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Spatial Orientation Shrinks and Expands Psychological Distance

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Abstract

Being objectively close to or far from a place changes how people perceive the location of that place in a subjective, psychological sense. In the six studies reported here, we investigated whether people's spatial orientation (defined as moving toward or away from a place) will produce similar effects—by specifically influencing psychological closeness in each of its forms (i.e., spatial, temporal, probabilistic, and social distance). Orientation influenced subjective spatial distance at various levels of objective distance (Study 1), regardless of the direction people were facing (Study 2). In addition, when spatially oriented toward, rather than away from, a particular place, participants felt that events there had occurred more recently (Studies 3a and 3b) and that events there would be more likely to occur (Study 4). Finally, participants felt more similarity to people who were spatially oriented toward them than to people who were spatially oriented away from them (Study 5). Our investigation broadens the study of psychological distance from static spatial locations to dynamically moving points in space.

Keywords

psychological distance, space, motion, distance perception, open data, open materials

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Americans, on average, take 5,117 steps a day (Bassett, Wyatt, Thompson, Peters, & Hill, 2010) and drive more than 14,000 miles a year (U.S. Department of Transportation, 2011). Mounting research on the psychology of spatial distance has articulated the many ways in which feeling closer to or farther from things changes the manner in which people represent and act on those very things (e.g., Trope & Liberman, 2010). Spatial distance has the power to shape judgments, yet most researchers who have studied spatial distance have adopted primarily a static or binary approach, conceptualizing objects as stationary, either near or far in space (Henderson & Wakslak, 2010). In the current research, we went a step further by considering the dynamic and changeable orientation of people who are moving toward or away from objects in their environment. We hypothesized that feelings of closeness are shaped not only by spatial distance, but also by people's orientation in space—that is, their movement toward or away from places, people, and things.

By analogy, one can view spatial orientation as a *vector*—a term used in physics to describe a quantity that has both magnitude (e.g., 1 mile) and direction (e.g., westward). In contrast, research in psychology to date has viewed distance predominantly as a *scalar*—a quantity that has a changeable magnitude but constant direction. In other words, past research has assumed that direction is inexorably linked with magnitude. However, this does not have to be the case: One can be equally distant from two different locations, but the direction one pursues to one location can be different from the direction one pursues to the other location. This is an example of orientation, or the direction in which a person is heading relative to a target object.

To be sure, past research has identified the effects of changing orientation on judgments of spatial distance. For instance, leaning toward (vs. away from) a computer monitor causes people to feel that the monitor is closer (and stimuli presented on the monitor are evaluated accordingly; Thomas & Tsai, 2012), and stepping toward

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(vs. away from) something causes people to treat that object as if it were closer (Koch, Holland, Hengstler, & van Knippenberg, 2009). We hasten to note that these findings, however, relied on changes in both orientation and distance, in which changes to orientation (e.g., stepping forward) also entailed changes to objective distance (e.g., being closer). In the studies reported here, we went beyond past research by holding objective distance constant and considering only the orientation of the person relative to the target object (and vice versa). We predicted that people will feel closer to a target when they are oriented toward it than when they are oriented away from it despite maintaining a constant objective distance.

To investigate this possibility, we conceptualized physical space as but one type of psychological distance (Liberman, Trope, & Stephan, 2007; Trope & Liberman, 2010). This broader construct encapsulates four dimensions along which targets can vary in their closeness to the individual: spatial, temporal, probabilistic, and social. People feel more distant from places when those places are further away in physical space and feel more distant from times when those times are from the past or future rather than the present. In addition, unlikely events feel more distant than likely events, and people who are perceived as dissimilar to the self feel more distant than people who are perceived as similar. Adopting this perspective affords consideration of orientation that is more broadly defined. With respect to time, people feel that future events are subjectively closer than past events, even when the objective temporal distance is held constant (Caruso, Van Boven, Chin, & Ward, 2013). In the social dimension, Smith and Trope (2006) identified power as one aspect of social distance, and people confer more status to employees who move upward, rather than downward, in a status hierarchy, even when the employees' ultimate rank in the hierarchy is held constant (Pettit, Sivanathan, Gladstone, & Carson Marr, 2013).

Viewed from the perspective of psychological distance as a broader, multidimensional construct, the closeness we predicted to be engendered by spatial orientation takes on a unique meaning. Despite differences among the four dimensions of distance, they are all avenues of removal from immediate experience in the here and now (Maglio, Trope, & Liberman, 2013). As a result, people extrapolate from information about a target's location along one avenue of psychological distance (i.e., physical proximity) to infer its location on all avenues (i.e., temporal, probabilistic, and social proximity). That is, if a place, person, or event feels psychologically close in one way, then it feels close in all ways (Bar-Anan, Liberman, Trope, & Algom, 2007; Fiedler, Jung, Wänke, & Alexopoulos, 2012; Van Boven, Kane, McGraw, & Dale, 2010). This shared meaning is further supported by explicit judgments across different dimensions.

Building from such cross-dimensional accounts, we reasoned that if spatial orientation toward a place, person, or event causes it to feel closer in physical space, it should cause similar feelings of closeness on each of the other three dimensions of distance as well. The following studies tested this account. For each study, we decided ahead of time on a minimum sample size per cell and collected data until that number was achieved. In all but one of our studies, we chose 20 participants per cell as a minimum on the basis of prior research on psychological distance (and experimental psychology more generally). Study 3a was the first in which we extrapolated from physical space to a different, nonspatial dimension of distance, so we targeted a larger minimum sample of 50 participants per cell, because we were unsure of the size of any effect we might observe.

Study 1

Method

Study 1 served two purposes. First, it tested the hypothesis that a spatial orientation toward (vs. away from) a location will cause that location to feel closer. Second, it examined the relative contributions of spatial orientation and objective distance as simultaneous yet independent inputs into subjective distance estimates.

Two hundred two volunteers were recruited at the Bay Street subway station in Toronto, Ontario, Canada. People were recruited at either the westbound platform (n = 101) or the eastbound platform (n = 101). All participants were asked to rate the subjective distance of another subway station on the line that they were traveling; the station was either coming up (e.g., the next stop) or just past (e.g., the previous stop). Specifically, participants were assigned randomly to conditions in which they rated the subjective distance of the Spadina station (two stops to the west), the St. George station (one stop to the west), the Bloor-Yonge station (one stop to the east), or the Sherbourne station (two stops to the east). Participants were asked, "How far away does the [name] station feel to you?" and rated the distance using a scale from 1 (*very close*) to 7 (*very far*).

Results

We carried out a 2 (orientation: toward, away from) × 4 (station: Spadina, St. George, Bloor-Yonge, Sherbourne) analysis of variance (ANOVA) on closeness ratings, which revealed no main effect of orientation, $F < 1$, and a main effect of station, $F(3, 194) = 24.10$, $p < .001$, $\eta_p^2 = .27$. This main effect was qualified by the predicted interaction between orientation and station, $F(3, 194) = 16.28$, $p < .001$, $\eta_p^2 = .20$. We decomposed this interaction by comparing

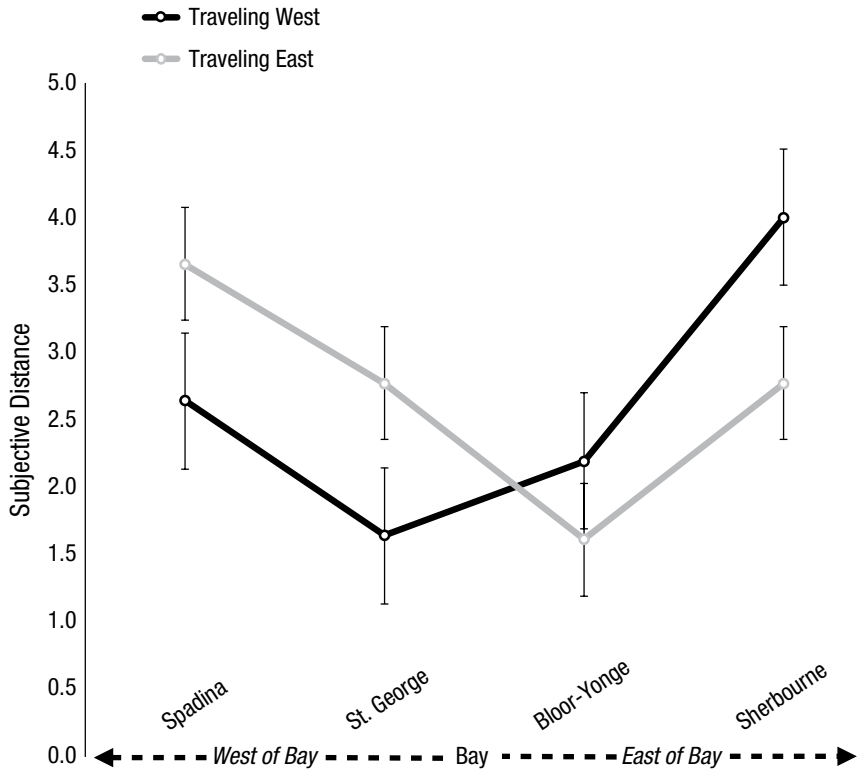

Fig. 1. Results from Study 1: subjective-distance rating as a function of the subway station being evaluated and the participant's orientation. All participants were physically located at the Bay Street station, at the midpoint between the St. George and Bloor-Yonge stations. Error bars indicate ±1 *SE*.

the subjective-distance ratings between participants traveling east and west for each of the four subway stations. Westbound participants rated the stations to the west of Bay Street as closer than did eastbound participants; this effect was obtained for both the station one stop to the west (St. George, $p < .001$, $\eta_p^2 = .28$) and the station two stops to the west (Spadina, $p = .001$, $\eta_p^2 = .20$). The opposite pattern held true for stations to the east of Bay Street. Eastbound participants rated the stations to the east of Bay Street as closer than did westbound participants; this effect was obtained for both the station one stop to the east (Bloor-Yonge, $p = .053$, $\eta_p^2 = .08$) and the station two stops to the east (Sherbourne, $p < .001$, $\eta_p^2 = .24$). Figure 1 summarizes these results.

Study 2

Method

To address an alternative interpretation of Study 1, in Study 2 we manipulated not only spatial orientation (in a manner similar to that in Study 1) but also the direction in which participants faced. Merely facing toward or away from a place does not change the proposed orientation construct (because the direction of one's pursuit remains the same regardless); therefore, we predicted that Study 2 would conceptually replicate Study 1.

Eighty volunteers were recruited at the Christie subway station in Toronto, Ontario, Canada. People were recruited at either the westbound platform ($n = 40$) or the eastbound platform ($n = 40$). As a manipulation check, participants were asked, "Are you traveling west or east?" All participants answered correctly. Participants were asked to rate the subjective distance of the University of Toronto campus, located 1.4 km (0.9 miles) to the east of the station, and all of them indicated that they were familiar with this location. Thus, the eastbound participants were spatially oriented toward the campus, whereas the westbound participants were spatially oriented away from the campus.

Direction faced was a separate, randomly assigned experimental factor: Participants made their distance estimates with their bodies facing either toward (i.e., east) or away from (i.e., west) the campus. To accomplish this manipulation, the research assistant positioned herself such that as she addressed the participants, she herself was facing either toward or away from the campus. She then said to the participants, "Please stand facing me

while you make your estimate." Thus, when the research assistant faced away from campus, participants faced campus, and when she faced campus, they faced away from campus. The research assistant used the subway platforms to identify which way she (as well as the participants) faced. All participants rated the subjective distance of the University of Toronto campus, using a scale from 1 (*very close*) to 7 (*very far*).

Results

We carried out a 2 (spatial orientation: toward, away) × 2 (direction faced: toward, away) ANOVA on closeness ratings, which revealed neither a main effect of direction faced nor an interaction between direction faced and spatial orientation, Fs < 1. However, the predicted main effect of spatial orientation did emerge, $F(1, 76) = 4.79$, $p = .032$, $\eta_p^2 = .06$; the University of Toronto campus felt closer to eastbound passengers ($M = 3.63$, $SD = 1.00$) than it did to westbound passengers ($M = 4.15$, $SD = 1.12$). Thus, estimates of subjective distance appear to be driven not by whether people are facing a target of interest but rather by whether they are heading toward or away from a target of interest.

Study 3

Because what is true for one dimension of psychological distance tends to be true for other dimensions (Maglio et al., 2013), in Study 3, we considered whether places that people are moving toward (vs. away from) are associated with events judged to have occurred more recently (i.e., closer in time). In addition, we sought to rule out a purely motivational account for the orientation effect. People tend to approach appetitive stimuli and move away from aversive stimuli (Higgins, 1997), and motivation can also change visual perception, causing people to see what they want to see in their environment (Dunning & Balcetis, 2013) and to rate desirable locations as physically closer than undesirable locations (Alter & Balcetis, 2011). Perhaps, then, people might view objects toward which they are oriented as more desirable and thus closer. To rule out this possibility, in Study 3, we investigated the role of orientation for both positive (Study 3a) and negative (Study 3b) events. Motivational accounts might predict that the relationship between spatial orientation and feelings of closeness would depend on the valence of the target under consideration (i.e., psychological distance would shrink among people oriented toward desirable events, but not among people oriented toward undesirable events). From our cognition-based perspective, orientation should be an influence regardless of the valence of the stimuli.

Study 3a

Method. One hundred volunteers were recruited at the intersection of Danforth Avenue and Woodbine Avenue in Toronto, Ontario, Canada. This location was selected because it is a major pedestrian intersection and is also approximately equidistant from two separate Shoppers Drug Mart locations (a large drugstore chain in Canada), one located to the west and one located to the east on Danforth Avenue (see Fig. 2a). People walking along Danforth Avenue were recruited when they were stopped by a traffic light at the Woodbine Avenue intersection. Only participants who were on the north side of the street (the same side as both of the Shoppers Drug Mart locations) and oriented eastward (i.e., stopped at the northwest corner of Danforth and Woodbine) were approached. Participants were asked to think about either the Shoppers Drug Mart near Danforth and Main Street (oriented-toward condition; $n = 52$) or the Shoppers Drug Mart near Danforth and Coxwell Avenue (oriented-away condition; $n = 48$). Conditions were assigned randomly. Participants were asked to estimate how many minutes had elapsed since any patron of that store had found a sale price on a desired item.

Results. Finding an item on sale was estimated to have happened more recently at the store toward which participants were oriented ($M = 7.65$ min, $SD = 9.98$) than at the other store ($M = 14.83$ min, $SD = 17.19$), $F(1, 98) = 6.65$, $p = .011$, $\eta_p^2 = .06$. This result is consistent with our hypothesis relating orientation to estimates of temporal distance. However, this study cannot exclude a motivational account (i.e., people might prefer to see the positive event as being closer in time at the location they were approaching) or a store-specific confound (i.e., differences in the stores might have driven the results). The next study was designed to test both of these accounts.

Study 3b

Method. Eighty-six volunteers were recruited at the intersection of Robson Street and Bute Street in Vancouver, British Columbia, Canada. As in Study 3a, this location was selected because it is a major pedestrian intersection and is also approximately equidistant from two target locations: a Starbucks coffee shop located to the northwest and another Starbucks located to the southeast, both on Robson Street (see Fig. 2b). People walking along Robson Street were recruited when they were stopped at a traffic light at the Bute Street intersection. Only participants on the north side of the street (the same side as both Starbucks locations) were approached. They were asked to think about the Starbucks at either Robson and Jervis Street ($n = 44$) or Robson and Thurlow

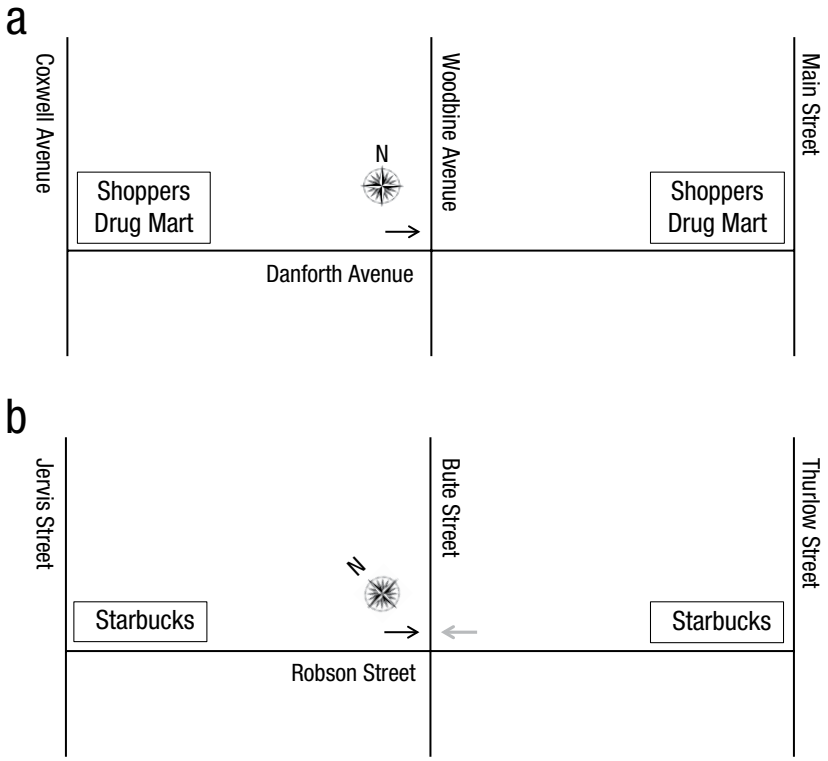

Fig. 2. Overview of the experimental design for Studies 3a and 3b. In Study 3a, all participants were recruited at the northwest corner of Danforth Avenue and Woodbine Avenue (a) as they waited to cross the intersection and continue east. This location is approximately equidistant from two separate Shoppers Drug Mart locations. Participants were asked to estimate how many minutes had elapsed since a patron of the store toward or away from which they were oriented had found a sale price on a desired item. In Study 3b, half of the participants were recruited at the northwest corner of Robson Street and Bute Street as they waited to cross the intersection and continue southeast (b; black arrow), and half were recruited at the northeast corner of the same intersection as they waited to cross the intersection and continue northwest (gray arrow). This location is approximately equidistant from two separate Starbucks locations. Participants were asked to think about one Starbucks location or the other. They were then asked to estimate how many minutes had elapsed since a patron of the indicated Starbucks had received an incorrect drink order.

Street (n = 42). Conditions were assigned randomly. We altered the design used in Experiment 3a by adding a second experimental factor: The researcher approached people (at random) who were walking in either direction (i.e., toward Jervis or toward Thurlow) rather than only people headed to the southeast. Participants were asked to estimate how many minutes had elapsed since a patron of the indicated Starbucks had received an incorrect drink order.

Results. Study 3b had a 2 (orientation: toward, away) × 2 (target: Starbucks at Jervis, Starbucks at Thurlow) design. The overall ANOVA revealed no effect of target (i.e., the particular Starbucks), $F < 1$, but did reveal a significant effect of orientation, $F(1, 82) = 6.86$, $p = .011$, $\eta_p^2 = .08$. Specifically, having a drink order prepared incorrectly was estimated to have happened more recently at the Starbucks toward which participants were oriented (M = 14.36 min, SD = 11.99) than at the other Starbucks (M = 25.43 min, SD = 25.78). We observed no interaction, $p > .18$, which suggests that this effect was not due to orientation causing one particular Starbucks to be judged as having lower quality than the other. Instead, spatial orientation seemed to influence whether events situated at any location were perceived as occurring closer or farther away in time.

Study 4

Method

The probability of an event can range from being very close (i.e., completely or nearly certain) to very far (i.e., very unlikely or improbable; Todorov, Goren, & Trope,

2007; Wakslak, Trope, Liberman, & Alony, 2006). Accordingly, when a location feels physically closer, an event at that location should feel more likely to occur. To test this relationship, we asked participants in Study 4 to estimate the likelihood that someone (not the participant) would win a lottery when participants were oriented toward or away from the location of the lottery drawing.

Fifty volunteers were recruited at the Bloor-Yonge subway station in Toronto, Ontario, Canada, for a study ostensibly related to perception of lotteries. We informed participants that

> The Ontario Lottery and Gaming Corporation (OLG) offers a number of different lotto games. In the LOTTARIO game, people choose six numbers from 1 to 45. To win the jackpot, one has to correctly pick all 6 of the numbers that come up in the LOTTARIO drawing. The LOTTARIO drawing takes place once per week at the OLG Toronto Prize Centre at Yonge and Dundas, 1.7 kilometres (1.1 miles) to the south of this station.

People were recruited at either the southbound platform (toward the location of the lottery drawing; $n = 25$) or the northbound platform (away from the location of the lottery drawing; $n = 25$). All participants estimated the likelihood that someone would win the jackpot in the next LOTTARIO drawing, using a scale from 1 (*not at all likely*) to 7 (*very likely*). In addition, participants rated their general familiarity with the OLG on a scale from 1 (*not at all familiar*) to 7 (*very familiar*).

Results

The likelihood that someone would win the next LOTTARIO drawing was estimated as higher by participants oriented toward the location of the drawing ($M = 4.00$, $SD = 1.73$) than by participants oriented away from the location of the drawing ($M = 2.80$, $SD = 1.71$), $F(1, 48) = 6.09$, $p = .017$, $\eta_p^2 = .11$. Greater familiarity with the OLG was associated with lower likelihood estimates, $r = -.343$, $p = .02$, but familiarity did not vary with orientation, $p > .80$, and orientation remained a significant predictor of likelihood in an analysis of covariance that included familiarity, $p = .009$. This suggests that spatial orientation exerted a unique effect on estimates of the likelihood that someone would win the lottery.

Study 5

Method

Social distance, the fourth and final dimension of psychological distance, has taken many forms. It can be conceptualized in terms of interpersonal power (Smith & Trope, 2006) or defined along a continuum of interpersonal similarity (Liviatan, Trope, & Liberman, 2008). In Study 5, we adopted the latter approach, predicting that when someone is spatially oriented toward another person, he or she will view that person as more similar, and when someone is spatially oriented away from another person, he or she will view that person as less similar.

Forty-five volunteers were recruited at the Eaton Centre shopping mall in Toronto, Ontario, Canada, for a study ostensibly related to feelings of social closeness. All participants were asked to think about a traveler at the Los Angeles airport. Participants were told that the traveler was either departing for a trip to Chicago (i.e., oriented toward participants; $n = 22$) or arriving from a trip to Chicago (i.e., oriented away from participants; $n = 23$). Conditions were assigned randomly. We used this design to imply that the traveler resided in Los Angeles, thereby holding objective spatial distance constant across the conditions and also holding constant any potential contribution of the traveler's home city to social closeness or distance. Participants were asked to indicate how similar they felt to the traveler, using a scale from 1 (*not at all similar*) to 7 (*very similar*).

Results

Participants felt that the traveler was more similar to them when the traveler was spatially oriented toward them ($M = 2.41$, $SD = 1.59$) than when the traveler was oriented away from them ($M = 1.61$, $SD = 1.03$), $F(1, 43) = 4.03$, $p = .051$, $\eta_p^2 = .09$. In addition to extending our scope to the final dimension of distance, this study further suggests that the effect of spatial orientation on feelings of closeness does not depend solely on the judge's orientation. That is, we examined the opposite case, in which the target of judgment was oriented toward or away from the static judge, and found a similar pattern of results.

General Discussion

Feelings of closeness arise as a function of both spatial distance and spatial orientation: Spatial orientation toward (vs. away from) something or someone gives rise to feelings of shorter spatial distance (Studies 1 and 2), shorter temporal distance (Study 3), smaller probabilistic distance (Study 4), and smaller social distance (Study 5). We observed a larger effect in the first study than in the later studies, which suggests that although feelings of closeness may generalize across different dimensions of distance, these feelings are perhaps strongest in the domain from which they originate (here, physical space). These studies thus add to a growing literature on the dynamics by which people, places, and

time move in psychological space (Caruso et al., 2013; Pettit et al., 2013).

Our findings raise new questions regarding how objective distance translates to subjective feelings of distance. The results from Study 3b counter a strictly motivational account by showing that orientation can make even negative events feel closer in time, but future work might explore the interaction of orientation, valence, and perceptions of psychological proximity. For example, if valence and orientation both affect perceptions of distance, might manipulating orientation change the quality of subjective experience of highly valenced events? Likewise, in Study 5, we manipulated the orientation of the target of judgment (rather than the orientation of the judge) and found the same pattern of results. This suggests that our findings do not depend solely on self-orientation, which might be evidence against an embodied-cognition interpretation of our findings (e.g., Labroo & Nielsen, 2010).

Rooted in theorizing on psychological distance, our findings should hold true only for egocentric distance judgments anchored on the experience of the self in the here and now (Trope & Liberman, 2010). Thus, people oriented eastward feel closer to locations east of themselves, and the opposite holds true for people oriented westward, but a person who happens to stumble onto a subway platform with no expectation of hopping aboard any train should feel equally far from westward and eastward locations. However, such a person should feel closer to passengers aboard a train headed toward his or her station than to people cruising in the opposite direction.

Our studies invite future research on the nature of orientation. For example, whether spatial orientation differs from other kinds of orientation (i.e., whether the psychological meaning of spatial orientation is derived from distance or is independent of distance) remains an open question. For example, our results may suggest a type of momentum in which moving objects in a mental simulation are thought to continue on a spatial course. Extending this idea of momentum, recent research has provided evidence of psychological momentum (i.e., momentum that occurs in settings that do not require a spatial dimension), such as the optimism that accompanies "being on a roll" (Markman & Guenther, 2007). Although this evidence suggests that movement through space captures but one instantiation of a broader orientation phenomenon, further empirical work is needed to resolve this issue fully.

For example, because directions can correspond to both spatial and nonspatial types of distance, future research might investigate other kinds of orientation that may or may not be related to (spatial) distance—such as the orientation created when the probability of an event is revised in an upward or downward direction. Research on psychological momentum might test this idea by searching for a phenomenon analogous to physical momentum—that is, an expectation that something subject to orientation will continue on its course, such as when people move in a positive or negative direction, or they move in the wrong direction (i.e., in an awkward direction). Along these lines, when we asked participants in our studies about their felt closeness to whichever location we specified, we may have inadvertently generated an interruption that weakened their momentum and thereby the degree of closeness they felt. Future research will likely benefit from extending investigations of momentum and orientation into a context that examines psychological distance.

Physical space stands alone as the only dimension of psychological distance that can be directly, physically experienced (according to Boroditsky, 2000), and this opens the door to new possibilities for the investigation of spatial orientation. For example, time passes at a constant rate, but the rate at which people move through space can vary dramatically. This insight might allow for consideration of velocity as a separable component in how trajectories shape feelings of closeness: Would a jogger headed downtown and stopped at a stoplight feel spatially closer to downtown than someone walking there but spatially farther from downtown than someone riding a bus there—even if all three were stopped at the same intersection and headed in the same direction? Answers to these and related questions would illuminate not only how people navigate spaces and perceive distances, but also the cognitive and behavioral consequences that arise from psychologically shrinking or expanding the physical space between oneself and the world at large.

Author Contributions

S. J. Maglio developed the study concept, which was refined by E. Polman. Both authors contributed to the study design. S. J. Maglio collected the data, and both authors analyzed and interpreted the data. Both authors drafted the manuscript and approved the final version of the manuscript for submission.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Open Practices

All data and materials have been made publicly available via the Open Science Framework and can be accessed at https://osf.io/7rajd/. The complete Open Practices Disclosure for this article can be found at http://pss.sagepub.com/content/by/supplemental-data. This article has received badges for Open Data and Open Materials. More information about the Open Practices badges can be found at https://osf.io/tvyxz/wiki/view/ and http://pss.sagepub.com/content/25/1/3.full.

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