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Original Article

Psychological Distance Cues in Online Messages

Interrelatedness of Probability and Spatial Distance

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Abstract: Growing evidence reveals that people rely on heuristic cues when processing online information. The current research, by adopting a construal level theory approach, examined whether psychological distance cues within online messages influence message processing. According to construal level theory, spatial and hypothetical distances (i.e., probabilities, likelihoods) share an association based on psychological distance. Construal level literature suggests that people overgeneralize this association and attribute unlikely events to distant places and likely events to close-by places. The current research provides a novel test of this relationship in an online communication setting. In two within-subjects experiments (Studies 1 and 2), we presented participants tweets depicting likely and unlikely events, and measured whether they attribute them to spatially close or far sources. Confirming our predictions, participants utilized the psychological distance cues and attributed the likely tweets to spatially close and the unlikely tweets to spatially far sources. In two follow-up experiments, we tested the same relationship by employing between-subjects designs. In Study 3 where participants saw one spatial distance and both likely and unlikely tweets, participants formed the same association albeit less strongly and attributed the unlikely tweets to spatially distant sources. In Study 4, where participants saw two spatial distances and only one tweet, the expected association was not formed. Findings suggest that comparison of likelihood information is necessary to form an association between source location and tweet likelihood. The implications of psychological distance and a construal level theory approach are discussed in the context of online heuristics and persuasion.

Keywords: psychological distance, construal level theory, online heuristics, spatial distance, probability

Over the past decade, the Internet has become one of the main information sources that people rely on for both the relatively trivial (e.g., restaurant choices) and the more consequential choices (e.g., health; Flanagin & Metzger, 2001; Purcell, Brenner, & Rainie, 2012). As reliance on the Internet grows, it becomes critical to understand how online information is processed. Growing evidence reveals that people tend to process online information in fast, intuitive, and effortless ways by resorting to heuristic strategies (Hilligoss & Rieh, 2008; Metzger & Flanagin, 2013; Sundar, 2008). Given the prevalence of low-quality information on the Internet (Eysenbach, Powell, Kuss, & Sa, 2002) and the potential negative consequences of relying on low-quality information (Kata, 2010; Zubiaga & Ji, 2014), it becomes highly relevant to identify the precise heuristic processes users utilize when evaluating online information.

The present paper extends the growing research on online cognitive heuristics by examining the processing of *psychological distance* cues embedded in the content of online messages. According to construal level theory (CLT; Trope & Liberman, 2003, 2010), psychological distance cues convey information about locations (spatial distance), time (temporal distance), people (social distance), and probabilities (hypothetical distance) of events. CLT argues that these four dimensions share a common meaning because they define the psychological distance of stimuli from the self, and therefore are also cognitively associated (Bar-Anan, Liberman, Trope, & Algom, 2007). This association is often overgeneralized and may be utilized in heuristic evaluation of information. For instance, under uncertainty, people tend to extrapolate unknown dimensions (e.g., temporal distance) based on the known distances of other dimensions (e.g., spatial distance; Wakslak, 2012). People also find scenarios to be truer when they include congruent psychological distance information across the four dimensions (Wright et al., 2012).

The present approach builds on the assumption that online messages, like other messages, commonly convey psychological distance cues such as locations, time, social actors, and probabilities. CLT offers a systematic way of investigating how the relationship between these cues can influence the overall interpretation of an online message. In the current study, by adapting previous CLT research (Wakslak, 2012; Study 1) to an online context, we examine

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whether information about different psychological distance dimensions interacts and influences the evaluation of tweets. Specifically, we focus on the relationship between event probabilities (i.e., hypothetical distance) and event locations (i.e., spatial distance) as depicted in tweets by examining how close or how far people expect likely and unlikely events to occur.

Psychological Distance

In CLT, psychological distance refers to the subjective distance that stimuli (e.g., events, objects, people, and situations) maintain from the center of people's direct experience (Liberman, Trope, & Stephan, 2007). People's direct experiences are centered on the *here* and *now*, with their *selves* and *reality* (Bar-Anan, Liberman, & Trope, 2006). Things that are spatially, temporally, socially, or hypothetically (i.e., hypothetical as opposed to being real) removed from this center of experience are said to be psychologically distant (Trope & Liberman, 2010). Psychological distance is suggested to play a fundamental role in guiding cognitive processing because it systematically influences how stimuli are mentally represented or construed (Bar-Anan, Liberman, Trope, & Algom, 2007; Liberman & Trope, 2008; Trope & Liberman, 2010). According to CLT, psychologically close stimuli are represented concretely and in detail while psychologically distant stimuli are represented abstractly. The association between construal level and psychological distance has been used to explain various cognitive and behavioral outcomes in areas like visual perception, memory, categorization, probability estimates, marketing, and consumer behavior (for reviews, see Soderberg, Callahan, Kochersberger, Amit, & Ledgerwood, 2014; Trope & Liberman, 2010). CLT is gaining recognition in communication science as well (e.g., de Bruijn, & Budding, 2016; Ellithorpe, Brookes, & Ewoldsen, 2016; Katz & Byrne, 2013; Kim, Sung, Lee, Choi & Sung, 2016; Lee, 2017; Lutchyn & Yzer, 2011; Nan, 2007).

Interrelatedness of Psychological Distance Dimensions

Spatial, temporal, social, and hypothetical distances mark different ways that stimuli can be distant from an observer's direct experience (Bar-Anan et al., 2007). Therefore, CLT asserts that these dimensions share an underlying meaning based on psychological distance (Liberman et al., 2007). As a consequence, spatial, temporal, social, and hypothetical distances become cognitively associated. Psychological distance of a stimulus on one dimension can act as a cue about its distance on another dimension (Trope & Liberman, 2010). Examples of this can be observed in our daily language through metaphors we use like *distant future* or *close friend* (Lakoff & Johnson, 1999). It is also not a coincidence that stories, and especially ones that employ very unlikely or hypothetical events (i.e., fairy tales or science fiction), usually take place *in a distant future* or a *long time ago* in *a land or galaxy far away* (Trope & Liberman, 2010).

The cognitive association between psychological distance dimensions was demonstrated empirically by Bar-Anan and colleagues (2007), with a picture–word version of the Stroop task (Stroop, 1935). They presented words cueing psychological distance such as *tomorrow*, *we*, *sure* (i.e., low psychological distance) and *year*, *others*, *maybe* (i.e., high psychological distance) on spatially close or distant locations of landscape photographs. Results showed that participants were faster to report the locations of the words (Experiments 3–6) and recognize the words (Experiments 9–13) when meaning of the words and spatial locations were distance-congruent (e.g., when the word *we* appeared nearby). Other studies showed that this distance-congruence effect influences outcomes such as the effectiveness of recommendations (Zhao & Xie, 2011), language use (Stephan, Liberman, & Trope, 2010), truth (Wright et al., 2012), and probability judgments (Wakslak, 2012).

A series of experiments by Wakslak (2012) specifically tested the interrelatedness of hypotheticality and spatial and temporal distances. The hypotheticality dimension of psychological distance encompasses a continuum between what is *real* and what is *hypothetical*. As the probability of an event increases, it becomes closer to being real, whereas low probabilities are indicative of hypothetical situations. Wakslak (2012) showed that people extrapolate hypotheticality information by relying on the available psychological distance information marked by spatial and temporal distances. Consistent with CLT, people expected improbable events (i.e., high hypotheticality) to occur further away in time and space compared with probable events (i.e., low hypotheticality). For instance, she found that people expected to receive an uncommon hand in a poker game in the later rounds of the game (i.e., far temporal distance) while expecting to receive a common hand in the earlier rounds (i.e., close temporal distance). Similarly, people were willing to bet more on an underdog if a boxing match took place in a spatially distant (vs. a near) venue while preferring to bet more on a favorite in a spatially close (vs. a distant) boxing venue (Wakslak, 2012). These findings empirically showed that probability is a psychological distance dimension and people's assessment of probability is automatically influenced by information about other psychological distance dimensions.

Interrelatedness of Psychological Distance Dimensions in Online Contexts

While previous research demonstrated the association between psychological distance dimensions in offline contexts (Bar-Anan et al., 2007; Wakslak, 2012, Wright et al., 2012), this association has not been fully explored in relation to online communication contexts. It is important to test whether this association holds in online contexts for at least three reasons. First, because online contexts permit different and more confounded associations between psychological distance dimensions compared with the offline contexts (Backstrom, Sun, & Marlow, 2010; Katz & Byrne, 2013; Norman, Tjomsland, & Huegel, 2016). While people's usual experiences are shaped within consistent psychological distance dimensions such as *here and now* or *not here and not now*, within online communication people more often experience inconsistent distance dimensions. For instance, video-conferencing technologies enable people to interact in real time with spatially distant others (i.e., now but not here). Similarly, one can choose to give a delayed response to an e-mail of a colleague who is sitting just next door (i.e., here but not now; Norman et al., 2016). Closely related to this *dissociation* of the dimensions is the issue that specific dimensions, particularly spatial distance, may have different implications in online contexts. For instance, according to CLT, close spatial distances should imply close social distances; however, whether this assumption holds in online contexts is debated (Cumiskey, 2011; Guadagno, Muscanell, Rice, & Roberts, 2013; Kaltenbrunner et al., 2012; Lim, Cha, Park, Lee & Kim, 2012; Norman et al., 2016). While according to some research, spatial distance can imply high social distance (Lim et al., 2012), other works show that spatial distance does not lead to increased social distances (Kaltenbrunner et al., 2012). Similarly, some offline principles relating to social distance also have been shown to differ in online contexts owing to the different nature of social cues (Guadagno et al., 2013). According to CLT, the repeated experiencing of dimensions with congruent distances results in their association, which may be even overgeneralized to different situations. However, it is unclear how increased experiences of incongruent psychological distance dimensions, as may occur online, will influence their association and their consequences.

A second reason why investigating the psychological distance dimensions in online contexts matters is due to the unique psychological distance cues provided by online communication technologies. Geo-logging applications (e.g., Foursquare) and social networking sites (e.g., Facebook, Twitter) provide ample spatial, temporal, social, and hypothetical distance cues that people do not have access to in offline contexts (Kaltenbrunner, et al., 2012; Katz & Byrne, 2013; Norman et al., 2016). For example, people now receive constant updates on where and when their friends or others are present as well as various social cues that define their social distance toward each other.

A third reason is the role heuristic and associative processes play in online information processing. Characteristics of the Internet like vastness of information, lack of quality standards, and source anonymity have been shown to instigate the reliance on heuristics (Danielson, 2006; Eysenbach, 2008; Flanagin & Metzger, 2008; Metzger, Flanagin, & Zwarun, 2003; Metzger, Flanagin, & Medders, 2010; Sundar, Knobloch-Westerwick, & Hastall, 2007). However, while conserving time and energy, heuristics and associative processes have also been linked to systematic biases and errors in judgments (Tversky & Kahneman, 1975). Given that people rely on the Internet for important decisions (Fox & Rainie, 2002; Horrigan, 2008), it becomes highly relevant to understand the factors that influence these decisions. While the influence of heuristics on information processing in offline contexts has received much research attention (Gigerenzer & Gaissmaier, 2011), less attention has been paid to how heuristics operate in online contexts. Initial research already identified and suggested important heuristic strategies that users apply to judge the qualities of online information such as accuracy and believability. For example, heuristic strategies were identified based on technological features (e.g., the MAIN model; Sundar 2008) and characteristics of information sources or social interactions (Metzger et al., 2010; Metzger & Flanagin, 2013). The present approach adds to this literature by focusing on the information conveyed in online message content and investigating how the association between psychological distance information may intuitively affect the processing of online messages.

The Present Research: Interrelatedness Between Probabilities and Spatial Distance in Tweets

Online communication contexts commonly contain psychological distance cues about spatial locations, social actors, time, and probabilities (Kaltenbrunner et al., 2012; Katz & Byrne, 2013; Norman et al., 2016). These cues may guide heuristic processing of online content. Following the assertion of CLT that they are cognitively associated, psychological distance cued on one dimension may trigger implicit tendencies in users about what distance to expect on other dimensions (Bar-Anan et al., 2007; Liberman et al., 2007; Wakslak, 2012). Consistent with this idea, the present research focuses on the relationship between two dimensions and examines whether information about hypothetical distance (i.e., probabilities) and spatial distance influences processing of online messages. In four studies, following an offline CLT paradigm (Wakslak, 2012; Study 1), we examine how people construe online messages given the information about spatial distance and probability.

Based on CLT, we expect people to construct messages in a distance-congruent way. More specifically, we expect people to associate an unlikely event with a spatially far distance and a likely event with a spatially close distance as presented in tweets (Hypothesis 1).

In addition to directly measuring the cognitive association between dimensions, we investigate the level of surprise people experience when they encounter distance-congruent versus distance-incongruent tweets. According to the surprise literature, surprise is an emotional and cognitive state that can be explained by the characteristics of the surprise-eliciting situations (i.e., low probabilities and unexpected outcomes) as well as by a process of sense-making (Kahneman & Miller, 1986; Maguire, Maguire, & Keane, 2011; Reisenzein, 2000). According to the *metacognitive explanation-based* (MEB) theory of surprise, people tend to experience common situations that they can smoothly comprehend. However, when an unusual situation occurs, people will try to explain this situation to make sense of it. MEB suggests that situations become surprising to the extent that they are difficult to explain (Foster & Keane, 2015). The level of surprise is thus seen as a reflection of the metacognitive sense of difficulty or effort that is experienced during the sense-making process (Foster & Keane, 2015). According to CLT, distance-congruent situations are more in line with people's direct experiences than distance-incongruent ones, presumably leading to less effortful, more fluent processing. For instance, people usually experience *actual* situations (i.e., high probabilities) and not *hypothetical* situations (i.e., low probabilities) in the *here* (low spatial distance). Based on the MEB theory of surprise (Foster & Keane, 2015), because distance-incongruent situations are more atypical than distance-congruent ones, people should find them more difficult to explain, resulting in higher levels of surprise when processing distance-incongruent events. Therefore, we expect people to report more surprise for tweets involving distance-incongruent information than for tweets with distance-congruent information (Hypothesis 2).

Study 1

Method

Participants

In all, 68 participants completed the experiment via an online survey on MTurk in return for $0.40. Participants were limited to MTurk users residing in the United States. Data from 59 participants were used in the final analysis (24 women, 35 men; M_{age} = 34.6 years and SD_{age} = 12.14). From the initial 68 participants, six were removed because they gave an incorrect response to a control question implemented to check whether participants were paying attention ("Please select Option 2 on this question to show that you are paying attention"). Three participants were removed for the unrealistic time spent reading the presented tweets. All inclusion criteria were set prior to data collection.

Materials, Measures and Procedure

Study 1 applied a one-factorial (psychological distance information in tweet: consistently matched vs. inconsistently matched) within-subjects design. Participants read a short introduction scenario and then saw two tweets on their screen. The topic of the introduction scenario was adopted from the East Coast/West Coast cats study of Wakslak (2012; Study 1). The introduction scenario informed participants that two of their friends took their cat to the veterinary. Participants did not receive any further information about the friends, except that one friend lived 3 miles and the other 3,000 miles away. To vary hypotheticality, participants were informed that cats could have either protein X or protein Y in their blood and having these proteins was either highly likely (85%) or unlikely (15%). Having either of these proteins was not presented to be good or bad, only that knowing the protein type would be useful for prescriptions.

After this short introductory scenario, participants saw two tweets presumably sent by the two friends without any indication of who sent each tweet. One tweet displayed the likely outcome: "I took my cat to the vet. It turns out my cat has protein X (like 85% of cats)," while the other displayed the unlikely outcome: "I took my cat to the vet. It turns out my cat has protein Y (like 15% of cats)" (see Figure 1). The name of the proteins and their likelihoods were counterbalanced (cf. Wakslak, 2012); in half of the cases the likely protein was called protein X and the unlikely one protein Y, while for the other half this was reversed.

Participants were randomly assigned to one of the two counterbalanced versions of the scenario and tweets. Next, participants received four pairs of questions. In the first pair of questions, participants had to choose which of the two presented tweets they thought belonged to the friend living close by or far away. Second, for each tweet, participants had to indicate on a continuous 7-point scale who they thought the sender of each tweet was (1 = *rather the friend living close by*, 7 = *rather the friend living far away*). In the third and fourth pair of questions, participants had to judge, on a continuous measure for each of the two tweets separately, how surprised they would be if the tweet belonged to (a) the friend living close by and (b) the friend living far away (1 = *not at all surprised*, 7 = *very much surprised*).

Following the original paradigm, participants also received recall questions about the scenario, questions

Figure 1. The likely and unlikely outcome tweets from Study 1. In the counterbalance condition the likelihoods for X and Y proteins were reversed (X = 15%, Y = 85%).

regarding mood, familiarity with Twitter and cats, and demographics after completing the four main measures. Finally, we asked participants to indicate what they thought the study was about to check awareness of our hypotheses. Upon completion of all questions, participants received a debriefing message about the aim of the study. On average the experiment took about 10 min to complete.

Results

Distance Matching

We first analyzed the responses to the forced-choice questions (i.e., "Which tweet do you think belongs to your friend living close by/far away?") with binary logistic regressions using counterbalancing as a predictor. Counterbalancing was not a significant predictor of participants' tweet choices (see Table 1). Next we conducted chi-square tests to assess the distribution of participants' responses. We found that 63% of the participants chose the high-probability tweet (37% the low-probability tweet) for their friend living close by, $\chi^2(1) = 3.81$, $p = .051$. For the far friend, this pattern was reversed with 61% of the participants choosing the low-probability tweet (39% the high-probability tweet), $\chi^2(1) = 2.86$, $p = .091$. Whereas this pattern followed the hypothesized direction, with most of the participants choosing the high-probability tweet for the close friend and the low-probability tweet for the far friend, the distributions were not significantly different.

Participants' responses to the second pair of questions (i.e., "Who do you think this tweet belongs to?") were analyzed in a repeated measures ANOVA with counterbalancing as the between-subjects factor and the likelihood of the tweet as the within-subjects factor. The main effect of likelihood of the tweet was not significant, $F(1, 57) = 2.28$, $p = .137$. The effect of counterbalancing was also not significant, $F(1, 57) = .98$, $p = .327$. However, there was a significant interaction between the likelihood of the tweet and counterbalancing, $F(1, 57) = 4.95$, $p = .03$, $\eta^2_G = .080$. Simple effects analyses showed that participants in the first counterbalancing group (Group 1: X = 85%, Y = 15%) associated the likely tweet with the spatially close friend (M = 3.1, SD = 1.86) and the unlikely tweet with the spatially distant friend (M = 4.9, SD = 1.88), $p = .01$, Bonferroni

Table 1. Study 1: Logistic regressions for the tweet choices predicted by counterbalancing

		95% CI for *OR*		
	B (*SE*)	Lower	*OR*	Upper
Question 1: Spatially close				
Included				
Constant	.07 (.37)			
Counterbalancing	.94 (.56)	.86	2.57	7.61
Question 2: Spatially far				
Included				
Constant	−.21 (.37)			
Counterbalancing	−.49 (.54)	.21	.81	1.77

Note. Question 1: R^2 = .04 (Hosmer & Lemeshow), .05 (Cox & Snell), .07 (Nagelkerke). Model $\chi^2(1) = 2.97$, $p = .085$. Question 2: R^2 = .01 (Hosmer & Lemeshow), .01 (Cox & Snell), .02 (Nagelkerke). Model $\chi^2(1) = .82$, $p = .365$.

corrected, Cohen's $d_z = .48$. However, participants in the second counterbalancing group (Group 2: X = 15%, Y = 85%) did not show the expected association (M_{likely} = 4.07, SD_{likely} = 1.93 vs. M_{unlikely} = 3.72, SD_{unlikely} = 1.91), $p = .618$, Bonferroni corrected.

Surprise

Surprise questions were analyzed with a repeated measures ANOVA with spatial distance of the source and likelihood as within-subjects and the counterbalancing as between-subjects factor. There was no significant main effect of counterbalancing, $F(1, 57) = .191$, $p = .664$. Counterbalancing also did not interact with any of the other variables. The main effect of spatial distance was not significant, $F(1, 57) = .112$, $p = .74$. Although likely outcomes tended to be less surprising than unlikely outcomes, the main effect of likelihood was not significant, $F(1, 57) = 3.35$, $p = .073$. However, as expected, we observed a significant interaction between spatial distance and likelihood, $F(1, 57) = 9.41$, $p = .003$, $\eta^2_G = .06$.

Participants found it more surprising when the likely tweet was sent by the spatially distant friend (M = 3.24, SD = 2.02) compared with the spatially close friend (M = 2.36, SD = 1.45), $p = .006$, Bonferroni corrected, Cohen's $d_z = .37$ (see Figure 2). Similarly, participants reported more surprise when the tweet with the unlikely outcome was sent by the spatially close friend (M = 3.61, SD = 1.97) than the

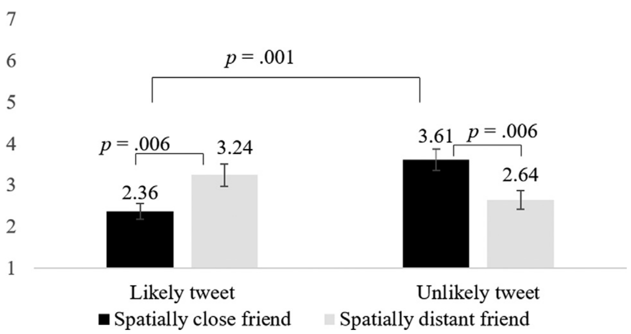

Figure 2. Surprise ratings as a function of the spatial distance of the source and the likelihood of the tweets in Study 1.

spatially far friend (M = 2.64, SD = 1.71), p = .006, Bonferroni corrected, Cohen's d_z = .37 Additional simple effects comparing the effect of likelihood showed that participants found it more surprising if the spatially close friend sent the unlikely tweet (M = 3.61, SD = 1.97) compared with the likely tweet (M = 2.36, SD = 1.45), p = .001, Bonferroni corrected, Cohen's d_z = .48. There was no significant difference of surprise for the spatially distant friend sending the likely (M = 3.24, SD = 2.02) and the unlikely tweet (M = 2.64, SD = 1.71), p = .107, Bonferroni corrected, Cohen's d_z = .22.

Control Variables

Participants' mood, familiarity with Twitter, and thoughts regarding the aim of the study did not influence the observed pattern of results. Correlational analyses between control and dependent variables revealed a significant correlation between participants' "familiarity with cats" and reported surprise when encountering that the "tweet with the likely outcome belongs to the friend living far away" (r = .28, p < .05). In an additional analysis, familiarity with cats was therefore entered as a covariate in a repeated measures ANOVA comparing participants' surprise about the tweet with the likely outcome if sent by a spatially close or distant source. This ANOVA yielded a main effect of spatial distance on surprise, $F(1, 57) = 8.59$, $p = .005$, $\eta^2_p = .13$, but no main effect of familiarity with cats on surprise, $F(1, 57) = 2.15$, p = .148. However, there was a significant interaction between familiarity with cats and spatial distance, $F(1, 57) = 4.52$, p = .038, $\eta^2_p = .07$. This interaction effect was further investigated among participants with high (+1 SD) and low familiarity (−1 SD) with cats. Spatial distance had a significant effect on surprise among participants with high familiarity with cats, $F(1, 57) = 12.76$, p = .001, η^2_p = .18, Bonferroni corrected. Participants who reported to have higher familiarity with cats were more surprised if the tweet was sent by a spatially distant (M = 3.81, SE = .36) than a close source (M = 2.28, SE = .27). By contrast, participants who reported being less familiar with cats were not more surprised if the source was spatially far or close, $F(1, 57) = .31$, p = .581, Bonferroni corrected.

Discussion of Study 1

The present results provide initial evidence for a distance-congruence effect in online messages. Results based on the applied forced-choice measures suggest that participants constructed tweets in a distance-congruent manner. However, the continuous measures revealed the same effect only for one of the two counterbalanced groups (i.e., Group 1 in which protein X was introduced as very likely, 85%, and protein Y as unlikely, 15% – as opposed to Group 2, X = 15%, Y = 85%). Why did the way proteins were introduced affect results? It could be that, when comparing events or describing compositions, reporting the lesser percentage first and the higher percentage later (X = 15% and Y = 85%) is less common than reporting the majority first and the remaining amount later (X = 85% and Y = 15%). In that case, a less intuitive presentation style in Group 2 might have diminished the distance-congruence effect. Overall we conclude that the results of the two questions were in line with H1, but only provide tentative evidence.

Study 1 also demonstrated that participants judged tweets depicting distance-incongruent information as more surprising than tweets involving distance-congruent information. Specifically, participants found it less surprising when a likely event occurred nearby (vs. far away) and an unlikely event occurred far away (vs. nearby). These findings confirm H2. We also found that participants more familiar with cats showed more surprise regarding distance-incongruent tweets. While experts have been shown to be less susceptible to construal level effects (Kim, Rao, & Lee, 2009), in the present case increased familiarity might have led to higher surprise for the distance-incongruent outcome as this poses an even stronger deviation from the familiar experience[1].

Overall, findings of the first study are in line with the previous literature on CLT and tentatively suggest that the distance-congruence effect also underlies processing of online messages. Based on psychological distance cues, online messages can appear to be consistent or inconsistent. The results of Study 1 provide initial support that participants are influenced by this consistency of psychological distance information when forming expectations and judging online messages. Accordingly, interrelatedness of psychological distance cues in online messages might be considered a

[1] This effect was not observed in the other three studies presented in this paper.

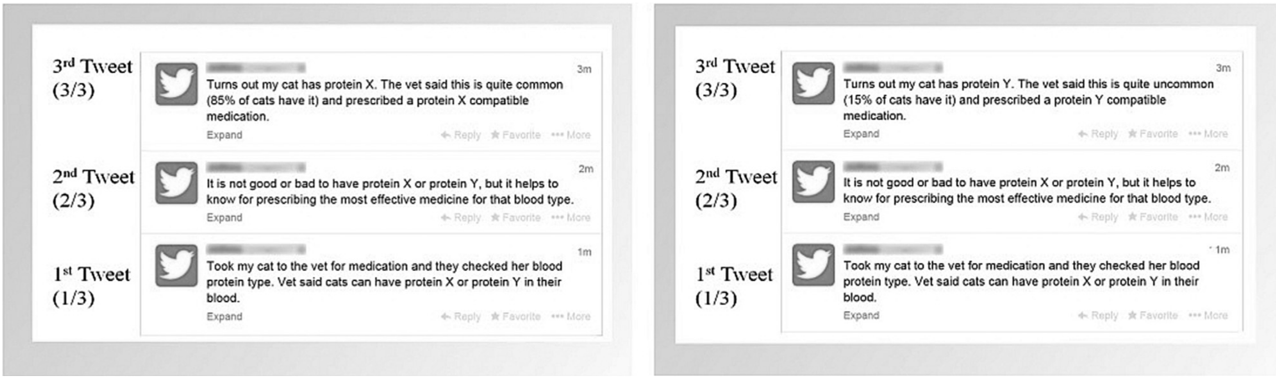

Figure 3. The likely and unlikely outcome tweets from Study 2. In the counterbalance condition the likelihoods for the X and Y proteins were reversed (X = 15%, Y = 85%).

heuristic strategy that online users can utilize. Nevertheless, to gain further trust in these initial findings and our hypotheses, we sought to conceptually replicate Study 1.

Study 2

In line with increasingly louder calls to replicate findings (Pashler & Wagenmakers, 2012), we conducted a second study to test the robustness of the effects observed in Study 1. In this second study we also decided to slightly improve external validity by improving the presentation of the stimuli (see Figure 3). Instead of presenting the scenario in a separate text, we presented it in the form of consecutive tweets, concluding with the same tweets used in Study 1.

Method

Participants

In all, 69 participants completed the experiment with a similar design to Study 1 via an online survey on MTurk in return for $0.40. Participants were limited to MTurk users residing in the United States. Similar to Study 1, following the pre-set inclusion criteria, participants who failed to respond correctly to the attention control question (five participants) and participants who did not fulfill the reading duration criteria (seven participants) were removed from the data set. In addition, by controlling for the MTurk worker IDs we tried to make sure that people who already joined Study 1 did not join Study 2. A total of 57 participants were included in the data analyses (13 women, 44 men; M_{age} = 31.4 years and SD_{age} = 10.5).

Materials, Measures and Procedure

As in Study 1, we employed a within-subjects design. The content of the scenario was identical to Study 1. However, this time the scenario was not presented as a separate introduction text but was presented within the content of three tweets (see Figure 3). The only information that was not included in tweets was that the tweets belonged to two friends living 3 miles or 3,000 miles away (no further information was provided about the friends). Similar to Study 1, the name of the protein and the likelihoods were counterbalanced. The measures and procedure were identical to Study 1.

Results

Distance Matching

As in Study 1, we first examined the responses to the forced-choice questions with binary logistic regression tests including counterbalancing as predictor. Results showed that counterbalancing was not a significant predictor of the tweet choice in either question (i.e., regarding the spatially close and the far friends; see Table 2). Next we examined participants' tweet choices with chi-square tests. Results showed that, as hypothesized, most of the participants (77.2%) thought that the likely event occurred spatially close, $\chi^2(1) = 16.86$, $p < .001$. Similarly, the majority of the participants (73.7%) thought that the unlikely outcome occurred spatially far away, $\chi^2(1) = 12.79$, $p < .001$.

Similar results were observed for the continuous measure. A repeated-measures ANOVA with the likelihood of the tweet as the within-subjects and the counterbalancing as the between-subjects factor revealed a significant effect of likelihood, $F(1, 55) = 12.5$, $p = .001$, $\eta^2_G = .18$. Participants believed that the tweet with the likely outcome was more likely to be sent by the friend living close by (M = 3.16, SD = 1.71) than the tweet entailing the unlikely outcome (M = 4.82, SD = 1.73). Counterbalancing did not have a significant main effect, $F(1, 55) = 1.08$, $p = .302$, and did not interact with likelihood, $F(1, 55) = .83$, $p = .367$. These findings provided additional support for H1.

Table 2. Study 2: Logistic regressions for the tweet choices predicted by counterbalancing

		95% CI for *OR*		
	B (*SE*)	Lower	*OR*	Upper
Question 1: Spatially close				
Included				
Constant	.75 (.43)			
Counterbalancing	.93 (.65)	.71	2.54	9.06
Question 2: Spatially far				
Included				
Constant	−.75 (.43)			
Counterbalancing	−.52 (.61)	.18	.6	1.95

Note. Question 1: R^2 = .04 (Hosmer & Lemeshow), .04 (Cox & Snell), .06 (Nagelkerke). Model $\chi^2(1)$ = 2.13, p = .144. Question 2: R^2 = .01 (Hosmer & Lemeshow), .01 (Cox & Snell), .02 (Nagelkerke). Model $\chi^2(1)$ = .74, p = .39.

Surprise

Questions measuring participants' surprise were analyzed with a repeated measures ANOVA as in Study 1. There was no main effect of counterbalancing, $F(1, 55) = .023$, $p = .881$. Counterbalancing also did not interact with the other variables. The main effect of spatial distance was not significant, $F(1, 55) = .01$, $p = .919$. We observed a tendency for the likely tweets to be perceived as less surprising than the unlikely tweets, but this main effect was not significant, $F(1, 55) = 3.43$, $p = .069$. However, there was a significant interaction between spatial distance and likelihood $F(1, 55) = 7.59$, $p = .008$, $\eta^2_G = .04$.

Simple effect analyses revealed that participants found it more surprising if the likely outcome tweet was sent by the spatially distant friend (M = 2.68, SD = 1.92) than by the spatially close friend (M = 2.00, SD = 1.38), p = .017, Bonferroni corrected, Cohen's d_z = .34. (see Figure 4). Participants also reported more surprise if the tweet with the unlikely outcome was sent by the spatially close friend (M = 2.84, SD = 1.99) than by the spatially distant friend (M = 2.16, SD = 1.47), p = .013, Cohen's d_z = .36. Participants also found it more surprising if the spatially close friend sent the unlikely tweet (M = 2.84, SD = 1.99), compared with the likely tweet (M = 2.00, SD = 1.38), p = .004, Bonferroni corrected, Cohen's d_z = .41. Similarly, participants found it more surprising when the spatially distant friend sent the likely tweet (M = 2.68, SD = 1.92), compared with the unlikely tweet (M = 2.16, SD = 1.47), p = .036, Cohen's d_z = .30.

Control Variables

Participants' mood, familiarity with cats, and thoughts regarding the aim of the study did not influence the observed pattern of results. Correlational analyses between the control and dependent variables revealed only a significant correlation between the variables "familiarity with

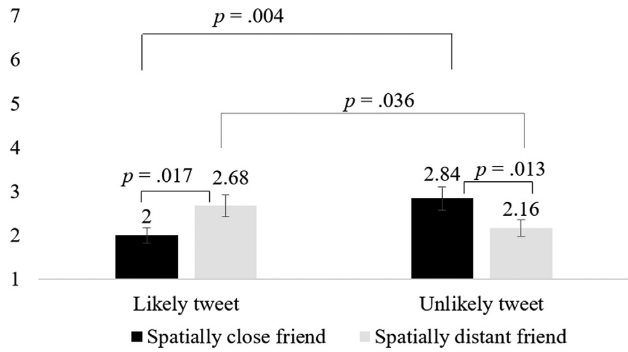

Figure 4. Surprise ratings as a function of the spatial distance of the source and the likelihood of the tweets in Study 2.

Twitter" and "surprise for hearing that the tweet with the likely outcome belongs to the friend living close by" (r = −.28, $p < .05$). In an additional analysis, Twitter familiarity was entered as a covariate in a repeated measures ANOVA comparing participants' surprise about the tweet with the likely outcome if sent by a spatially close or distant friend. This analysis yielded a main effect of spatial distance on surprise, $F(1, 55) = 6.52$, $p = .013$, $\eta^2_p = .11$, but no main effect for Twitter familiarity on surprise, $F(1, 55) = 2.41$, $p = .126$, and no interaction effect, $F(1, 55) = .75$, $p = .391$.

Discussion of Study 2

The results of Study 2 complement the findings of Study 1 by providing further evidence for our hypotheses. Results suggest that participants expected online messages to convey consistent psychological distance information. When asked to match two separate psychological distance information pertaining to event likelihood and source location, participants did so by taking psychological distance consistency into consideration. Rather than randomly assigning spatial distance information to event likelihoods, they matched far distances with low-probability outcomes and close distances with high-probability outcomes. Participants were also more surprised when the spatial location and likelihood of the tweet content conveyed distance-incongruence. In line with Study 1, these results confirm the distance-congruence effect and suggest that users indeed utilize consistency of available psychological distance information while processing online messages.

Studies 3 and 4

The findings from Studies 1 and 2 provided initial evidence for a distance-congruence effect in users' (heuristic) processing of online messages. As predicted by CLT, participants attributed tweets that displayed likely situations to spatially close locations and tweets that displayed unlikely situations to spatially distant locations. However, both studies applied a within-subjects design in which participants received information about low versus high psychological distance on two separate dimensions (i.e., spatial and hypothetical distance). It is possible that this design enhanced the distance-congruence effect, because participants could "directly experience" and compare different combinations of psychological distance information. However, what if participants received only information about one dimension, for example, that a tweet was sent from a friend living nearby? Without the presentation of alternative scenarios (e.g., tweet from a friend living far away), will participants still infer psychological proximity on all other dimensions? For example, would they implicitly expect the tweet to be about a rather likely than an unlikely event? And will they still be surprised if the tweet includes incongruent psychological distance information?

To test these questions and examine if our previous findings hold in scenarios that offer no direct comparison of alternative psychological distances, we split the original within-subjects design into two additional between-subjects design studies. In Study 3, we applied spatial distance as a between-subjects factor. Participants were randomly assigned to encounter tweets either from a friend living nearby or far away. They had to choose whether they thought their friend sent the tweet with the likely or unlikely outcome. In Study 4, hypothetical distance represented the between-subjects factor. Participants were randomly assigned to either read the likely or unlikely outcome tweet. They had to choose whether they believed the spatially close or far friend has written the tweet.

Study 3

Method

Participants

A total of 424 participants completed Study 3 on MTurk in return for $0.40. Participants were limited to MTurk users residing in the United States. Similar to Studies 1 and 2, a set of criteria were used to determine the data eligible for analyses (see parentheses for the number of participants failing to fulfill each criteria). Participants were required to participate in either study (Study 3 and 4) only one time (n = 5), respond correctly to an attention control question (n = 13), not have extreme reading durations (n = 8), and respond correctly to recall questions[2] (n = 19, of whom nine also failed the attention control check). After applying these inclusion criteria, the final data set of Study 3 consisted of 388 participants (176 women, 212 men; M_{age} = 35.14 years, SD_{age} = 11.06).

Materials, Measures and Procedure

Participants were randomly assigned to one of the two spatial distance conditions. In the close spatial distance condition, participants were told that they have a friend living 3 miles away. In the far spatial distance condition, the friend was living 3,000 miles away. As in Studies 1 and 2, the friend took his/her cat to the vet and tweeted about this event. Participants were presented with two sets of tweets, one displaying the high-probability (i.e., the cat having the likely – 85% chance – protein) and the other the low-probability outcome (i.e., the cat having the unlikely – 15% chance – protein). Spatial distance of the friend was the only information that differed between conditions.

Measures were similar to Studies 1 and 2. The first question asked participants to pick the tweet they thought belonged to their friend. The second question asked the same thing with a continuous measure (1 = *rather the tweet with the 85% protein*, 7 = *rather the tweet with the 15% protein*). The next two questions asked participants how surprised they would be if the tweet with the likely and respectively the unlikely outcome belonged to their friend (1 = *not very surprised*, 7 = *very surprised*). Finally, questions regarding familiarity with Twitter, familiarity with cats, mood, and recall were asked.

Results

Distance Matching

We examined the frequency of attributing the likely versus unlikely tweet to the (assigned) spatially close versus far friend with a chi-square test. Results revealed a significant association between spatial distance and tweet probability, $\chi^2(1) = 4.87$, $p = .027$. In both conditions, a majority of participants thought their friend sent the likely tweet (spatially close = 88.8%, spatially far = 80.7%). Of all participants who thought their friend sent the unlikely tweet, 62.7% belonged to the spatially far and only 37.3% to the spatially close condition. An examination of the continuous measure in a between-subjects t test did not show any significant difference between both spatial distance conditions. Although the spatially close friend was more strongly associated with the likely tweet (M = 2.32, SD = 1.61) than the spatially

[2] The recall questions in Study 3 were: "In the tweets you just read, where did your friend live?"; "According to the tweets, how common was it for cats to have Protein X/Protein Y in their blood?" Similar recall questions were also asked in Studies 1 and 2 but are not reported among the inclusion criteria as all participants responded to them correctly.

distant friend (M = 2.57, SD = 1.69), this difference was not significant, $t(386) = 1.50$, $p = .13$, Cohen's $d = .16$.

Surprise

Questions measuring participants' surprise were analyzed with a repeated-measures ANOVA with the likelihood of the tweet as the within-subjects and the spatial distance of the tweet source as the between-subjects factor. There was a significant main effect of the tweet likelihood on surprise, $F(1, 386) = 477.59$, $p < .001$, $\eta^2_G = .39$. Overall, participants were more surprised if tweets depicted the unlikely situation (M = 4.58, SD = .09) than the likely situation (M = 2.09, SD = .07). There was no significant main effect of spatial distance, $F(1, 386) = 1.13$, $p = .288$. Most importantly, we observed a significant interaction effect between spatial distance and hypotheticality on surprise, $F(1, 386) = 6.81$, $p = .009$, $\eta^2_G = .01$. Simple effect analysis revealed that participants found it more surprising if the tweet with an unlikely outcome was sent by a friend living close by (M = 4.79, SD = 1.66) than far away (M = 4.37, SD = 1.77), $p = .017$, Bonferroni corrected, Cohen's $d = 0.25$ (see Figure 5). For the likely tweet, no such difference was observed (spatially close: M = 2.01, SD = 1.38; spatially far: M = 2.18, SD = 1.46), $p = .219$, Bonferroni corrected.

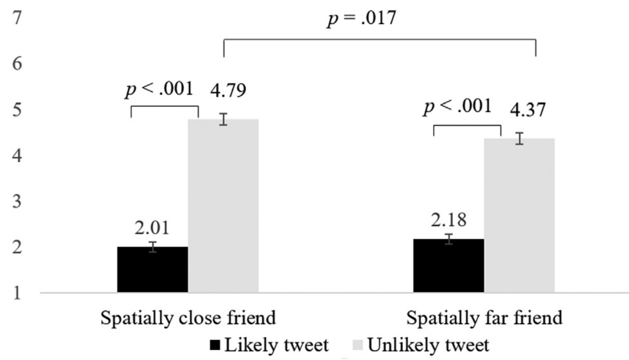

Figure 5. Surprise ratings as a function of the spatial distance of the source and the likelihood of the tweets in Study 3.

Control Variables

Correlational analyses between the control (i.e., participants' mood, familiarity with cats and twitter, and thoughts regarding the aim of the study) and dependent variables revealed a weak correlation between the mood of the participants and the responses to the forced-choice question ($r = .11$, $p < .05$), but including mood as a predictor in a binary logistic regression did not change the effect of spatial distance on tweet choice[1].

Study 4

Method

Participants

A total of 417 participants completed Study 4 on MTurk in return for $0.40. The same criteria described in Study 3 were used for the final data set. After following these inclusion criteria, the final data set for Study 4 consisted of 378 participants[3] (172 women, 206 men; M_{age} = 35.73 years and SD_{age} = 11.51).

Materials, Measures and Procedure

In Study 4, participants were randomly assigned to one of the two hypothetical distance conditions. All participants were told they have a friend living spatially close (3 miles) and a friend living spatially far (3,000 miles). After participants were given the information regarding the friend taking his/her cat to the vet, they were either presented with the tweet with the high-probability outcome (i.e., the cat having the likely – 85% chance – protein) or the low-probability outcome (i.e., the cat having the unlikely – 15% chance – protein). This was the only information that differed between the two conditions.

The first question asked participants to choose the friend (i.e., the friend living 3 miles or 3,000 miles) that they thought had sent the tweet. The second question measured the same relationship with the continuous measure. The next two questions asked participants to indicate how surprised they would be if they learnt that the friend living close versus far away sent the tweet. Again, questions regarding familiarity with Twitter, familiarity with cats, mood, and recall[4] were asked.

Results

Distance Matching

Analyses were identical to Study 3. All results were nonsignificant. A chi-square test did not show any significant association between tweet probability and spatial distance, $\chi^2(1) = .27$, $p = .605$. An almost equal number of participants in the likely and unlikely tweet conditions attributed the tweet either to the spatially close or far friend. Analyses of the continuous measure with a between-subjects t test

[3] Two participants were removed for completing the study multiple times, eight did not respond correctly to the attention control question, nine had extreme reading durations, 29 did not respond correctly to the recall questions. Among the participants who failed to respond to the recall questions, six of them also did not respond correctly to the attention control question. One participant did not fulfill any criteria.

[4] Recall questions in Study 4 were: "In the tweets you just read, where did your two friends live?"; and "According to the tweets, which protein does your friend's cat have?

yielded similar findings, with participants in the likely (M = 4.03, SD = 1.67) and unlikely tweet conditions (M = 4.15, SD = 1.61) choosing mid-scale responses, $t(376) = .7$, $p = .486$.

Surprise

A repeated-measures ANOVA examining surprise with spatial distance as the within-subjects and hypotheticality as the between-subjects factor yielded no main effect of spatial distance, $F(1, 376) = 2.64$, $p = .105$, or hypotheticality $F(1, 376) = .17$, $p = .681$ (see Figure 6). There was also no interaction between spatial distance and hypotheticality, $F(1, 376) = .01$, $p < .927$.

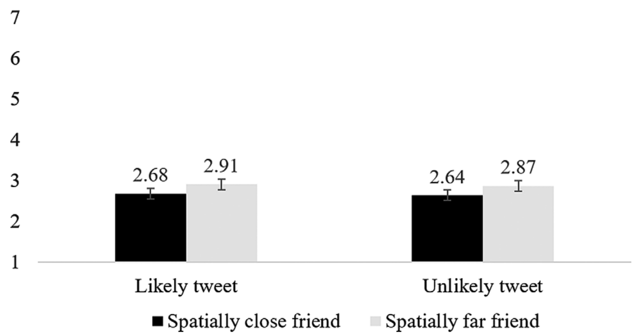

Figure 6. Surprise ratings as a function of the spatial distance of the source and the likelihood of the tweets in Study 4.

Discussion of Studies 3 and 4

Studies 3 and 4 did not reveal consistent findings. While the results of Study 3 were generally consistent with the CLT predictions, no effect was observed in Study 4. In Study 3 we found that presenting spatial distance information about a tweet's source influences participants' expected hypotheticality of the event depicted in the tweet. We also observed this pattern in the examination of the continuous measure, although here results were not significant. Results regarding participants' surprise were also mostly in line with CLT predictions. Although spatial distance did not influence participants' surprise about a tweet depicting a highly likely event, participants were more surprised if a tweet depicting an unlikely outcome was provided by a spatially close than a spatially distant source. Overall, although results were less distinct, these findings are generally in line with the present hypotheses and findings obtained in the within-subjects experiments.

While Study 3 provided partial evidence for the association between psychological distance cues, Study 4 yielded no significant results. In Study 4, we found that the information about the probability of an event depicted in a tweet did not influence participants' expected spatial distance of the tweet's source. We can think of two potential explanations for these results. One speculative explanation is that perhaps a likelihood comparison (as in Study 3) is more critical in instigating a link between spatial distance and likelihood dimensions. In other words, the availability of the comparison between the likely outcome and the unlikely outcome might have cued the participants to use the spatial distance information in Study 3. In comparison, in Study 4 presentation of a single outcome might have not been a strong enough cue to establish the expected connection and therefore this information might have been discarded[5]. A second reason for this null-finding could be that the distance-congruence effect is not as strong in online contexts as it is in offline contexts. As argued by others, online contexts might permit different and more confounded associations between psychological distance dimensions (Backstrom et al., 2010; Katz & Byrne, 2013; Norman et al., 2016) thus leading to the current inconsistent findings.

General Discussion

In four experiments we have tested how spatial distance and probability information interact and influence users' processing of messages in a Twitter context. According to CLT, probabilities and spatial distance have an association based on psychological distance (Trope & Liberman, 2010; Liberman et al., 2007). Previous research in offline contexts has shown a distance-congruence effect whereby common events are attributed to close spatial distances and uncommon events to far spatial distances (Wakslak, 2012). However, psychological distance dimensions, (e.g., spatial distance) are suggested to have different implications in online contexts and thus may also operate differently than they do offline (Guadagno et al., 2013; Kaltenbrunner et al., 2012; Norman et al., 2016). Overall, our findings suggest that spatial distance and probability information are also cognitively associated when presented in an online communication format. In two within-subjects experiments, and particularly with slightly enhanced stimuli in Study 2, we found that participants took psychological distance cues

[5] In order to assess this possibility, we examined participants' responses to an open-ended question about what they thought the experimenter's hypothesis was. We analyzed whether participants' responses included any reference to the event probability (e.g., the commonness or rarity of the event). Our examination showed that about 2% of participants (who were all in the low-probability condition) made a reference to the probability of the event. By contrast, in Study 3, 34% of the participants mentioned probability in their responses. While we cannot draw definite conclusions from this analysis, it supports the notion that participants in Study 4 might have discarded the presented probability information.

presented in tweets into account and construed the tweets by matching likely outcomes with spatially close sources and unlikely outcomes with spatially distant sources. Furthermore, participants reported more surprise for tweets depicting distance-incongruence, which is consistent with the expectations of both the MEB theory of surprise (Foster & Keane, 2015) and CLT. We conclude that these results in general support our hypotheses.

In order to test if the distance-congruence effect also holds in online situations that do not promote a direct comparison of alternative psychological distance scenarios, we conducted two more experiments that employed a between-subjects design. Results of Study 3 were generally in line with the present assumptions. Participants were told that they received a tweet either from a friend living close by or far away (i.e., the between-subjects factor), and had to choose whether the tweet probably depicted a likely or an unlikely outcome. Although in both conditions a majority of the participants opted for the likely outcome tweet, this tendency was stronger if participants thought the tweet came from a close-by source. The smaller group of participants opting for an unlikely outcome were mostly in the spatially distant condition. Participants receiving a tweet from a friend living nearby where also more surprised than participants receiving a tweet from a far-away friend if the tweet depicted an unlikely event. Although these findings are mostly in line with our assumptions, they appear less clear-cut than those of Studies 1 and 2, in which we observed a more symmetric distance-congruence effect (e.g., compare Figures 2 and 4 with Figure 5). It appears that the within-subjects designs enhanced the distance-congruence effect by allowing for direct comparisons of alternative tweet scenarios.

In Study 4, participants received either a tweet depicting a likely outcome or an unlikely outcome (i.e., the between-subjects factor) and had to choose whether this was sent by a friend living nearby or far away. This study provided no evidence of the congruence-effect, which suggests that the likelihood comparison is necessary to establish a link between spatial and likelihood information. On a related note it could also be suggested that this phenomenon is not as stable in online contexts as in offline contexts. Therefore, further research might want to explore different ways of providing initial hypotheticality information in online contexts to further test for potential distance-congruence effects.

In summary, the findings of Studies 1, 2, and 3 support previous CLT research that showed associations between different dimensions in offline contexts (Bar-Anan et al., 2007; Stephan et al., 2010; Trope & Liberman, 2010; Wakslak, 2012; Wright et al., 2012; Zhao & Xie, 2011). The present approach complements this work by showing that psychological distance dimensions are also related similarly when presented within an online communication format.

Implications of Distance-Congruence as an Online Heuristic

Next to complementing basic CLT research, the present findings contribute to a better understanding of how users may process online information. Previous research on online credibility has shown that people often evaluate online information heuristically based on available cues (Hilligoss & Rieh, 2008; Metzger & Flanagin, 2013; Metzger et al., 2010; Sundar, 2008). Past literature suggests that related cues may stem from technological features of media (Sundar, 2008), characteristics of the information source, and social interactions between users (Metzger et al., 2010). The present research extends these findings by suggesting psychological distance cues conveyed in online messages are other important sources of information that users take into account in their heuristic processing.

Our findings suggest that the cognitive association between different psychological distance dimensions affects how online messages are processed. Specifically, the present findings suggest that people's general tendency to cognitively associate spatial and hypotheticality (or likelihood) information might also affect how they process online messages. The distance-congruence effect observed in the present approach might imply, for instance, that users looking at online hotel (or other product) reviews assess a rare incident reported by a reviewer to be more likely if the hotel is far away than if it is nearby, which may influence their purchase decision. Or, to provide another example, online messages sketching an event of low hypotheticality (e.g., "we will meet the deadline tomorrow") may be deemed more likely when communicated by a collaborator in a spatially close as compared with a spatially distant location. While the current research specifically examined the relationship between probability and spatial distance, based on previous CLT research (Bar-Anan et al., 2007), we expect associations between other dimensions to influence such online judgments in a similar way.

Psychological Distance, CLT, and Online Persuasion

The present findings reveal a tendency of users to expect consistent psychological distance information in online messages. This finding is highly relevant for online persuasion outcomes considering that distance-congruence has been linked to truth judgments (Wright et al., 2012). In their study, Wright and colleagues (2012) presented participants with marketing statements that involved temporal (yesterday vs. last year) and social distance information (self vs. friend). They found that messages involving consistent psychological distance information (i.e., *self* presented with *yesterday* and *friend* presented with *last year*) were perceived to be truer than statements involving inconsistent psychological distance information.

Wright et al. (2012) speculate that the underlying reason for this truth effect is processing fluency. Processing fluency refers to the metacognitive ease or difficulty experienced during processing of information and it is found to mark information as more familiar, positive, and true (e.g., Alter & Oppenheimer, 2009; Reber & Schwarz, 1999; Topolinski & Strack, 2009). While the current research did not explicitly measure perceived truth, it suggests that online messages may appear consistent or inconsistent to users based on the embedded psychological distance information. Accordingly, given the link between congruence, fluency, and previous findings showing that distance-congruent messages are perceived as more believable (Alter & Oppenheimer, 2008, 2009; Wright et al., 2012), it might be argued that distance-congruence positively affects the persuasiveness of online messages in a heuristic manner. In summary, users seem to expect consistent psychological distance information in online messages, as the present studies suggest, and consistent information may make these messages more believable and persuasive.

Indeed, in their CLT of mobile persuasion, Katz and Byrne (2013), proposed several ways in which congruence among CLT elements might be used to deliver persuasive messages via mobile technologies. One of these suggestions is to create *distance-cue matching*, by matching the psychological distance of messages with the psychological distance in people's mind. For instance, mobile devices can track the location of users and calculate their distance from areas of interest. Consequently, they could deliver a *distance-cue matched* persuasive message (e.g., when a person trying to quit smoking is near a tobacco store, the device can deliver psychologically close health messages matching the close psychological distance in the person's mind). The present findings indirectly support these theoretical applications of CLT to mobile persuasion (Katz & Byrne, 2013).

The current research focused on CLT's premise that psychological distance dimensions are interrelated. However, other important premises could be derived from CLT and fruitfully applied to online contexts in future research. For example, congruence between *construal level* and psychological distance may have important implications for users' processing of online messages too. According to CLT, repeated pairing of detailed and concrete observations within close psychological distances and less detailed and more abstract observations within far psychological distances creates close cognitive associations between construal level and psychological distance (Bar-Anan, Liberman, & Trope, 2006). A recent study has shown that congruency between users' construal level of the mindset (i.e., concrete vs. abstract mindset) and the spatial distance depicted in (i.e., spatially close vs. far) can enhance believability judgments for a news item (Sungur, Hartmann, & van Koningsbruggen, 2016). A similar congruence effect has been shown by matching linguistic construal level (i.e., concrete vs. abstract language) and spatial distance (i.e., actual presentation location of information; Hansen, & Wänke 2010). In general, the premise of CLT regarding interactive effects between construal levels (e.g., either based on the linguistic construal or based on users' mindset) and psychological distance cues provided in a message may have significant implications for users' judgments of online information. This distance-congruence is also acknowledged in the CLT of mobile persuasion as a means of delivering persuasive messages (Katz & Byrne, 2013). In summary, investigating how construal levels interact with psychological distance cues in online messages provides an important direction for future research.

Limitations and Future Research

As any study, the present approach was not without limitations. Even though MTurk has been shown to be a valid and reliable data source (Buhrmester, Kwang, & Gosling, 2011; Holden, Dennie & Hicks, 2013), conducting research on MTurk still involves certain limitations. For instance, it is possible that some MTurkers use multiple accounts and can join studies multiple times.[6] Also, in the current research we only tested the relationship between two psychological distance dimensions. Future studies should also investigate how people utilize other psychological distance cues. Next to this issue, it can be argued that the scenario employed in the current research was not very realistic. Even though the tweets used in the present studies may be considered unrealistic because they communicated about a fictional protein, we believe they are not unrealistic for portraying people who tweet about their cats (as a simple Twitter search on the term *my cat* reveals), particularly as sharing personal experiences and daily chatter are very common on Twitter (Honey & Herring, 2009; Java, Song, Finin, & Tseng, 2009). However, future research may further increase ecological validity by using actual Twitter content as experimental stimuli.

[6] We would like to thank the anonymous reviewer for suggesting this possibility.

Conclusion

In line with CLT, we found evidence that users cognitively associate the psychological distance dimensions of spatial distance and hypotheticality while processing tweets. Participants associated tweets depicting high-probability events with spatially close sources and tweets depicting low-probability events with spatially distant sources. Participants also showed more surprise when distance dimensions were incongruent, indicating the unexpected and disfluent nature of such matching. Although findings are only tentative and further research is warranted, they may form the basis for innovative future studies on the processing, believability, and persuasiveness of online communication.

Acknowledgment

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