



ASSOCIATION FOR CONSUMER RESEARCH

Labovitz School of Business & Economics, University of Minnesota Duluth, 11 E. Superior Street, Suite 210, Duluth, MN 55802

Movement Through Time and Space Shapes Psychological Distance

Eugene Caruso, University of Chicago, USA

Leaf Van Boven, University of Colorado Boulder, USA

We argue that consumers perceive moving through time in ways analogous to their physical movement through space. Consequently, we show in four studies that future events 1) are psychologically closer when people physically move toward them in space and 2) are psychologically closer than past events of equivalent objective distance.

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The Influence of Tracking Time on Judgments of Experiences, Time, and the Self

Chairs: Gabriela Tonietto, Washington University in St. Louis, USA

Selin A. Malkoc, Washington University in St. Louis, USA

Paper #1: How “Time until the End” Influences Actual versus Predicted Consumer Experiences: A Resource Allocation Account

Claire Tsai, University of Toronto, Canada

Min Zhao, Boston College, USA

Nicole Robitaille, Queens University, Canada

Paper #2: When an Hour Feels Shorter: Salient Endpoints Contract the Perception and Consumption of Time

Gabriela Tonietto, Washington University in St. Louis, USA

Selin Malkoc, Washington University in St. Louis, USA

Stephen Nowlis, Washington University in St. Louis, USA

Paper #3: Movement through Time and Space Shapes Psychological Distance

Eugene Caruso, University of Chicago, USA

Leaf Van Boven, University of Colorado Boulder, USA

Paper #4: Neglecting Decline: Biased Views of Personal Development Driven by Failure to Recall and Predict Negative Change

Sarah Molouki, University of Chicago, USA

Daniel Bartels, University of Chicago, USA

Oleg Urminsky, University of Chicago, USA

SESSION OVERVIEW

Consumers regularly keep track of their time by attending to the passage of time (Sackett et al. 2010), planning out their activities (Lynch, Netemeyer, & Spiller 2010; Tsai & Zhao, 2011), marking their time (Zauberman et al. 2010), and monitoring their behavior over time (Kivetz, Urminsky, & Zheng 2006). The papers in this session build on and extend this literature by examining unique outcomes of tracking time. Together, they explore how tracking time by attending to the unfolding of a current experience (paper 1), by scheduling (paper 2), by estimating temporal distance (paper 3), and by recalling personal events over time (paper 4) influence consumers' perception of the current experience (paper 1), time (papers 2 and 3), and the self (paper 4).

The first paper, by **Tsai, Zhao, & Robitaille**, examines how tracking progress toward the end of a negative experience influences the unpleasantness of the experience. In particular, the authors propose that the unpleasantness of negative experiences can depend on the amount of time left until the end of the experience. While consumers predict that a negative experience will become less aversive over time, the authors demonstrate that experiences become more unpleasant when there is less time until the end.

Next, paper 2, by **Tonietto, Malkoc, & Nowlis**, examines how tracking time through scheduling influences consumers' unscheduled time by creating boundaries around free time. The authors argue that boundary tasks increase the salience and rigidity of the endpoint of time intervals, leading the endpoint to feel perceptually more finite and thus contracted. The authors demonstrate that unaccounted time that ends in a boundary scheduled task feels subjectively contracted, leading consumers to do less with their available time.

The third paper, by **Caruso & Van Boven**, examines how consumers track time by judging psychological distance from the present. In particular, movement through time is perceived analogously to movement through space, leading physical movement toward (vs. away from) an event to reduce psychological distance. Analogous

to physically moving forward or back, consumers perceive that they are continuously moving towards events in the future but away from events in the past. In line with this, the same objective length of time feels shorter if projected into the future than into the past.

Finally, the fourth paper, by **Molouki, Bartels, & Urminsky**, examines how consumers track personal change over time. In particular, the authors compared predicted, actual, and recalled personal change over the course of a year. They demonstrate that both prospectively and retrospectively, consumers underestimated personal change while overestimating perceived improvement. Although consumers tend to both improve and decline over time, they are more likely to remember past improvements and selectively neglect declines, and made nearly uniformly positive predictions of future change.

Together, the papers in this session contribute to our understanding of how consumers track their time and their ensuing judgments. In so doing, the papers identify unique drivers of biases in both prospecting and recall (papers 1 & 4), asymmetries between past and future judgements (paper 3), and the malleability of time (papers 2 & 3).

How “Time until the End” Influences Actual versus Predicted Consumer Experiences: A Resource Allocation Account

EXTENDED ABSTRACT

Consider two passengers, Chloe and Debra, who have just passed two subway stations. Chloe has two more stations to go, whereas Debra has ten more. Who would feel more tired now? While their experience should be similar given the same distance traveled, in the present research, we posit that their experiences can be a function of the amount of time left until the end of the trip. Further we propose that time until the end will have differential effects on predicted and actual experiences. Specifically, when predicting a future experience, people are forward looking and thus would focus on the affective state following the end of the experience (Elster and Loewenstein 1992; Loewenstein 1987; Tversky and Griffin 1990). Therefore, for negative consumption events, people might focus on the relief at the end and expect the events to be less aversive toward the end. However, when actually experiencing the events, people might focus more on the ongoing experience (Tversky and Griffin 1990). Therefore, time until the end signals the effort that they have exerted (Drolet and Gibb 2003), which affects their experience negatively (“I am tired because I have used up nearly all my coping resources or mental effort”).

To test our hypothesis, we first conducted a field study using subway passengers. Participants were passengers who were either riding (experiencers) or waiting for (predictors) the subway. Participants were either asked to report how they felt during their subway ride (experiencers) on a 7-point scale (1 = not at all tired, 7 = extremely tired) or predict how they would feel after riding the subway for two stops (predictors) on the same 7-point scale. To calculate participants' current location and total trip distance, we asked participants to record at which subway station they got on (experiencers) or were waiting (predictors). Experiencers also reported which subway station they had just passed. All participants reported at which station they planned to get off.

As expected, predictors who had shorter trips (shorter time until the end) predicted the experience of riding the subway for two stations into their journey as less negative than those who had longer trips (longer time until the end), even though they would have travelled the same distance ($t(1, 80) = 3.86, p = .053$). By contrast, the results reversed among experiencers: regression analysis showed that passengers rated their experience *more* negatively when they had less time until the end of their trips ($\beta = -1.69, t = -2.30, p = .02$). To compare experiences and predictions, we examined the ratings for experiencers who had traveled two stops when taking the study. As expected, those on shorter trips rated their experience more negatively than passengers who still had a long way to go ($t(1, 33) = 8.85, p = .006$). The results supported our hypothesis.

In study 2, we replicated our findings with university students. Study 2 employed a 2 (role: predictor vs. experiencer) \times 2 (time until the end: short vs. long) between-subjects design. Participants were told that they would need to do eight or 18 sets of a handgrip exercise. To control for effort and task difficulty, we asked participants to hold up an object for three seconds during each set using their non-dominant hand. After trying out the handgrip, predictors forecast how pleasant, negative/positive, and tired they would feel after doing seven sets of exercise by moving unmarked sliders (not at all; extremely/positive/very tired). At this point, time until the anticipated end would either be three seconds (1 set left; 8-set condition) or 33 seconds (11 sets left; 18-set condition). Experiencers did seven sets and then evaluated their experience. To explore the underlying mechanism we asked all the participants to report how painful they would expect the rest of the task to be. All the items were measured using unmarked sliders with proper anchors. Data were recorded by the computer using a 0–10 continuous scale.

Consistent with study 1, a two-way ANOVA revealed a significant two-way interaction ($F(1, 102) = 9.95, p = .002$). Planned contrast showed that predicted experience was less aversive when time until the end was shorter ($p = .03$). (Higher number indicates less aversive experience.) However, the results reversed for the experiencers ($p = .02$), even though they all did seven sets. Mediation analysis using 5000 bootstrap (Hayes 2013) confirmed that the anticipated pain partially mediated the direct path.

Study 3 further tested our hypothesis concerning the experiencers and employed a 2 (time until the end) \times 2 (need to conserve energy) between-subjects design using a similar handgrip exercise. If participants felt they had ample energy during the exercise, they would expect the remaining exercise to be less aversive and have lower need to conserve and allocate their energy during the exercise, thereby weakening the effect of time until the end.

All participants sampled a fruit juice prior to the handgrip exercise. They were told the beverage was either a new energy drink (low need to conserve energy) or a new fruit juice (control – need to conserve energy). They then proceeded to the handgrip exercise. A two-way ANOVA revealed a significant two-way interaction ($F(1, 107) = 5.41, p = .02$). As in study 2, control participants rated the experience as more aversive when they had less workout time remaining ($p = .03$). However, the effect disappeared when participants thought the juice was an energy drink ($p > .24$).

In sum, evidence from three studies demonstrate that people intuit that a negative episode feels less aversive if the end is near, but in reality, the episode actually feels worse when the end approaches. Our findings add to research on duration knowledge and affective misforecasting.

When an Hour Feels Shorter: Salient Endpoints Contract the Perception and Consumption of Time

EXTENDED ABSTRACT

Scheduling is a widely adopted strategy for organizing time, and consumers often schedule several of their activities while leaving intervals of “free” time open in between (Southerton 2003). While prior research has examined effects of scheduling on the individual scheduled tasks (Milkman et al. 2012; Tonietto and Milkoc, forthcoming), how the intervals of unscheduled time created by scheduling may be perceived and consumed remains unexamined. In the present work, we propose that intervals bounded by scheduled tasks will feel subjectively contracted, limiting the use of that time. In particular, we propose that by creating boundaries that mark a salient end to intervals of free time, scheduled tasks can make these intervals feel perceptually more finite and thus contracted.

Perceived finitude is driven by two principles: the salience and the rigidity of the endpoint such that time feels perceptually more finite (1) when the end of the interval is more salient (Kaufman, Lane, and Lindquist 1991; Weiss 2014), and (2) when the end represents a rigid and sharp change (Weiss 2014). We propose that because boundary tasks embody both of these principles when they mark a salient, rigid end to an interval, such intervals will feel perceptually more finite compared to equivalent intervals that lack such boundaries, leading time to subjectively contract. Importantly, only boundaries that fulfill the two principles of perceived finitude should contract time. Therefore, we predict that only terminating (vs. initiating) boundaries that mark a rigid (vs. flexible) end to an interval will contract time. Importantly, we argue that boundary tasks will also have downstream consequences for the consumption of available time. In particular, once time feels contracted, it should also feel less sufficient and more constrained, reducing consumers’ willingness to spend their time. As such, we predict that intervals that saliently end in a scheduled boundary task will be consumed less effectively and productively. Eleven studies provide support for these propositions.

The first set of studies provided initial evidence that boundary tasks contract time, using a correlational field study (Study 1A) and a randomized lab experiment (Study 1B). In Study 1A, conference attendees estimated the time before a presidential address to be shorter if they had scheduled to attend it, compared to those who had not planned to attend. In Study 1B, participants evaluating a one-hour interval indicated that time felt shorter when it was bounded by an upcoming task than when it was not, and this effect was mediated through perceived finitude of the interval. To establish that boundary tasks uniquely contract subjective, but not objective time, in Study 2, we asked participants to estimate both the objective time they had and the subjective amount of time they felt they had to spend reading a book during a one-hour interval. We find that while objective estimates of time did not differ, participants evaluating a bounded interval felt that they had subjectively less time. Thus, we find that temporal contraction is driven by subjective, rather than objective differences in perceived time.

In Study 3, we aimed to show that boundary tasks would contract time perception for both desirable and undesirable boundary tasks, establishing that savoring towards a future task could not account for our effect. To test this, participants imagined either an hour available later (no boundary), an hour available before a dinner with friends (desirable boundary), or an hour before a dentist appointment (undesirable boundary). Countering a savoring based account, we find that time felt contracted prior to both the desirable and undesirable boundary tasks. Importantly, anticipating a fun dinner did

not differ from a dentist appointment, demonstrating that the mere presence and not the valence of the boundary task drives the effect.

In Study 4, we next sought to examine whether the effect would uniquely manifest for boundaries that terminate (vs. initiate) the interval, in line with the first principle of perceived finitude. Participants were given a hypothetical calendar for the day and indicated their perceived duration for four intervals throughout the day. Two of these intervals preceded a terminating scheduled task where one of the intervals (bounded) ended when the terminating task began. The other two intervals followed from an initiating scheduled task where one of the intervals (bounded) began when the initiating task ended. Replicating earlier results, time subjectively contracted prior to a terminating boundary. However an initiating boundary did not contract time. Building on this result, in Study 5, we tested whether the effect would only occur if the boundary task was specifically (vs. roughly) scheduled, and thus represented a rigid end to the interval. To test this, participants indicated the perceived duration of an interval that was either bounded or unbounded by either a specifically (i.e., coffee from 2:00pm-3:00pm) or roughly scheduled task (i.e., coffee sometime between 2:00pm and 5:00pm). Consistent with the second principle of perceived finitude, only the specifically scheduled task contracted time. That is, a boundary task only contracts time when the end is rigid and inflexible such that the terminating task must specifically mark the endpoint of the interval in order to contract time.

Finally, five studies (Studies 6A-6E) explored whether bounded time, in addition to feeling shorter, may also be underutilized. We find that people choose to take part in fewer tasks during bounded intervals (6A-6B), and perform fewer productive and extended tasks, opting instead for shorter and less productive tasks (6A and 6C). In addition, during bounded intervals, participants forgo both desirable leisure and productive work activities (6D), as well as financially superior options (6E) that could objectively be completed within the available time.

Together, these results identify a unique driver of time perception, finding that intervals bounded by a terminating scheduled task feel contracted. Our results establish that how consumers structure and organize their day around scheduled tasks has important implications for how they perceive and consume their free time.

Movement through Time and Space Shapes Psychological Distance

EXTENDED ABSTRACT

Time is an abstract concept that is only experienced indirectly, which makes the very notion of time difficult to comprehend. Once people move beyond the narrow spans of time that their biological clocks, broadly speaking, are capable of tracking, they conceptualize time by building mental representations that draw from their direct experience with spatial distances (e.g., Boroditsky, 2000; Lakoff & Johnson, 1980, 1999). The idea that travel through time has a direction—reflected in numerous metaphors, such as the “arrow of time” and “moving through time”—implies a spatial relationship. As a result of this mapping of time onto space, both literally and metaphorically, people’s movement through space can affect their representation of movement through time (Boroditsky, 2000; Casasanto & Boroditsky, 2008; Miles, Nind, & Macrae, 2010).

Here we explore two implications of the metaphorical mapping of time and space. We suggest that people’s experience of movement through time is analogous to their experience of movement through space in that they perceive the distance between the self and future events as continually diminishing whereas they perceive the distance

between the self and past events as continually increasing. Just as diminishing spatial separation makes objects seem spatially closer and increasing spatial separation makes objects seem spatially more distant, diminishing temporal separation makes events seem temporally closer and increasing temporal separation makes events seem temporally more distant. We hypothesize that this spatial metaphor of events in time implies two phenomena. First, physical movement toward events in space should reduce their psychological distance to the present. Second, there should exist a fundamental asymmetry in the psychological distance of past and future events whereby future events are psychologically closer to the present than past events of equivalent objective distance. We tested these predictions in a series of studies.

Study 1 tested our prediction that physical movement toward events in space would reduce their psychological distance to the present. Participants wrote down six personally-relevant events (e.g., “my final exams”) on separate sheets of large paper, which an experimenter taped to a door at the end of a long hallway. All participants reported how psychologically distant each event was. Some participants made these evaluations from a stationary position approximately 4 feet away from the posters; some participants made these evaluations from a stationary position approximately 30 feet away from the posters; and some participants made these evaluations after physically moving toward the posters (i.e., walking from 30 feet away to 4 feet away) or away from the posters (i.e., walking from 4 feet away to 30 feet away). We found that people who walked forward reported that these events were psychologically closer than did people who walked backward or who were in a close or far stationary position.

The next two studies tested whether future events are psychologically closer than past events of equivalent objective distance. In each study, participants were asked to imagine a point in either the past or in the future, and to report the point’s psychological distance. When considering specific times (one month, one year; Studies 2a-2b) or specific events (Valentine’s Day; Study 3), people reported that the future was closer than the past.

In Study 4, we experimentally reversed the spatially-grounded arrow of time by manipulating the direction of participants’ apparent physical movement, which we reasoned would influence their orientation to the past and future. Some people had the (virtual) experience of moving forward in space, consistent with their natural orientation of thoughts, whereas others had the (virtual) experience of moving backward in space, reversing their natural orientation of thoughts. Consistent with our predictions, we found that people’s virtual movement moderated the temporal asymmetry in psychological distance, such that backward movement eliminated the tendency for future times to be psychologically closer than past times.

The existence of this temporal asymmetry has important implications for theories of psychological distance that assume temporal symmetry (e.g., Trope & Liberman, 2010), and for theories of episodic memory that assume people remember the past in largely the same way that they imagine the future (e.g., Addis, Wong, & Schacter, 2007). More broadly, we believe that the temporal asymmetry in psychological distance reflects a general “bias toward the future” whereby people are psychologically oriented toward the future more than the past (Parfit, 1984). This future orientation is highly functional, as future events can typically be acted upon more successfully than past events. The fact that action can facilitate the realization of future desires but not past ones may help explain why people devote more resources to prepare for things that lie ahead than for things that lie behind. This is in part why it makes sense for car windshields to be bigger than rearview mirrors and for the meteorologist to dis-

cuss the weather for the upcoming week rather than the preceding one. Thus, just as people mobilize resources to prepare for approaching sights and sounds, they apparently have a more general tendency to prepare for the (approaching) future by reducing its psychological distance from the here and now.

Neglecting Decline: Biased Views of Personal Development Driven by Failure to Recall and Predict Negative Change

EXTENDED ABSTRACT

Imagine yourself ten years in the future. Will you be fundamentally the same person you are today, just with grayer hair? Or will you be a significantly changed individual with different preferences, values, and personality characteristics? Because our conception of what we will be like in the future is central in guiding our decisions (March, 1978), making incorrect predictions about how we will change (or not change) over time can lead to undesired outcomes. For example, consumers who hold inaccurate views about their own future preferences might make suboptimal product choices, whether they are selecting between snacks (Simonson, 1990; Kahneman & Snell, 1992) or cars (Busse, Pope, Pope, & Silva-Risso, 2014). More generally, anticipating major change in what defines the self can undermine the motivation to reduce spending (Bartels and Urminsky 2016) and preserve resources for the future (Bartels and Urminsky 2011). Therefore, exploring how people see themselves changing over time and identifying any consistent errors in these beliefs is crucial for understanding and guiding future-oriented behavior.

Research has revealed that people seem to exhibit systematic biases in evaluations of their own personal change. A large portion of this work suggests that people overestimate positive change, seeing themselves on a trajectory of constant improvement (e.g., Wilson & Ross, 2001; Kanten & Teigen, 2008). In contrast, other research suggests that people view themselves as relatively stable going forward. For example, Quoidbach, Gilbert, & Wilson (2013) found in a large cross-sectional study that people systematically underestimate the absolute magnitude of future personal change when compared to the absolute magnitude of remembered past change (though their design did not allow for assessments of actual within-participant change, which left the specific form of the bias unclear).

Taken together, these findings present a puzzle. Do people believe that they have stopped changing, or do they believe the biggest improvements are yet to come? In our study, we directly compare participants' beliefs about their own (absolute and directional) change to their actual change in a one-year longitudinal study in order to develop a more complete understanding of predictive and retrospective biases.

College students from across the United States were recruited by a research firm to answer two online surveys about their self-perceptions, separated by one year. A total of 155 participants completed both surveys. Using similar stimuli to those in Quoidbach et al. (2013), we measured change in three domains: personality (Big Five traits; Goldberg, 1992), personal values (Schwartz, 1992), and preferences (favorite food, type of music, hobby, book, and vacation spot, best friend). At Time 1 (December 2013), each participant provided measures of current personality traits, values, and preferences as well as a prediction of these items one year in the future. At Time 2 (December 2014), participants again provided current measures as well as a recollection of their evaluations one year ago.

In our analyses, we distinguish between degree of absolute change (combining increases and decreases) and directional change (amount of net improvement vs. decline). To analyze directional

change, we conducted a pre-test (N=100), which confirmed that increases in the personality traits and values we measured were viewed positively and decreases in the same were viewed negatively, and identified in which preference categories people saw change negatively or were open to change.

We found that both predicted and remembered absolute change were significantly underestimated relative to actual absolute change for personality ($ts(154) > 8.39, ps < .001$) and values ($ts(154) > 5.54, ps < .001$). However, on average, participants also demonstrated a self-improvement bias. That is, for both personality and values, participants predicted ($ts(154) > 4.02, ps < .001$) and remembered ($ts(154) > 2.38, ps = .018$) greater improvement than they had actually experienced. This is because people were much more likely to predict and remember positive (vs. negative) changes, despite the fact that our sample actually underwent positive and negative change in equal proportions. Nonetheless, participants were significantly more likely to report remembering negative change than they were to predict it, resulting in a somewhat attenuated positivity bias in recall compared to prediction. Further analysis revealed that the largest errors were made by the subset of people who in fact declined over the course of the year. On average, these participants ignored their decline and instead reported a smaller improvement, simultaneously leading to both an overall underestimation of the absolute magnitude of change and an overestimation of improvement.

Participants also predicted that an average of 1.04 of their initial preferences (out of 6) would change over the following year, while, in actuality, 1.33 out of 6 preferences changed ($z = 2.31, p = 0.02$). However, we found that the degree of underestimation differed across the preference questions, $F(5, 766) = 3.86, p = .002$. Change was underestimated for items in categories where change was rated as undesirable in our pretest (hobby, music, and best friend), $t(151) = 3.35, p = .001$, but not for items where change was rated as neutral (food, book, and vacation), $t(153) = 0.85, p = 0.40$. This finding again supports the idea of a positive directional bias: people denied change in preferences when they viewed this change as a bad thing.

Our study reconciles previous findings by demonstrating that people can underestimate the absolute magnitude of personal change while simultaneously holding beliefs that they will continue to improve. Notably, this result emerges because people do not equally underestimate all types of change, but especially deny changes that are viewed in a negative light. Whereas actual change in our sample was evenly peppered with improvements and declines, and individuals acknowledged this variability to a certain extent in their past, the future was seen as uniformly positive. Thus, we suggest that people's self-views do not in fact resemble an "End of History Illusion," with the present moment marking the end of their personal development (Quoidbach et al., 2013). Instead, people think of the present moment as a watershed moment of a different sort: it is the moment when their somewhat rocky past will resolve into a consistent upward trajectory from now on.

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