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Case Report

Too close to call: Spatial distance between options influences choice difficulty☆

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ABSTRACT

In language, people often refer to decision difficulty in terms of spatial distance. Specifically, decision-difficulty is expressed as proximity, for instance when people say that a decision was "*too close to call*". Although these expressions are metaphorical, we argue, in line with research on conceptual metaphor theory, that they reflect how people think about difficult decisions. Thus, here we examine whether close spatial distance can actually make decision-making harder. In six experiments (total $N = 672$), participants chose between two choice options presented either close together or far apart. As predicted, close (rather than far) choice options led to more difficulty, both in self-report (Experiment 1A–1C) and behavioral measures (decision-time, Experiment 2 and 3). Identifying a boundary condition, we show that close choice options lead to more difficulty only for within-category choices (Experiment 3). The too-close-to-call effect is theoretically and methodologically relevant for a broad array of research where choice options are visually presented, ranging from social cognition, judgment and decision-making to more applied settings in consumer psychology and marketing.

1. Introduction

When people talk about difficult decisions, they often invoke spatial language. For instance, people may say that a decision "*was too close to call*" or "*the alternatives were close*". Even though the words used in such expressions refer to spatial distance between choice options, listeners immediately understand that the speaker is actually talking about the difficulty of the decision. We propose that this metaphorical connection between spatial distance and decision-difficulty is not merely a figure of speech and test whether the spatial distance between two choice alternatives affects experienced decision difficulty. If this were the case, it would be important for at least two reasons. First, spatial distance is a key feature of the world that is present in many choice situations. People often encounter choice options in a specific spatial arrangement, for instance on shelves in a store, on websites, in brochures, or on computer screens, to name but a few possibilities. Second, as Hastie (2001) observed, one of the most important questions in decision research is: *What makes a decision difficult?* If linguistic references to "close" alternatives are not merely a way to describe difficulty of choice, the spatial distance between choice options may be part of the answer in many choice situations. Hence, we examine whether a choice between two alternatives is indeed more difficult when the alternatives are presented close to one another in physical space.

2. Space and decision-making

As is the case for other conceptual metaphors (IJzerman & Koole, 2011; Lakoff & Johnson, 1980; Lee & Schwarz, 2014; Schwarz & Lee,

☆ This experiment was conducted before Experiment 1A, therefore, we could not base the power calculations on the effect sizes found in this experiment.

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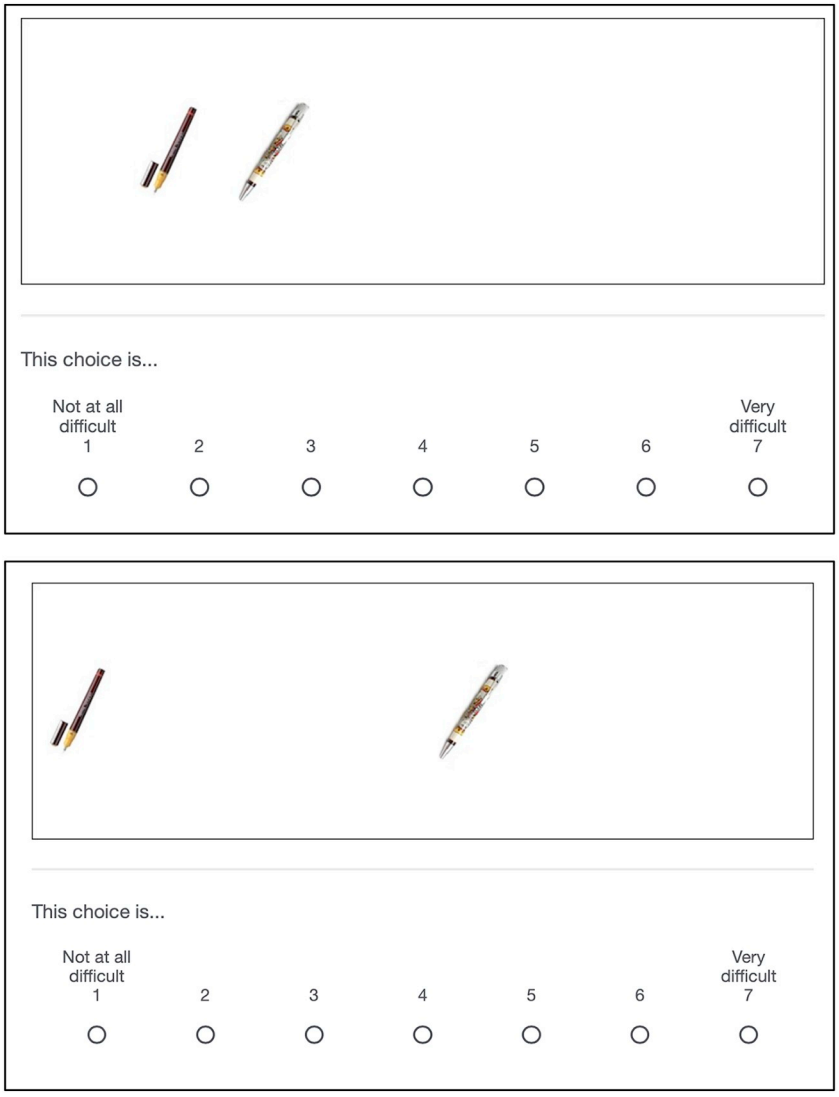

Fig. 1. Example of close choice options (top) and far choice options (bottom). Note that participants did not see the same pairs far and close.

2018), the metaphorical relationship between closeness and decision-difficulty shows that decision-making is grounded, in part, in concrete experiences of spatial distance. This is apparent in the way in which people intuitively use spatial dimensions in decision-making to make decision-making easier. For instance, people write list of pros and cons of a decision on alternate halves of a piece of paper, keeping them physically separated, or use different hands for different options (Calbris, 2008).

The idea that decisions are harder when choice options are spatially close to one another has not yet been tested directly. However, some suggestive support comes from research on the influence of response key placement in dichotomous categorization-tasks. When people have to indicate which of two categories a single stimulus belongs to, they are slower to do so when the response keys are set close together on the keyboard instead of far apart. For example, people take longer to indicate whether a word is positive or negative, whether a cube is a lighter or darker shade of blue, or whether the color of a word on the screen is red or blue when the response keys are close together (Lakens, Schneider, Jostmann & Schubert, unpublished studies; Lakens, Schneider, Jostmann, & Schubert, 2011). In these tasks, participants are presented with a single stimulus and decide its assignment to one of two categories, thus making an epistemic decision. What varies is the spatial difference between the response keys that correspond to the categories.

In contrast, the present studies vary the spatial distance between two consumer products and ask participants to choose the one they prefer. The spatial distance of the response keys is held constant. Of interest is whether the spatial distance between the choice alternatives influences the subjective experience of choice difficulty. Note that spatial distance here refers to allocentric spatial distance, that is, distance between two objects outside the self, here the distance between the choice alternatives. This is different from egocentric spatial distance, that is distance between the self and an object in the world, that

has been the focus of construal level theory (Trope, Liberman, & Wakslak, 2007; Trope & Liberman, 2010). The egocentric distance relevant to construal level theory is held constant in the present experiments.

3. Current experiments

In five studies we examine whether a choice between the same two alternatives is experienced as more difficult when they are spatially close to one another rather than farther apart in space. We predict that decision-making is harder when the choice options are close to one another. We test this hypothesis using different choice options and different measures of decision-difficulty.

For all experiments, Cohen's d_z effect sizes (Cohen, 1988; Lakens, 2013) and 95% confidence intervals around the effect size are calculated using a procedure developed by Wuensch (2012). Sample sizes were calculated using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) with the alpha level set to 0.05. All participants were treated in accordance with the American Psychological Association's Ethical Principles in the Conduct of Research with Human Participants. We report all measures, manipulations, and exclusions, as well as how the final sample was determined, for each of the experiments. Data was only analyzed after data collection ended and collection was not resumed after analyses. For directional hypotheses, we report one-sided *p*-values. All data, materials, and analyses scripts can be found here: https://osf.io/36mdq/?view_only=d8dcff390f054e14bc9e46c6d44125de

4. Experiment 1A

In Experiment 1A we asked participants to choose between two writing instruments (for instance a ballpoint and a mechanical pencil) and report on how difficult the choice was. Chronologically, Experiment 1A was run after Experiment 1B. Based on the effect size of Experiment 1B, we calculated 199 participants to detect $d_z = 0.20$ with 0.80 power. In case this effect size was inflated, we collected an additional 50 participants which would give us 0.77 power to detect an effect size of $d_z = 0.15$. However, we did not set the sample size calculation to a one-sided tail, and correcting for this, the sample size of 250 gave us 0.93 power to detect an effect of $d_z = 0.20$.

4.1. Method

4.1.1. Participants and design

Two-hundred-fifty-one participants (123 male, 127 female, 1 other, $M_{age} = 36.29$, $SD = 11.88$) were recruited on Amazon Mechanical Turk to participate in a 1-minute survey for $0.15. Distance (close vs. far) was manipulated within participants.

4.1.2. Procedure

Participants were told they would be presented with choices between different products and asked to indicate how difficult the choice was (1 – *not at all difficult*, to 7 – *very difficult*). There were two different choice sets of two writing instruments; half of the participants saw combination A close and combination B far and vice versa for the other half (Fig. 1). At the end of the experiment participants indicated their age and sex.

4.2. Results and discussion

Preliminary analyses showed that counterbalance conditions had no effect on the results; they are not considered further. We conducted a dependent sample *t*-test on difficulty with distance as within-subject factor. In line with our hypothesis, decision difficulty was higher for close choice options ($M = 3.18$ $SD = 1.69$) than for far choice options ($M = 2.96$, $SD = 1.65$), $t(250) = 2.171$, $p = .016$ (one-sided), $d_z = 0.14$, 95% CI [0.01, 0.26].

5. Experiment 1B

In Experiment 1B we asked participants to make a choice between the writing instruments, and report on difficulty and confidence. We calculated that we needed 100 participants to detect $d_z = 0.25$ with 0.80 power given alpha = 0.05 and a one-sided test.

5.1. Method

5.1.1. Participants and design

One-hundred participants (46 male, 54 female, $M_{age} = 37.29$, $SD = 11.82$) were recruited on Amazon Mechanical Turk to participate in a 1-minute survey for $0.15. Distance (close vs. far) was manipulated within participants.

5.1.2. Procedure

The procedure was the same as in Experiment 1A, with the exception that participants were now asked to choose one of them by clicking on it (Fig. 2). As in Experiment 1A, we measured difficulty, by asking participants to indicate how difficult the decision was (1 – *not at all difficult*, to 7 – *very difficult*). We also asked participants to indicate how confident they were about their decision (1 – *not at all confident*, to 7 – *very confident,* reverse coded). These items were averaged to form an overall index of decision-difficulty ($r = 0.52$). Participants made two choices in total, once between two spatially close choice options and once between two spatially far choice options and order of presentation was counterbalanced. At the end of the experiment participants indicated their age and sex. We also collected a personality measure and the state participants resided in for another project; these variables are not reported here.

5.2. Results and discussion

Preliminary analyses showed that the counterbalance condition had no effect on the results; hence it will not be considered further. Higher scores on the difficulty index indicate more difficulty (ranging from 1 to 7). We conducted a dependent sample *t*-test on this index with distance as a within-subject condition. As expected, participants found it more difficult to make a decision when they saw the choice options close together ($M = 2.62$, $SD = 1.37$) rather than far apart ($M = 2.35$, $SD = 1.15$), $t(99) = 2.015$, $p = .023$ (one-sided), $d_z = 0.20$, 95% CI [0.00, 0.39].

6. Experiment 1C

To ensure these findings are not particular to the writing instruments used, Experiment 1C provides a conceptual replication of Experiment 1A and 1B, using different kinds of baked goods. We presented two different baked goods close to one another vs. farther apart

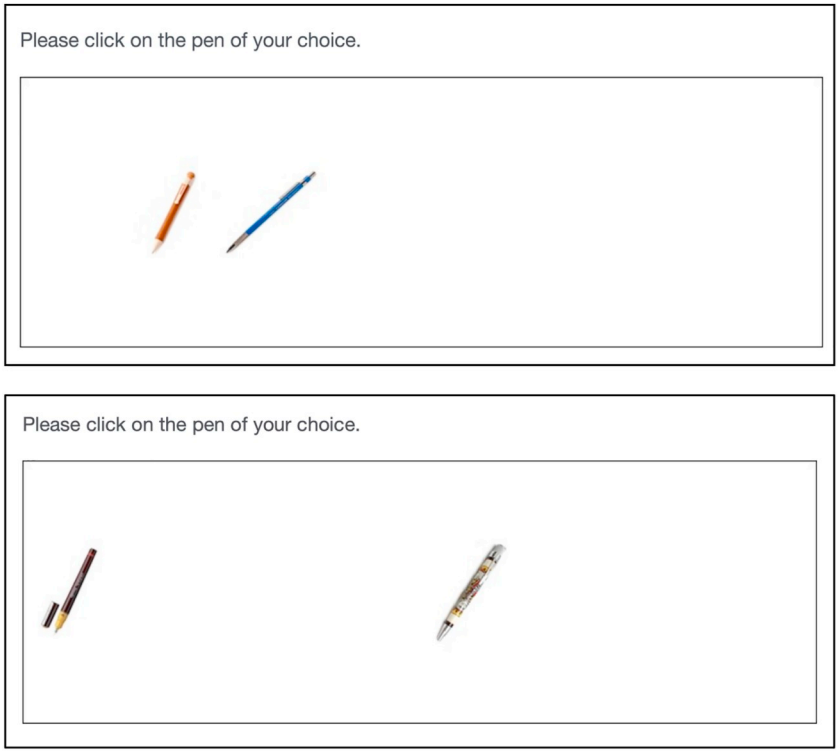

Fig. 2. Example of far choice options (top) and close choice options (bottom). Note that participants did not see the same pairs far and close.

in sixteen trials and asked people to choose one of the two. We then assessed decision difficulty as in Experiment 1A. We calculated that we needed 156 participants to detect $d_z = 0.20$ with 0.80 power given alpha = 0.05 and a one-sided significance test. However, due to an error in the request for participants from the online participants recruitment platform Cloud Research, we only collected data from 150 participants, resulting in 0.79 power to detect $d_z = 0.20$.

6.1. Methods

6.1.1. Participants and design

One-hundred-fifty participants (80 males, 69 females, 1 not specified, $M_{age} = 36.81$, $SD = 12.54$) were recruited on Amazon Mechanical Turk to participate in a 7-minute survey for $0.70. Distance (close vs. far) was manipulated within participants.

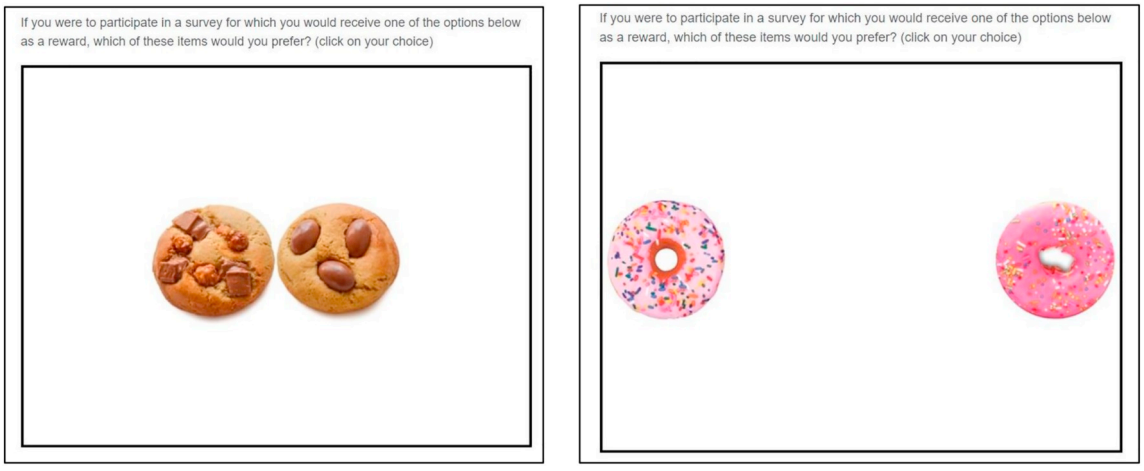

Fig. 3. Example of far choice options (top) and close choice options (bottom).

6.1.2. Procedure

Participants were told they would be asked to choose between different products as a hypothetical reward for participation in a study. In 16 trials they then saw product pairs (cookies, donuts, muffins, and cupcakes, see Appendix A) on the screen and chose one of them by clicking on it (Fig. 3). On the next page they reported how difficult the choice was (1 = very easy, to 10 = very hard) and how confident they felt about it (1 = very unsure, to 10 = very confident). Each participant saw 8 close pairs and 8 far pairs. All participants saw the same 16 pairs, with the combination of stimuli and distance counterbalanced between participants. Finally, we asked participants to indicate whether there were any baked goods in the experiment that they would eat under no circumstance by ticking a box next to the different goods (cookie, cupcake, donut, muffin). At the end of the experiment participants indicated their age and sex. We also collected a personality measure and the state participants resided in for another project; these variables are not reported here.

6.2. Results and discussion

If participants indicated that they did not eat a specific baked good (cookies, cupcakes, donuts of muffins), the respective trials were excluded (17.3%). Confidence ratings were recoded such that higher scores indicate lower confidence and combined with difficulty ratings, $r(128) = 0.78$, $p < .001$, to create a single index of decision difficulty. Higher scores on this index indicate higher difficulty.

Replicating Experiment 1A, a dependent sample t-test on this index with distance as a within-subject condition showed an influence of spatial proximity on choice difficulty. The same choices were experienced as more difficult when the choice alternatives were presented spatially close to one another ($M = 3.27$, $SD = 1.46$) rather than farther apart ($M = 3.12$, $SD = 1.39$), $t(129) = 1.717$, $p = .044$ (one-sided), $d = 0.10$, 95% CI [−0.01, 0.21].

7. Experiment 2

The self-reports collected in Experiment 1A-1C support the notion that a choice between the same options is experienced as more difficult when the options are presented close in space rather than farther apart. Experiment 2 goes beyond self-reports by using response latencies as a behavioral measure of choice difficulty. As numerous studies indicated, making difficult decisions requires longer deliberation than making easy decisions (e.g., Luce, 1998; Luce, Bettman, & Payne, 1998). Based on an exploratory study, we estimated an effect size of $d_z = 0.35$, and aimed for at least 67 participants to achieve 0.80 power, while upper bounds were determined by the number of volunteers who signed up in the specified lab period. However, because in this calculation the tail parameter should have been “one” instead of “two”, the power calculation is overly conservative, and the real power for detecting this effect given this sample size was 0.88.

7.1. Method

7.1.1. Participants and design

Seventy-six (52 female, 24 male, $M_{age} = 22.97$, $SD = 7.93$) participants were recruited at the Vrije Universiteit Amsterdam for 10 course credits or €2. The experiment took about 8 min to complete. Distance was manipulated within subjects, with decision-time as the main dependent variable.

7.1.2. Materials

We used 96 images of writing instruments to create 48 pairs (i.e., marker, mechanical pencil, ballpoint, fountain pens, etc., see Appendix B). Images were obtained from the Internet and modified to have the same orientation, size (160 by 160 pixels), and background color (white).

7.1.3. Procedure

In each choice trial, participants saw two writing instruments displayed on the computer screen and were asked to choose which one they preferred as a gift for themselves. In the close condition, the centers of the images were separated by 160 pixels (i.e., images were adjacent). In the far condition, the centers of the images were separated by 480 pixels (i.e., three times the image width). To reduce demand effects, we varied the locations of the pairs, while keeping distance constant within each condition (see Appendix C for the possible locations for each condition). In each trial, the choice pair remained on screen until participants indicated their choice by pressing either the [F] (for the left item of the pair) or [J] key (for the right item of the pair) on the keyboard, for which reminder labels were placed at the bottom of the screen. After this, a new pair appeared. Pairs were presented in random order and each participant completed 48 trials. At the end of the experiment, we recorded participants' sex and age.

7.2. Results and discussion

Ten participants were excluded from analyses because they had participated in a related previous experiment. However, including them did not change the pattern of results. To reduce the influence of extreme values, decision-times below 300 ms. or decision-time Z-values higher than 3 standard deviations from the group mean were excluded from analyses, although this also did not influence the pattern of results. In accordance with these criteria, we excluded 3.3% of the response-time data.

We predicted that it would be more difficult for participants to choose between two writing instruments when they were presented close together, compared to farther apart. This was the case. Participants were slower to indicate their choice when the writing instruments were shown close together ($M = 1603$, $SD = 485$) rather than far apart ($M = 1533$, $SD = 447$), $t(65) = 2.657$, $p = .005$ (one sided), $d_z = 0.33$, 95% CI [0.08, 0.57]. These findings conceptually replicate our findings from Experiment 1A-C, using visual stimuli.

8. Experiment 3

In Experiment 3 we identify a boundary condition for the too-close-to-call effect. So far, we found that close spatial distance between choice alternatives increases decision-difficulty. We have argued above that this occurs because close spatial distance makes it harder for people to differentiate the preferred choice option from the non-preferred choice option. Differentiation is particularly important in choices between two options from the same category – so called within-category choices. All preceding experiments were of this type. In contrast, between-category choices (e.g., a choice between a ball and a hat) require a process of abstraction to align choice options along the same dimensions to enable comparison (Johnson, 1989). Hence, spatial proximity of the choice options should increase choice difficulty more for within-category choices than for between-category choices.

In Experiment 3 we test this prediction by varying the distance

between choice options as well as the type of choice (between vs. within-category). The within-category choice condition also provides a direct replication of Experiment 3. We estimated an effect size of $dz = 0.35$, thus aiming for at least 67 participants to achieve 0.80 power; upper bounds were determined by the number of participants who signed up in the specified lab period. However, because in this calculation the tail parameter should have been "one" instead of "two", the power calculation is overly conservative, and the real power for detecting this effect given this sample size was 0.88.

8.1. Method

8.1.1. Participants and design

Ninety-five (26 female, 69 male, $M_{age} = 20.14$, $SD = 1.72$) participants were recruited at the University of Southern California for 1 course credit. The experiment took about 8 min to complete. Distance and choice type (within-category vs. between-category) were manipulated within subjects, with decision-time as the main dependent variable.

8.1.2. Materials

For the within-category choice type, we used the same images of writing instruments as in Experiment 2, constituting a direct replication. For the between-category choice type, we used 96 images of different objects (Kovalenko, Chaumon, & Busch, 2012) to create 48 pairs (see Appendix D). Images were modified to have the same orientation, size (160 by 160 pixels), and background color (white).

8.1.3. Procedure

The experiment followed the same procedure as Experiment 2 with the following exceptions. First, to make instructions applicable to both writing instruments and different category objects, we asked participants to indicate which of two *items* they preferred as a gift. Second, within-category and between-category options were presented in a blocked design, with block order counterbalanced.

8.2. Results and discussion

Using the same criteria as in Experiment 2, we excluded 1.7% of the data. Preliminary analyses showed that presentation order did not influence the pattern of results and is not discussed further. We performed a mixed model repeated measures analysis with distance and type of choice options as within-subjects factors. We expected that close spatial distance would increase choice difficulty for within-category choices (writing instruments) because they require differentiation, but not for between-category choices (different objects). This was the case. An interaction between distance and type of choice option $F(1, 92) = 11.269$, $p = .001$, $\eta_p^2 = 0.11$ revealed that participants who made a within-category choice were slower to indicate their preference when the choice options were presented close together ($M = 2065$ ms, $SD = 675$ ms) rather than farther apart ($M = 1991$ ms, $SD = 695$ ms), $t(92) = 2.625$, $p = .005$ (one-sided), $d_z = 0.27$, 95% CI [0.06, 0.48]. This directly replicates Experiment 2 and conceptually replicates Experiment 1A-C.

For between-category choices (different category objects) the effect of distance was reversed and participants were faster to indicate their preferences when the choice options were close ($M = 2109$ ms, $SD = 625$ ms) rather than farther apart ($M = 2182$ ms, $SD = 728$ ms), $t(92) = 2.556$, $p = .006$ (one-sided), $d_z = 0.27$, 95% CI [0.06, 0.47]. Importantly, this reversal was unpredicted – we merely expected a pronounced attenuation of the impact of spatial distance. The reasons for the observed reversal remain unclear. Given that between-category choices rely strongly on processes of abstraction in order to align comparable dimensions (Johnson, 1989), and perhaps closeness can facilitate this process, but at this point we can only speculate. Note that while for reasons of consistency we reported a one-sided *p*-value for this effect, we do urge great caution in interpreting this unpredicted finding.

Finally, a main effect of type of choice option showed that within-category choices were faster ($M = 2028$ ms, $SD = 668$ ms) than between-category choices ($M = 2145$ ms, $SD = 660$ ms), $F(1, 92) = 7.808$, $p = .006$, $d_z = 0.29$, 95% CI [0.08, 0.50], which probably reflects that choices between more similar (i.e. same category items) are easier than between choices between very different choice options (i.e. different categories) (Mellers & Biagini, 1994). There was no main effect of distance, $F(1, 92) = 0.001$, $p = .970$, $\eta_p^2 = 0.00$). Together, these findings directly replicate the findings from Experiment 2 (within-category choices) and reveal a boundary condition.

9. General discussion

In language, decision-difficulty is often expressed in spatial language. That is, when a decision is difficult, people might say that the decision is "too close to call". But are close choice options really more difficult or is this a mere figure of speech? In this work we drew on work in conceptual metaphor theory and embodied cognition and argued that spatial distance between choice options does matter. Specifically, in line with the metaphor, we predicted that close choice options would lead to more decision difficulty than choice options that were presented far apart. The results of five experiments provided empirical support for our prediction: Making a choice was more difficult when the options were presented in close proximity than when they were presented farther apart. This was reflected in self-reports of higher difficulty (Experiments 1A-1C) and lower confidence (Experiments 1B and 1C) as well as in the behavioral effect of longer decision times (Experiment 2 and 3). This effect occurred only for within-category choice situations, revealing a boundary condition.

As far as we know, this is the first work to examine between choice options as a factor in decision difficulty. So far, spatial distance has mostly received attention in research on Construal Level Theory (Trope et al., 2007; Trope & Liberman, 2010). In this theoretical frame, the focus is on egocentric spatial distance, that is, distance between the self and some object in the world. In contrast, our manipulation is based on allocentric spatial distance, that is, distance between two objects in the world. Nevertheless, future work might find fruitful avenues in exploring how egocentric and allocentric distance exert similar or different effects on choice behavior.

The current findings show a that spatial distance, a relatively subtle manipulation that does not change the properties of the individual choice options, can influence how difficult people find it to make a choice. One might assume that the choices made were not consequential for the participants in our studies. An interesting question for future research is to manipulate the importance of the choice to see whether spatial distance exerts an effect under such choice circumstances. On the one hand, one may predict that subtle cues can only influence experience under situations of ambiguity or low importance. If so, then an important decision would prompt more thorough processing of the choice and eliminate the influence of spatial distance. On the other hand, work on metaphorical effects of weight on perceived

importance of a book has shown that the effect of weight increases under more knowledge, not less (Chandler, Reinhard, & Schwarz, 2012), suggesting that metaphorical embodied effects operate not merely in the realm of ambiguity and heuristics.

In this work, we used mostly visual stimuli, specifically pictures of products. One intriguing question is whether distance can also influence choice difficulty when people are choosing between options that are verbally presented, such as product descriptions, for instance. Indeed, often in life, people encounter choices in a verbal manner. One possibility is that it depends on the complexity of the verbal information. If choice options are simply represented by s single word (e.g., ball pen) then choice options might be processed similarly to visually represented choice options. However, if choice options include more text to be read and understood, different processes related to reading and understanding might come in to play in the experience of the decision.

In Experiment 3 we identified a boundary condition to our effect. Close choice options are more difficult only for choice options that belong to the same category (within-category). This is in line with our reasoning that spatial distance can help "keep things apart" (Lakens et al., 2011). Indirectly, this suggests that ease of differentiation is a good candidate for the underlying process. However, we have not tested this directly and future work might successfully measure differentiation directly. Unexpectedly, we found that for choice options that do not belong to the same category, choices became easier when choice options were close. Because we did not expect this reversal, we are hesitant to speculate on them findings here. Nevertheless, these findings do suggest that the influence of spatial distance is dynamic, and exerts differential influence depending on the decision-maker's task and the type of stimuli. As such, spatial distance seems to operate not only on the visual level, but possibly taps into conceptual processes.

10. Conclusion

Spatial distance is a key feature of many choice processes. So far, research on choice has largely neglected this factor. As far as we know, we are the first to show that close spatial distance – in line with the metaphor of a choice being "too close to call" or "close alternatives" relating spatial distance to difficulty – that close choice options lead to more difficult choices. This work opens up new avenues in research aimed at understanding what makes decisions difficult and add to an ever-growing body of research showing that metaphors are not mere linguistic tools, but often provide a window into people's experiences with the world around them.

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Appendix A

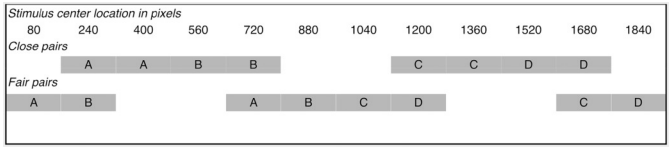
Baked goods used in Experiment 1C

Appendix B

Pairs used in Experiment 2

Appendix C

The table below shows the possible locations of each of the stimulus pairs. The first row indicates the 12 different positions possible on the screen, each with the location of the center of the position in pixels. The row marked with close pairs indicates the 4 different positions of close pairs. The row marked with Far pairs indicates the 4 possible locations for far pairs. Pairs are indicated by similar letters. Thus, as an example in the CLOSE condition, for pair A one stimulus would appear at the 240 pixel position, and one stimulus at the 400 pixel position. As an example in the FAR condition, for pair A one stimulus would appear at the 80 pixel position, and one stimulus at the 720 pixel position



Appendix D

Object pairs used in Experiment 3

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