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Automatic Processing of Psychological Distance: Evidence From a Stroop Task

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A picture–word version of the Stroop task was used to test the automatic activation of psychological distance by words carrying various senses of psychological distance: temporal (tomorrow, in a year), social (friend, enemy), and hypotheticality (sure, maybe). The pictures implied depth, with the words appearing relatively close to or distant from the observer. The participants classified the spatial distance of words faster when the word's implicit psychological distance matched its spatial distance (e.g., a geographically close word was classified faster when it was "friend" than when it was "enemy"). The findings are consistent with the idea that psychological distance is accessed automatically, even when it is not directly related to people's current goals, and suggest that psychological distance is an important dimension of meaning, common to spatial distance, temporal distance, social distance, and hypotheticality.

Keywords: construal level, picture–word Stroop paradigm, psychological distance, automatic activation

Consider the four contrasts: here/there, tomorrow/in a year, we/others, and certain/maybe. What do these four pairs have in common? According to Construal Level Theory (CLT, Liberman, Trope, & Stephan, in press; Trope & Liberman, 2003), each of these pairs forms a continuum that denotes a different dimension of psychological distance. Psychological distance refers to the distance of a stimulus (object or event) from the perceiver's direct experience. The four dimensions are as follows: (a) spatial—how distal in space is the stimulus from the perceiver; (b) temporal—how much time (past or future) separates the perceiver's present time and the target event; (c) social—how distinct is a social object from the perceiver's self (e.g., self vs. others, friend vs. stranger); and (d) hypotheticality—how likely is the target event to happen (or an object to exist), or how close it is to the perceiver's reality. According to CLT, values on these dimensions are related to psychological distance and thus have a shared meaning. The present research investigates whether this shared meaning is automatically accessed when people encounter values on these dimensions (e.g., whether the stimulus "tomorrow" activates meaning of psychological proximity).

CLT contends that spatial distance, temporal distance, social distance, and hypothetically are different manifestations of a similar underlying meaning—psychological distance. Distancing a target along any of these dimensions increases the gap between the target and the perceiver's direct experience. Therefore, direct experience would be the common zero point of all four dimensions. It is the maximally proximal target: located *here*, occur *now*, pertain to the *self*, and exist in *reality*.

Psychological distance is related to the way people think about stimuli, because the distance between the stimulus and the perceiver's direct experience affects the perceiver's construal of the stimulus. As stimuli become more distant on any of these dimensions, the amount of sensory information and concrete knowledge about them tends to diminish. Consequently, the perceiver's construal of psychologically distal targets requires higher-level, more abstract mental representations. For example, at this moment, you are reading an article. You probably possess a great amount of concrete knowledge about this event: how the article looks, what the shape of the article is, what the immediate surroundings are (e.g., the light in the room), or how this action makes you feel. However, as the psychological distance between the perceiver and the event increases, the amount of concrete knowledge tends to decrease. Thus, you would probably know much less about the event if you were thinking about reading an article a year from now (temporally distant target), if you were thinking about reading the article in a different country (spatially distant target), if you were thinking about a stranger who reads this article (socially distant target), or if you were thinking about reading a scientific article printed in magic ink (a highly hypothetical target). In all these examples, you would need to resort to high-level, schematic knowledge to construe more distal events or objects.

Although people usually have less concrete knowledge about more psychologically distant targets, this rule has many excep-

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tions. For example, sometimes people are equally familiar with their siblings and their distant acquaintances. We might, occasionally, know much more about events that are distal in time or space than about more proximal events, and people often know more about imaginary objects than about real ones. Nevertheless, CLT maintains that people tend to use high-level construals when they think of distant stimuli and low-level construals when they think of proximal stimuli, even if the amount of available knowledge about the stimuli is similar, and the available information about the stimuli does not favor one construal level over another (see Liberman et al., in press, for a review).

CLT maintains that different carriers of distance (temporal, spatial, social, or hypothetical) have similar effects on construal, because they all convey common information and entail similar psychological processes. The goal of this research is twofold. First, we tested the prediction that psychological distance is automatically activated, even in cases in which it is unrelated to the task at hand and can even impede performance. Second, we tested the prediction that all representations of psychological distance produce the same pattern of responding. We demonstrate that cues that pertain to temporal distance, social distance, or hypotheticality can affect and be affected by people's processing of the spatial location of a target stimulus in systematic and predictable ways.

Our experimental tool was the picture–word version of the Stroop task (e.g., Arieh & Algom, 2002; Shaki & Algom, 2002; see Melara & Algom, 2003, for a recent review and a theory of the Stroop phenomenon). The Stroop effect (Stroop, 1935) is psychology's classic measure to test the selectivity of attention (indeed, its failure) to a relevant aspect of the stimulus. When naming the print color in which color words are printed, people are affected by the meaning of the carrier words. A popular extension of the Stroop task entails the replacement of the original attribute of print color by a picture (see MacLeod, 1991, for a review). A word (not one of color) is embedded inside a line drawing, and the observer's task is to name the picture or to name (read) the word. Typically, the irrelevant stimulus facilitates or impedes performance, according to the congruency between the two stimuli.

In this study, we developed a unique version of the picture–word task. The observer responded to the embedded word only. The picture served to create depth and convey various amounts of spatial distance (of the word) from the observer. A word appeared on the background of the picture, located either nearer to or farther away from the observer. We used two tasks with respect to the target word: naming and distance classification. It is important to realize that the words themselves were not words related to spatial distance in any usual dictionary sense. On the surface, the words and their locations did not form Stroop-like stimuli (e.g., the combinations of the words "maybe" with long distance does not, prima facie, seem more or less congruent than, say, the word "sure" with long distance). Such stimuli do not usually fall into congruent and incongruent classes. They only did so in terms of CLT, which maintains that any concept along the four dimensions carries an underlying meaning associated with psychological distance from the observer.

To appreciate the experimental task, look at the four panels of Figure 1. In each panel, a word is embedded in a picture of a landscape, and your task is to indicate, while timed, whether the word is near or far. Because (a) you can ignore the word itself, (b) the words are irrelevant to the task at hand, and (c) there is not an apparent association between the meanings of the words and your task anyway, there is no compelling reason to expect a difference in performance across the four panels. CLT does predict a difference. According to CLT, Panels A and D depict congruent stimuli, and Panels B and C depict incongruent stimuli, so performance should be better in the former than in the latter. The present research examines this prediction as well as the reverse one: Naming of the words that carry various senses of psychological distance is affected by their spatial location.

To verify that the present procedure can test our theoretical assumption, we must meet two preliminary conditions. First, we establish that the current setup yields the ordinary Stroop effect under standard preparation. Presenting the explicit words of distance, "near" and "far," at different spatial distance creates standard Stroop stimuli (i.e., combinations that naturally divide into congruent and incongruent classes). It is equally important to establish that presenting just any two words within those landscapes does *not* yield a Stroop effect. We planned Experiments 1, 2, 7, and 8 to satisfy these indispensable conditions.

Overview of the Experiments

The same procedure was used in a series of 13 experiments. Each entailed a set of landscape pictures with a word embedded within each picture. The words could appear in either a proximal position or a distant position from the observer. A pair of words conveying CLT distance defined an experiment. Each word in the pair appeared within each of the pictures in each of the two spatial locations. In Part I, the participant's task was speeded classification of distance. The pair of words conveyed temporal distance (Experiment 3), social distance (Experiments 4 and 5), or hypotheticality (Experiment 6).

In Part II, the participant's task changed to classifying the words themselves, rather than their distance. The pairs of words conveyed temporal distance (Experiment 9), social distance (Experiments 10 amd 11), or hypotheticality (Experiments 12 and 13).

Part I: How Near or Far is the Word From the Observer?

Experiments 1 and 2

The first experiment examined whether classifying distance of words that are themselves related to distance is affected by the words' meaning. Stimuli appeared on a picture with clear depth cues (e.g., a picture of an alley of trees), ensuring clear discrimination between spatially proximal and distal stimuli in the picture. Participants indicated whether the target stimulus appearing within the pictures was near or far. The two target words were "near" and "far." Participants were instructed to focus only on the location of the target word and ignore its meaning. On congruent trials, the meaning of the word matched its distance (e.g., the word "near" in a proximal position). On incongruent trials, location and meaning mismatched. We expected faster responses on congruent trials than on incongruent trials.

The second experiment sought to rule out the possibility that just any pair of words would yield a similar Stroop effect. Therefore, in the second experiment, we used the words "nail" and "screw" as targets. Neither CLT nor Stroop theory predicts a differential effect of word on distance classification under this preparation.

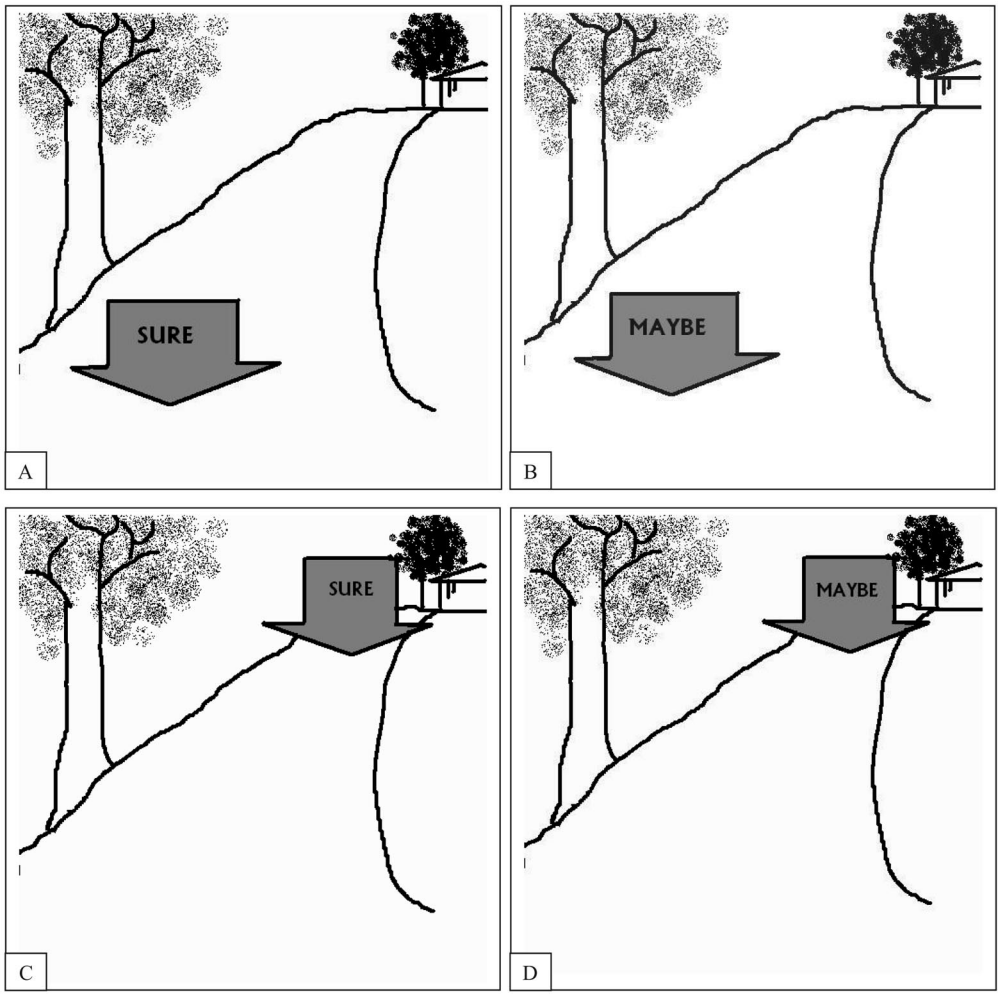

Figure 1. Illustration of the four types of stimuli used in all experiments. The four panels illustrate the four possible Spatial-Location × Word-Meaning combinations in each of the experiments. The four conditions are as follows: a word of proximity located near the observer (a congruent condition; Panel A), a word of distance located near the observer (an incongruent condition; Panel B), a word of proximity located far from the observer (an incongruent condition; Panel C), and a word of distance located far from the observer (a congruent condition; Panel D). The actual stimuli were color photographs, not drawings. The present illustration demonstrates words related to hypotheticality—"sure" denotes proximity in that domain, and "maybe" denotes distance. These words were used in Experiments 6 and 12.

Method

Participants. Ten introductory psychology undergraduates participated in Experiment 1 (6 women, 4 men), and 13 (10 women, 3 men) participated in Experiment 2, in exchange for course credit (ages in both experiments were 22–28 years, M = 24.1). All were native Hebrew speakers. There were no gender effects in any of these and subsequent experiments.

Materials. In Experiment 1, we used 16 color images. We found the images on the Internet, through the Google Image Search tool. We selected images that conveyed a clear depth perception. These were scenery pictures of alleys with trees, rolling hills, or roads. Superimposed on each of these 16 images was a green arrow pointing to a certain location in the picture. We made two versions of each image—one with an arrow that pointed to a relatively distal location and one with an arrow that pointed to a relatively proximal location. To make sure that the stimuli conveyed depth clearly, we usually located distal targets on the top right of the screen and proximal targets on the bottom left of the screen (this was true for 12 of the 16 images). The word appeared inside the arrow in black ("Courier New" font). The font size of the words was 24 when they were printed on a spatially proximal arrow and 18 when they were printed on a spatially distal arrow. The words were either "near" or "far." The words were written in Hebrew and were 4 letters each. Each of the 32 images (16 images × 2 spatial locations) was presented with each of the words, thus creating a total of 64 stimuli. Figure 1 illustrates the makeup of the stimuli. In Experiment 2, we used the same 64 stimuli, with a single notable exception: The words were changed to "nail" and "screw" (in Hebrew).

Apparatus. Displays were generated by a computer attached to a 19-in. (48.3-cm) LCD monitor, using 1152 × 864 resolution graphics mode. Responses were entered via the computer keyboard. Participants viewed this display from a distance of about 50 cm and gave left responses with the D key and right responses with the J key.

Procedure and design. Participants performed the task in individual cubicles. Each participant was first presented with an example—1 of the 64 possible stimuli—selected randomly for each participant. Participants were informed that they would next see similar images with clear depth perspective and with similar green arrows pointing to either a proximal or a distal location in the image. Participants were asked to respond according to the location of the arrow. Half of the participants were asked to respond with a left response to indicate proximal spatial location and with a right response to indicate distant spatial location. The responses were reversed for the other half of the participants. Participants were informed that the words, printed on the arrows, were irrelevant to the current task. The stimuli remained on the screen until the participant responded. The intertrial interval between participant's press and the display of the next stimulus was 500 ms. Error trials were followed by a 500-ms feedback beep. Stimuli were selected randomly. Each of the 64 stimuli (16 images × 2 locations × 2 words) appeared two times. Thus, there were a total of 128 trials for each participant.

Results and Discussion

The mean reaction times in all four conditions (Word × Distance) for each experiment are presented in Table 1. The graphs in Figure 2 illustrate the difference between congruent and incongruent trials for each experiment.

Experiment 1. The first 10 trials of each participant were ignored in the analyses. Reaction times exceeding the mean of all correct responses by more than three standard deviations were excluded. The same procedure was repeated in all subsequent experiments and resulted in the removal of less than 1% of all observations in each experiment. In all reaction-time analyses, error trials (less than 3% of all trials) were excluded. We conducted a within-participants analysis of variance (ANOVA) with spatial location (proximal, distal) and word type ("near," "far") as independent variables.

The interaction of distance and word, $F(1, 9) = 25.07$, $p < .001$, partial $\eta^2 = .73$, documented the presence of an appreciable Stroop effect in the data. Participants classified distance faster when it matched the word's meaning ($M = 715$ ms for congruent trials) than when distance and word mismatched ($M = 750$ ms for incongruent trials). The Stroop effect amounted to 35 ms.

We found a main effect of spatial location, $F(1, 9) = 25.07$, $p < .001$, partial $\eta^2 = .73$, indicating faster performance when stimuli were spatially proximal (33 ms difference). There was no main

Table 1
Mean Reaction Times (in ms) and SDs for All Experiments

Word				Spatial-distance-sorting task				Words-sorting task			
				Spatially proximal		Spatially distal		Spatially proximal		Spatially distal	
English	Hebrew phonetic	Hebrew IPA	Word length	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
				Experiment 1				Experiment 7			
Near	Karov	Karov	4	**706**	**29**	775	29	**669**	**22**	707	33
Far	Rakhok	Raxok	4	726	33	**724**	**26**	719	33	**701**	**36**
				Experiment 2				Experiment 8			
Nail	Masmer	Masmer	4	547	21	585	17	590	15	621	18
Screw	Boreg	Boreg	4	547	21	590	14	629	15	654	25
				Experiment 3				Experiment 9			
Tomorrow	Makhar	Maxar	3	**600**	**22**	652	24	**663**	**16**	681	24
Year	Shana	ʃana	3	621	22	**645**	**21**	662	18	**648**	**16**
				Experiment 4				Experiment 10			
Friend	Yadid	Jadid	4	**621**	**29**	687	28	**634**	**17**	647	19
Enemy	Oyev	ʔojev	4	638	27	**676**	**26**	667	20	**639**	**18**
				Experiment 5				Experiment 11			
We	Anakhnu	ʔnaxnu	5	**614**	**28**	675	27	**651**	**16**	665	19
Others	Akherim	ʔxerim	5	629	24	**667**	**26**	679	13	**662**	**15**
				Experiment 6				Experiment 12			
Sure	Batuakh	Batuʔax	4	**603**	**18**	677	30	**649**	**27**	627	30
Maybe	Ulay	ʔulaj	4	611	21	**653**	**19**	654	26	**649**	**27**
									Experiment 13		
Certainly	Vaday	Vadaj	4					**659**	**16**	679	24
Possibly	Aitakhen	ʔitaxen	4					692	16	**642**	**16**

Note. Congruent cells are in boldface. IPA = International Phonetic Alphabet.

effect for word, $F(1, 9) = 3.43$, $p = .1$. Similar results (proximal targets yield faster response) were obtained in the subsequent experiments as well. CLT has no prediction about main effects in this task, and we deem it irrelevant to the current research. We can only hypothesize that it might result from the fact that the proximal targets were bigger in size, or maybe proximal targets are more important than distal targets. However, only further research can reveal the real causes.

Experiment 2. The critical term to examine is again that of Word × Distance. It is notable that the interaction was not present in the data ($F < 1$). We did not detect differences in performance with the word as a function of distance. The ANOVA yielded a main effect of spatial location, $F(1, 12) = 7.33$, $p < .02$, $\eta^2 = .38$, indicating faster performance when stimuli were spatially proximal (40 ms difference). There was no main effect for word, $F < 1$.

Experiment 1 demonstrated that distance words that were irrelevant to a distance-discrimination task nonetheless affected performance. When the arrow pointed to a relatively proximal location, participants responded faster when the word was "near" than when the word was "far." When the arrow pointed to a relatively distal location, participants responded faster when the word was "far" than when the word was "near."

In Experiment 2, we did not find an interaction between words unrelated to distance and judgments of distance. The standard Stroop effect was obtained in Experiment 1, but no Stroop effect was obtained in Experiment 2. These experiments set the stage for the experiments that would test our main question of interest: Would the semantic meaning of words that denote social distance, temporal distance, and hypotheticality interfere with (or facilitate) distance discrimination of those words?

Experiments 3–6

In the next four experiments, we tested pairs of words that denote proximity or distance on social, temporal, and hypothetical dimensions and thus, according to CLT, share meaning with spatial distance. In Experiment 3, we tested temporal dimension with the words "tomorrow" (proximal entity) and "year" (distal entity). Experiment 4 tested the social dimension with the words "friend" (proximal entity) and "enemy" (distal entity). To rule out valence as an alternative explanation for a Stroop effect in Experiment 4 (people prefer friends to be near and enemies far), in Experiment 5, we used another pair of words related to social distance, "we" (proximal entity) and "others" (distal entity). In Experiment 6, which tested the dimension of hypotheticality, the words were "sure" (proximal entity) and "maybe" (distal entity). We predicted that in each of these experiments, participants would respond faster to congruent trials (in which psychological distance matched spatial distance) than to incongruent trials (in which psychological distance mismatched spatial distance).

Method

Participants. Eighteen introductory psychology undergraduates participated in Experiment 3 (11 women, 7 men, ages 20–30 years, $M = 24.1$), 13 (10 women, 3 men, ages 21–39, $M = 24.9$) participated in Experiment 4, 15 (10 women, 5 men, ages 22–32, $M = 23.9$) in Experiment 5, and 12 (10 women, 2 men, ages 21–29, $M = 23.9$) in Experiment 6. All of these students participated in exchange for course credit. All were native Hebrew speakers.

Materials, design, apparatus, and procedure. The materials were the same as in Experiment 1, except for the two printed words in each experiment. The words in Experiment 3 were the Hebrew words for "tomorrow" and "year," the words in Experiment 4 were the Hebrew words for "friend" and "enemy," the words in Experiment 5 were the Hebrew words for "we" and "others," and the words in Experiment 6 were the Hebrew words for "sure" and "maybe."[1] The apparatus, procedure, and design were the same as in Experiment 1.

Results and Discussion

Main effects. As in Experiments 1 and 2, the ANOVA yielded a main effect of spatial location for Experiments 3–6, indicating faster performance when stimuli were spatially proximal. For Experiment 3, $F(1, 17) = 13.12$, $p < .01$, partial $\eta^2 = .44$; for Experiment 4, $F(1, 12) = 19.53$, $p < .001$, partial $\eta^2 = .62$; for Experiment 5, $F(1, 14) = 22.81$, $p < .001$, partial $\eta^2 = .62$; and for Experiment 6, $F(1, 11) = 8.46$, $p < .05$, partial $\eta^2 = .43$. There was no main effect for word in any of these experiments, Fs < 1.

Experiment 3. The results revealed a Stroop effect engendered by the words associated with temporal distance. The Word × Distance interaction, $F(1, 17) = 13.12$, $p < .01$, partial $\eta^2 = .44$, documented a faster distance response to congruent ($M = 622$ ms) than to incongruent ($M = 637$ ms) combinations.

Experiment 4. As predicted, words associated with social distance also engendered a Stroop effect. The Word × Distance interaction, $F(1, 12) = 19.53$, $p < .001$, partial $\eta^2 = .62$, documented faster distance response to congruent ($M = 649$ ms) than to incongruent ($M = 663$ ms) combinations.

Experiment 5. Again, the results revealed a Stroop effect engendered by words associated with social distance. The Word × Distance interaction, $F(1, 14) = 22.81$, $p < .001$, partial $\eta^2 = .62$, documented faster distance response to congruent ($M = 640$ ms) than to incongruent ($M = 652$ ms) combinations.

Experiment 6. Words related to hypotheticality also led to results that reveal the predicted Stroop effect. The Word × Distance interaction, $F(1, 11) = 8.46$, $p < .05$, partial $\eta^2 = .43$, documented faster distance response to congruent ($M = 627$ ms) than to incongruent ($M = 643$ ms) combinations.

Experiments 3–6 demonstrated that words related to psychological distance affect decisions with respect to the spatial distance of the words. These words intruded on spatial distance, despite the fact that they were irrelevant to the task at hand and are not explicitly associated with spatial distance. The results are consistent with the assumption, suggested by CLT, that psychological distance is a common meaning that spatial dis-

[1] Using the Hebrew word-frequency norms (Frost & Plaut, 2001), we calculated the average frequency of all the words that were used in this study and the other studies reported in this article. For three of the five pairs (tomorrow–year, sure–maybe, certainly–probably), the distal word was more frequent than the proximal word. For one pair (we–others), the proximal word was the more frequent word. For one pair (friend–enemy), the frequency of both words was similar. Therefore, we do not believe that the results were affected by the words' frequency in any way that undermines our interpretation of the results.

tance shares with temporal distance, social distance, and hypotheticality.

Part II: Classifying the Meaning of Words Presented at Various Distances From the Observer

Experiments 3–6 demonstrated the automatic activation of psychological distance by words associated with different dimensions of psychological distance. Our goal was to demonstrate that psychological distance is activated to affect perception and action, even when distance is implicit and unrelated to the task at hand. Does the reverse activation also take place? Does the spatial position in which a word appears influence the perception of the word? Of course, the activation in question is confined to CLT-related words denoting various senses of distance from the self. Would participants process spatial cues when asked to classify words associated with temporal distance, social distance, or hypotheticality?

In Part II of our research, we set to demonstrate that Stroop-like effects can be obtained when the words serve as the to-be-attended stimuli (and their spatial distance is the task-irrelevant attribute). We repeated the previous experiments with a single exception: Participants were instructed to respond to the words and ignore their spatial distance. To set the stage for these experiments, we first established that the Stroop-like effect is unique to the classification of distance words. Experiments 7 and 8 therefore parallel Experiments 1 and 2. They show that the Stroop effect is obtained with words that explicitly mean distance (near, far) but that no effect is obtained with words unrelated to distance.

Experiments 7 and 8

In Experiment 7, we examined whether classification of words related to spatial distance ("near" and "far") is affected by their spatial distance on a landscape. Presented with the same pictures as in previous experiments, participants were instructed to focus on the word and ignore its position. We expected participants to perform faster on congruent trials (e.g., the word "near" in proximal position) than on incongruent trials (e.g., the word "near" in distal position). In Experiment 8, we sought to rule out the possibility that just any pair of words would yield a similar Stroop effect. In Experiment 8, we used the words "nail" and "screw" as targets.

Method

Participants. Ten introductory psychology undergraduates participated in Experiment 7 (all women, ages 22–37 years, M = 24.3), and 13 (8 women, 5 men, ages 22–29 years, M = 23.4) participated in Experiment 8, all in exchange for course credit. All were native Hebrew speakers.

Materials, design, apparatus, and procedure. The materials and procedure in Experiment 7 were the same as in Experiment 1, except that the instructions did not refer to the depth perspective of the images but rather to the words themselves. Specifically, after viewing the exemplar image, participants were informed that they would see similar images, all with a target word printed on a green arrow. The participants were asked to respond to the presented word by pressing the key that was allocated to represent that word. Participants were informed that the spatial location of the words was irrelevant to the task at hand. The design and apparatus were the same as in Experiment 1. Experiment 8 was identical to Experiment 7, with the exception that the words were "nail" and "screw."

Results and Discussion

Main effects. The ANOVA for Experiment 7 yielded a marginal main effect of word, $F(1, 9) = 4.4$, $p = .08$, indicating faster performance when the word was "near." There was no main effect for spatial location, $F < 1$. The ANOVA for Experiment 8 yielded a main effect of word, $F(1, 12) = 17.93$, $p < .01$, partial $\eta^2 = .6$, indicating faster performance when the word was "nail." There was also a main effect for spatial location, $F(1, 12) = 8.36$, $p < .05$, partial $\eta^2 = .41$, indicating faster performance when the stimuli were spatially near. As in Experiments 1–6, we do not deem this effect as relevant, because our reasoning produces predictions only for the interaction effect.

Experiment 7. The interaction of word and distance, $F(1, 9) = 8.55$, $p < .05$, partial $\eta^2 = .49$, documented the presence of a Stroop effect in the data. Our participants classified the words "near" and "far" faster when the word's meaning matched its spatial distance (M = 685 ms for congruent trials) than when word's meaning and distance mismatched (M = 713 ms for incongruent trials). This effect amounted to 28 ms.

Experiment 8. The critical effect to examine was again the interaction of Word × Distance. This interaction was not present in the data ($F < 1$). We did not detect differences in performance with word identification as a function of distance. Therefore, there was absolutely no effect when the words "nail" and "screw" were presented.

Experiment 7 demonstrated that the irrelevant location of distance words affected the speed with which they were classified for content. When the arrow pointed to a relatively proximal location, participants classified the word "near" faster than the word "far." When the arrow pointed to a relatively distal location, participants classified the word "far" faster than the word "near." In Experiment 8, classification of words unrelated to distance was *not* affected by their distance.

These experiments set the stage for the experiments that would test our question of interest: Does the spatial position of words conveying psychological distance (temporal, social, and level of hypotheticality) affect their classification?

Experiments 9–13

In the final five experiments, we tested whether spatial distance affects the classification of words that denote proximity or distance on temporal, social, or hypothetical dimensions. In each pair, one of the words denoted psychological proximity, whereas the other denoted psychological distance. In Experiments 9–12, we used the same stimuli as in Experiments 3–6. In Experiment 13, we used new stimuli words, related to hypotheticality. We predicted that in each of these experiments, participants would respond faster to congruent trials (when the word's meaning and its distance matched) than to incongruent trials (when the word's meaning and its distance mismatched).

Method

Participants. Sixteen introductory psychology undergraduates participated in Experiment 9 (12 women, 4 men, ages 20–40

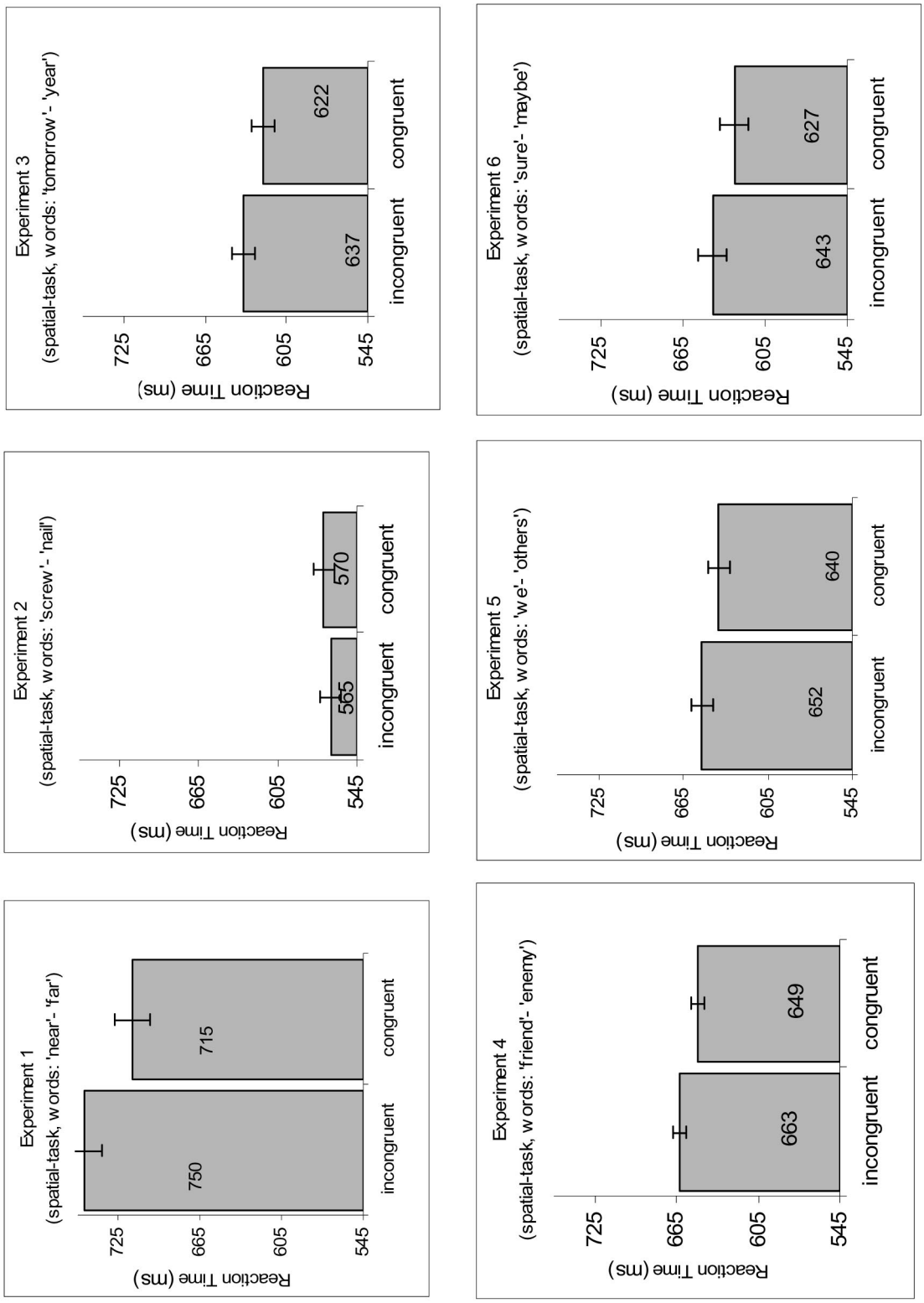

Figure 2. Average reaction times for congruent and incongruent trials in all experiments. Incongruent trials were significantly slower than congruent trials in all experiments, excluding Experiments 2, 8, and 12. In the spatial task, participants classified the spatial distance of the words, and in the words task, participants classified the words. Error bars denote 95% confidence intervals.

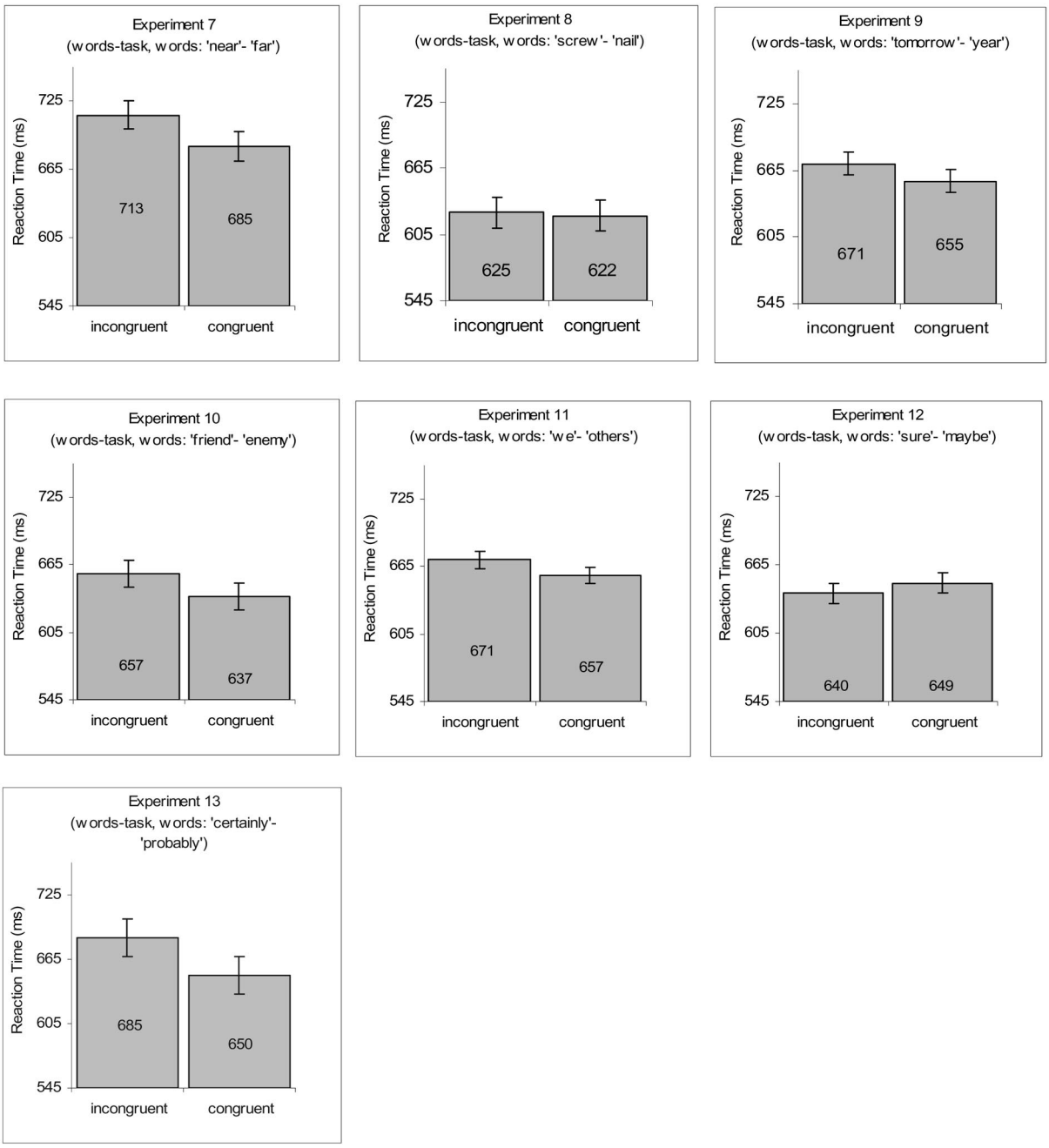

Figure 2. Continued

years, $M = 26.4$), 13 participated in Experiment 10 (9 women, 4 men, ages 20–26 years, $M = 23.5$), 14 participated in Experiment 11 (8 women, 6 men, ages 20–31 years, $M = 23.6$), 10 participated in Experiment 12 (9 women, 1 man, ages 21–29 years, $M = 24.3$), and 14 participated in Experiment 13 (7 women, 7 men, ages 19–30 years, $M = 24.1$). All of these students participated in exchange for course credit. All were native Hebrew speakers.

Materials, design, apparatus, and procedure. The materials were the same as in Experiment 1, except for the two printed words in each experiment. The words were all in Hebrew. The words were "tomorrow" and "year" (Experiment 9), "friend" and "enemy" (Experiment 10), "we" and "others" (Experiment 11), "sure" and "maybe" (Experiment 12), and "certainly" and "possibly" (Experiment 13). The apparatus, procedure, and design were the same as in Experiment 7.

Results and Discussion

Main effects. The only significant main effect was in Experiment 9. We found a main effect of word, $F(1, 15) = 5.36$, $p < .05$,

$\eta^2 = .26$, indicating faster performance when the target word was "year" than when it was "tomorrow."

Experiment 9. The results revealed a Stroop effect engendered by the distance of the words associated with temporal distance. The Word × Distance interaction, $F(1, 15) = 5.21$, $p < .05$, partial $\eta^2 = .26$, documented faster response to congruent ($M = 655$ ms) than to incongruent ($M = 671$ ms) combinations.

Experiment 10. As predicted, distance also engendered a Stroop effect for classification of words associated with social distance. The Word × Distance interaction, $F(1, 12) = 6.77$, $p < .05$, partial $\eta^2 = .36$, documented faster response to congruent ($M = 637$ ms) than to incongruent ($M = 657$ ms) combinations.

Experiment 11. Again, the results revealed a Stroop effect engendered by the distance of words associated with social distance. The Word × Distance interaction, $F(1, 13) = 9.77$, $p < .001$, partial $\eta^2 = .43$, documented faster response to congruent ($M = 657$ ms) than to incongruent ($M = 671$ ms) combinations.

Experiment 12. Contrary to our prediction, there was no interaction, $F(1, 9) = 1.88$, $p = .22$. Classification speed of the words "sure" and "maybe" did not interact with the words' distance. Congruent trials (a spatially proximal "sure" or spatially distal "maybe") were slower ($M = 649$ ms) than incongruent trials ($M = 640$ ms). This difference was opposite to our prediction and not significant.

One possible explanation for the surprising results of Experiment 12 is that the words "sure" and "maybe" have activated another meaning, in addition to psychological distance. This additional meaning might have blocked or weakened the activation of psychological distance meanings. The word "sure" in Hebrew (*batuah*) has the additional, frequently used meaning of "safe." This explanation, however, is challenged by the results of Experiment 6, which used the same two words and yielded the predicted results. It is possible that in Experiment 6, psychological distance was more accessible than in Experiment 12, because in Experiment 6, the task explicitly referred to judgment of distance, whereas in Experiment 12, participants discriminated between two words, and no explicit reference to distance was made. Perhaps, to obtain the predicted effect in a task of words classification, the words have to be associated with psychological distance more strongly than in Experiment 6. We therefore conducted Experiment 13, with two other words that denote hypotheticality and do not have any additional meaning ("certain" as the proximal word and "probable" as the distal word).

Experiment 13. This time, the results revealed a Stroop effect engendered by the distance of words associated with hypotheticality. The Word × Distance interaction, $F(1, 13) = 10.11$, $p < .001$, partial $\eta^2 = .44$, documented faster response to congruent ($M = 650$ ms) than to incongruent ($M = 685$ ms) combinations.

Experiments 9–13 demonstrated that classification of words that denote different meanings of psychological distance was facilitated or impaired, depending on the distance at which they were presented. Participants responded faster to congruent trials (when the word's spatial distance matched the psychological distance conveyed by the word's meaning) than to incongruent trials (when the word's spatial distance mismatched the psychological distance conveyed by its meaning). The results are consistent with our hypothesis that psychological distance is a common meaning that temporal distance, social distance, and hypotheticality share with spatial distance.

General Discussion

Nine experiments examined performance in a Stroop-like task with word and spatial distance as dimensions. In Experiments 3–6, spatial distance (near, far) was the relevant dimension: Participants decided the distance of the words, ignoring their meanings. The words were related to temporal distance (Experiment 3), social distance (Experiments 4 and 5), and hypotheticality (Experiment 6) but did not have direct explicit relation to spatial distance. However, CLT contends that they are all different types of psychological distance and are, therefore, closely related to spatial distance, which is another manifestation of psychological distance. This prediction was supported by the Stroop-like effects that emerged in these experiments. Participants could not ignore the psychological distance that was conveyed by words: Performance was facilitated when the words and spatial location matched by CLT and was impaired when words' meanings and distance mismatched by CLT.

In Experiments 9–13, the meanings of the same words were the target dimension to which participants responded: Participants classified the words, ignoring their spatial locations. In these experiments, again, the observed Stroop-like effects supported CLT's hypothesis. Performance was facilitated when meaning and spatial distance matched and was impaired when meaning and spatial distance mismatched. We interpret the results of the nine experiments as providing initial evidence for the claim that temporal distance, social distance, hypotheticality, and spatial distance form different types of the core concept of psychological distance. Moreover, psychological distance is activated in an automatic fashion (to affect perception and action) upon exposure to any one of these types.

The results of Experiments 3–6 suggest that psychological distance denoted by each word was accessed, although it was irrelevant to the spatial discrimination task (i.e., despite the fact that the participants were instructed to ignore the meaning of the words). In our design, words were uncorrelated with the spatial location of the target stimuli; hence, participants could not benefit from reading the words or processing their meanings. The fact that meaning did affect performance attests to an involuntary activation of psychological distance denoted by the words. The meanings of the words interfered with performance on incongruent trials but facilitated performance on congruent trials. Note that the very terms, congruent and incongruent (with the words used), are only sensible by CLT analysis. The results validate this analysis.

Similarly, the spatial distance of the word was accessed involuntarily in Experiments 9, 10, 11, and 13, when the task required response to the word itself (and performance could not benefit from attending to the spatial distance of the words). Participants were instructed to attend to words, and the entire spatial layout was not mentioned at all. According to Bargh, Chaiken, Raymond, and Hymens (1996), concepts are defined as chronically accessible if they affect behavior or cognition, even when intentional thought and attention are focused on aspects that do not relate to these concepts. In this view, the activation of the psychological distance of the words in Experiments 3–6, and of both words and arrow locations in Experiments 9, 10, 11 and 13, suggests that psychological distance is a chronically accessible aspect of meaning. We contend that the participants' failure to ignore the psychological distance of the stimuli in our experiments attests to the fact that the psychological distance of objects is accessed automatically. This

suggests that psychological distance is an important determinant of perception and action.

Alternative Accounts

Could other factors, besides psychological distance, explain our results? We will address location in two-dimensional space, natural word order, and markedness as potential alternative explanations.[2]

Location in a Two-Dimensional Space

Our experiments used two-dimensional stimuli to represent a three-dimensional reality. To enable easy perception of physical distance, we positioned the majority of the distant targets at the right and top of the picture and the majority of the proximal targets at the left and bottom of the picture. In addition, the distant targets were always smaller than the proximal targets. Would these cues alone, when they do not suggest distance, produce congruency effects similar to those found in our studies?

To examine these questions, we conducted an experiment ($N = 22$) in which participants decided whether a target word was on the top or bottom end of the screen. The target words were not superimposed on pictures, and the background was blank. We used three pairs of English words that differ in psychological distance (sure and maybe, us and them, and week and year). The results did not reveal any congruency effect, as the difference between conditions was never more than 5 ms. These results suggest that vertical location cannot explain our results.

In another experiment ($N = 23$), we examined congruency effects when distance was manipulated without confounding two-dimensional cues. We used the same landscape stimuli as in the original studies, but this time we ensured a zero correlation between the two-dimensional location of the targets and their implied physical distance. In the new set of materials, in half of the 16 images the distant target was lower than the proximal target, and in half of the images the proximal target was positioned at the right side of the screen and the distal target was positioned at the left side of the screen. Finally, the size of the target arrow and the word printed on it were constant, regardless of their distance. We used the words "week" and "year," which pertain to the temporal distance dimension. The results showed that congruent stimuli (a proximal "week" and a distant "year") elicited faster responses than did incongruent stimuli ($p < .05$). These results argue against an interpretation of our findings in terms of a confound with location in the two-dimensional space or size of the letters.

Natural Word Order

Another possibility is that our results could have been produced by an order preference whereby in all dimensions, people prefer the word order near–far to the order far–near. For instance, people would say "in the near and distant future" more often than "in the distant and near future." According to the word-order account, congruency in our studies was between word order and spatial distance.

We examined this possibility with the word pair "salt" and "pepper," for which order preferences but no distance differences exist. We found that participants ($N = 24$) preferred the order salt–pepper to pepper–salt, ($p < .01$). However, English speakers ($N = 26$) did not show congruency effect in an experiment identical to Experiments 1–6 with these words, as the difference between conditions was 3 ms.

We also examined whether the word pairs in our experiments produce consistent order preferences. Hebrew speakers ($N = 24$) preferred the order near–distant in the pairs friend–enemy ($p < .01$) and we–others ($p < .001$). However, there was a marginally significant preference for the order distant–near in the pair maybe–sure ($p = .08$) and no significant order preference for the pairs tomorrow–year and certainly–possibly. This pattern does not suggest a consistent preference for the order near–distant. In view of all the findings on word order, we do not believe that it accounts for the findings of our studies.

Markedness

According to Proctor and Cho (2006), congruency effects in binary classification tasks may reflect congruency in polarity. If one item of each pair is coded as + and the other item in each pair is coded as −, congruency emerges when the two items that are identical in polarity (i.e., two + items or two − items) are paired. Proctor and Cho further suggest that a common feature according to which polarity is assigned is markedness.[3] Broadly defined, an unmarked concept is the more basic, default form of the marked concept. Could our results reflect congruence in markedness rather than a common dimension of distance? We conducted several experiments to examine that.

Does the distance Stroop task produce congruence with markedness? We used the pair even and odd, in which even is unmarked and odd is marked (Proctor & Cho, 2006) but neither is more distal than the other. We conducted three experiments that were similar to Experiments 1–6 but used the word pairs four–nine, three–eight, and five–six. In previous studies, these stimuli yielded congruency effects with several different binary classification tasks (see Proctor & Cho, 2006). In our spatial-distance Stroop task, however, English-speaking participants did not show any congruency effect with the pair four–nine ($N = 24$) or with the pair

[2] A full description of the methods of the additional experiments will be provided upon request.

[3] Polarity might also be assigned according to salience. Specifically, Rothermund and Wentura (2004) suggested that saliency causes many effects in binary classification tasks, such as the implicit association test. They showed that participants respond faster if the salient ends of both dimensions (the figures) are mapped onto one response and the nonsalient categories (the background) are mapped onto the other response. We do not think that this analysis can be applied to our results, however. What is the salient (figure) stimulus, and what is the nonsalient (background) stimulus in our studies? On the spatial dimension, it seems that the proximal stimulus constitutes the salient figure, whereas the distal stimulus constitutes the ground (in our studies, the proximal stimuli were larger than the distal ones, a feature that further supports their relative salience). To classify other stimuli, we can use Rothermund and Wentura's formulation of gender-identity implicit association tests, which examined the pairs self–others and male–female. According to their analysis, "others" is more salient than "self," and the opposite gender is more salient than the participant's gender. In Experiment 4, we used the pair we–others. If "others" is the figure and more salient stimulus, then it should be more congruent with proximity than with distance. Our results, however, show the opposite. We think that the same logic may be applied also to friend versus enemy (enemy is the figure, being more distinct and negative).

five–six ($N = 22$). However, the word "three" was more easily paired with close than with distant ($N = 21$, $p < .05$), an effect opposite to the prediction that markedness (i.e., odd) would be associated with distance. These results suggest that markedness does not produce congruence effects in our paradigm and therefore does not account for our findings.

Can we consistently classify near stimuli as unmarked and distal stimuli as marked? We examined more closely how the different criteria of markedness play out with respect to our stimuli. One criterion is that the less marked concept, being semantically more primitive, is included in the definition of the marked concept. For example, "hope," the unmarked item, may be included in the definition of "despair" more than vice versa (i.e., it is more natural to say "despair is lack of hope" than "hope is lack of despair"). We applied this criterion to our stimuli. Specifically, Hebrew speakers ($N = 24$) judged the statement "distance is a lack of proximity" as more natural than "proximity is lack of distance" ($p < .0001$), indicating that proximity is unmarked. They also judged "others are people who are not us" as more natural than "we are those who are not others" ($p < .05$), indicating that "us" is unmarked. "People say maybe when something is not sure" was judged more natural than the reverse definition ($p < .01$), indicating that "sure" is unmarked; "people say possibly when something is not certain" was also judged as more natural than the reverse definition ($p < .01$), indicating that "certain" is unmarked. No preference was found between "a friend is someone who is not an enemy" and "an enemy is someone who is not a friend." We could not construct reasonable statements for the pair tomorrow–year and did not include this pair in our study. In conclusion, by the test "which term's definition includes the other term," proximity is unmarked. In three of the five word pairs, the psychologically proximal word was the unmarked term; in one pair, no difference in markedness was found; and one pair was not testable. Thus, mapping of distance to markedness is moderately consistent.

There are other tests of markedness, however. Proctor and Cho (2006) suggested that "a term is said to be marked when it does not neutralize to describe the name of the dimension and unmarked when it does" (p. 419). By this criterion, because the dimension is called "distance" (more often than "proximity"), "distant" should be the unmarked concept. We are not sure if this criterion yields clear results with our word pairs; that is, the dimension might be called both probability and certainty, both animosity and friendliness. We cannot construct a clear test for the temporal-distance dimension, because neither tomorrowness nor yearliness seem like names of dimensions. In sum, by the "name of the dimension" test, no clear mapping of our word pairs to marked or unmarked emerges.

What is the relation between markedness and distance? Although we do not think that markedness is a likely account for our findings, we do believe that distance is related to markedness. People experience proximal stimuli before they experience distal stimuli both developmentally and in everyday life. We typically know about our own hunger before we consider the hunger of other people, we are concerned with what is about to happen tomorrow before we consider next year, and we think of the certain before we think of the less likely. Likewise, we have more experience with spatially close stimuli than with spatially distal stimuli. Children, it seems, gradually expand their perceptions and conceptions to include stimuli of increasing distances. In this sense, it is reasonable to suppose that the more proximal concepts are more primitive.

But distance is not the only determinant of frequency of experiences, and frequency of experience is not the only determinant of markedness; therefore, markedness is a broader concept than distance. For example, female is marked category and male unmarked, even is unmarked and odd is marked, but none of the words in each pair is more distal than the other. We believe, and our results demonstrate, that when markedness is unrelated to distance, no congruence emerges with spatial distance, as measured in our Stroop task.

Why Would People Automatically Assess Psychological Distance?

We think that the importance of psychological distance stems from its effect on construal. Specifically, people tend to construe psychologically distant targets in relatively abstract, high-level terms and proximal targets in more concrete, low-level terms. CLT contends that higher levels of construal are engendered by distance from direct experience and that level of construal is consequential for a variety of outcomes. Indeed, research conducted within the framework of CLT demonstrated many important consequences of distancing on evaluation, decision making, confidence, self-control, and creativity, all of which were hypothesized to be mediated by the effect of distancing on level of construal (see Liberman et al., in press, for a review). Conceptually similar effects of distancing have been demonstrated with temporal distancing (Liberman & Trope, 1998; Nussbaum, Liberman, & Trope, 2006; Trope & Liberman, 2003), spatial distancing (Fujita, Trope, Liberman, & Levin-Sagi, 2006; Henderson, Fujita, Trope, & Liberman, 2006), hypotheticality (Wakslak, Trope, Liberman, & Alony, 2006), and social distance (for a review, see Pronin, Gilovich, & Ross, 2004). These lines of research suggest that distancing on all of the psychological-distance dimensions produce similar outcomes because of their similar effects on construal. For example, recent studies on self-control view self-control dilemmas as a conflict between behavioral implications of high-level construal of the situation (the alternative that requires self-control) and low-level behavioral implications of the same situation (the temptation). This view has been supported by research showing that higher construal level enhanced self-control (Fujita et al., 2006) and that temporal and physical distancing produced similar effects (e.g., Ainslie & Haslam, 1992; Frederick, Loewenstein, & O'Donoghue, 2002; Mischel & Ebbesen, 1970; Vohs & Heatherton, 2000). We believe that the important consequences of construal level, such as success at self-control, make psychological distance a highly accessible concept, as the present findings demonstrate.

We emphasize, however, that the fact that different distances have similar effects on construal does not logically entail that the dimensions would be interrelated. Therefore, the present experiments go beyond previous findings on the effect of distances on construal and on construal-related phenomena. Moreover, we think that the interrelations among distance dimensions have important psychological implications, some of which we discuss next.

Interrelations Among the Other Three Psychological Distance Dimensions

In the current research, we examined the interrelations between spatial distance and three other psychological-distance dimensions: temporal distance, social distance, and hypotheticality. We chose spatial distance, because it was easier to create stimuli that combined variable spatial distance and printed words. Nevertheless, we believe that with suitable tasks, similar interrelations can be found among each of the dimensions of psychological distance.

The interrelations among different dimensions of psychological distance can also be examined by using methods that require more complex cognitive functions and that take place in a more natural social context. Such interrelations have been demonstrated in studies that measured changes in people's estimations of a target's distance on one dimension of psychological distance as a function of the distance of the same target on other psychological-distance dimensions. For instance, Stephan, Liberman, and Trope (2006) requested participants to imagine meeting their roommate either on the following day or 6 months later and to describe that roommate. Participants then indicated how familiar (i.e., how socially proximal) the roommate seemed to them. It was found that expecting to meet the roommate sooner enhanced his or her perceived familiarity. This study demonstrates the effect of temporal distance on social distance. It is notable that in this study, temporal distance was unrelated to the social distance of the targets—there was no reason to believe that a roommate who would arrive the next day would be more familiar than a roommate who would arrive in six months. These findings, as well as the findings of the present research, demonstrate a certain degree of interchangeability among the different distance dimensions and suggest that all of these distances have in common a single dimension of psychological distance.

Is Distance a Basic Dimension of Meaning?

It is interesting to consider how distance differs from evaluation, potency, and activity, the three basic dimensions of meaning uncovered in the classic studies by Osgood and his colleagues (e.g., Osgood & Suci, 1955). If distance is chronically accessible and automatically accessed, why didn't it emerge in Osgood & Suci's (1955) research as a basic dimension of meaning? We think that distance, although always important and relevant, is not part of the invariable semantic meaning of a word. For example, if I see a tiger, it is very important and relevant to assess whether it is near or far. If I see a ball I like, it is very relevant whether it is mine or another child's or whether it belongs to a friendly or a hostile child. Being near to or far from a perceiver, however, is not part of the semantic meaning of "tiger" or "ball." Only some words in the language (e.g., the words used in our studies) denote invariably distant or proximal entities. Distance, we believe, is a basic dimension, because it is important and relevant, not because it organizes the semantic space in a relatively stable way, like the dimensions of evaluation, potency, and activity. Distance is not only relative and context-dependent, it is also dependent on the interaction between the perceiver and the situation. That is why, we believe, Osgood, who assessed general meaning, did not uncover it in his studies of meaning.

Hierarchy of Psychological Distance Dimensions

Is it possible that some dimensions of distance are more primary than other dimensions? In other words, is it possible that concepts of some distances (e.g., temporal distance) are developed on the basis of and understood as a metaphor to other distances (e.g., spatial distance). Such hierarchy is suggested by the findings of Boroditsky and her collogues (Boroditsky, 2000, 2001; Boroditsky & Ramscar, 2002). Boroditsky (2000) suggests that the domain of time is shaped by metaphorical mappings from the domain of space. She has found spatial supremacy that supports this view (Boroditsky, 2000, Experiments 2 and 3): Thinking about space before answering questions about time influenced the participants' responses, but thinking about time before answering questions about space did not have a similar effect.

It is important to note that our results cannot speak to a hierarchy between the different dimensions of distance, nor were our studies designed to detect such hierarchy. The results of Experiment 3 show that concepts related to time can affect the processing of spatial distance. The fact that the temporal domain interferes with the processing of the spatial domain does not rule out, however, the possibility that the spatial domain is superior to the temporal domain or other domains of distance.

Conclusions

The current research demonstrates that people process stimuli composed of spatial location (with respect to the observer) and a word that denotes temporal distance, social distance, or hypotheticality more easily if the stimuli are identical (rather than different) in their relative psychological distance. This was found despite the fact that the tasks required response to only one of the dimensions. The results are interpreted as reflecting a tendency to access psychological distance of stimuli automatically, even when it is neither directly related to nor instrumental for people's current goals. These findings implicate psychological distance as an important dimension of meaning, reflecting the commonality of the four different dimensions.

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