric constructs are not present but the lexical item in question is preferred (e.g., describing a book that is on top of another book as being *on* a table even though it is not directly in contact with or being supported by the table). In response to these inadequacies, researchers have developed more multi-

componential approaches in which they propose that a variety of different factors feed into the meanings of spatial relational terms (Coventry & Garrod, 2004; Feist, 2000, 2010). These factors include geometric contact and geometric inclusion, which are factors less likely to extend to abstract concepts, as well as factors such as location control that are more likely to extend to abstract concepts. One example of a factor that may extend to abstract concepts is object association. More specifically, research by Coventry and Prat-Sala (2001) revealed a complex interaction between the factors of control and object association such that when figure control was high, acceptability of *on* was higher when the figure-ground combination was unusual (e.g., a brick on a plate) and lower when the figure-ground combination was expected (e.g., a fish on a plate). Whether or not this spatial factor of expectedness plays a significant semantic role in non-spatial uses of *in* and *on* and whether it has the same complex interaction with figure control has yet to be explored.

Interestingly, Jamrozik and Gentner's (2015) research on the abstract uses of *in* and *on* suggests another factor that should be taken into consideration. It is a factor that has not previously been considered as a spatial meaning component: valence. Throughout their studies, Jamrozik and Gentner (2011; 2014; 2015) provide a variety of stimulus examples. More often than not, these examples are indicative of a particular relationship between control and valence: Statements associated with higher figure control are often more positive (e.g., *Jordan is on a roll*) than statements associated with lower figure control (e.g., *Casey is in a depression*). Jamrozik and Gentner (2015) explain that this is evidence of a natural correlation between control and positive valence. They point out that the correlation is not perfect, and there are certainly examples for which the relationship does not hold (e.g., *on thin ice*; *in shape*).

Given all of this, we first set out to explore the potential relationships between control, valence, and the comprehension of *in* and *on* in non-spatial contexts. We then set out to explore the potential relationships between control, valence, and expectedness and how these factors might influence the production of *in* and *on* in non-spatial contexts.

Experiment 1

In line with previous results (cf. Jamrozik and Gentner, 2015), we predicted that participants would rate the figures of conventional *on* phrases as having more control than the figures of conventional *in* phrases. We also predicted that participants would rate conventional *on* phrases as more positive than conventional *in* phrases.

Method

Participants A total of 47 college students participated in exchange for course credit: 24 in Version 1 and 23 in Version 2. The mean age of participants was approximately 19 (M = 18.8, SD = 1.7). Forty were female (85%) and seven were male (15%). Only one participant reported being a non-native English speaker.

Materials and Design Participants in this experiment were presented with 160 sentences. Each sentence consisted of a human figure and either a prepositional phrase or verb phrase. Of these sentences 89 were the target stimuli used by Jamrozik and Gentner (2015): 44 *in* sentences and 45 *on* sentences. We developed the remaining 71 filler sentences by following a procedure similar to the one described by Jamrozik and Gentner (2015) in which we selected conventional abstract uses of prepositions (other than *in* and *on*) and verbs from online idiom dictionaries and randomly assigned them common gender ambiguous names. Using a procedure similar to that described by Jamrozik and Gentner (2015), names were selected for use if they appeared in the top 1,000 names given to both males and females in social security records of American children born between 1990 and 2000. Of the 71 filler sentences, 21 were prepositional phrases (e.g., *Peyton is at ease*; *Bailey is under the weather*), 26 were verb + preposition phrases (e.g., *Quinn is letting the cat out of the bag*; *Alex is beating around the bush*), and 24 were verb phrases (e.g., *Noel is taking it easy*; *Taylor is jumping the gun*).

Procedure Participants took part in this study via SurveyMonkey.com. After consenting, participants were asked to answer a standard set of demographic questions: their age, gender, native language, and other languages they are able to speak, write, read, or understand.

Participants then read and rated the 160 sentences described previously. Following from Jamrozik and Gentner (2015), the sentences were presented one at a time on the screen and in a pseudo-randomized order such that there were never two *in* sentences, *on* sentences, or target sentences presented back-to-back. Participants were instructed to "imagine the scenario each sentence describes and think about how much the person controls or is controlled by the situation" as well as "the degree to which the situation being described is likely to be a positive or negative event in that person's life." For each sentence, participants were presented with a figure-control question (i.e., "To what degree does the person have control of the situation?") to which they would respond on a scale ranging from "1-extremely low control of the situation by the person" to "5-extremely high control of the situation by the person." On the same page participants were presented with a valence question (i.e., "To what degree is the situation being described likely to be a positive or negative event in their life?)" to which they would respond on a scale from "1-extremely negative" to "5-extremely positive." We also developed 19[1] catchtrials that were presented in a pseudo-randomized order such that there was only ever one catchtrial per sentence and never more than two

[1]There were originally 20 catchtrials; however, due to experimenter error, one catchtrial in which the response was five was not included in the final version of the study.

catchtrials appearing back-to-back. Catchtrials involved asking participants to provide a specific numerical rating from one to five on the scale provided.

At the end of the experiment, participants were then presented with an electronic debriefing form. Two versions of the experiment were developed due to concerns that participants might simply provide the same response to both the figure control and valence questions. Participants were assigned to one version, and the only difference between them being that the valence scale response options were flipped such that "extremely positive outcome" was associated with one and "extremely negative outcome" was associated with five. These responses were reversed scored before analysis.

Results

Of the 47 participants described previously, 12 were removed from further data analysis: one for reporting a native language other than English, two for responding incorrectly to three or more of the catchtrials, and nine for not finishing the study. Thus, data for 35 participants were used in the following analyses.

To determine whether the mean figure-control ratings produced by participants in the current study were aligned with the mean figure-control ratings produced by participants in Jamrozik and Gentner's (2015) Experiment 1a, we conducted a pairwise correlation, $r(88) = .94$, $p < .001$.

It should not be surprising, then, that when we conducted a mixed-model ANOVA with preposition as a within-subjects variable and version as a between-subjects variable that we found the same significant effect of preposition on ratings of figure-control reported by Jamrozik and Gentner (2015): Participants in the current study rated figures *on* ground as having more control ($M = 3.6$, $SD = .48$) than figures *in* ground ($M = 3.1$, $SD = .47$), $F(1, 33) = 132.81$, $p < .001$, $\eta p^2 = .801$. As expected, there was no significant main effect or interaction involving version.

To determine the proportion of stimuli that fit with our predictions, we conducted a median-split analysis using the control ratings. The results showed that our predictions held for 64% of the *on* sentences (ratings falling above the median) and 66% of the *in* sentences (ratings falling below the median).

When we conducted a mixed-model ANOVA with preposition as a within-subjects variable and version as a between-subjects variable using valence scores, we found that participants rated figures *on* ground as more positive ($M = 3.26$, $SD = .28$) than figures *in* ground ($M = 2.92$, $SD = .24$), $F(1, 33) = 103.97$, $p < .001$, $\eta p^2 = .759$. We also expected that if participants were simply providing the same response to the control and valence questions that we would see significant difference across versions when the anchoring of the valence question was reverse. No significant main effect or interaction involving version was observed.[2]

To determine the proportion of stimuli that fit with our predictions, we conducted a median-split analysis using the valence ratings. The results showed that our predictions held for 42% of the *on* sentences (ratings falling above the median) and 57% of the *in* sentences (ratings falling below the median).

Discussion

As predicted, we were able to replicate the results of Jamrozik and Gentner's (2015) Experiment 1a using their set of conventional phrases. In addition to finding that *on* is associated with more figure-control than *in*, we also observed that *on* phrases were rated as more positive than *in* phrases. This evidence suggests that, in addition to control, valence may serve as a meaning component that can be used to differentiate between abstract uses of *in* and *on*. That being said, our median-split analyses revealed that control might play a more predictable role than valence across a variety of different contexts. We argue that these patterns are consistent with a multi-componential approach, meaning that consideration of a variety of different semantic factors might be useful when investigating the non-spatial semantics of *in* and *on*.

A significant limitation of Experiment 1 is that these findings might also be due to a lack of counterbalancing because participants were always presented with the same order of ratings: control followed by valence. It could be that a significant effect of valence was found only because valence ratings were always considered through the lens of control. It is also possible that these findings might simply be the result of characteristics particular to the sentences that were used as stimuli. Furthermore, even though using conventional phrases served to enhance the ecological validity of Experiment 1, it also limited the degree to which we were able to explore the potential interaction between control and valence.

Experiment 2

With mounting evidence that control is an important factor in distinguishing between the meanings of *in* and *on* in non-spatial contexts, we wanted to take a multi-componential perspective and explore the potential relationships between control, valence, and expectedness and how these factors

[2]Due to experimenter error, the *in* sentence *Noel is in the know* was absent from the stimuli presented to the participants. Instead the filler phrase *out of practice* was inadvertently presented twice, once with the name Avery and once with the name Noel. Because the missing phrase would have likely been rated by our participants as positive and a situation in which there was low control of the situation by the person, this could be viewed as a confound since we may have inadvertently eliminated data that could have served to refute our hypothesis. To address this possibility, we eliminated from analysis the *on* phrase with the most positive valence rating (*Adrian is on task*; $M = 4.71$) and conducted the same set of analyses described in the main text. Even without this sentence, the pattern of results and the significance tests outcomes were the same: A significant main effect of preposition was found for both control and valence ratings.

might influence the production of *in* and *on* in non-spatial contexts.

Method

Participants A total of 122 college students participated in exchange for course credit. The mean age of participants was approximately 18 (M = 18.1, SD = 1.8). Nineteen were male (16%) and 103 were female (84%). Only three participants reported being non-native English speakers.

Materials and Design We developed 64 stories for this experiment. Eight base stories were created. The stories averaged 3 sentences (or 45 words) in length. Each base story was associated with a general theme and a fictitious person name that was gender ambiguous. Eight story types were developed from each base story by fully crossing the following factors: control of the figure (high vs. low), valence of the outcome (positive vs. negative), and expectedness of the scenario (expected vs. unexpected). Eight versions of the experiment were then created, each containing only one story from each base and only one of each story type. Each participant was randomly assigned to a particular version of the experiment, and the order in which the stories were presented to participants was completely randomized.

We also selected eight nonwords to serve as novel prepositional objects for the production portion of this experiment. Using a procedure similar to the one described by Jamrozik and Gentner (2015), we generated these eight nonwords using the ARC Nonword Database (Rastle, Harrington, & Coltheart, 2002: https://www.cogsci.mq.edu.au/research/resources/nwdb/nwdb.html): *vight*, *slief*, *thwom*, *yease*, *prach*, *gwinn*, *malse*, and *zaiff*. The eight nonwords were assigned in a pseudo-randomized fashion such that each participant saw each nonword only once during the experiment and that each nonword appeared with a different story type across each of the eight versions.

Procedure Participants took part in this study via SurveyMonkey.com. After consenting, participants were asked to answer a standard set of demographic questions: their age, gender, native language, and other languages they are able to speak, write, read, or understand.

We then asked participants to read and respond to eight short stories (see Table 1 for examples). Four catch trials were also included in each version of the experiment. Catchtrials involved asking participants to provide a specific numerical rating from one to five on the scale provided.

After reading each story, participants were presented with three questions and their respective scales: a figure-control question (i.e., "To what degree does the person have control of the situation?") to which they would respond on a scale ranging from "1-extremely low control of the situation by the person" to "5-extremely high control of the situation by the person;" a scenario expectedness question (i.e., "To what degree is the situation natural and expected?") to which they would respond on a scale ranging from "1-extremely unnatural and unexpected" to "5-extremely natural and expected;" and an outcome valence question (i.e., "To what degree is the situation being described likely to be a positive or negative event in their life?)" to which they would respond on a scale from "1-extremely negative" to "5-extremely positive." Participants were then asked to imagine that they overheard someone talking about the fictitious person they just read about in the story and to decide whether *in* or *on* was more likely to appear in the novel statement that they overheard (e.g., "Adrian is ____ a gwinn").

After reading eight stories and responding to the four questions following each story, participants were then presented with an electronic debriefing form.

Table 1: Example of two story types developed from one base story.

Figure-control	Valence outcome	Scenario expectedness
High	Positive	Expected
Lee works at a local pizza place and has spent lots of time developing their customer service skills. Because of what they learned, Lee always wears a clean uniform to work. Lee just found out that they are going to be promoted.		
Low	Negative	Unexpected
Lee's parents forced them to get a job at the local pizza place owned by their family. Lee's manager makes every employee wear a clown suit to work. Lee just found out that they are going to be fired.		

Results

Of the 122 participants described previously, four indicated that they were fluent in another language other than English but failed to specify which language despite explicit instructions to do so. It was determined that these failures to respond were likely due to participants not paying close enough attention to the questions being presented to them; therefore, their data was excluded from further analysis. Of the remaining 118 participants, 11 were removed from further data analysis: three for reporting a native language other than English, four for responding incorrectly to one or more of our four catchtrials, three for not finishing the study, and one for attempting to complete the study a second time. Thus, the data for 111 participants was used in the following analyses.

Ratings We first needed to determine whether participants were sensitive to the ways in which we manipulated the three variables across the different story types; therefore, we conducted a one-way by items ANOVA for each factor. Table 2 shows that, on average, stories were rated in accordance with our manipulations.

In order to explore the roles that outcome valence and scenario expectedness might play in decisions of figure-control, we then conducted a repeated measures ANOVA on control ratings using figure-control, outcome valence, and scenario expectedness as within-subjects variables and version as a between-subjects variable. Version did have a significant effect overall, $F(7, 103) = 4.75$, $p = .004$, $\eta p^2 = .180$, suggesting that participants' control ratings differed depending on the sets of stories they received. Moreover,

every time version participated in an interaction, the interaction was statistically significant. Even though these complex interactions were not analyzed further, this pattern suggests that the following pattern of effects might be driven by only a subset of the stories presented to participants.

Table 2: Mean ratings (and standard deviations) across factor levels for figure-control, outcome valence, and scenario expectedness.

	Factor Levels		*p*-value
Figure-Control	Low	High	
	2.59(1.38)	3.53(1.45)	< .001
Outcome Valence	Negative	Positive	
	1.65(0.83)	4.18(1.06)	< .001
Scenario Expectedness	Unexpected	Expected	
	2.70(1.40)	3.26(1.26)	< .001

Of the three within-subjects variables, two had significant effects on participants' ratings of control: figure-control and valence. The significant effect of valence was such that participants' ratings of control were higher in response to high figure-control stories (M = 3.53, SD = 1.45) as compared to low figure-control stories (M = 2.59, SD = 1.38), $F(1, 103) = 143.42$, $p < .001$, $\eta p^2 = 0.533$. Such an effect is not surprising. What is more interesting is that ratings of control were also influenced by valence, $F(1, 103) = 87.17$, $p < .001$, $\eta p^2 = .458$. More specifically, ratings of control were higher in response to positive valence stories (M = 3.39, SD = 1.44) as compared to negative valence stories (M = 2.72, SD = 1.47). Unlike valence, expectedness did not have a significant impact on participants' control ratings: Control ratings made in response to stories with expected outcomes (M = 3.06, SD = 1.48) were not significantly different from stories with unexpected outcomes (M = 3.05, SD = 1.50).

Interestingly, there were two significant interactions that did not involve the between-subjects variable of version. One was an interaction of figure-control and outcome valence, $F(1, 103) = 41.02$, $p < .001$, $\eta p^2 = .285$ (see Figure 1). This interaction was such that stories with positive outcomes received higher control ratings when they described high control situations (M = 4.10, SD = 1.16) as compared to low control situations (M = 2.69, SD = 1.34), $F(1, 103) = 172.85$, $p < .001$, $\eta p^2 = 0.627$; however, these differences in control ratings were observed to a lesser degree when stories with negative outcomes described high control situations (M = 2.96, SD = 1.49) as compared to low control situations (M = 2.49, SD =1.41), $F(1, 103) = 15.85$, $p < .001$, $\eta p^2 = .133$.

The other interaction of interest involved expectedness, which alone did not have a significant impact on control ratings. The interaction of expectedness and valence, $F(1, 103) = 46.17$, $p < .001$, $\eta p^2 = .310$, was such that participants rated the figures of stories with positive outcomes as having more control when the scenario was expected than when it was unexpected, $F(1, 103) = 23.01$, $p < .001$, $\eta p^2 = .183$; however, the opposite pattern was observed for stories with negative outcomes: Participants rated figures as having less control when the scenario was expected than when it was unexpected, $F(1, 103) = 18.31$, $p = .001$, $\eta p^2 = .151$ (see Figure 2).

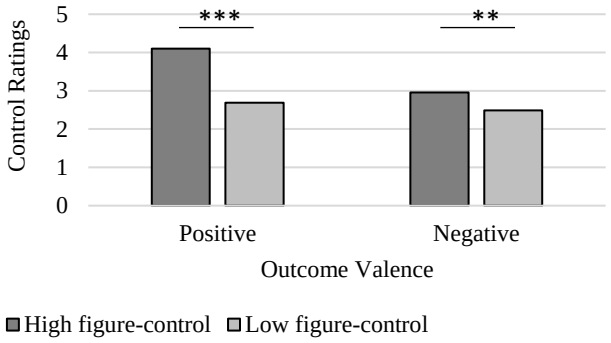

Figure 1: Mean control ratings across levels of figure-control and valence.

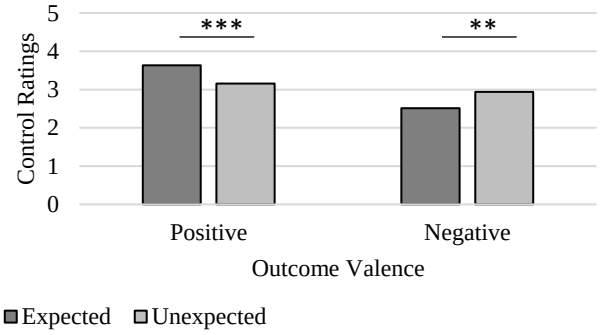

Figure 2: Mean control ratings across levels of expectedness and valence.

In addition to the pervasive influence of version, another concern arose during data analysis. Due to experimenter error 34% of the stories presented to participants actually contained the lexical items *in* and *on*; therefore, it is possible that ratings of control might have had more to do with lexical priming than the factors of interest. This lexical items confound was distributed across versions such that of the eight stories read by each participant at least one but no more than three contained a lexical item confound.

To analyze the impact that this lexical items confound may have had, we coded stories containing the word *in* as one and stories containing the word *on* as three. All "neutral" stories were coded as two, which included all stories that did not contain the lexical items *in* and *on* as well as two stories that contained both *in* an *on*. These codes were constructed such that high scores on the lexical items confound would be associated with high figure-control. The concern, then, was that high lexical confound ratings might predict high figure-control ratings; however, the results of a linear regression

actually showed the opposite to be significant: Low lexical confound ratings were associated with higher figure-control ratings, $F(1, 886) = 4.74$, $p = .030$, with an R^2 of .01. Participants' predicted control ratings decreased -.19 points for each increase in lexical confound, suggesting that seeing the lexical item *on* (as opposed to *in*) caused participants to produce lower ratings of control. This is a surprising finding that cannot be readily explained on the basis of lexical priming and does not align with the findings of Jamrozik and Gentner (2015).

Production We hypothesized that the factors of figure-control, outcome valence, and scenario expectedness would have an influence on production. In particular, we were interested in the likelihood that participants would choose either *in* or *on* to complete a novel phrase about the figure described in the story. A mixed effect logistic regression analysis looking at the choice between *in* and *on* as a function of all three within-subjects factors, the between-subjects factor of version, and all of their possible interactions revealed only significant effects involving figure-control, $F(1, 103) = 4.69$, $p = .033$, and outcome valence, $F(1, 103) = 24.13$, $p < .001$ (see Table 3). The figure-control effect was such that *on* was more preferred when figure-control was high (43%) and less preferred when figure-control was low (35%). The outcome valence effect was such that *on* was more preferred when the outcome was positive (47%) and less preferred when the outcome was negative (32%). Despite the pervasive influence of version in the ratings data, version did not play a significant role in production.

Table 3: Percentage of on responses and number of biased version across the eight story types.

Figure-Control	Outcome Valence	Scenario Expectedness	% *on* Responses	*on* vs. *in* Biased Versions
High	Positive	Expected	57	1 vs. 1
High	Positive	Unexpected	49	2 vs. 1
High	Negative	Expected	30	1 vs. 1
High	Negative	Unexpected	34	2 vs. 1
Low	Positive	Expected	41	1 vs. 2
Low	Positive	Unexpected	40	0 vs. 2
Low	Negative	Expected	31	2 vs. 2
Low	Negative	Unexpected	32	2 vs. 2

Discussion

The severe limitations related to this experiment do not allow us to make any strong claims regarding the observed findings; however, we think that a discussion of these findings is useful for generating hypotheses that can be addressed in future research. The most severe limitations of Experiment 2 involve the unaccounted for variation across the story sets that resulted in significant effects tied to version and the lexical confounds present in particular stories. Another significant limitation of Experiment 2 is a lack of counterbalancing due to the fact that participants were always presented with the same ordering of ratings: control, expectedness, valence, and production.

Very generally, the results of this experiment suggest that the relationships between control, valence, and expectedness may be more complex than we originally anticipated. For example, when stories had positive outcomes, participants' ratings of control may have been influenced more by figure-control than when stories had negative outcomes. It is possible that when situations have a negative outcome, we would prefer to think that the person did not have as much control over the events. Another potential example of these complex relationships is the significant interaction of expectedness and valence. What this interaction may suggest is that when ordinary events are involved, positive outcomes are associated with more figure control; however, when strange occurrences result in positive outcomes, people may be more likely to think that the person has less control over the situation. Interestingly, the pattern seems to switch when going from positive outcomes to negative outcomes. When something bad happens and it is an ordinary event, people may tend to sympathize and not attribute control to the person involved. When things go awry, the abnormality of a situation may cause us to think that the person had more control over the events that took place.

As for the production of *in* and *on*, our results were consistent with Jamrozik and Gentner's (2015) findings: *On* was more preferred when the person was described as having more control and less preferred when the person was described as having less control. We also found evidence to suggest that *on* may be more preferred when outcomes are positive and less preferred when outcomes are negative.

Conclusion

In the domain of spatial semantics the success of multi-componential approaches is clear. Our data is consistent with the hypothesis that non-spatial uses of prepositions have a multi-componential structure like their spatial counterparts. As a case in point, consider the title of this paper. Despite the connections *in* has with negative valence, being in shape is not perceived as significantly worse ($M = 4.57$) than being on top of it ($M = 4.63$). Even though multiple factors of meaning will likely be needed to account for the types of complex patterns we observed in our data, what is less clear is the origin of these factors and the relative impact each of them might have during either comprehension or production. It may be that the spatial and abstract meanings of spatial prepositions share features due to happenstance; however, many cognitive linguists propose that the abstract meanings associated with indirect metaphors are derived via metaphorical connections from their spatially-based meanings (e.g., Brugman & Lakoff, 1988/2006; Tyler & Evans, 2001, 2003). We argue that future research should focus on exploring the implications this type of research has for theories of indirect metaphors, specifically, and lexical semantics, more generally.

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