Temporal Distance, Event Representation, and Similarity

Samuel B. Day (s-day2@northwestern.edu)
Department of Psychology, Northwestern University
2029 N. Sheridan Drive Evanston, IL 60208-2710 USA

Daniel M. Bartels (d-bartels@northwestern.edu)
Department of Psychology, Northwestern University
2029 N. Sheridan Drive Evanston, IL 60208-2710 USA

Abstract

A recent line of research suggests that an event's temporal distance from the present has an effect on the way in which it is likely to be construed. Specifically, more distant events are proposed to be represented primarily in terms of abstract, decontextualized information, while events in the near future tend to produce relatively more concrete, situation-specific construals. In the current study, we examine the extent to which this sort of effect can differentially emphasize *commonalities* between two events. Similarity ratings were collected for pairs of events sharing either high-level or low-level commonalities, and described as occurring in either the near or distant future. Consistent with predictions, an interaction was observed between temporal distance and commonality level. Broader implications for cognitive processing are discussed.

Introduction

One of the remarkable strengths of the human cognitive system is its flexibility. Not only are we able to store vast amounts of information about our world, organized into categories, scripts and schemas, we also seem particularly proficient at tailoring that information to fit the current demands of our environment. In particular, we seem capable of representing the same entity or event in a wide variety of ways. In addition to taxonomic organizations that can differentially emphasize various aspects of the same individual (e.g., *animal* / *mammal* / *dog* / *collie* / *Rover*), we appear to fluently cross-classify things based on goals, scripts, and evaluations (Barsalou, 1983, 1985; Ross & Murphy, 1999). Further, activation and retrieval of specific information can be highly subject to effects of general context (e.g., Tulving, 1972; Godden & Baddeley, 1975). Similarly, contextual or top-down effects may have a substantial impact on how new experiences are perceived and encoded (Bower, Black, & Turner, 1979; Bransford & Johnson, 1972). An important implication of this variation in representation concerns the impact that it may have on the processes that operate this activated information.

An intriguing recent body of research demonstrates an additional factor which may broadly affect event representations: temporal distance. Given the importance of our perceptions of the future for our ability to plan, to set and pursue goals, and to generally make long-term judgments, predictions, and choices, these effects have received surprisingly little attention in cognitive science on the whole. In the current paper, we examine the impact of such temporally-based construals on the ubiquitous process of similarity judgment. A demonstration that these construal effects may influence similarity—which is widely implicated in such fundamental cognitive processes as retrieval, categorization and inference—could serve to emphasize the expansive role that this kind of context-based effect plays throughout cognition.

Temporal Construal Theory

A recent set of studies in the judgment and decision making literature suggests that the way a person construes an event can be influenced by the temporal context in which that event takes place. According to Temporal Construal Theory (TCT) (Liberman & Trope, 1998; Sagristano, Trope, & Liberman, 2002; Trope & Liberman, 2000), events in the near future are likely to be represented largely in terms of concrete, circumstantial, and goal-irrelevant features, while the representations of events in the distant future tend to emphasize features that are more abstract, central, and goal-relevant. Trope and Liberman refer to these sparser, less contextualized representations characteristic of the distant future as *high-level* construals, and to the more enriched and highly contextualized representations more common in near future events as *low-level* construals.

These differences in representation can have behavioral consequences. For instance, one might agree to give a talk at a conference on some date in the distant future, perhaps focusing almost exclusively on the event's abstract, positive aspects: the opportunity to receive feedback on one's work, the opportunity for public exposure, and so on. As the date of the conference approaches, however, one's focus may begin to shift to some of the contextualized details that were absent in the initial representation. For instance, the time demands one faces in preparing for the presentation might become more salient, making the whole experience seem more effortful. The net effect, in this case, would be that the presentation loses some of the positive valence it once had.

These proposed differences in event representations can lead to changes in preference, depending on whether an event is described as being in the near or distant future. In one set of studies (Liberman & Trope, 1998), participants were given descriptions of events which, like the conference example, had opposite evaluative valences for high- versus low-level construals. For instance, one set of participants was asked to judge their likelihood of attending a lecture that was described as relevant and interesting but scheduled at an inconvenient time of day, while another set considered the case of a less interesting lecture, but one which was scheduled for a more convenient time. In the first group, the high-level construal was assumed to be positive

(relevant, pleasant experience) and the low-level construal negative (the logistics of fitting it into one's schedule). The second group was expected to have the opposite pattern of appraisal: a more negative impression of the abstract details of the situation, but a more positive sense of the low-level procedures involved in participating. While participants were more likely to attend the interesting lecture overall, this difference was more pronounced when the lecture was described as taking place a year from now rather than tomorrow. In other words, the decision pertaining to the near future seemed to give significantly more weight to the concrete, contextual aspects of the situation. The overall preference for the interesting lecture is also relevant, since it is consistent with the theory's suggestion that more proximal events are represented by some combination of contextual and abstract information, while distant events are primarily abstractly represented.

Note, however, that in these studies, the focus is on shifts in preference; representation is just a tool for the demonstrations. As such, this and all of their evidence concerning how we represent events is second-order, in that we have to infer differences in event representation from people's choices, or from people's preferred descriptions of events (see Liberman & Trope, 1998). One purpose of the present study was to seek more direct evidence for differences in event representation as a function of temporal context.

Similarity and Representational Level

Similarity is widely held to be one of the most critical concepts in cognition, and there are few aspects of mental life that do not seem to depend on it in one way or another. Similarity is seen as playing a vital role in recall through reminding (Hintzman, 1984; Ross, 1984); most theories of categorization rely heavily on the concept of similarity to determine category membership of a new item (Hintzman, 1986; Medin & Schaffer, 1978; Nosofsky, 1984); similarity is proposed to be fundamental in making generalizations, inferences and knowledge transfer (e.g., Novick, 1988; Osherson, et al, 1990; Ross, 1984).

It has been demonstrated that judgments of similarity are not simply a function of low-level featural overlap, but also depend on structural relationships between representations (Gentner & Markman, 1997; Markman & Gentner, 1993). This is true not only in terms of the impact of commonalities in the relations and relational systems themselves, but also in the way that attributes in corresponding roles that are defined by those structures are emphasized.

These "deeper" commonalities of relational systems are extraordinarily useful for generating new knowledge and for applying existing knowledge to new situations. For example, recognition of a common causal structure in two ostensibly different systems may lead to a deeper understanding of one system via analogical inferences from the other (*see* Gentner, 1983; Hummel & Holyoak, 1997).

Thus, the similarity rating task seems particularly apt in the current context, first because it acts as a connection to deeper aspects of cognition in general, and also because it may provide added insight into situations in which high-level, relational commonalities may be highlighted in comparison.

Experiment

The primary goal of this study was to determine whether temporal distance could affect event representations in such a way as to alter the perceived similarity between events. There are two significant motivations for this approach. First, it would provide a fairly direct way of assessing representation that would not need to rely on complex secondary tasks. Second, and perhaps more important, it would provide a bridge linking temporal effects such as these to a much broader set of cognitive issues. The critical role that similarity is proposed to play in so many mental activities suggests that observed systematic changes in similarity should have a relevant and far-reaching impact on cognition generally.

Just as any entity or event may be represented in a wide variety of ways, so may any pair of things share a great number of commonalities. Some have gone so far as to suggest that this robs similarity of any explanatory power (Goodman, 1972), since all pairs of items are potentially infinitely similar to one another (*e.g*., two things may both have mass, may both be smaller than the sun, etc.). A more measured and practical approach has been to emphasize the relative salience of the various pieces of information in each entity's representation. This salience could vary as a function of things such as prior knowledge, recent exposure or priming, and even the nature of the comparison context itself (Medin, Goldstone, & Gentner, 1993; Tversky, 1977; Gentner & Markman, 1997; Gentner, Rattermann & Forbus, 1993). Information that is more salient in a representation is assumed to be given more weight in judgments of similarity. Importantly, as previously noted, the properties that contribute to similarity judgments are not limited to concrete perceptual features, but also include the more abstract, relational concepts that structure and bind those features together (Gentner & Markman, 1997).

The predictions for the current study are straightforward. If the representations of two events are composed primarily of high-level, abstract descriptions of those events, then commonalities (or lack of commonalities) at that level of analysis should play a major role in their perceived similarity. That is, we would expect similarity ratings to be driven significantly by abstract, structuring information such as goals, causes and relationships. If, on the other hand, the representations also contain information involving low-level concrete and perceptual aspects of the situations, an impact of the commonalities at that situation-specific level should also be observed.

Consider for a moment your representation of visiting a dentist's office. This representation could include fairly high-level information pertaining to conscientiousness and long-term health benefits, as well as more concrete situational information about the particular setting and sensations involved. Now consider two different events to which this situation could be compared: the act of joining a health club, or the act of getting a tattoo. The health club event seems to share a number of abstract characteristics with the dentist visit (the goal of health benefits, etc.), but

appears quite different in terms of the situation-specific details. The tattoo, on the other hand, shares a surprising number of low-level, concrete features (reclining chair, needles, physical pain), but little in the way of high-level commonalities. The important outcome of this is that the abstraction level at which the dentist event is construed should have significant (and opposite) effects on the outcomes of these two comparisons.

This is exactly the situation that we created in our study. Participants were asked to give similarity ratings for pairs of events that shared primarily either high-level or low-level commonalities. Further, these events could be described as taking place in either the near future or the distant future. If, in fact, the temporal relationship of the events to the present time has an impact on their level of construal, then we should expect to see an interaction between temporal distance and level of commonality, such that pairs with high-level commonalities should be perceived as *more* similar in the distant than the near future, while pairs sharing low-level features should become *less* similar in the distant future relative to the near future.

Participants

Twenty-three Northwestern University undergraduates participated in this study for partial course credit.

Materials and Procedure

The materials for this experiment consisted of sentence pairs describing two events that a fictitious character was planning to undertake in the future. Each test item included a *standard* sentence, and one of two *comparison* sentences. These comparison sentences were constructed to share either high-level or low-level commonalities with the standard, but not both. In addition to these test items, the material set included several filler sentence pairs, which were either *literally similar*, sharing both high- and low-level features, or *non-similar*, sharing neither.

Additionally, these events were described as taking place either in the near future ("this week") or the distance future ("next year"). This distinction acted as a between-subjects factor, with all events for a particular participant being described at the same temporal distance. Commonality level served as a within-subjects factor, with half of the standards randomly being paired with high-level comparison sentences and the other half with low. Thus, the experiment was a 2 (temporal distance: near vs. distant future) × 2 (commonality level: high vs. low pairing) mixed design.

In total, 10 test items (five at each commonality level) and 13 filler items were presented in a completely randomized order (different for each participant), with the exception that all participants were given the same two initial items (one literally similar, and one non-similar) to help "anchor" their rating range and reduce variability. Within each item, sentence order was randomized, with the standard appearing first in approximately half of the pairs. A typical test item might read as follows: "Tomorrow, Karen will go to the dentist. Tomorrow she also will join a health club." Sample materials are given in Table 1.

The experiment was implemented as a computer-based task. After instructions, the first sentence pair appeared on the screen, followed by the prompt "How similar do you think these activities are to each other?" Beneath this prompt was a horizontal bar, with endpoints labeled "very dissimilar" and "very similar". Participants were instructed to click a location on this bar to indicate their perception of the similarity of the two events. This response was normalized to a value between 0 and 1, for the "dissimilar" and "similar" endpoints, respectively. To ensure that participants were attending to the task, response latencies of less than 3 seconds for any item resulted in the warning "Too Fast" appearing on the screen, followed by a delay of several seconds before proceeding to the subsequent item.

Table 1. Sample events. Low-level comparison sentences were designed to share concrete features and procedures with the standard, while High-level comparisons share more abstract commonalities.

Event Standard	Low-level comparison	High-level comparison
Reading and coding completed research questionnaires	Doing taxes	Conducting telephone surveys
Going door-to-door distributing leaflets about the environment	Going trick-or-treating with daughter	Writing letters to congressmen and local council members
Going to the dentist	Getting a tattoo	Joining a health club
Buying diamond necklace for wife	Buying expensive watch for self	Taking wife out for gourmet meal
Calling colleges requesting information packets	Calling hotels to arrange Summer trip to Mexico	Taking the SAT

Results

Consistent with predictions, a 2 × 2 ANOVA revealed an interaction between temporal distance and commonality level, F (1, 21) = 8.60, $p < .01$. Participants rated high-level pairs as more similar in the distant future condition (M = 0.63, SD = 0.11) than in the near future condition (M = 0.58, SD = 0.10). Conversely, low-level pairs were rated as more similar in the near future condition (M = 0.54, SD = 0.10) than in the distant future condition (M = 0.40, SD = 0.09).

A main effect of commonality level was also observed. Participants rated high-level pairs as more similar (M = 0.60, SD = 0.11) than low-level pairs (M = 0.47, SD = 0.12) overall, F (1, 21) = 18.84, $p < .001$. Additionally, there was a marginal trend for participants to rate near future events as more similar than distant future events (p = .092). This latter effect is more pronounced in the across-item analyses: a 2 × 2 ANOVA run across items revealed the same interaction between temporal distance and commonality level, F (1, 18) = 7.77, p = .012, the same main effect of commonality level, F (1, 18) = 9.96, p = .005, and a significant effect of temporal distance, F (1, 18) = 4.73, $p <$ .05. This final effect reflects the fact that the low-level comparisons showed a more dramatic decrease with temporal distance than the corresponding increase in the high-level comparisons. In fact, post-hoc t-tests indicated that only the low-level comparisons changed significantly across distances (t (1,22) = 3.67, $p < .01$) (see discussion below).

Discussion

The primary predictions of the experiment were confirmed. Participants judged event pairs with abstract, high-level commonalities to be more similar in the distant future than the near future, while pairs sharing more concrete and low-level procedural features showed the opposite pattern. This supports the proposal that temporal distance is in fact influencing the level at which events are construed, and that these representational differences are stable enough to be reflected in perceived similarity.

The two observed main effects, while not predicted, are in retrospect completely consistent with the assumptions of temporal construal theory. While distant events are assumed to be represented primarily in terms of their abstract characteristics, proximal events are suggested to have more "enriched" representations that combine some contextual and some abstract information. Consistent with this characterization, the greatest observed effect was the drop in the similarity of low-level pairs between close and distant conditions, contributing to both of these additional effects. As noted above, although both low- and high-level comparisons changed in the predicted direction with temporal distance, this change was only statistically significant for the low-level pairs.

The second main effect—the overall preference for high-level commonalities—has been replicated in more recent pilot data, and is consistent with prior research showing a preference for relational over attributional similarity (Gentner & Clement, 1988; Goldstone, Medin, & Gentner, 1991).

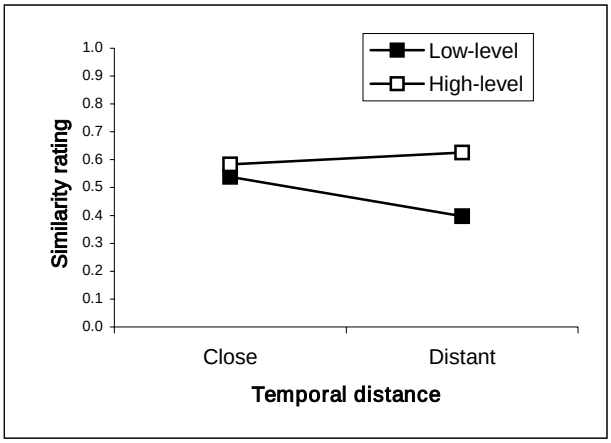

Figure 1. Interaction between commonality level and temporal distance.

The most immediate implication of these findings is that this sort of temporally-based context effect should now be predicted to influence many of the other cognitive processes in which similarity participates. For instance, it is possible that categorization of events and entities considered as being in the distant future may be based on somewhat more abstract dimensions than those considered in the immediate present. This categorization would in turn affect the inferences that an individual is likely to make in the absence of explicit knowledge, and their confidence in the accuracy of those inferences. One interesting prediction is that these perceived similarities may influence the extent to which knowledge is successfully transferred from one domain to another. Moreover, this knowledge transfer—which is seen as relying on the mapping of structural commonalities—might benefit more generally from the abstract representations characteristic of temporal distance.

Preliminary pilot data collected by the authors suggest that temporal context may have an effect on cued retrieval. That is, the perceived increase in similarity associated with an "appropriate" encoding situation (temporally close for low-level commonalities, temporally distant for high-level commonalities) may improve the probability of retrieving an event from memory when cued with the previously compared event.

The results suggest a number of avenues for future research. One important direction would involve varying the kind of high-level commonalities involved in the comparisons to include abstract characteristics other than those emphasizing individual plans and goals. While this proved to be a useful way of describing future events for our experimental purposes, it could potentially lead to confounds such as attribution of particular personality traits to the characters (e.g., planning to do x is consistent with planning to do y), and the use of a broader set of abstract event commonalities would help to address this.

Another interesting approach would be the examination of temporal distance in the opposite direction, seeing whether similar results could be obtained with events that occurred

in the recent or distant past. Taking this a step further, it may be the case that the important dimension in these effects is *psychological distance* rather than simply temporal distance. If this were the case, we might expect to find similar effects by varying dimensions such as similarity of the character to the participant, or the probability of a future event occurring.

Conclusions

We spend a great deal of time thinking about the future. In fact, this capacity seems to be a defining and distinctive characteristic of human cognition. We consider possible outcomes, evaluate potential alternatives, and pursue distant goals that may take years or even decades to achieve. Because our mental focus is so often situated in the future, it seems particularly relevant to consider the influence of temporal distance on cognition. The current study, though modest, highlights just how far-reaching these effects may be.

Acknowledgements

This work was supported by ONR award N00014-02-1-0078. Thanks to Jason Jameson, Jennifer Asmuth, Wisconsin Badger hockey, and the Similarity and Analogy group.

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