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Although subjective judgment of future time plays an important role in a variety of decisions, little is known about the factors that influence such judgments and their implications. Based on a time as distance metaphor and its associated conceptual mapping between space and time, this article demonstrates that spatial distance influences judgment of future time. Participants who consider a longer spatial distance judge the same future time to be longer than those considering a shorter distance. Intertemporal preferences, for which judgment of future delays is a critical factor, also shift with consideration of spatial distance: participants who consider a longer spatial distance also reveal a greater degree of impatience in intertemporal decisions as they perceive a longer delay to future rewards. The current findings support the importance of subjective judgment of future time in intertemporal preferences by introducing a factor that changes time perception without directly changing the value of outcomes.

Although the role of future duration in consumer decision making is well known, most research in economics, psychology, and consumer behavior either does not explicitly consider subjective judgments of future time or considers it to be ratio-scaled objective information (e.g., a 3-month delay is three times as long as a 1-month delay) that is then integrated into the decision. Recently, however, researchers have suggested that subjective judgment of future duration systematically differs from objective duration—that is, a 1-month duration may be perceived to be relatively shorter by some and longer by others (Kim and Zauberman 2009; Van Boven et al. 2010; Wittmann and Paulus 2008; Zauberman et al. 2009).

Because duration is a fundamental aspect of many consumer experiences and decisions, such differences in subjective judgment of future time can play a significant role in many aspects of consumer decision making. For example, in planning a vacation, a consumer's decision about how many days to stay in one location would depend on whether the duration of stay is perceived to be long enough to enjoy that location. The decision to lock oneself into a long-term service contract for cable TV, the Internet, or a cellular phone would depend on the consumer's perception of how long the contract period is. Finally, subjective judgments regarding future time are particularly important in intertemporal decisions that involve trade-offs between two temporally spaced outcomes, for example, receiving $10 now versus $15 in 1 month. Indeed, recent work has demonstrated that individuals who judge a future time to be longer (vs. shorter) reveal more impatience for delayed consumption because the same waiting time (e.g., a month from today) is perceived to be subjectively longer (Kim and Zauberman 2009; Zauberman et al. 2009). In addition to its relevance to consumer decision making, considering subjective judgment of future time is theoretically significant because it implies that consumer preference can be influenced merely by shifting how long or short a future time is perceived to be without influencing the value of goods per se.

The goal of the current article is to investigate an important factor that can influence subjective judgment of future time and intertemporal preferences even though this factor is often not directly related to the outcome of such intertemporal decisions. In particular, we investigate whether spatial distance, a contextual variable that is not temporally related and is not expected to have a direct systematic independent effect on the value of outcomes, influences judgment of future time. We argue that when spatial distance information is salient,

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duration judgments are influenced by a time as distance metaphor and its associated conceptual mapping from the concrete source concept of distance to the abstract target concept of time. Specifically, we show that when spatial distance information is available in a temporal judgment context and is associated with the judgment of future time, spatial distance will influence how long or short individuals judge a future time to be. For instance, an individual in Philadelphia may perceive the same 3-month duration from today to be longer when she is expecting to be in Los Angeles 3 months later than when she is expecting to be in New York. This relationship between spatial distance and future temporal judgment then helps us test and demonstrate the proposition that intertemporal preferences rely strongly on subjective duration perception. We demonstrate that longer spatial distances (and hence longer judgments of future duration) are associated with greater impatience in intertemporal decisions as there is a greater perceived delay to the receipt of future rewards.

SUBJECTIVE PERCEPTION OF FUTURE TIME

There has been extensive research on human judgment of experienced time, most of which looks at the perception of actual time passage for events lasting a few seconds to minutes (Block and Zakay 1996; Church 1984; Treisman 1963) or longer, lasting weeks, months, and years (Zauberman et al. 2010). However, much less is known about how people mentally represent and process future time. That is, we currently do not know how susceptible future time judgment is to the context in which such judgments are made and whether any context-related changes in subjective duration perception are then incorporated into intertemporal preference. To date there have been only a few empirical studies that directly investigate the nature of subjective judgment of future time. In one of the first empirical studies directly measuring individuals' subjective perception of future time, Zauberman and colleagues (2009) demonstrated that individuals do not subjectively judge future time on a ratio scale (i.e., 3 months from now is three times longer than 1 month from now), but instead judge it nonlinearly, which is consistent with findings in psychophysics (e.g., Stevens's Power Law; Stevens 1957). That is, a 3-month duration is perceived to be shorter than three times the length of a 1-month duration (Kim and Zauberman 2009; Zauberman et al. 2009). The perception of future duration also has been shown to depend on the events being considered. For example, Van Boven et al. (2010) demonstrated that participants who described their future dentist visit affectively judged their visit to be more proximal than those who described it unemotionally; Bilgin and LeBoeuf (2010) showed that intervals ending with losses are perceived to be shorter than equivalent intervals ending with gains; and Liberman and Förster (2009) showed a high level of construal leads people to judge the duration to a future event to be longer while a low level of construal does the opposite. However, beyond such scattered evidence, very little is known about the nature of subjective judgment of future time. In this article, we focus on understanding a subtle influence on subjective judgment of future time, namely, that future time judgment is affected by spatial distance.

METAPHORS AND SPATIAL REPRESENTATION OF FUTURE TIME

Future time is an abstract concept. When people attempt to process abstract concepts, they often rely on metaphors using concrete concepts from more tangible domains that are easier to understand. Such metaphors provide a specific conceptual mapping from the more tangible source concept to the more abstract target concept (see Landau, Meier, and Keefer [2010] for a review). Zhang and Li (2012) argue that these concepts must be activated to trigger metaphorical transfer. They demonstrate this using the mapping of weight (the more concrete source concept) to importance (the more abstract target concept).

A common strategy for understanding temporal information is to use metaphors involving distance. That is, people often describe temporal information in spatial terms, and the conceptual mapping from distance (more concrete source concept) to time (more abstract target) helps individuals form temporal judgments. Other metaphors for time are also possible; we consider one such metaphor, time as a resource or supply, and its possible influence on judgments in the general discussion. However, our focus in this article is on time as distance.

Spatial descriptions of time are frequently used, especially for two types of temporal information, temporal ordering of events and duration. In describing a temporal sequence of events, people spatialize them as if the events are ahead (in front of) or behind (in back of) them in space (i.e., "resubmission of this paper is *behind* schedule"). Such spatial representation of the temporal ordering of events has been demonstrated in empirical studies in cognitive psychology. For example, Boroditsky and Ramscar (2002) showed that activating different spatial representations changed individuals' interpretation of ambiguous temporal-relation words like "forward." When participants imagined themselves moving toward a chair rather than the chair moving toward them, they interpreted "Next Wednesday's meeting has been moved forward 2 days" to mean that the meeting was being delayed to Friday rather than expedited to Monday.

A metaphor often used for describing temporal duration is time as distance, for example, "this meeting was too *long*" or "that meeting is *far* in the future." In this article we focus on this time as distance metaphor. Metaphoric theories posit that such spatial description of time is not just a matter of linguistic (and graphical) expression but also of thought (Gentner 1983; Lakoff 1993; Lakoff and Johnson 1980; Landau et al. 2010). That is, it is not that people merely describe time spatially but that they conceptualize (or mentally represent) it in terms of space. Thus, providing cues related to distance (e.g., locations at different distances or a map) would not only evoke the time as distance metaphor but also a conceptual mapping from the source concept of distance to the target concept of time and an associated representation of this mapping, such as a time line. Such metaphors (and the associated conceptual mapping from distance to time) are often based on our sensory experiences and learned over many occasions (Lakoff and Johnson 1980). For example, in people's experiences, traveling longer distances takes more time, so longer salient distances will lead to judgments of greater time via metaphoric transfer from distance to time (Landau et al. 2010).

In sum, metaphoric transfer involves two major components. First, a specific metaphor is activated. Second, that metaphor has an associated conceptual mapping and representation. Because different metaphors have different associated mappings and representations, different metaphors can lead to different judgments. In the present article, we focus on the time as distance metaphor and demonstrate that spatial distance information influences judgments of future time. Our main goal in demonstrating such space-time effects is to identify contextual factors that influence judgments of future duration and impatience in intertemporal decisions. Our reasoning is that as long as there exists a metaphor and conceptual mapping between spatial distance and duration, then we should be able to influence future time judgment by changing spatial distance, which can be utilized to influence consumer preference for time-related decisions.

To ensure that we invoke the time as distance metaphor and the associated conceptual mapping between spatial distance and duration in our studies, we provide participants specific locations associated with time points (e.g., today in Philadelphia; 3 months later in Los Angeles). Then, we change the spatial distance between two locations (e.g., 3 months later in New York vs. Los Angeles) and test whether this change influences judgments of future time (e.g., "How long or short is 3 months?"). The mapping between distance and time in the time as distance metaphor is that longer distances are associated with longer times. Thus, we hypothesize:

> **H1**: When two temporal points are associated with specific spatial locations, greater spatial distance between the locations will lead a given future duration to be perceived as subjectively longer.

For the case of the time as distance metaphor and its associated conceptual mapping, metaphoric transfer theory makes a specific prediction, positing that the abstract notion of time is understood via concrete distance, not vice versa. That is, although time is spatially represented, space is not temporally represented (Lakoff 1993). Several pieces of evidence support this unidirectional relationship. First, the asymmetric relationship from space to time is common in our use of language. In everyday language, although time is often described metaphorically in terms of space, space is not described in terms of time—people more frequently use spatial metaphors to describe temporal events than temporal metaphors to describe spatial locations (Casasanto, Fotakopoulou, and Boroditsky 2010; Clark 1973; Lakoff 1993).

Second, in empirical studies of metaphoric transfer, spatial information has been used to demonstrate conceptual mapping for various perceptual and judgmental processes, such as perceived power (Giessner and Schubert 2007), social dominance (Schubert 2005), emotional attachment (Williams and Bargh 2008), and pitch of music (Rusconi et al. 2006), but very little evidence exists for the opposite effect—from an abstract judgment to a more concrete spatial distance judgment. Boroditsky (2000) directly tested directionality in the space-time relationship and found that spatial priming influenced interpretation of an ambiguous temporal relation word but temporal priming did not influence interpretation of an ambiguous spatial-relation word (e.g., "Which one is *ahead*?").

In the current article, we empirically test the directionally of the effect for judgments of future duration. Based on the metaphoric conceptual mapping from space to time, we hypothesize:

> **H2**: Greater spatial distance associated with two temporal points will lead to increased subjective judgment of this duration. However, greater temporal distance associated with two spatial points will not lead to increased subjective judgment of the spatial distance between these locations.

This test of the asymmetric relationship also allows us to examine a possible alternative relationship between time and distance assessments. Construal level theory (CLT) posits that objects and events are mentally represented at different levels of construal (high vs. low) as a function of psychological distance from the self in the here and now (Trope and Liberman 2010). A distant future event is construed at a higher level (or abstractly), and a near future event is construed at a lower level (or concretely); a high level of construal leads to a judgment of greater psychological distance, while a low level of construal results in a judgment of less psychological distance. This relationship between level of construal and psychological distance judgment suggests that space and time might be related to each other symmetrically through changes in construal.

Testing whether there is an asymmetric effect between space and time allows us to explore whether the space-time effects we demonstrate are more consistent with metaphoric transfer and conceptual mapping between space and time or with a symmetric impact of construal level. Note, however, that this test is restricted to the focal effects we demonstrate. Even if we observe an asymmetric relationship in this case, we do not imply that changes in construal are not involved in other types of space-time relationships.

THE SPACE-TIME RELATIONSHIP AND INTERTEMPORAL PREFERENCE

We next link the implications of changes in future time perception to consumer decisions. Many decisions consumers face in their everyday lives are intertemporal decisions requiring a trade-off between smaller sooner and larger delayed rewards. For example, consumers decide whether to buy a newly released TV today or to save the money for future spending, or they consider whether to pay more to receive an ordered item sooner or pay less and have it delivered later. Although researchers in multiple disciplines have extensively studied the causes and consequences of consumer impatience in intertemporal decisions in various settings (Frederick, Loewenstein, and O'Donoghue 2002; Hoch and Loewenstein 1991; Malkoc and Zauberman 2006), until recently this literature has generally assumed that duration (or waiting time until the receipt of delayed rewards) is the same as calendar time (e.g., 3 months is three times as long as 1 month) and has largely neglected the role of subjective judgment of future time.

When individuals' subjective time judgment is focal, however, consumers' impatience for immediate over delayed rewards can be explained not only by how much they internally discount the value of delayed outcomes but also simply by how long or short they perceive the delay to be (Kim and Zauberman 2009; Wittmann and Paulus 2008; Zauberman et al. 2009). For instance, if a consumer perceives a given future time (e.g., 1 month) to be longer compared to one who perceives it to be shorter, then the first would reveal greater impatience (higher discounting) for delayed consumption because a perception of longer future time would mean a subjectively longer waiting time for delayed consumption. A corollary of this point is that if any contextual cue, such as distance, shifts consumers' perceptions of time, their intertemporal preference also should change, even when the contextual cue (e.g., distance) is unrelated to the direct valuation of the outcomes. While this is a straightforward logical deduction, very little research exists showing this effect. In the current article, we hypothesize that intertemporal preference can be shifted by a contextual cue (spatial distance) that is directly relevant not to the value of intertemporal outcomes but only to the subjective judgment of future time. Specifically, we hypothesize:

H3: When a given future duration is associated with specific spatial locations, greater spatial distance between the locations will lead to a greater degree of impatience (greater temporal discounting) in intertemporal decisions.

We test our hypotheses about the effect of spatial distance on subjective duration judgment and intertemporal preferences in six studies. In studies 1–3, we test the predicted relationship between space and time (hypothesis 1). We demonstrate that the effect is not driven by overall changes in construal level (study 1A) and that the effect is unidirectional from space to time (hypothesis 2; study 2). We manipulate spatial distance using a hypothetical map where spatial distance between two locations is varied (studies 1A and 2), using an actual map of the United States (study 3), and without presenting any map (study 1B). In studies 4 and 5, we demonstrate that spatial distance information influences not just subjective duration judgment but also the degree of impatience in intertemporal decisions (hypothesis 3). We do so using two strategies. First, we test whether consideration of spatial distance influences intertemporal preference when spatial distance information is directly embedded in an intertemporal preference task such that an immediate reward will be given at location A and a delayed reward will be given at location B (study 4). This setup is frequent in consumer settings when there will be a sale offering price discounts in the future but at a different location. Second, we also test our prediction when intertemporal preference does not involve any trade-offs of spatial locations, which is more similar to the standard intertemporal preference task (study 5). In this case, we demonstrate a pure carryover of the space-time relationship effect on subjective duration judgment to a subsequent but unrelated intertemporal preference task.

STUDY 1A

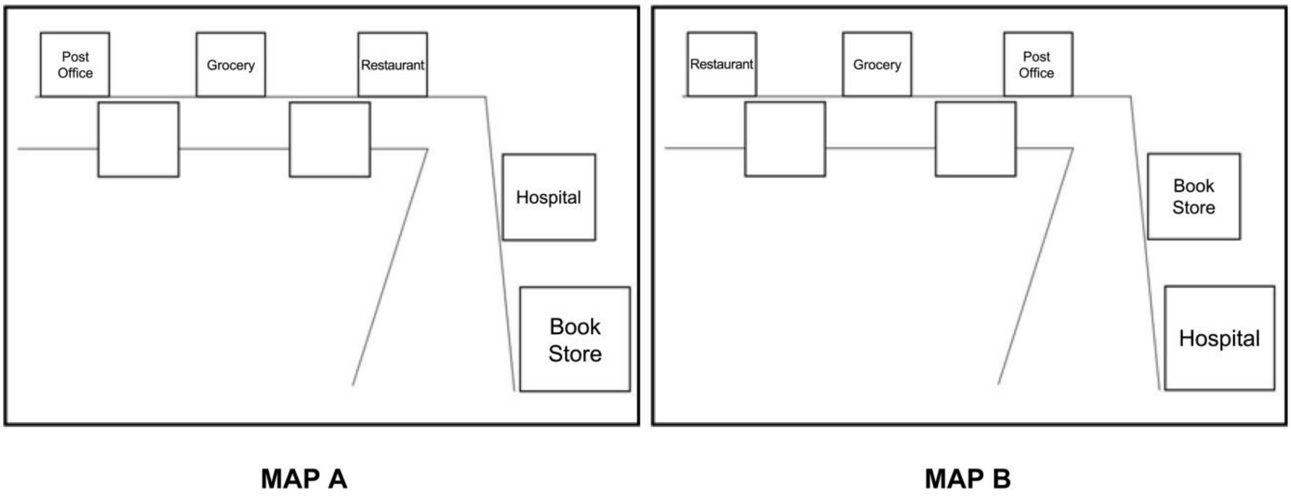
In study 1A, we tested the hypothesized effect of spatial distance on subjective perception of future time (hypothesis 1). Specifically, we manipulated the spatial distance between two locations using a map and examined whether those who consider a longer spatial distance between the two locations perceive the same future time to be subjectively longer than those who consider a shorter spatial distance. In addition, to test the role of CLT, we examined whether the spatial distance manipulation we implement results in changes in participants' mental construal level by utilizing the Navon letter task, which has been used in previous studies and which is designed to measure or manipulate participants' local (low-level) or global (high-level) processing (e.g., Förster and Higgins 2005; Liberman and Förster 2009).

Method

One hundred and eighty-two University of Pennsylvania undergraduates (94 female; $M_{age} = 19.88$, SD = 1.48) were randomly assigned to one of two spatial distance conditions (long vs. short). On a computer screen, participants were presented with a hypothetical map where spatial distance between two locations (a post office and a book store) was manipulated, and they were asked to memorize the location of each building (see fig. 1). Once they had memorized the map, they moved to the next screen, where they were asked to mentally visualize the location of the post office and the bookstore on the map. Then, participants' subjective judgment of future time was measured using a computerized line scale. Specifically, they were asked, "Suppose that you have to visit the post office tomorrow and the book store in three months. How long do you consider the duration between tomorrow and a day in three months?" They indicated their subjective judgment of this duration by adjusting the length of a physically unbounded line scale. Initially, a small, black, square-shaped bar (e.g., 40 × 40 pixels) was shown on the left side of the computer screen, and participants were asked

FIGURE 1

MAPS OF A HYPOTHETICAL TOWN (STUDIES 1A AND 5)



to adjust the length of the bar using the left and right arrow keys on the keyboard to indicate their judged magnitude of the duration. For example, if they considered the duration to be short, they should adjust the length of the bar to be as short as they feel would be equivalent to the duration, and if they considered the duration to be long, they should extend the bar to the right so that the length feels equivalent to their subjective duration estimate.

Following the elicitation of the time judgments, all participants completed a computerized Navon letter task (see Förster and Higgins [2005] for details) to measure their construal level. A fixation cross was presented on a computer screen for 500 milliseconds, and then one of eight global letters, made up of local letters, was presented. Participants' task was to press either a blue/red key if the global letter contained the letter L/H either as the global or local letters. The remaining seven global letters were then presented sequentially. Four letters contained the letter L/H as global letters (e.g., an H letter made of small F or T letters and an L letter made of small F or T letters), and the other four contained the letter L/H as local letters (e.g., an F letter made of small L or H letters and a T letter made of small L or H letters). Participants completed three trials of this task, with the eight letters presented in random order for each trial (the first block was practice). The measure used in the analysis followed the procedure detailed in Förster and Higgins (2005), in which reaction times from the second and third blocks were log-transformed and averaged separately for local and global letters; reaction times for incorrect answers were excluded.

Results and Discussion

The spatial distance from the left end of the physically unbounded scale was measured in millimeters. Confirming hypothesis 1, participants judged the 3-month duration to be longer in the long distance condition than did those who were in the short distance condition ($M = 221.17$ mm, SD $= 228.44$ mm, vs. 165.72 mm, SD $= 128.29$ mm; $t(180) = 2.08$, $p < .05$).

Next, we examined whether this difference in perceived temporal distance was driven by changes in local/global processing, as described above. We first examined whether participants' local processing was different across conditions, while controlling reaction times for the global letters (Förster and Higgins 2005). The analysis revealed no statistically significant differences in local processing between the long and short distance conditions ($M_{long} = 634.09$ ms, SD $= 372.46$ ms, vs. $M_{short} = 648.66$ ms, SD $= 299.14$ ms; $\beta = .02$, $t(179) = .51$, NS). There were also no differences in reaction times for global processing (after controlling reaction times for the local letters; $M_{long} = 602.88$ ms, SD $= 446.91$ ms, vs. $M_{short} = 505.73$ ms, SD $= 274.94$ ms; $\beta = .004$, $t(179) = .11$, NS). These results are inconsistent with the possibility that the observed effect of spatial distance on perceived future duration was driven by changes in construal level.

In this study, the Navon letter task was administered after participants judged duration. Although the manipulation and the Navon letter task have only one intervening judgment between them, it is possible that the spatial distance manipulation might not have carried over to the second Navon letter task. For this reason, we ran another study with a separate group of University of Southern California undergraduates ($N = 112$) where the Navon letter task came before the duration judgment. As before, participants were exposed to the two versions of the map and then considered the two locations (a post office and a book store), manipulated to represent long and short spatial distances. This was then directly followed by the Navon task. In this study participants also were not different in local ($t(109) = .2$, NS) and global processing ($t(109) = -.79$, NS). Although participants made duration judgments only after three trial sessions of the Navon letter task, their duration judgments were still significantly different between the long (176.67 mm, SD = 91.15 mm) and short (149.74 mm; SD = 92.12 mm) conditions using either a nonparametric test (Mann-Whitney U = 1,223.5, $p < .05$) or a parametric test (five outliers over three standard deviations from the mean were dropped; $t(105) = 2.23$, $p < .03$).

Finally, although our main prediction was supported, it is important to address whether specific design features of the current study are responsible for the effect. To address this issue, we ran an additional posttest and study 1B. In study 1A and other studies in the current article, we measured participants' subjectively judged duration using a linear line scale, as described above. Because we are measuring participants' overt behavioral responses, we do not know directly whether the observed effect is driven by actual changes in how participants represent duration or simply by how they perceive the physical length of the scale. That is, the same length on the line scale may be perceived to be shorter for the participants exposed to a longer line than for those exposed to a shorter line in the spatial distance manipulation, and these participants may then use longer lines in their response to indicate the same perceived magnitude of duration. In this case, the space-time effect we observed could be attributed to changes in perception of the line length of the response scale rather than to changes in duration judgments due to metaphoric transfer and conceptual mapping between space and time.

We addressed this issue by examining whether space-time dependency is observed when participants do not generate their response using a linear line scale. Specifically, we revised the duration reproduction task, which is one of the most commonly used methods for measuring elapsed time perception (Wittmann and Paulus 2008), to be a future duration simulation task. That is, participants mentally simulate the passage of a given future duration, and we measure the duration between the onset and offset of this simulated time passage. In this study, after a spatial distance manipulation similar to that in study 1A, University of Pennsylvania undergraduates ($N = 168$) were asked to mentally simulate time passage from tomorrow to a day in 2 months by pressing a "tomorrow" button when they began the simulation and then pressing a "two months" button when completed. The elapsed time between the two button presses was recorded in milliseconds. One extreme outlier in the short distance condition was detected and dropped from the analysis (the response of 58,783 ms was more than seven standard deviations from the mean of this cell without that response). Analysis of the mental simulation time revealed that participants who memorized the long-distance map took longer to mentally simulate the anticipatory time passage of 2 months than those who memorized the short-distance map ($M_{long} = 11{,}003.74$ ms, SD = 11,437.43 ms, vs. $M_{short} = 8{,}001.76$ ms, SD = 7,158.78 ms; $t(165) = 2.06$, $p < .05$). These results lend additional support to our account by demonstrating that the effect of spatial location on subjective duration perception is not an artifact of using a line scale.

STUDY 1B

In manipulating the longer spatial distance in study 1A, the distance between the two locations on the map of the long distance condition was not only longer than the distance in the short distance condition, there were also more buildings located between the two target buildings. One possible alternative account to explain the proposed space-time effect could be a process analogous to the filled duration effect in elapsed time perception research, showing that a duration that is "filled" with discrete events like clicks or words is perceived to be longer than an empty duration (Ornstein 1969). A similar effect has been reported showing longer retrospective judgments of duration based on more event markers in the past (Zauberman et al. 2010). To address this question, in study 1B we tested the spatial distance effect on subjective perception of future time (hypothesis 1) without presenting a map.

Method

One hundred and sixteen University of Southern California undergraduates (52 female; $M_{age} = 19.90$, SD = 2.05) were randomly assigned to long or short spatial distance conditions and were asked to mentally image two locations. Specifically, participants in the long distance condition were asked to close their eyes and to imagine one location on the far left side of their mental imagery and the other location on the far right side. Those in the short distance condition were asked to imagine one location and to imagine another location right next to it in their mental imagery. Once they were done mentally imaging the two locations, they were asked to imagine that they were visiting the first location on that day and the other location in 1 month. Then they indicated their judgment of duration between that day and a day in 1 month by pulling a computerized string, as described in study 1A. Participants' responses were coded in millimeters.

Results and Discussion

Results showed that those who mentally imagined a long distance judged the 1-month duration to be longer than those who imaged a short distance ($M_{long} = 155.87$ mm, SD = 111.19 mm, vs. $M_{short} = 114.91$ mm, SD = 83.59 mm; $t(114) = 2.26$, $p < .05$). These results demonstrate that the effect of distance on subjective duration judgment does not require presentation of a physical map or intervening locations to manipulate spatial distance.

STUDY 2

Study 2 was designed to test the directionality of the space-time relationship (hypothesis 2). Although CLT posits that distances in different domains are processed similarly and that the space-time relationship should thus be bidirectional, metaphoric transfer and its associated conceptual mapping predict that the influence will be unidirectional from space to time. To test the directionality of the space-time effect, we asked half of the participants to consider temporal distance first and then to judge spatial distance between two locations and the other half of the participants to consider spatial distance first and then to judge temporal distance.

Study 2 also aimed to demonstrate further that the space-time effect is not conditional on the specific procedure used in study 1A. In study 1A, to manipulate spatial distance between two locations, participants were asked to memorize a hypothetical map. Although this procedure ensured that participants would process spatial distance as we intended, the memorization process may have induced cognitive load, which could increase the likelihood that spatial distance information would have an effect on judgment of future time. To address this question, in study 2 participants were not asked to memorize a map or mentally visualize it. Instead, they simply judged whether the spatial distance between two locations was long or short. Finally, we also show that the effect is observed across a broad age range, not just with college student participants.

Method

Two hundred participants from an online panel (88 female; M_{age} = 30.72, SD = 10.98) were randomly assigned to one of four conditions: 2 (direction: space → time vs. time → space) × 2 (distance: long vs. short). Similar to study 1A, participants in the space → time cells were presented with a map on a computer screen (fig. 2), where the distance between two buildings was either long or short. Unlike the procedure in study 1A, however, they were not asked to either memorize a map or mentally visualize it. Instead, they were asked to imagine that they were visiting either building A and building G (long distance condition) or building E and building F (short distance condition) and to indicate how long or short they considered the distance between the two buildings on an 11-point scale (where 1 = very short, 11 = very long).

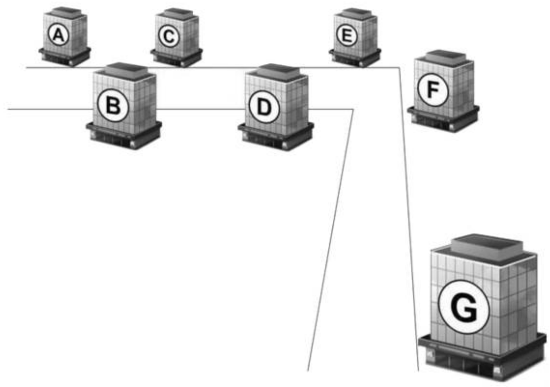
Next, participants' subjective judgment of future time was measured. Similar to study 1A, participants first imagined visiting building A (vs. E) today and building G (vs. F) in 3 months and then indicated their judged duration between today and a day in 3 months by moving a slider with anchors of very short and very long at each end point that encoded responses on a scale going from 0.0 to 100.0. In using the slider, participants were instructed to move the slider toward the left as needed to reflect the duration if they considered the duration to be short and to the right if they considered it to be long.

Participants in the time → space cells considered future time first and then judged the physical distance between the two buildings. Given that we need to manipulate temporal duration at short versus long levels, we used two different durations that were sufficiently far apart in subjective perception. Specifically, participants were asked to think about the duration between now and 2 years later (long distance condition) or between now and tomorrow (short distance condition). We selected these durations, rather than the 3-month duration used for the temporal judgments in the other condition, to make sure that this manipulation was sufficiently strong so that any lack of effect would not likely be due to a weak manipulation. Participants then indicated how long or short they considered the duration between now and tomorrow (short distance) or between now and 2 years later (long distance) on an 11-point scale (where 1 = very short, 11 = very long).

Next, they were provided with a map (fig. 2) and told to imagine: "You are visiting building F today. On a day in 2 years (vs. tomorrow), you have to visit building G. How long or short do you consider the distance between building G and building F?" They indicated physical distance between the two buildings by moving the same slider as in the other condition.

FIGURE 2

A MAP OF A HYPOTHETICAL TOWN (STUDIES 2 AND 4)



Results and Discussion

Manipulation Check. Participants in the space → time cells indicated the distance between the two buildings to be longer in the long distance condition than in the short distance condition (M_{long} = 7.62, SD = 2.45, vs. M_{short} = 3.02, SD = 1.22; $F(1, 196) = 110.21$, $p < .001$). Similarly, participants in the time → space cells indicated the duration between now and 2 years later to be longer than the duration between now and tomorrow (M_{long} = 6.48, SD = 2.39, vs. M_{short} = 4.40, SD = 2.46; $F(1, 196) = 22.15$, $p < .001$).

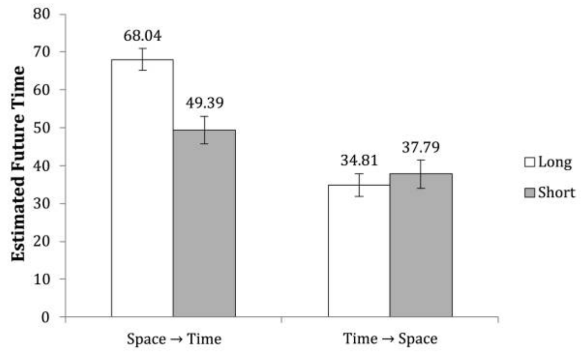
Main Analyses. Main effects of both distance (long vs. short) and direction (space to time vs. time to space) emerged ($F(1, 196) = 5.72$, $p < .05$; $F(1, 196) = 46.74$, $p < .01$). Importantly, these main effects were qualified by a significant direction × distance interaction ($F(1, 196) = 10.88$, $p = .001$); see figure 3. Specifically, replicating the spatial distance effect on subjective duration perception in studies 1A and 1B, when spatial distance perception preceded duration perception, participants in the long distance condition judged the same 3-month duration to be longer than those in the short distance condition ($M_{long} = 68.04$, SD = 20.33, vs. $M_{short} = 49.39$, SD = 25.11; $F(1, 196) = 17.55$, $p < .001$). However, when the temporal distance judgment was made before the spatial distance judgment, there was no significant difference in judged physical distance between the two buildings across the long versus short distance conditions ($M_{long} = 34.81$, SD = 21.82, vs. $M_{short} = 37.79$, SD = 25.33; $F(1, 196) < 1$). The interaction ($F(1, 196) = 10.53$, $p = .001$) and two simple effects replicate when responses were normalized separately for each direction condition.

Finally, our online panel participants had a wide age distribution (min = 18, max = 78), which also enabled us to test the effect of age on the space-time relationship. An ANCOVA analysis with participants' age as a covariate revealed that age was not a significant predictor of duration perception ($F(1, 195) < 1$) and that the space-time effect was still significant when participants' age was controlled for ($F(1, 195) = 16.60$, $p < .001$).

The results of study 2, together with similar findings about the interpretation of temporal-relation words (Boroditsky 2000), demonstrate the unidirectional nature of the space-time relationship proposed by metaphoric transfer and the associated conceptual mapping, supporting hypothesis 2. Study 2 again replicates the space-time effect reported in study 1A in a different setting, where participants were not required to memorize or mentally visualize a map. This rules out the possibility that the space-time effect we observed in studies 1A and 2 is conditional on decision makers being under cognitive load from memorizing a map. The current study also demonstrates that the space-time effect holds for participants over a broad age range.

FIGURE 3

FUTURE TIME AND PHYSICAL DISTANCE AS A FUNCTION OF LONG VERSUS SHORT DISTANCE (STUDY 2)



NOTE.—Error bars represent standard errors of the mean.

STUDY 3

The goal of study 3 is twofold. First, we replicate the space-time effect using an actual map of the United States rather than hypothetical maps. Second, we test the effect of spatial distance on future time judgments in a meaningful context that is important for consumer welfare and policy decisions—duration to retirement. Specifically, we asked participants to think about when they will turn age 65 and retire and to judge the future time to their retirement. We linked this judgment to spatial distance by asking people to consider that they were retiring to a location either farther from or closer to their current location. We predicted that those who think they will retire to a city farther away from their current location will subjectively judge duration to their retirement at 65 to be longer than those who think they will retire to a more closely located city.

Because this study examines future temporal judgment related to retirement, we implemented this study using a broad range of ages, similar to the procedure of study 2. However, compared to study 2, where all participants judged the length of a relatively short fixed future time (e.g., 3 months), in this study there are reasons to expect an age effect on subjective duration perception. That is, participants at different ages judged the duration to when they turn 65 and retire, which means that participants at different ages judged durations of different lengths (e.g., duration to judge = 65 minus their current age). Therefore, there should be a main effect of age such that older participants judge the duration to their retirement to be shorter compared to younger participants. In addition, unlike studies 1 and 2, where participants judged a given duration, in the current study participants judged duration to a specific future event, retirement. Although retirement is an abstract future event for younger participants, and hence the space-time effect on duration judgment should be strong, for older participants retirement may be a more concrete event. Therefore, older people should be less susceptible to the spatial distance manipulation because their more concrete mental image of retirement may have a stronger impact on their judgment of duration than the spatial distance information. To examine this possibility, we tested a spatial distance × age interaction.

Method

One hundred participants from an online panel participated in this study. Because this study required participants to see a map of the United States with 365 grid points (see fig. 4), those who were not able to see the entire map on their computer screen were screened out. At the beginning of the study, a blank rectangle equivalent in size to the map that would be displayed in the main part of the study was shown, and participants were asked whether they were able to see the entire rectangle without scrolling down the screen. Those participants who indicated they were not able to see the entire rectangle on their screen ($N = 26$) were directed to other unrelated studies without completing this study. The remaining 74 participants (49 female; $M_{age} = 33.66$, SD = 11.72) were randomly assigned to one of two spatial distance conditions (long vs. short).

All participants were presented with a map of the United States, where the map was divided into 365 numbered blocks. They were told that the height and width of each block was approximately 100 miles. Next, they were asked to write the number of the block closest to their current location and then to imagine that they were going to live in their current location until age 65. To manipulate spatial distance, participants in the long distance condition were told: "Imagine also that when you turn 65, you are going to retire to a place in a city/town that is at least 1,000 miles away from your current location (that is, in a block that is at least 10 blocks away from the block of your current location). Think about where you would like to retire that is at least 1,000 miles away from where you are now and then please indicate the number of the block you want to retire to." Participants in the short distance condition were asked to imagine that they were retiring to a place within the block of their current location and to indicate the number of the block. On the next screen, all participants were asked to close their eyes and to imagine moving from their current location to the city/town they are going to retire to.

Participants' subjective judgment of duration to their retirement was then measured by moving a slider scale (as in study 2). Specifically, participants were asked to think about the day in the future when they turn 65 and retire, think about the duration between the present and the day they retire, and then to indicate how long they considered that duration to be on a scale anchored by very short to very long. At the end of the study, after the demographic questions, participants indicated on an 11-point scale to what extent they had thought about their retirement concretely (1 = not at all, 11 = very much).

Results and Discussion

To take into account the impact of participants' age, we tested a distance × age interaction by estimating the following regression model:

$$\text{Perceived Duration} = b_0 + b_1 \text{distance} + b_2 \text{age} + b_3(\text{distance} \times \text{age}).$$

This analysis revealed both a main effect of spatial distance ($b_1 = 37.53$; $t(70) = 2.83$, $p < .01$) and a main effect of age ($b_2 = -.63$; $t(70) = 2.23$, $p < .05$). These main effects were qualified by a significant distance × age interaction ($b_3 = -1.03$; $t(70) = 2.77$, $p < .01$). To understand this interaction, we tested for the size of the spatial distance effect on perceived duration at different values of age by following the procedure detailed in Hayes and Matthes (2009) using their SPSS macro. Specifically, we tested whether perceived duration was significantly different across spatial distance conditions at low age (one standard deviation below the sample mean), moderate age (the sample mean), and high age (one standard deviation above the sample mean). This analysis revealed that the conditional effect of spatial distance was significant at low age (age = 21.94; $\theta = 14.92$, SE = 6.11; $t(70) = -2.44$, $p < .05$) but not at moderate age or old age (age = 33.66; $\theta = 2.83$, SE = 4.29; $t(70) = .66$; $p = .51$; age = 45.39; $\theta = -9.25$, SE = 6.12; $t(70) = -1.51$, $p = .14$); see figure 5. To further examine our rationale for the spatial distance by age interaction, we examined whether participants' age and how concretely they thought about retirement were correlated and found that these two variables were significantly correlated ($r = .42$, $p < .001$), supporting our rationale. Finally, in a follow-up analysis, we find that participants' current location on the map did not affect their duration perceptions.

The results of study 3 demonstrate that the spatial distance effect on subjective duration perception extends to perceived duration to retirement but only for younger people who are not thinking about their retirement concretely. This is important and consistent with a metaphoric transfer theory (and our study 2), in which the effect is expected only when the subsequent judgment is abstract, not concrete. Now that we have established the space-time effect and provided evidence consistent with a metaphoric transfer process (hypotheses 1 and 2), the next two studies examine whether spatial distance exerts an impact on consumer preference, especially intertemporal preference, via associated changes in subjective duration judgment.

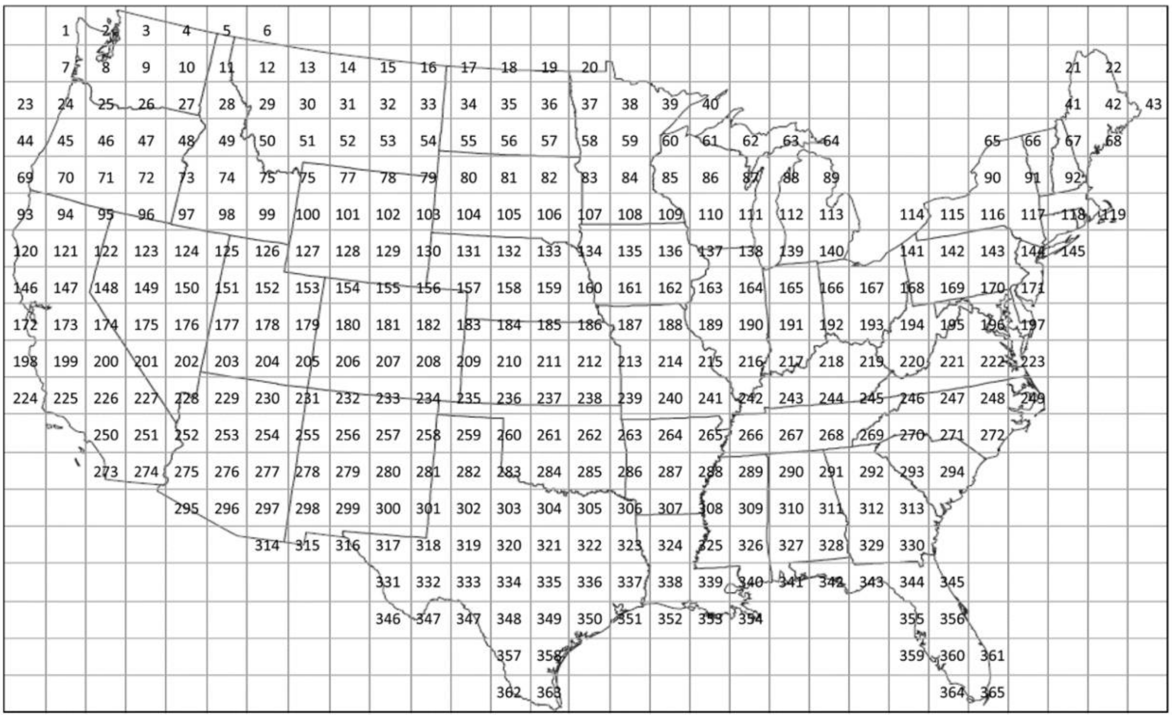
STUDY 4

Studies 4 and 5 examine whether changes in subjective duration perception affect impatience in a subsequent intertemporal preference task (hypothesis 3). This is important since it allows us to test for the unique effect of perceived duration in such intertemporal judgments. We predicted that those who consider future time for places farther apart would perceive longer durations and require a greater amount of monetary compensation when delaying immediate rewards (hypothesis 3) because longer perceived duration corresponds to longer perceived delay (or waiting time until the receipt of rewards).

Study 4 also aimed to rule out two processes that are possibly involved in the space-time effect that have not yet been addressed in our studies. First, participants may have perceived that two buildings are more dissimilar to each other in the long distance condition than in the short distance condition, which may have influenced their future time judgment by creating distinctive mental images of the two time points they judged. Second, participants may have inferred that moving between two buildings was more difficult in the long distance condition than in the short distance condition. We examine these alternative processes to see if they can explain our results; we expect that our results will hold even after we control for these factors.

FIGURE 4

A MAP OF THE UNITED STATES WITH 365 GRID POINTS (STUDY 3)

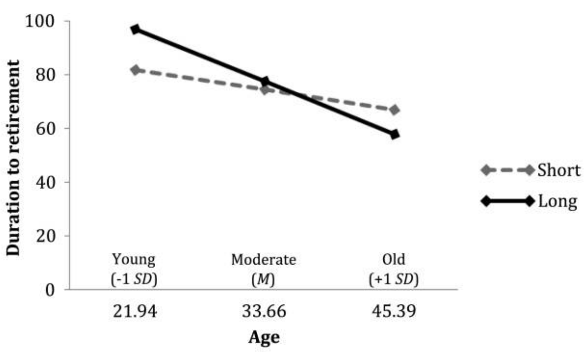


Method

Two hundred participants from an online panel (110 female; M_{age} = 33.9, SD = 12.06) participated in the computerized study. The procedure was similar to that of study 2. Participants were presented with a hypothetical map where several buildings are located along the street (fig. 2) and were asked to imagine visiting building A and building G in the long distance condition or building E and building F in the short distance condition. Then they were asked to indicate how long or short they considered the distance between the two buildings to be on an 11-point scale (where 1 = very short, 11 = very long). Next, participants' subjective duration perception and their intertemporal preference were measured. For subjective duration perception, similar to study 2, participants first imagined visiting building A (vs. E) today and building G (vs. F) in 3 months and then indicated their subjective perception of duration between today and a day in 3 months by moving a slider (see study 2 for complete details). In the intertemporal choice task, they imagined recently winning a raffle and having two options for receiving a cash prize: (1) a $100 cash prize today or (2) a greater cash prize in 3 months. Specifically, participants were told that if they want to receive $100 today, they have to visit building A (vs. E), but if they want to wait for 3 months to receive a greater cash prize, they have to visit building G (vs. F) on a day in 3 months. Then, they indicated the smallest amount of a cash prize they wanted to receive in 3 months that would make them equally happy between receiving $100 today and receiving that amount in 3 months. The order of the subjective duration perception task and the intertemporal choice task was counterbalanced.

FIGURE 5

DURATION TO RETIREMENT AS A FUNCTION OF SPATIAL DISTANCE AND PARTICIPANTS' AGE (STUDY 3)



Finally, participants were asked to indicate how similar they thought the two buildings were (on an 11-point scale, where 1 = not at all and 11 = very much) and how easy or difficult they thought it would be to move from one building to the other (on an 11-point scale, where 1 = very easy and 11 = very difficult). In addition, participants indicated their monitor screen size as an added control for a possible artifact that the size of the map and the length of the slider may look different depending on the participant's monitor size.

Results and Discussion

There was no main effect of the task order ($F(1, 196) = 1.06$, $p = .31$) and no distance by order interaction ($F(1, 196) < 1$) for subjective duration judgment; therefore, data were analyzed by pooling across the orders. Demonstrating the spatial distance effect on perceived duration, participants who considered a longer spatial distance judged the same 3-month duration to be longer than those who considered a shorter spatial distance ($M_{long} = 54.21$ mm, SD = 26.08 mm, vs. $M_{short} = 44.84$ mm, SD = 23.25 mm; $F(1, 198) = 7.18$, $p < .01$). Results replicated when monitor size ($F(1, 197) = 7.26$, $p < .01$) or age was controlled for ($F(1, 197) = 6.55$, $p = .01$).

Next, we tested whether participants' intertemporal preference was different as a function of the spatial distance. One extreme outlier in the long distance condition was detected and removed from the analysis (this response, $110,000, deviated by more than 55 standard deviations from the mean of his or her cell without that response). Participants in the long distance condition requested a marginally greater amount of compensation for 3 months' delay than those in the short distance condition (M_{long} = $262.93, SD = $189.98, vs. M_{short} = $224.77, SD = $134.38; $F(1, 197) = 2.66$, $p = .1$). It is possible that the effect of spatial distance on intertemporal preference was weakened in this experiment because the intertemporal task came after their judgment of duration for half the participants or because participants were not asked to memorize a map, as compared to studies 1A or 5. When analyzing only the responses of those who did the intertemporal preference task immediately after the spatial distance manipulation, we indeed found a significant spatial distance effect on intertemporal preference (M_{long} = $275.11, SD = $198.66, vs. M_{short} = $209.25, SD = $92.57; $F(1, 100) = 4.72$, $p = .03$).

Although the spatial distance effect on intertemporal preference for the entire data set was only marginally significant, this does not preclude examining the possible mediating role of duration judgment in the spatial distance effect on intertemporal preference (see Zhao, Lynch, and Chen [2010] for a detailed discussion). Using a bootstrapping procedure (Preacher and Hayes 2004; Zhao et al. 2010), we identified the indirect path from the spatial distance manipulation to subjective duration perception ($a = 9.27$, $t = 2.64$, $p < .01$), the indirect path from subjective duration perception to intertemporal preference holding the manipulation constant ($b = 1.31$, $t = 2.81$, $p < .01$), and the direct effect from the manipulation to intertemporal preference after controlling for the mediator ($c' = 26.04$, $t = 1.11$, NS). Confirming the mediating role of subjective duration perception, the 95% confidence interval of the indirect effect or the effect of spatial distance on intertemporal preference through subjective duration perception ($a \times b$) from the bootstrapping did not include zero ($a \times b = 12.13$; 95% CI, 1.27 to 26.47).

Perceived Similarity and Perceived Difficulty. The difference in the perceived similarity of the two buildings between spatial conditions was marginally significant such that participants in the long distance condition indicated that the two buildings were less similar than those in the short distance condition ($M_{long} = 8.45$, SD = 2.17, vs. $M_{short} = 8.95$, SD = 1.70; $F(1, 197) = 3.31$, $p = .07$). Importantly, the effect of spatial distance on duration judgment remained significant after controlling for perceived similarity ($F(1, 196) = 6.37$, $p = .01$). Likewise, participants in the long distance condition expected that it would be more difficult to move from one building to the other than those in the short distance condition ($M_{long} = 3.79$, SD = 2.42, vs. $M_{short} = 2.67$, SD = 2.07; $F(1, 197) = 12.23$, $p < .01$), but again the spatial distance effect remained significant after controlling for perceived difficulty ($F(1, 196) = 6.37$, $p = .01$). The results of a multiple-mediator model (Preacher and Hayes 2008) further indicate that neither perceived similarity nor perceived difficulty mediates the impact of spatial distance on subjective judgment of future time or the effect of spatial distance on intertemporal preference.

Study 4 demonstrates that spatial distance affects intertemporal preference by influencing subjective duration perception. The effect was stronger when the intertemporal preference task immediately followed the distance manipulation. We also showed that duration judgments mediate the effect of distance on intertemporal preference. Finally, we showed that issues regarding effects of similarity and difficulty that might have been associated with the distance manipulation did not account for our results.

STUDY 5

In study 4, spatial distance information was embedded in the intertemporal preference task (immediate reward today at place A vs. delayed reward in 3 months at place B). Although such trade-offs in spatial locations are not uncommon in actual intertemporal decisions in everyday life, a stronger test of our theory would be showing a pure carryover effect, that is, an effect from a prior consideration of distance information that is not directly related to the intertemporal preference task. To test for such a carry-over effect, in study 5 we presented participants with an intertemporal preference task that did not involve trade-offs in spatial locations. They responded to this task after they had judged future time in an earlier task.

Method

One hundred and eighty-seven University of Pennsylvania undergraduates (101 female; $M_{age} = 19.79$, SD =

1.64) were randomly assigned to one of two spatial distance conditions (long vs. short). The procedure was similar to study 1A, where participants memorized and then mentally visualized a map (fig. 1). Participants then imagined visiting the post office tomorrow and the bookstore in 1 month and indicated how long they considered the duration between tomorrow and a day in 1 month to be by placing a mark on a 155 millimeter continuous line scale anchored by "very short" on the left end point and "very long" on the right. Next, to measure intertemporal preference, participants imagined receiving a $75 gift certificate valid on that day and indicated the dollar gift certificate they would require instead if they had to wait for 1 month to receive it.

Results and Discussion

The spatial distance from the left end of the scale was measured in millimeters. Confirming hypothesis 1, a *t*-test revealed a significant difference between conditions such that participants who memorized the long-distance map judged the same 1-month duration to be subjectively longer than those who memorized the short-distance map (M_{long} = 70.26 mm, SD = 36.08 mm, vs. M_{short} = 56.73 mm, SD = 32.80 mm; $t(185) = 2.68$, $p < .01$). Next, participants' degree of impatience was compared, revealing that those in the long-distance map condition required a larger gift certificate to delay the $75 certificate available today than those in the short-distance map condition, supporting hypothesis 3 (M_{long} = \$94.53, SD = \$22.78, vs. M_{short} = \$88.08, SD = \$16.38; $t(185) = 2.22$, $p < .03$). Mediation analysis further confirmed that subjective duration judgment mediated the effect of spatial distance on intertemporal preference ($a = 13.52$, $t = 2.68$, $p < .01$; $b = .10$, $t = 2.49$, $p = .01$; the bootstrapped 95% CI for the indirect effect lies between .13 and 3.13). These results show that even when the intertemporal decisions did not involve any direct spatial distance information, as long as participants' subjective duration judgment was altered due to a preceding spatial distance task, their impatience in intertemporal decisions was shifted.

GENERAL DISCUSSION

In this article we test the effect of spatial consideration on judgment of future duration and subsequent intertemporal preferences. Based on a time as distance metaphor and conceptual mapping between space and time, as proposed in linguistics and cognitive psychology, we demonstrate that subjective judgment of future time is influenced by consideration of spatial distance, an instance of metaphoric transfer. Importantly, we further demonstrate that intertemporal preference, for which subjective perception of future delays is a critical factor, shifted with spatial distance. This supports the importance of subjective future time judgment in intertemporal preferences by introducing a factor that changes time perception without directly changing the value of outcomes.

We present results from six studies and demonstrate that considering spatial distance influences individuals' judgment of future time. The effect of spatial distance on perceived duration was not driven by scaling artifacts (study 1A), use of an explicit map (study 1B), changes in the level of construal (study 2), cognitive load (study 2), or perceived similarity between locations or difficulty of moving across them (study 4). We further demonstrated that spatial distance information affects individuals' intertemporal preference (or impatience) by altering their subjective perception of future times (studies 4 and 5).

Asymmetry between Distance and Time

In addition to the important finding that seemingly irrelevant context cues such as distance can affect individuals' future duration assessments and intertemporal preference, we showed that the relationship (mapping) between distance and time is asymmetric, from distance to time but not the reverse. Why might this be the case? One argument is that people use what they learn from experience-based domains to understand concepts that are more abstract. For instance, individuals process spatial information from an early age, before they know how to tell time. They constantly process the physical distance they have to travel, the location of other people or their toys, and so on. They also learn from experience that going a longer distance usually means more time. Such relationships become well-learned, automatic associations that can be used to understand temporal concepts.

Although our asymmetric findings do not support the predictions of construal level theory (studies 1A and 2), it is important to note that we do not intend to imply that CLT plays no part in judgments involving space and time. As we only have limited evidence regarding the role of construal level (e.g., a null effect from a Navon letter task in study 1A and the asymmetric relationship in study 2), future research may investigate more systematically when space and time are related because of a metaphor and its conceptual mapping and when they are linked through construal levels. Also, although distance may be naturally a more concrete concept than time, future research might investigate conditions under which time would be more concrete (e.g., asking people to consider time intervals that are very familiar to them, such as the time between paychecks). In such situations the mapping between time and distance may be more symmetric.

Although we have provided evidence consistent with what conceptual metaphor theory posits, we did not directly demonstrate that conceptual mapping is responsible for the effect we found. We have, however, attempted to further our understanding of metaphoric transfer by emphasizing that explicit consideration of the link of a given metaphor to a specific mapping and its associated effects is critical. In the next section, we extend this notion by arguing that different metaphors for time have different mappings and hence different effects. We also propose some future research on factors influencing which temporal metaphor is activated.

Other Metaphors for Time

A critical step in the metaphoric transfer process is which metaphor (and mapping) is activated. Any focal concept, such as time, may have several potential metaphors. What makes the active metaphor critical is that each metaphor will be associated with a particular mapping and different mappings may have different implications for judgments. In this article, we have concentrated on the time as distance metaphor, with a mapping from distance to time as represented by a time line. However, another metaphor for duration might be time as a supply or resource, as in such expressions as "I wasted my time" or "time is running out." Here the conceptual mapping would be from a limited supply of some concrete item (e.g., food) to the limited time supply. This metaphor and mapping would also provide notions of part-whole relationships learned from experience. If time is represented as a resource, then according to this mapping, a given time would be perceived as longer when the supply of time is limited (the amount of the total resource is smaller) than when the supply of time is greater. That is, providing a cue regarding the supply of time could lead to thoughts/associations of how large a part a given length of time is of the whole supply. Such associations or thoughts would then lead to longer judgments of a given length of time with a smaller supply. This possibility might lead to findings contrasting with those in the current article.

We explored a context that might provide initial evidence for this possibility. When we examined the effect of making future time judgments when one's life span is salient, we found such contrast effects (Kim, Zauberman, and Bettman 2012). We reasoned that although people do not naturally think about a limited time supply when they judge future times (e.g., 1 month from today), the time as a resource metaphor may be activated when they are reminded of limits to available time, such as the limits of their lifetimes. Specifically, we argued that participants who were reminded of their death (and hence the scarcity of their time resource) would activate the time as resource metaphor. Hence, they would treat time as a resource and judge the same future time to be longer (because it is a greater proportion of the limited supply of time) compared to those who are not reminded of their death. Supporting this hypothesis, participants who were primed with death-related words judged the same 1-month duration to be longer compared to those in the control condition. Demonstrating the contrast effect more directly, participants who were experimentally manipulated to believe their remaining life span is shorter judged the same future durations to be longer than those who believe their remaining lifetime is longer. These results, along with the findings in the current article, indicate that judgments of future time depend critically on which metaphor and associated conceptual mapping are activated. Future research might more directly compare the various metaphors, their implications for judgment, and factors that influence which temporal metaphor is activated.

Implications for Consumer Intertemporal Preference

As we argued earlier, relatively little is known about how people perceive and represent future times, which is an important aspect of many consumer decisions. Our evidence for the space-time effect therefore is important not only for establishing the link between space and time perceptions but also for demonstrating that subtle contextual changes can affect how long or short a given future time is perceived to be, subsequently influencing consumers' time-related decisions.

Impatience in intertemporal trade-off decisions has been extensively studied in economics, psychology, neuroscience, and marketing. Until recently, future time has been mostly treated as ratio-scaled objective information (e.g., 2 months is twice as long as 1 month) and not considered as a psychological factor driving one's intertemporal preferences. Several recent studies have empirically demonstrated the role of individuals' idiosyncratic judgment of future time in intertemporal decisions (Ebert and Prelec 2007; Kim and Zauberman 2009; Zauberman et al. 2009), and we demonstrate that spatial distance can have an important influence on such perceptions and hence on intertemporal choice.

The implications of the relationship of future time perception to intertemporal preference are important. Impatience and inconsistent intertemporal preferences are challenging problems from both theoretical and practical perspectives. When individuals' subjective time perception is not considered, possible solutions for diminishing impatience have been centered on altering the perceived value of consumption or even restricting individuals' options to make impatient decisions (e.g., using pre-commitment devices). However, when subjective duration perception is taken into account, individuals' impatience levels can be influenced simply by subtle contextual cues (such as spatial distance) that change future time perception.

The current article focuses on the impact of spatial distance information on intertemporal preferences. However, it is important to note that the implications of the proposed space-time interdependence are not restricted to intertemporal trade-offs but could generalize to other time-relevant decisions. Consumers make many other decisions where future duration is a key component. For example, when evaluating vacation packages to different locations, consumers' evaluations may be influenced by the spatial distance to the locations because the perceived durations of the vacations may be influenced by the spatial distance.

Conclusions

When thinking about time, it is hard not to consider its relationship to space. We examined a novel aspect of the space-time relationship relating to subjective judgment of future time, one with direct implications for consumers' decision making via the influence of spatial distance on future time judgment and subsequent intertemporal preferences for monetary outcomes. We believe that this is only a first step in the important process of understanding the constructive nature of future time judgment and its implications for intertemporal preferences.

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