Embodied metaphor and abstract problem solving: Testing a metaphoric fit hypothesis in the health domain

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HIGHLIGHTS

- People use metaphor to conceptualize both abstract problems and their solutions.
- We test the interactive effect of metaphoric fit between these understandings.
- Solutions are favored when their metaphoric effects fit a problem's metaphoric framing.
- Solutions with seemingly irrelevant metaphoric effects are seen less favorably.

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ABSTRACT

How do people evaluate candidate solutions to abstract problems that are difficult to grasp? According to conceptual metaphor theory, people can conceptualize abstract ideas in terms of well-known bodily states, even if they are not currently experiencing those bodily states. Extending this perspective, we test a novel *metaphoric fit* hypothesis concerning the (mis)match between embodied-metaphoric framings of an abstract problem (in these studies, depression) and candidate solutions (depression treatments). In Studies 1 and 2, framing depression metaphorically as being physically down or darkened increased the perceived effectiveness of depression medications framed metaphorically as solving those bodily problems ("lifting" and "illuminating," respectively). Consistent with conceptual metaphor theory, this effect was mediated by subjective certainty about depression. Studies 3 and 4 manipulated problem and solution framings to test the interactive effects of metaphoric fit and misfit on solution evaluations. These findings reveal a new route by which embodied knowledge influences problem solving.

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Introduction

People reason about abstract problems using not only knowledge about those problems specifically, but also bodily experiences such as perceptual imagery, "gut-level" affective reactions, and motoric routines. Conceptual metaphor theory (Lakoff & Johnson, 1980) suggests a distinct route by which embodied knowledge influences problem solving. The theory posits that people can understand abstract problems in terms of well-known bodily states, even if they are not currently experiencing those states. Supporting research (discussed shortly) shows that linguistically framing a target abstract problem as a bodily problem leads people to generate solutions that are suited, analogically, to address the bodily problem. The practical implication of these

findings is that metaphor use, although epistemically beneficial, may sometimes produce suboptimal solutions to the abstract problem at hand.

While prior research has focused on solution generation, everyday problem solving often requires evaluating available solutions. For example, consumers confronting health problems must evaluate several candidate treatment options, often without a full medical understanding of the problems' nature or the complex means by which candidate treatments purportedly work. It is not surprising, then, that many health communications employ metaphoric language and imagery to frame abstract health problems and treatments in terms of familiar, perceptually salient bodily states (e.g., "Drug X *tackles* athlete's foot"; Forceville, 1996). This article examines whether such metaphoric framings prompt people to evaluate candidate solutions in ways that are consistent with their knowledge of the relevant bodily states.

Specifically, we extend conceptual metaphor theory to formulate a novel *metaphoric fit* hypothesis: If an embodied-metaphoric framing of an abstract problem prompts people to reason about it using their

knowledge of a bodily problem, then they should positively evaluate candidate solutions that are themselves framed metaphorically as addressing that bodily problem (Studies 1–3). Additionally, we test whether solution evaluations are negatively affected by metaphors that imply a mismatch between that solution and the problem (Study 4). The current studies test this hypothesis in the context of people's evaluations of depression treatments, but they point to unexamined embodied influences on abstract problem solving across domains.

Embodied metaphor and problem solving

Traditional models propose that people reason about problems by processing information specific to that problem and its candidate solutions (Newell & Simon, 1972). From this perspective, people address health problems, for instance, by acquiring medical information (e.g., from experts) to increase the pool of available solutions and apply rational criteria for settling on an optimal solution (Elstein, Shulman, & Sprafka, 1978).

This traditional view is influential but incomplete. A growing literature on embodied cognition reveals that people also access bodily experiences when reasoning about problems (for a review, see Gibbs, 2005). Studies show, for example, that people are better at learning and solving problems when they concurrently gesture in a manner that matches their verbal description of those problems (e.g., circling with the hand when describing the passage of time; Alibali, Bassok, Solomon, Syc, & Goldin-Meadow, 1999; Cook, Mitchell, & Goldin-Meadow, 2008).

What processes mediate embodied influences on abstract problem solving? Mainstream embodiment theories (Barsalou, 1999, 2008) propose that abstract concepts contain sensorimotor representations of relevant bodily states. To illustrate, people's *influenza* concept may contain, in addition to propositional knowledge of viruses and treatments, sensorimotor representations of bodily symptoms (e.g., fever) that routinely occur during experience with the flu. On this view, people reason about abstract problems in part by monitoring concurrent, problem-relevant bodily states (Kirsh & Maglio, 1994).

Conceptual metaphor is an independent process whereby people systematically map features of an abstract concept onto analogous features of a sensorimotor state or well-scripted interaction with the physical environment. Returning to our example above, people can understand influenza as *navigating difficult terrain* ("I'm not *out of the woods* yet") or as being *physically restrained* ("It's still *got a grip* on me"). In this way, an embodied metaphor allows people to draw on their knowledge of a bodily state as a framework for reasoning about the abstract concept. Importantly, conceptual metaphor theory proposes that this knowledge-mapping provides a subjective sense of certainty about the abstract concept (Keefer, Landau, Rothschild, & Sullivan, 2011), a cognitive mediational process not implied by the embodied cognition perspective. Conceptual metaphor theory further differs from other views on embodied cognition by suggesting that people can use metaphor to reason about an abstract problem by analogy to their knowledge of a bodily state *even if they are not currently experiencing that state*. For instance, they can reason about influenza in terms of navigating difficult terrain without concurrently traversing a path.

Prior research suggests that individuals often use analogies to reason about abstract problems (Gentner & Smith, 2012; Hoffman, Eskridge, & Shelley, 2009; Paletz, Schunn, & Kim, 2013). This research has explored how experts (e.g., scientists, teachers) attempt to reason about or communicate deeply abstract or largely unknown issues. While such research highlights the importance of (often non-embodied) metaphor in problem solving, it does not shed much light on the everyday use of metaphor by non-experts to solve problems. However, prior studies show that messages metaphorically comparing an abstract problem to an embodied problem cause people to generate solutions to the abstract problem that fit their understanding of how to solve the embodied problem. In one compelling demonstration, Thibodeau and Boroditsky (2011) showed that participants who read an article comparing a city's crime problem to an aggressive animal generated more aggressive and punitive crime-reduction strategies, whereas those who read an article framing the same facts in disease-metaphoric terms recommended addressing the root causes of crime, consistent with their knowledge of curing disease.

Importantly, these prior studies do not examine metaphoric influences on evaluations of extant solutions. Instead, research on analogy and problem solving focuses almost exclusively on either the use of metaphors to generate solutions or to communicate a particular, abstract idea (Bearman, Ball, & Ormerod, 2007). In the current research, we shift focus to the important but unexplored domain of people's need to evaluate available solutions. Solution evaluation is common in everyday problem solving: voters decide among proposed policies, consumers choose products to meet their needs, and politicians select among negotiation strategies. Such evaluations can be difficult when not only the problem is abstract, but so too are the means by which candidate solutions purportedly address that problem. Using metaphor to understand both the problem and the effectiveness of candidate solutions may facilitate evaluation in such cases.

The current research: testing a novel metaphoric fit hypothesis

On the basis of the foregoing theorizing, we hypothesized that solution evaluations would be uniquely influenced by an interactive "fit" between accessible metaphoric framings of an abstract problem and candidate solutions. To specify, if a metaphoric framing of an abstract problem leads people to understand that problem in terms of a bodily problem, then they should be more (less) favorable toward solutions that purport to solve (ignore) the metaphorically linked bodily problem.

The current studies test this hypothesis in the context of evaluations of treatments for depression. Like many mental illnesses, depression is abstract in that its defining symptoms are not immediately visible or easily traced to a concrete cause. It is not surprising, then, that people reach for various metaphors to describe depression experience (Mallinson, Kielhofner, & Mattingly, 1996). The most common metaphor (e.g., in depressed clients' reports) compares depression to being spatially *down* or *low* (McMullen & Conway, 2002). Related spatial metaphors compare depression to a physical weight holding one down, and therapy as "easing" or "removing" that burden (Korman & Angus, 1995; Levitt, Korman, & Angus, 2000). Another common metaphor compares depression to a state of *darkness* (McMullen & Conway, 2002), a metaphor famously employed by William Styron to describe his personal experience with depression (Styron, 1990).

Indeed, both *space* and *light* metaphors are conventionally used to talk about moods and other affective experiences in a number of cultures and language families (Kövecses, 2005; Meier & Robinson, 2005). This is likely because they originate in direct experiential correlations in human bodily functioning: both being inactive (i.e., "down") and lower levels of ambient light positively correlate with depression symptoms.[1]

Nevertheless, we expected these metaphors to influence depression treatment evaluations even in the absence of concurrent bodily experiences of being low, stuck, or in the dark. We expected this because we

[1] The common metaphoric representations of depression in terms of embodied experiences with verticality and illumination are not arbitrary. Positive emotions are normally associated with increased motivation and activity (being *up*) and negative emotions with inactivity or incapacitation (being *down*). Similarly, levels of light directly influence affect, with bright light resulting in more positive affect (Golden et al., 2005) and a lack of light exposure resulting in more negative emotions (e.g., Seasonal Affective Disorder; Lam & Levitan, 2000). These non-metaphoric embodied associations between emotional experience and interactions with the physical world likely form the basis for metaphoric representations of depression. This process enables a person to think and talk about abstract features of depression that *are not physically up/down or dark/light*. It is in this sense that we refer to the associations between depression and *verticality* and *illumination* as metaphoric. For further discussion of how embodied associations form the basis for conceptual metaphors, see Williams, Huang, and Bargh (2009).

posit that metaphors help people comprehend depression using knowledge of how bodily states operate – what they are like and how to change them – and not necessarily their current sensorimotor experience. Indirectly supporting this claim are studies showing that, even when not physically down or darkened, people think about abstract emotion information in terms of space (Meier & Robinson, 2006; Weger, Meier, Robinson, & Inhoff, 2007) and light (Meier, Robinson, Crawford, & Ahlvers, 2007). This suggests that when a down- or dark-metaphoric framing of depression is salient, framing a depression treatment as "uplifting" or "illuminating" will influence its perceived effectiveness, despite the fact that these metaphoric framings are, in a strict literal sense, peripheral to understanding depression's nature or the actual means by which a candidate treatment purportedly alleviates depression symptoms.

We test this claim in two stages. First we isolate whether framing depression metaphorically results in more favorable evaluation of a metaphorically fit treatment (Studies 1 and 2). Then we further probe the effects of metaphoric fit by manipulating the metaphoric framing of both depression and treatments (Studies 3 and 4).

According to conceptual metaphor theory, metaphor use helps people understand a concept that they otherwise find vague, complex, or uncertain (Lakoff & Johnson, 1980). If our predicted effects on treatment evaluation are in fact due to the use of a metaphor to understand depression, then these effects should be mediated by participants' certainty that they understand depression. That is, using the salient metaphor should make people feel as though they understand depression's nature, in turn predicting their reliance on embodied knowledge to evaluate a candidate treatment's effectiveness. We test this hypothesis in Study 2.

We further reasoned that if a metaphoric framing of an abstract problem leads people to draw on their knowledge of that metaphor's bodily problem to evaluate candidate solutions, it should produce negative evaluations of solutions framed as solving alternative bodily problems. Thus, in Study 4, we predicted that framing depression as darkness would lead participants to negatively evaluate a treatment framed as elevating because spatial movement does not necessarily solve the problem of being in the dark.

Study 1

We predicted that framing depression metaphorically as being spatially down would result in more favorable evaluations of an anti-depressant medication framed as having an elevating effect.

Method

Fifty-nine adults were recruited online through Amazon's Mechanical Turk Service (32 women; $M_{age} = 32.63$; 71.12% White; compensation = $.40).

Metaphor framing manipulation

In a purported study of consumer attitudes, participants were randomly assigned to read one of two articles ostensibly as background for the product they would evaluate later in the study. In the *depression is down* condition, the article contained metaphoric expressions that subtly compared depression to being down (e.g., "Depressed individuals feel that while other people's lives have both ups and downs, their life has considerably more downs"). In the *no metaphor* condition, those metaphoric expressions were replaced with literal paraphrases (e.g., "Depressed individuals feel that while other people's lives have both positive and negative periods, their life has considerably more negative periods").

Anti-depressant effectiveness

Participants were then instructed that they would be evaluating an anti-depressant medication, named "Liftix," slated to appear on the market in the next few months. A brief description of Liftix included expressions framing the medication's effects in terms of spatial elevation (e.g., "has been shown to lift mood"; "patients everywhere have reported feeling uplifted").

Participants reported their perceptions of Liftix's effectiveness by indicating their agreement with 4 statements. Sample items are: "This medication seems like an effective way to manage the symptoms of depression"; and "This treatment doesn't seem like it would do anything to treat depression" (reverse scored). Responses were made on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*) and averaged, after reverse scoring, to form composite perceived effectiveness scores ($\alpha = .77$).

Results

In this study, as in Studies 2 and 4, we did not observe gender or age main effects on treatment evaluations, nor did these demographic factors interact with our experimental manipulations (all $ps > .11$). Including gender or age as covariates in our primary analyses did not change the pattern of results for any reported effects (gender effects in Study 3 are detailed below). Because race/ethnicity representation in all samples was low, we did not test for main effects or interactions involving race/ethnicity.

Scores on anti-depressant effectiveness were submitted to a one-way ANOVA (*depression is down* vs. *no metaphor*). As predicted, participants in the *depression is down* condition perceived Liftix as more effective ($M = 4.72$, $SD = .99$) than participants in the *no metaphor* condition ($M = 4.00$, $SD = 1.48$), $F(1, 57) = 4.55$, $p = .03$, $\eta^2 = .08$.

Discussion

As predicted, framing depression as the bodily state of being down or low (vs. without a provided metaphor) increased the perceived effectiveness of an anti-depressant medication framed as having an elevating effect. This finding supports our broader claim that using embodied metaphor to frame an abstract problem as a bodily problem increases favorability toward a solution framed as resolving that bodily problem.

An alternative interpretation is suggested by cognitive fluency research showing that stimuli that are easier to process automatically elicit positive affect (Alter & Oppenheimer, 2009; Winkielman & Cacioppo, 2001) and favorable product evaluations (Labroo, Dhar, & Schwarz, 2008). It is possible that participants in the *depression is down* condition preferred Liftix merely because it was described in spatial language similar to the metaphoric framing of depression, thereby increasing its fluency and eliciting a more positive evaluation. Study 2 addresses this possibility.

Study 2

Study 2 conceptually replicates Study 1. We manipulated the salience of a dark-metaphoric framing of depression (rather than a down-metaphoric framing) and measured evaluations of an anti-depressant framed as having an illuminating effect.

Study 2 addresses the cognitive fluency interpretation just mentioned by providing a stronger test of whether metaphor use mediated the primary predicted effect. Conceptual metaphor theory suggests that using an embodied metaphor to conceptualize an abstract problem will facilitate comprehension of that problem. Thus, we predicted that framing depression as dark would bolster participants' sense that they understand the nature of depression. Insofar as felt certainty results from applying embodied knowledge to understand depression, it should predict favorability toward an anti-depressant framed as solving that bodily problem (i.e., by means of illumination). Support for this prediction would favor the metaphor account over the cognitive fluency account. Whereas the latter can explain why a solution would be evaluated more positively when its semantic framing (metaphoric or

otherwise) matches that of the problem, it does not lead us to predict that a metaphoric framing of a problem would increase certainty about that problem (because it precedes solution framing), nor that this increased certainty would positively predict liking for a metaphorically fit solution.

Method

Participants were 54 Mechanical Turk workers (33 women; $M_{age} = 36.09$; 74.07% White; compensation = $.40).

Metaphor framing manipulation

As in Study 1, participants were randomly assigned to read one of two articles. In the *depression is dark* condition, the article contained metaphoric expressions that compared depression to being darkened (e.g., "Depressed individuals feel that while other people's lives have both bright and dark periods, their life has considerably more dark periods"). Participants in the *no metaphor* condition read the same non-metaphoric article used in Study 1.

Depression certainty

Participants then rated their agreement with six statements assessing their certainty about depression. Sample items are: "I feel like I have a clear idea of what depression is like"; and "I am unclear about what depression is really like" (reverse scored; 1 = *strongly disagree*, 7 = *strongly agree*; α = .81).

Anti-depressant effectiveness

Participants read a description of a new anti-depressant medication, labeled Illuminix, containing expressions comparing the medication's effects to illumination (e.g., "has been shown to brighten mood"; "patients everywhere have reported a brighter outlook").

Participants then evaluated Illuminix's effectiveness. Because the measure of perceived effectiveness used in Study 1 included a small number of items, in Study 2 we included 4 additional items (e.g., "This looks like an effective treatment for depression") for a total of 8 (α = .83).

Results

As predicted, framing depression metaphorically as a state of darkness (vs. with no provided metaphor) increased participants' confidence that they understand the nature of depression ($M = 5.71$, $SD = .83$ vs. $M = 5.17$, $SD = .96$), $F(1, 52) = 4.78$, $p = .03$, $\eta^2 = .09$. It also led participants to view Illuminix as a more effective depression treatment ($M = 5.04$, $SD = .89$ vs. $M = 4.46$, $SD = .97$), $F(1, 52) = 5.29$, $p = .02$, $\eta^2 = .10$.

We then tested our prediction that a dark-metaphoric depression framing increased the perceived effectiveness of Illuminix by means of bolstering felt certainty about depression's nature. First, we verified our prediction that depression certainty predicted higher perceived

effectiveness, $\beta = .38$, $t = 2.90$, $SE = .13$, $p = .006$. We tested the mediation model using Preacher and Hayes's (2008) boostrapping procedure. The resulting confidence interval did not include zero (.03, .44), supporting our mediation prediction (Fig. 1 depicts the mediation model).

Discussion

Replicating the effect found in Study 1 using another common embodied metaphor, Study 2 shows that framing depression metaphorically as dark (vs. with no metaphor provided) increased participants' favorability toward a metaphorically fit depression treatment — that is, one framed as illuminating.

Beyond providing converging evidence for metaphoric fit, Study 2 makes a theoretical advance by providing direct evidence in line with our claim that the effect is due to metaphor use. Consistent with conceptual metaphor theory's account of metaphor's epistemic function, participants provided with an embodied metaphor for depression felt more certain that they understood depression. Critically, this increased certainty fully mediated the effect of depression framing on positive evaluations of a metaphorically fit treatment.

This finding is consistent with our theoretical account of embodied metaphor's role in problem solving, yet it is difficult to explain as the result of cognitive fluency. Fluency may account for why a medication is evaluated positively when its metaphoric framing semantically matches that of the health risk. Yet it cannot explain why this effect was mediated by feelings of increased certainty about the health risk prior to evaluating the medication. Instead, we interpret this finding as evidence that an accessible metaphor caused people to understand depression in terms of a bodily problem (being in the dark) and consequently apply their knowledge of that bodily problem to evaluate a candidate treatment.

One limitation of Studies 1 and 2 is that they do not compare evaluations of metaphorically fit and non-fit treatments. Thus we cannot rule out the possibility that a metaphoric framing of depression increases the perceived effectiveness of any treatment, even if not framed as solving the bodily problem to which depression is compared. We address this limitation in Study 3 by manipulating depression framing and treatment framing. Another goal of Study 3 was to increase the generalizability of our findings by examining evaluations of a non-medicinal depression treatment: close interpersonal relationships.

Study 3

Study 3 addresses the alternative possibility that framing depression metaphorically increases the perceived effectiveness of any treatment, rather than metaphorically fit treatments, as we hypothesize. We compared (between-subjects) evaluations of the same depression treatment framed in either metaphorically fit or non-fit terms. We predicted that a spatial metaphoric framing of depression (versus no
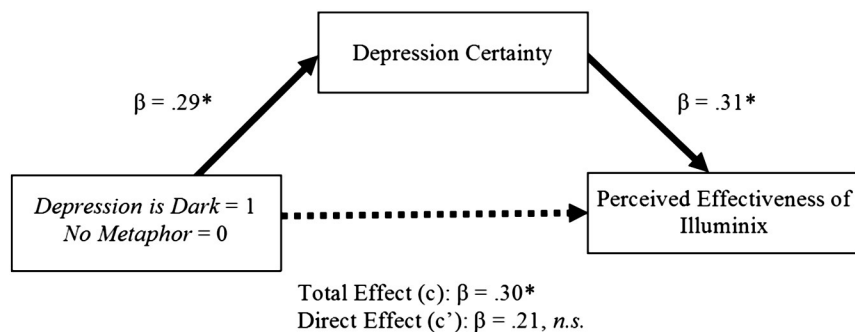

Fig. 1. Mediation of the effect of depression framing (*depression is dark* vs. *no metaphor*) on perceived effectiveness of a metaphorically fit treatment ("*Illuminix*") by depression certainty (*Study 2*). *Note*: The direct effect coefficient represents the effect of the independent variable after controlling for the effect of the proposed mediator. Total adjusted R^2 for the model = .18, $F(2, 52) = 5.63$, $p < .01$. *Significant at $p < .05$.
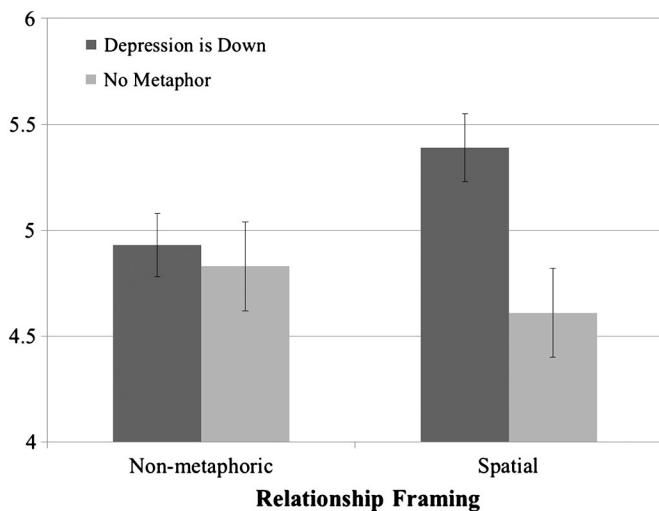
Fig. 2. Perceived effectiveness of a depression treatment (close relationships) by depression framing and relationship framing (controlling for gender) (*Study 3*). *Note*: Scale ranged from 1 to 7; higher scores indicate higher perceived effectiveness.

metaphor) would cause participants to view a depression treatment as more effective if it was framed as solving the bodily problem of being down, but not if the same treatment was framed in non-metaphoric terms.

To test whether the observed metaphoric fit effects generalizes to depression treatments other than anti-depressant medications, we measured the perceived effectiveness of close interpersonal relationships for alleviating depression. Participants read an article that, depending on condition, described relationships' therapeutic benefits in terms of elevation (a potential metaphoric fit) or equivalent non-metaphoric terms.

Method

Participants were 82 undergraduates (42 women, $M_{age} = 19.40$)[2] at a large mid-western university.

Metaphor framing manipulation

Participants were randomly assigned to read either the *depression is down* or the *no metaphor* articles used in Study 1.

Relationship framing manipulation

Participants then read one of two (fabricated) articles about depression and relationships, ostensibly from a popular online magazine. In both versions of the article, the columnist described her personal experience with depression and the importance of her relationships for helping her to recover. The *spatial-metaphoric* version contained metaphoric expressions comparing relationships' effectiveness to lifting one out of depression (e.g., "How many days have you been down in the dumps until the right guy or gal came along to perk you up?"; "…I can say that relationships were the only thing that pulled me out of my depression"). The *non-metaphoric* version contained literal paraphrases of those metaphoric expressions (e.g., "How many days have you been in a crummy mood until the right guy or gal came along to change things?"; "…I can say that relationships were the only thing that helped me with my depression").

Relationship effectiveness

Finally, participants rated their agreement with five statements assessing their perceptions that relationships can effectively treat

depression symptoms. Sample items are: "I believe that relationships can help to manage the symptoms of depression"; and "I don't think that relationships would do anything for depression" (reverse scored). These items were modeled after the eight items used in Study 2 to assess evaluations of the anti-depressant medication. We excluded the three items that were inappropriate for the context of evaluating close relationships (e.g., "This company seems to really understand the nature of depression").

Results

Preliminary analyses revealed a gender difference in perceived relationship effectiveness, with men being more skeptical of relationships' effectiveness than women, $p = .058$. Therefore, we submitted relationship effectiveness scores to a 2 (depression framing: *depression is down* vs. *no metaphor*) × 2 (relationship framing: *spatial-metaphoric* vs. *non-metaphoric*) ANCOVA controlling for gender. This test revealed a significant two-way interaction, $F(1, 77) = 4.21$, $p = .04$, $\eta^2 = .05$ (see Fig. 2 for means).[3]

When depression was framed as being down, participants perceived relationships as more effective depression treatments if relationships were framed as elevating ($M = 5.39$, $SD = .64$) versus without a provided metaphor ($M = 4.93$, $SD = .69$), $F(1, 38) = 4.73$, $p = .04$, $\eta^2 = .12$. In contrast, when depression was framed in non-metaphoric terms, we observed no differences in perceived relationship effectiveness between the *spatial-metaphoric* ($M = 4.61$, $SD = .97$) and *non-metaphoric* conditions ($M = 4.83$, $SD = .94$, $F(1, 40) = .60$, $p = .44$).

Also consistent with predictions, among participants who received the *spatial-metaphoric* description of relationships, those provided with the *depression is down* framing saw relationships as more effective than those in the *no metaphor* condition, $F(1, 37) = 8.46$, $p = .006$, $\eta^2 = .23$. However, participants who received the *non-metaphoric* description of relationships saw relationships as equally effective in both the *depression is down* and the *no metaphor* conditions, $F(1, 41) = 0.12$, $p = .72$.

Discussion

By comparing participants' evaluations of a depression treatment framed as having either spatial or equivalent non-metaphoric effects, we were able to rule out the possibility that a metaphoric framing of depression increases the perceived effectiveness of any depression treatment. Rather, when participants were encouraged to think about depression metaphorically as being physically down, they evaluated close interpersonal relationships as a more effective treatment for depression, but only if relationships were themselves framed metaphorically as having an elevating effect. Even though engaging in close relationships may be a powerful depression treatment, participants primed to construe depression as being physically down did not seem to appreciate this benefit so long as relationships were not framed as "lifting" one up.

Although Studies 1 to 3 provide converging evidence for our metaphoric fit hypothesis, they manipulated the salience of embodied metaphors by means of exposure to articles framing depression as a bodily problem. Although the metaphoric articles were matched to the non-metaphoric articles on length and tone, it is possible that metaphoric descriptions were perceived as more vivid or impactful in ways that may account for the effects. Study 4 addresses this issue by providing a converging test of our hypothesis using another procedure to manipulate metaphoric framing.

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[2] Due to experimenter oversight, ethnicity information was not collected for this sample.

[3] Because controlling for gender alone does not control for possible gender moderation effects (Hull, Tedlie, & Lehn, 1992), we also tested the possibility that depression or relationship framing (or their interaction) was moderated by participant gender. The interaction of depression and relationship framing remained significant even after controlling for all possible moderation effects by gender, $F(1, 74) = 4.39$, $p = .039$, $\eta^2 = .04$. The three-way interaction between depression and relationship framing and gender, and all two-way interactions with gender, were non-significant ($ps > .05$).

Study 4

Study 4 conceptually replicates the previous studies using visual imagery, rather than linguistic expressions, to manipulate metaphoric framing. All participants were exposed to the same list of words referring to emotions and mood states, but we manipulated the appearance of those words to prime associations between depression and either space (*depression is down*) or light (*depression is dark*).

As in Study 3, we compared evaluations of depression treatments framed in metaphoric or non-metaphoric terms, except that here it was a within-subjects factor. Participants saw advertisements for an anti-depressant medication metaphorically framed as having an elevating effect (as in Study 1) and an alternative anti-depressant with effects framed in non-metaphoric terms. By showing participants both advertisements, we intended to create a situation that better approximates how health decisions are normally made among competing alternatives. Building on the previous studies, we predicted that framing depression as down would cause participants to evaluate an "elevating" anti-depressant as more effective than an equivalent anti-depressant framed in non-metaphoric terms.

Our metaphoric fit hypothesis suggests that metaphorically framing a problem not only increases preference for metaphorically fit solutions, but also decreases preference for metaphorically misfit solutions. Study 4 tests this reasoning. Specifically, we predicted that framing depression as being darkened would cause participants to evaluate the elevating anti-depressant as less effective than the non-metaphoric alternative, because spatial solutions fail to address the bodily problem of being darkened.

Method

Participants were 44 undergraduates (22 women; $M_{age} = 18.84$; 86.36% White) at a large mid-western university.

Metaphor framing manipulation

Participants were told that they would first complete a task studying how people interpret media information under varying viewing conditions. They were asked to categorize a list of emotion words as either positive or negative as quickly as they could for 48 trials. The list of words included 12 positive (e.g., *excited*, *overjoyed*) and 12 negative (e.g., *lonely*, *sad*) emotion words used in the PANAS-X (Watson & Clark, 1999). All words were presented twice in a randomized order on a gray background one at a time until participants had categorized all of the words.

We modified the appearance of the words across conditions to manipulate embodied-metaphoric framing. Participants randomly assigned to the *depression is down* condition viewed all of the positive emotion words at the top of the screen and all of the negative emotion words at the bottom of the screen (Meier & Robinson, 2006; Schubert, 2005). In contrast, participants assigned to the *depression is dark* condition viewed all the words in the center of the screen, but the positive emotion words were in white text and the negative emotion words were in black text (Meier, Robinson, & Clore, 2004). Post-session interviews revealed that no participants expressed suspicion about this procedure.

Anti-depressant effectiveness

Participants were then presented with two advertisements for anti-depressant medications. One was the same advertisement used in Study 1 for Liftix — an anti-depressant with an elevating effect. The other advertisement featured Effectrix, the description of which was matched in length and tone to that of Liftix but, critically, did not contain any spatial-metaphoric expressions (e.g., "has been shown to improve mood"; "patients report fewer symptoms after taking Effectrix"). We measured perceived effectiveness using the same eight items used in Study 2 ($\alpha_{Liftix} = .93$, $\alpha_{Effectrix} = .95$). The presentation order of the
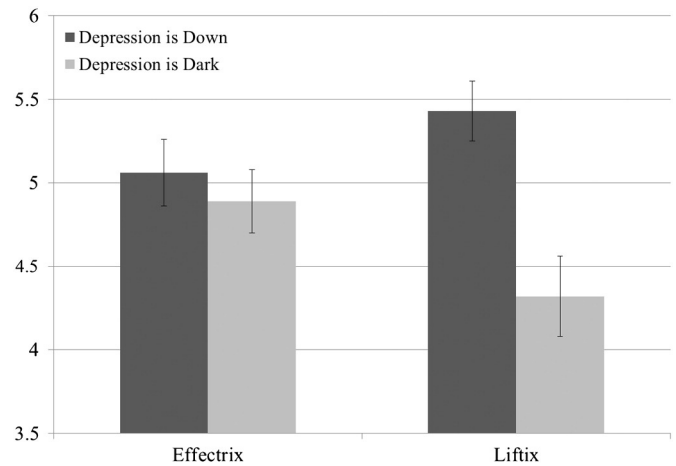

Fig. 3. Perceived depression treatment effectiveness of non-metaphoric ("*Effectrix*") and spatial ("*Liftix*") framing anti-depressants by depression framing (*Study 4*). *Note*: Scale ranged from 1 to 7; higher scores indicate higher perceived effectiveness.

ads was counterbalanced, and preliminary analyses revealed no main effects or interactions involving presentation order.

Results

Anti-depressant effectiveness scores were submitted to a 2 (*depression is down* vs. *depression is dark*; between) × 2 (anti-depressant framing: *spatial-metaphoric* vs. *non-metaphoric*; within) mixed-model ANOVA. This test revealed the predicted interaction, $F(1, 42) = 10.06$, $p = .003$, $\eta^2 = .24$ (see Fig. 3 for means).

Replicating the results of the previous studies, participants primed with the metaphor *depression is down* evaluated Liftix – the spatially "elevating" anti-depressant – as more effective ($M = 5.43$, $SD = .90$) than did participants primed with the metaphor *depression is dark* ($M = 4.32$, $SD = 1.19$), $F(1, 42) = 12.13$, $p = .001$, $\eta^2 = .28$. In contrast, and also as expected, evaluations of Effectrix – an equivalent anti-depressant framed without the use of metaphor – did not vary between participants primed with the metaphor *depression is down* ($M = 5.06$, $SD = 1.04$) and those primed with the metaphor *depression is dark* ($M = 4.89$, $SD = .94$), $F(1, 42) = .31$, $p = .58$.

Replicating Study 3 with a within-subjects manipulation of treatment framing, participants primed with the metaphor *depression is down* evaluated the *spatial-metaphoric* anti-depressant as more effective than an equivalent anti-depressant framed in non-metaphoric terms $F(1, 23) = 4.19$, $p = .05$, $\eta^2 = .18$. Furthermore, priming the metaphor *depression is dark* had the opposite effect, leading participants to rate the spatial-metaphoric anti-depressant as *less* effective than its non-metaphoric counterpart, $F(1, 19) = 5.54$, $p = .03$, $\eta^2 = .29$.

Discussion

Using a visual imagery procedure that avoids potential confounds of linguistic expressions, we replicated Studies 1 and 3 by showing that framing depression as down (versus not priming this particular metaphor) increased preference for a depression treatment framed metaphorically as solving that bodily problem (i.e., of "lifting" mood). Replicating Study 3, the down-metaphoric framing increased the perceived effectiveness of an "elevating" depression treatment, but did not influence the perceived effectiveness of a depression treatment not framed in spatial-metaphoric terms.

Also as predicted, embodied-metaphoric framing of a problem decreased preference for a metaphorically misfit solution. Specifically, framing depression as a state of darkness led participants to evaluate the "elevating" anti-depressant as *less* effective than an equivalent medication framed in non-metaphoric terms. That is, participants led

to think about depression as darkness evaluated treatments on the basis of whether they "illuminate"; consequently, they devalued a metaphorically elevating medication, regardless of its potential therapeutic benefit, presumably because it does not address the problem of darkness.

General discussion

We examined whether thinking of an abstract health risk metaphorically in terms of a bodily problem would cause individuals to positively evaluate treatments that are metaphorically framed as solving that bodily problem. Across four studies, we found converging evidence to support this hypothesis. Participants exposed to messages metaphorically framing depression in terms of an embodied problem (Study 1: *depression is down*, Study 2: *depression is dark*) viewed as more effective anti-depressant medications with appropriate metaphoric effects (Study 1: *lifting*, Study 2: *brightening*). Study 2 further demonstrated that this effect of metaphoric fit was due specifically to an increase in felt certainty after metaphor exposure, supporting the proposed mediating role of conceptual metaphor use, and casting doubt on an alternative fluency explanation.

Studies 3 and 4 provide more complete tests of metaphoric fit by manipulating the salience of metaphors for both problems and solutions. Participants in Studies 3 and 4 exposed to the metaphor *depression is down* (verbally or visually) viewed depression treatments as more effective if they were framed as having an elevating effect. Critically, in Study 4 we found the opposite pattern for participants primed with the metaphor *depression is dark*: they saw the spatially-framed depression treatment as *less* effective than a non-metaphoric alternative. Just as metaphoric fit improves evaluations of apt solutions, metaphoric misfit (i.e., when a solution's metaphoric effects seem inappropriate to a problem) decreased favorability.

Implications for clinical problem solving

Our research shows that there are clearly both costs and benefits to describing health problems and treatments in metaphoric terms. Metaphors for therapeutic (e.g., counseling, medication) or non-therapeutic behaviors (e.g., exercise, diet, relationships) that fit a patient's metaphoric understanding of a health problem can increase perceived treatment effectiveness and perhaps result in better outcomes for patients. For example, patients who perceive light box therapy (e.g., Golden et al., 2005) as an effective way to dispel the "darkness" of their depression might come to have more positive clinical outcomes in part through increased optimism that treatment will be effective (i.e., a placebo effect). Indeed, such optimism may exert a top-down influence on a patient's emotional regulation (Ochsner & Gross, 2005) adding to the observed benefits of light box therapy.

On the other hand, metaphoric misfit may drive people away from behaviors that may in fact benefit them or toward unhelpful solutions. Following the above example, someone who tends to see their depression in spatial metaphoric terms may have more skepticism about the effectiveness of light box therapy, despite its demonstrated benefits, and this doubt may undermine treatment. Worse yet, people may become more supportive of unnecessary or even unhealthy treatment options that seem apt due to metaphoric fit.

Clinicians should attend carefully to the role of metaphor, as it may exert undue influence on how people think about and respond to treatments. When symptoms, disorders, or treatments are particularly abstract, metaphor threatens to bias decision making in previously unacknowledged ways that may be beneficial in some cases, though harmful in others.

Implications for research on problem solving

Understanding metaphoric fit also has important implications for understanding persuasion broadly. For example, in a recent advertising campaign, an American university metaphorically presents the challenge of *career success* as a *journey* and offers itself as a solution by metaphorically describing the university as "Career GPS" capable of guiding an individual to success (University of Phoenix, 2013). The paired metaphors for the problem (i.e., how one achieves career success) and the solution (i.e., education at the University of Phoenix) provide individuals with a framework for metaphorically understanding the problem and a solution designed to increase the perceived effectiveness of that solution specifically.

Indeed, many important social issues (e.g., crime, poverty) and policy solutions are described metaphorically, and this may bias problem solving in disastrous ways. If a politician frames a group as a *disease* threatening the health of a nation, genocidal measures that seem to *cleanse* or *sanitize* those groups from society may be seen as especially effective (common language in the rhetoric of genocide; Musolff, 2010). In short, a metaphoric fit between problem and solution framings may make solutions seem self-evidently effective, yet point to actions with disastrous consequences.

While research in consumer and political psychology has explored many processes that influence problem-solving decisions, our research on metaphoric fit makes an important contribution to a growing literature demonstrating that people are often swayed by irrelevant details when thinking about how to solve problems. Metaphoric language, which has no direct bearing on the actual quality of a solution, may encourage individuals to prefer (resist) solutions if their framing suggests a metaphoric fit (misfit) with a salient metaphor for a problem. To the extent that solutions are framed metaphorically as having effects that address an embodied understanding of a problem, people may even end up supporting solutions that are little more than snake oil clothed in metaphor.

Limitations and directions for future research

While metaphoric fit likely has far reaching consequences for consumer and political behavior, we focused on a small subset of metaphors for depression specifically. First, we focused on common metaphors for depression, though our theory would suggest that these effects would extend to novel or idiosyncratic metaphors for depression (e.g., depression is a storm) and treatment (e.g., therapy is a shelter) as well. It is also important to test how these effects might generalize to new domains. For example, if a person understands her drug addiction as a prison, she may be likely to find solutions that promise "freedom" more appealing than solutions with only non-metaphoric effects. As noted above, these extensions are important because metaphor could bias evaluations and result in poor decision making. Put simply, drug addiction is not in fact a prison, and reasoning about in that manner can be misleading.

There are also important epistemic factors which were not explored in this research. For example, if people feel increasingly uncertain about an abstract problem, like depression, or its potential solutions, the metaphoric fit effects observed in these studies should be exaggerated as uncertainty increases reliance on metaphor for understanding target concepts (Keefer et al., 2011; Landau, Keefer, & Rothschild, 2014). Conversely, allowing individuals access to non-metaphoric information that satisfies epistemic needs for understanding the nature of abstract problems or their solutions may attenuate or eliminate any effect of metaphoric framing.

The effects of our experiments also must be interpreted with some degree of caution. First, participants receiving our non-metaphoric framings are unlikely to have refrained from all metaphor use. As we noted in the Introduction, people commonly rely on metaphor to make sense of depression and depression treatment, and they may have done so in the absence of a salient metaphoric framing. Hence, our observed effects should be seen as conceptually replicating a number of prior findings (Landau, Meier, & Keefer, 2010; Ottati & Renstrom, 2010) demonstrating the effects of making a particular metaphor

salient (vs. not). The results of our perceptual framing manipulation (Study 4) help speak to this issue by demonstrating that an embodied metaphor primed outside of conscious awareness also influenced treatment evaluations in the predicted direction. However, we do not have direct evidence that participants in Study 4 actually applied the metaphor to understand depression.

Furthermore, space and light are sometimes associated in experience (low is associated with dark and high with bright). Although in Study 4 we observed expected differences between these two metaphoric framings, we cannot speak to how specific participants' idiosyncratic understandings of these concepts, or their association, may have differed. Because physical ecology influences how people understand embodied concepts like space and light, it is possible that individual differences could moderate metaphoric fit effects. For example, people who live in ecologies with more change in elevation (e.g., hills or mountains) might find spatial metaphors more helpful for understanding problems than individuals living in relatively flat regions because they regularly experience difficulties related to changing altitude. By the same token, it is also possible that people from regions with high levels of seasonal affective disorder (due to dramatic changes in the number of daylight hours over the year) may be more likely to use the concept of darkness to understand depression (see Harrison, 2004). At this stage, we can only speculate about the ways in which differences in bodily experience may moderate the effects of metaphor exposure, but they bear interesting implications for future research.

Conclusions

These studies test, and support, our view that metaphoric fit is an important phenomenon that influences problem solving. The effects of metaphoric fit are not, however, univocal: metaphors can both increase and decrease the perceived effectiveness of treatment options presented in metaphoric terms. This issue is of growing importance because people are given increasing agency over health decisions (Mol, 2008). Unfortunately, most people do not have the training or expertise to make fully informed health decisions, relying instead on information gleaned from lay health theories (Popay & Williams, 1996) or direct-to-consumer advertisements. Such information is piecemeal at best and often misleading (Hoffman & Wilkes, 1999; Sansgiry, Sharp, & Sansgiry, 1999), and thus offers people little solid footing for making informed choices about complex health issues. Health problem solving is therefore inherently uncertain for many, inclining people to base their problem solving efforts in part on embodied metaphoric knowledge.

But this research also has broad implications for how individuals apply metaphors to understand other abstract problems and solutions. The metaphoric fit hypothesis could be applied to study problem solving cognition in relationships, public policy, the workplace, or any other domain in which abstract problems and their solutions are prone to being understood through embodied metaphor. Because metaphor plays such a crucial role in allowing people to make sense of their social environment, the effects of metaphoric fit on problem solving present many important possibilities for future research.

Acknowledgment

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