Temporal distance moderates description dependence of subjective probability

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Abstract

Probability judgment is *description-dependent*; different descriptions of the same event can elicit different judged probabilities. We propose that the temporal proximity of an event moderates the degree of description dependence in probability judgment. According to construal level theory, near future events are represented more concretely than distant future events. These more concrete representations are predicted to be more stable, and therefore less susceptible to description dependence effects. Consistent with this prediction, changing an event's description by unpacking it into constituent parts influenced its judged probability more when the event took place in the distant rather than the near future. Specifically, greater description dependence was found for distant events regardless of whether the unpacking manipulation increased (Experiment 1) or decreased (Experiment 2) judged probability.
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Keywords: Description dependence; Temporal construal; Support theory; Unpacking

Alternative descriptions of the same event lead to different judgments of probability, a pattern referred to as description dependence in probability judgment (Tversky & Koehler, 1994). Description dependence of judgments violates the principle of description invariance, which requires that hypotheses referring to the same event be assigned the same probability. Numerous studies, however, have illustrated description dependence in probability judgment. For example, Fischhoff, Slovic, and Lichtenstein (1978) showed that both car mechanics and laypeople assigned higher probability to a residual hypothesis of why a car would fail to start (something other than the battery, the fuel system, or the engine) when this hypothesis was broken down into more specific causes (e.g., the starting system, the ignition system). Tversky and Koehler (1994) incorporated description

dependence into support theory, a formal model of subjective probability.

A key implication of description dependence is that people generally accept judgment and decision problems in the form presented to them, and do not spontaneously transform a given problem to some consistent representation (Slovic, 1972; Tversky & Kahneman, 1986). For example, in a study of framing in decision making, McNeil, Pauker, and Tversky (1988) asked respondents to choose between two alternative treatments for lung cancer, surgery and radiation therapy, whose outcomes were described in terms of either survival or mortality rates. These two logically equivalent but descriptively different frames led to substantial differences in experienced physicians' choice of the two treatments. If decision makers spontaneously transformed problems and represented them in a consistent way (e.g., always in terms of survival rates), then such framing effects would disappear. Formal decision tools are useful precisely because they impose a consistent framework on how decision problems are represented.

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Construal level and description dependence

Short of using formal decision tools, one potential way to reduce description dependence in intuitive judgment is to identify those conditions that best encourage the formation of *stable* and *consistent* representations of judgment and decision problems, despite the varied ways in which the problems may present themselves. In this paper, building on construal level theory (Trope & Liberman, 2000, 2003), we investigate whether an event's temporal proximity may influence people's propensity to generate a stable, consistent representation of it, and thereby moderate the extent to which alternative descriptions of the same event influence probability judgments.

Construal level theory (CLT) proposes that the temporal distance of an event systematically influences people's construal of that event (Trope & Liberman, 2000, 2003). According to CLT, distant future events tend to be represented more schematically in terms of a few abstract features (high-level construals), while near future events tend to be represented in terms of their more concrete details (low-level construals). These different construals have been found to influence judgment and behavior in numerous ways. Liberman and Trope (1998), for example, show that individuals use more superordinate terms (''why'' aspects of an event) to describe distant future activities and more subordinate terms (''how'' aspects of an event) to describe near future activities. For example, the activity ''ordering seafood for a party'' would be construed in terms of its overall purpose or goal when the party is six months from now (e.g., offering a diverse and healthy menu) whereas the same activity would be construed in terms of the concrete means for achieving this goal when the party is tomorrow (e.g., visiting the seafood section of a supermarket).

In an extension of CLT to object categorization, Liberman, Sagristano, and Trope (2002) showed that people used narrower, more specific categories to classify objects related to an event (e.g., camping trip) when it took place in the near rather than the distant future. This finding implies less flexibility in categorization for an event taking place in the near future. Along similar lines, Forster, Friedman, and Liberman (2004) found that abstract construals resulted in more creative problem-solving, whereas concrete construals led to greater single-mindedness in problem-solving.

Cumulatively, these findings suggest a general conjecture: that distant future construals may be more flexible and malleable whereas near future construals may be more concrete and stable. In line with this interpretation, Trope and Liberman (2003) observe that

''a defining characteristic of high-construal features is that changes in these features produce major changes in the meaning of the event. . .Changes in [low-construal] features produce relatively minor changes in the meaning of the event.''

This characterization of high- and low-construal features prompts a parallel conjecture about the differential effects of description changes for probability judgment of temporally distant vs. proximal events. Description changes that alter high-construal features of a distant event will tend to have substantial effects on the judge's representation of the event's core meaning or ''essence'', and consequently may lead to large changes in judged probability. In contrast, description changes that affect low-construal features of a proximal event will have relatively small effects on the judge's representation of the event's core meaning, and consequently result in small changes in judged probability.

We propose, then, that because proximal events are more likely to be represented relatively stably in terms of low-construal features, likelihood judgments of these events will tend to be rather *insensitive* to description changes. Likelihood judgments of more abstractly represented distant events, in contrast, will be more susceptible to manipulations of event description, because those description changes may more readily change the perceived core essence of the event in question. This hypothesis, while by no means following directly from CLT, is prompted by CLT's characterization of proximal events as concretely represented and distant events as more abstractly represented.

Packed and unpacked descriptions

We focus specifically on unpacking, a particular type of description manipulation in which an aggregate event A is redescribed as a disjunction of several mutually exclusive subcomponents (A_1 or A_2 or A_3). Numerous studies have found the judged probability of an unpacked description (such as ''dying from heart disease, cancer, or some other natural cause'') to be greater than the judged probability of its packed counterpart (''dying from a natural cause'') (Fischhoff et al., 1978; Fox & Tversky, 1998; Koehler, Brenner, & Tversky, 1997; Rottenstreich & Tversky, 1997; Tversky & Koehler, 1994). Support theory (Tversky & Koehler, 1994) suggests that unpacking an event may remind the judge of possibilities that would not spontaneously be considered and/or increase the salience of the listed possibilities. More recent research (e.g., Sloman, Rottenstreich, Wisniewski, Hadjichristidis, & Fox, 2004) indicates that unpacking an event into components may sometimes *decrease* judged probability, depending on the nature of the unpacked components. This diversity of unpacking effects allows for examining how generally temporal perspective may moderate description dependence.

Our analysis predicts larger unpacking effects for abstractly represented distant events, and smaller unpacking effects for concretely represented proximal events. This prediction holds regardless of the direction of change driven by the unpacking manipulation. When unpacking a hypothesis tends to increase its judged probability, it should do so more strongly when the event is distant rather

than proximal. Similarly, when unpacking a hypothesis tends to decrease its judged probability, it should do so more strongly when the event is distant rather than proximal.

We test whether temporal perspective moderates the size of unpacking effects in two experiments. In Experiment 1, we examine unpacking into *typical* (strong) components, which is predicted to *increase* judged probability to a greater degree for distant future events. In Experiment 2, we examine unpacking into *atypical* (weak) components, which is predicted to *decrease* judged probability to a greater degree for distant future events. Both predicted patterns reflect the same general principle: greater description dependence for distant events, and less description dependence for proximal, more concretely-construed events.

Experiment 1

In Experiment 1, we manipulate both the specificity of event description (packed or unpacked) and the temporal distance of the event (either "tomorrow night" or "six months from today"). Events are unpacked into typical constituents, which, consistent with past work, is expected to generally increase judged probability. The central prediction is that the increase in judged probability due to unpacking will be smaller when the event is temporally proximal, because the more concrete construal encourages a more stable representation of the event that is less susceptible to changes in the event description.

Method

Participants and design

Participants were 185 undergraduate students who participated in the experiment in return for class credit. The design was a 2 (temporal distance: tomorrow night vs. six months from today) × 2 (packed vs. unpacked) between subjects design.

Procedure

Participants were presented two scenarios that asked them to imagine that they were in charge of organizing a birthday party and a catered event, respectively. In the first scenario, participants indicated their likelihood of getting imported alcoholic drinks for a friend's birthday party.

In the second scenario, participants indicated their likelihood of getting seafood for a catered event.

Following Liberman and Trope (1998), we manipulated temporal distance by indicating that the event was going to take place either "tomorrow night" (proximal condition) or "six months from today" (distant condition). The packed condition specified the general category ("imported alcoholic drinks" and "seafood"), whereas the unpacked condition listed exemplars of each category ("Heineken, Corona, and Beck's or other imported alcoholic drinks" and "shrimp, lobster, salmon or other seafood").

To illustrate the manipulations in Experiment 1, the second scenario read as follows:

> Imagine that you are in charge of organizing a catered event, which is going to take place tomorrow night (six months from today).
> [Packed description condition]: How likely are you to order seafood for this event?
> [Unpacked description condition]: How likely are you to order shrimp, lobster, salmon or other seafood for this event?

Participants made likelihood judgments using a nine-point scale (1 = not at all likely, 9 = very likely).

Results and discussion

To investigate the effects of temporal distance of an event and its description specificity on its subjective probability, we conducted a two-way analysis of variance on the likelihood ratings. Results for each item are shown in Table 1. Across the two items, there was no main effect of temporal distance on likelihood judgments: whether the event took place in the near future ($M = 5.25$, $SD = 2.14$) or distant future ($M = 5.48$, $SD = 1.93$) did not influence its subjective probability, $F(1,181) = .56$, $p = .46$. There was also no main effect of description specificity: the likelihood of an event did not change significantly whether its description was packed ($M = 5.20$, $SD = 2.0$) or unpacked ($M = 5.51$, $SD = 2.08$), $F(1,181) = 1.05$, $p = .31$ (see Fig. 1).

The temporal distance and description specificity interaction, however, was significant, $F(1,181) = 4.38$, $p < .04$, suggesting that the unpacking effect was moderated by temporal distance of the event. The pattern of unpacking

Table 1
Mean likelihood ratings (and standard deviations) for the two items in Experiments 1 and 2

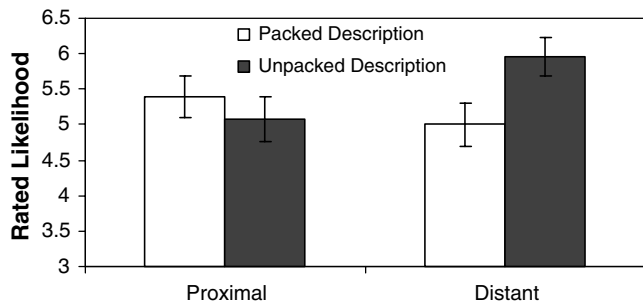| Item	Packed proximal	Unpacked proximal	Packed distant	Unpacked distant
Experiment 1: Typical unpacking				
1. Imported alcoholic drinks	5.67 (2.80)	5.33 (2.91)	4.88 (2.96)	5.36 (2.97)
2. Seafood	5.14 (2.47)	4.83 (2.64)	5.12 (2.32)	6.50 (2.28)
Experiment 2: Atypical unpacking				
1. Imported alcoholic drinks	4.71 (2.53)	4.03 (2.78)	5.23 (2.91)	2.95 (2.09)
2. Seafood	4.54 (2.15)	4.11 (2.69)	6.06 (2.17)	4.49 (2.61)

Fig. 1. Results of Experiment 1: Mean likelihood ratings as a function of temporal distance and description specificity. Error bars represent standard errors of the mean.

effects was consistent with the prediction that concrete representations are less susceptible to description dependence effects. There was a significant unpacking effect in the distant condition, such that likelihood ratings were higher in the unpacked condition ($M = 5.9$, $SD = 1.82$) than in the packed condition ($M = 5.0$, $SD = 1.94$), $F(1, 181) = 4.55$, $p < .04$. In contrast, there was no effect of unpacking in the near future condition, $F(1, 181) = .61$, $p = .43$, as similar likelihood ratings were observed in the packed ($M = 5.4$, $SD = 2.04$) and unpacked conditions ($M = 5.1$, $SD = 2.24$).

Note that there was no effect of unpacking in the proximal condition. This null result is somewhat surprising given previous demonstrations of unpacking effects. Our central hypothesis merely predicts a shrinking of the unpacking effect for proximal events, and this result is in fact quite consistent with the hypothesis (taken to its extreme) that respondents are more likely to generate a consistent, stable representation of the target event when it is temporally close. Furthermore, it is worth noting that many previous studies demonstrating unpacking effects tend to involve more abstract events, with no obvious temporal immediacy (e.g., likelihoods of causes of death, likelihoods of causes of car failures, likelihoods of characters' guilt in legal or crime scenarios, etc.).

Experiment 2

To further test the general principle that description dependence is more substantial for distant future events, we now consider an unpacking manipulation that has been shown to decrease, rather than increase, judged likelihoods: unpacking an event into atypical and implausible components.

Sloman et al. (2004) illustrated cases in which unpacking an event into atypical components reduced its judged probability relative to its packed description (see also Hadjichristidis, Sloman, & Wisniewski, 2001). For example, participants rated the probability of "death from a natural cause" to be higher than "death from asthma, the flu, or some other natural cause." To account for these deviations from the traditional unpacking effect, Sloman et al. (2004)

have proposed an account they called the narrow interpretation hypothesis, in which the unpacked exemplars serve to define the judge's interpretation of the category. In this view, atypical, unusual exemplars inhibit judges from considering more typical, more common exemplars. Suppression of these more common exemplars leads to lower judgments than in the packed case, where these exemplars would more likely be spontaneously generated.

As before, we predict an interaction between temporal distance and event description, but (compared to Experiment 1) the direction of the unpacking effect should reverse based on the atypical unpacking. Atypical-unpacked descriptions are hypothesized to *reduce* judged likelihoods substantially in the distant (abstract construal) case, but less so in the proximal (concrete construal) case. The general principle again is that description changes should have a greater influence on judgments of distant than proximal events.

Method

Participants and design

Participants were 127 undergraduate students who participated in the experiment in return for class credit. As in Experiment 1, the design was a 2 (temporal distance: tomorrow night vs. six months from today) by 2 (packed vs. unpacked) between subjects design. The order of the two items was kept constant across conditions.

Procedure

Scenarios, manipulations and the stimuli were the same as in Experiment 1 save for the unpacking of events into their atypical exemplars. For the item *imported alcoholic drinks*, the atypical constituents were Negra Modelo, St. Pauli Girl, and Fat Tire[1] while for the item *seafood*, they were octopus, shark, and eel. As in Experiment 1, participants used a nine-point scale to indicate their likelihood of ordering these items (1 = not at all likely, 9 = very likely).

To verify that our participants perceived our atypical constituents as indeed more atypical than our typical constituents from Experiment 1, we ran an independent pretest ($n = 21$). Following Sloman et al. (2004), participants were asked to indicate how good an example was an item of its category on a 7-point scale (1 = poor example; 7 = good example). Participants made ratings for the unpacked exemplars used in Experiment 1 (intended to be typical) and those in Experiment 2 (intended to be atypical). Results were consistent with desired manipulation ($M_{typical} = 5.77$; $M_{atypical} = 3.65$, $t(19) = 4.61$, $p < .001$).

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[1] Fat Tire, a niche American beer brand, was mistakenly included in the unpacking of *imported alcoholic drinks*. Indeed, this makes it a truly atypical exemplar of imported alcoholic drinks. This oversight does not change the logic of the empirical predictions.
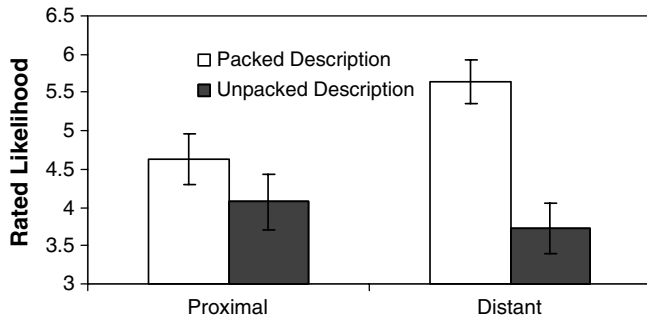
Fig. 2. Results of Experiment 2: Mean likelihood ratings as a function of temporal distance and description specificity. Error bars represent standard errors of the mean.

Results and Discussion

Across the two items, there was no main effect of temporal distance on likelihood judgments: whether the event took place in the near future ($M = 4.35$, $SD = 1.98$) or distant future ($M = 4.68$, $SD = 2.05$) did not influence its subjective probability, $F(1,123) = .95$, $p = .33$. Judgments were lower overall when the event was unpacked into atypical exemplars ($M = 3.89$, $SD = 2.09$) than when it was packed ($M = 5.13$, $SD = 1.66$), $F(1,123) = 13.18$, $p < .001$ (see Fig. 2), consistent with Sloman et al. (2004).

Consistent with our central hypothesis, the interaction between temporal distance and event description was significant, $F(1,123) = 4.05$, $p < .05$. There was a significant atypical unpacking effect in the distant condition, $F(1,123) = 17.38$, $p < .001$, such that likelihood ratings were lower in the unpacked condition ($M = 3.72$, $SD = 2.00$) than in the packed condition ($M = 5.64$, $SD = 1.59$). In contrast, the effect of unpacking in the proximal condition was not significant, $F(1,123) = 1.21$, $p = .27$, as similar likelihood ratings were observed in the unpacked ($M = 4.07$, $SD = 2.20$) and packed conditions ($M = 4.62$, $SD = 1.61$). This pattern of results provides further evidence in support of our prediction that concrete construal of near future events renders them relatively insensitive to changes in their description.

General discussion

In two experiments, we explored how different construals of the same event influenced by its temporal distance interact with its description specificity to affect probability judgments. Unpacking an event into typical (Experiment 1) or atypical (Experiment 2) components had a greater effect on judgments of distant events compared to proximal events. These results are consistent with the general hypothesis that proximal events are represented more concretely and stably than distant events, and therefore that judgments of distant events are more sensitive to description changes.

We have motivated our central hypothesis based on the notion that concrete representations of proximal events are more stable (and hence less susceptible to description changes) than more abstract representations of distant events. Despite their thematic similarities, concreteness of representation and stability (in response to description changes) are not identical concepts. What is most central to our predictions is a consideration of the extent to which a description change may change the essence of the event under consideration. In this light, the unpacking manipulation and context we have used may be particularly well suited for linking concreteness and stability. When unpacking the distant event of shopping for seafood, the very essence of the event changes from a consideration of whether a general class of food should be provided (in the packed case) to a consideration of the virtues of particular offerings (in the unpacked case). In contrast, when unpacking the proximal event of shopping for seafood, the core event changes less: in either case, one must consider the low-construal, practical aspects of the task (e.g., whether it is worthwhile to visit the seafood counter) and the nature of the particular exemplars listed is relatively less important. Whether description dependence *in general* is always reduced for judgments of proximal events, or whether the finding is limited to the unpacking manipulation, is a natural question for future research. In either case, the notion that the nature of the event description interacts with the temporal construal is an intriguing one. An additional contribution of our findings is that temporal distance can be added to the list of influences on the size of unpacking effects (see Brenner, Koehler, & Rottenstreich, 2002).

While much previous work has highlighted the strengths of abstract, high-level construals of distant future events, the present results suggest a possible strength of concrete, low-level construals of proximal events. Based on the results, judgments of proximal events are sometimes less susceptible to changes in idiosyncratic features of the event description. These results are in some sense a counterweight to the greater creativity and flexibility seen in abstract construals compared to the stability and single-mindedness seen in concrete construals (Forster et al., 2004). In cases where the same event is described differently, stability and single-mindedness can be virtues, yielding judgments closer to the normative standard of description invariance.

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