Title

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Abstract

Previous studies have shown that when choosing one of the logically equivalent frames (e.g., "half full" or "half empty"), speakers tend to choose one based on a reference point. For example, when the amount of water in a glass with 500ml capacity was originally 0ml (or 500ml) and then increased (or decreased) to 250ml, speakers tended to express the content of water in the glass as "half full" (or "half empty"). We examined why speakers chose one of the logically equivalent frames. In addition, we examined whether an irrelevant reference point affected speakers' choice of frame. In order to examine these two issues, we conducted three behavioral experiments using a frame choice task. Specifically, participants were presented with a task-relevant (story-based) or task-irrelevant (prime-based) reference point and then asked to choose a frame. Following this, they were asked to reveal the reason for the frame choice. Our findings were summarized with the following two points. First, when reference points were task-relevant, many participants chose a frame based on the reference point with explicit reason. Second, even when reference points were task-irrelevant, they affected frame choices and almost all of our participants did not report the effect of the irrelevant reference point. These results indicate that the effect of reference points on frame choices is robust and that people do not always notice the effect.

Keywords: frame choice; reference point hypothesis; reference point

Introduction

Since Tversky and Kahneman (1981) first documented framing effects, many researchers have examined their mechanisms from several perspectives (e.g., Keren, 2011; Kühberger, 1998; Levin, Schneider, & Geath, 1998; Soman, 2004). Most previous studies have examined how differences in framing (i.e., difference in expression) influence people's psychological processes, such as decisions, judgments, or evaluations. In contrast, other recent research has discussed how speakers frame outcomes (e.g., Honda & Matsuka, 2014; Keren, 2007; McKenzie & Nelson, 2003; Sher & McKenzie, 2006, 2008). In this article, we discuss the cognitive processes of speakers' choice of frame. Particularly, we focus on speakers' choice of frame based on a reference point.

Speakers' choice of frame: Reference point–based framing

McKenzie and colleagues proposed the reference point hypothesis in order to explain frame choice behavior (McKenzie & Nelson, 2003; Sher & McKenzie, 2006, 2008). According to Sher and McKenzie (2006, p. 471), the reference point hypothesis states that in describing a fixed state of proportionate affairs, speakers are more likely to describe the proportion in terms of "X1" when X1 has increased relative to the reference point (the norm, or what one would have expected) than when X1 has decreased relative to the reference point. Imagine a glass with a capacity of 500ml that contains 250ml water. The reference point hypothesis predicts that people tend to describe the content of the glass as "half full" when the glass previously contained 0ml rather than when it previously contained 500ml. In contrast, people prefer the expression, "half empty," when the glass previously contained 500ml than when it previously contained 0ml. In other words, a certain frame is chosen in one situation (i.e., when the proportion denoted by the frame is increased relative to a reference point) more often than in the other situation (i.e., when the proportion denoted by the frame is decreased relative to a reference point).

The reference point hypothesis states that people choose one of the logically equivalent frames based on a reference point. McKenzie and Nelson (2003) as well as Sher and McKenzie (2006; see also Honda & Yamagishi, 2017; Keren, 2007; Juanchich, Teigen, & Villejoubert, 2010; Moxey & Sanford, 1993a, 1993b; Teigen & Karevold, 2005) showed that speakers' verbal behaviors were well

explained in terms of the reference point hypothesis in the context of conveying quantitative information.

Does a speaker choose a frame based on the reference point with explicit reason?

Previous studies have examined the reference point hypothesis from various perspectives and found that a wide range of speakers' verbal behaviors can be explained in terms of the reference point hypothesis. In other words, when people choose one of the logically equivalent frames in communicating information about quantity, they focus on the change in quantity from the reference point to the present situation.

However, we raise the following research question: Does a speaker report that s/he chose a "full" (or "empty") frame because s/he notices that the amount of water has increased (or decreased) compared to the reference point? No previous studies have examined this topic in detail.

In particular, the following two points have not been clarified previously. First, previous studies have not directly examined the reason why a speaker chooses a particular frame. So far, researchers have mainly examined the effect of reference points on frame choice by manipulating the reference point. In other words, previous studies have mainly analyzed frame choice behaviors. However, to the best of our knowledge, no studies have directly examined the reason why a speaker chooses one of the logically equivalent frames.

Second, previous studies have not examined what kind of reference point affects speakers' choice of frame. They have only examined how a task-relevant reference point (i.e., a change in quantity from the reference point that is unequivocally important information in the situation) affects speakers' choice of frame. These findings indicate that a speaker tends to focus on the reference point in a communicative situation. Furthermore, many studies on judgment and decision making have shown that reference points play an important role in human decisions, judgments, and evaluations (e.g., Allen, Dechow, Pope, & Wu, 2017; Kahneman & Tversky, 1979; Tversky & Kahneman, 1992). Given that reference points affect various aspects of cognitive processes, even irrelevant reference points in a communicative situation may affect the speaker's choice of frame. Furthermore, the speaker may not notice the effect of the irrelevant reference point on her/his choice of frame.

On the basis of these considerations, we examined the following two aspects in the present study. First, we examined the reason a speaker gave for choosing one of the logically equivalent frames. We did so by directly asking participants why they chose one of the logically equivalent frames. Second, we examined whether a task-irrelevant reference point affected the speakers' frame choice.

In order to examine these two aspects, we conducted three behavioral experiments. In the following sections, we shall report the results of these experiments.

Experiment 1

In Experiment 1, we used the same experimental paradigm as that used by McKenzie and Nelson (2003). In particular, participants were presented with the reference point through a cover story and asked to choose one of the logically equivalent frames. As a new experimental procedure in the present study, participants were also asked to reveal the reason why they chose the frame. In this task, the presented reference point was relevant information in the communicative situation. We examined whether participants chose a frame based on task-relevant information about the reference point with explicit reason.

Method

Participants Two hundred Japanese (M_{age} = 43.75, SD_{age} = 8.69) participated in this experiment. They were recruited via a website and randomly assigned to one of the two groups (low or high reference point group).

Task, materials, and procedure Participants were asked to make a frame choice and reveal the reason for their choices. In the frame choice, we presented the following cover story according to McKenzie and Nelson (2003):

> A glass with 500ml capacity in front of you is filled with 0ml water. You then leave the room briefly and come back in 10 minutes to find that the water is now at the 250ml water. What is the most natural way to describe the glass now?

Then, participants were asked to choose which frame was more natural, "The glass is half full" or "The glass is half empty." This cover story was used for the low reference point group. For the high reference point group, the first sentence was "A glass with 500ml capacity in front of you is filled with 500ml water." After the frame choice, participants were asked to answer why they chose the frame.

Results and discussion

The left panel of Figure 1 shows the result of frame choice. It was found that participants in the low reference point group chose the full frame more than those in the high reference point group ($\chi^2(1) = 7.64$, $p < .01$, $h = 0.42$). This result was consistent with the prediction of the reference point hypothesis.

As for the choice reason, we examined whether it was consistent with the reference point hypothesis for frame choices that were in accordance with its prediction (i.e., full frame choice for the low reference point group and empty frame choice for the high reference point group). In this examination, two independent evaluators, who did not know the goal of the present research, were first instructed about the reference point hypothesis. They then checked whether each description was consistent with the reference point–based frame choice. Inconsistent evaluations were resolved

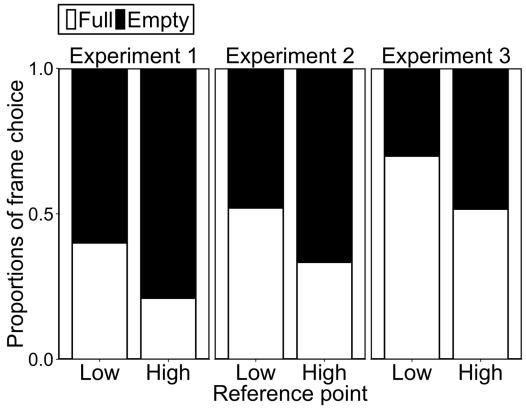

Figure 1. Proportions of frame choice (i.e., "half full" or "half empty").

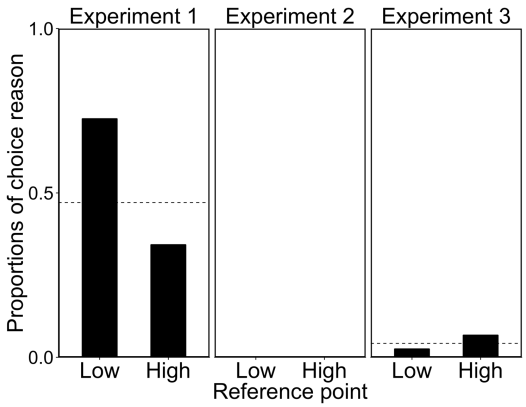

Figure 2. Proportions of frame choice reason for which participants revealed the reference point. The dotted line denotes the mean proportion along the two groups.

between the evaluators[1]. The accordance rate of the two evaluators was 97.4%.

The left panel of Figure 2 shows the proportions of reference point–based frame choice. We found that the proportions differed between the full and empty frame choices ($\chi^2(1) = 14.15$, $p < .001$, $h = 0.79$). In total, around 50% of participants stated that their choices were based on the reference point.

Taken together, we found that for the task-relevant reference point presented through the cover story, around 50% of the participants who chose the frame consistent with the prediction of the reference point hypothesis stated that their choice was based on the reference point. In other words, in many cases, participants chose a frame based on the reference point with explicit reason.

Experiment 2

In Experiment 2, we examined whether a task-irrelevant reference point affected frame choice. Participants were presented with a reference point in a priming task, which served as a task-irrelevant reference point. Then, they were asked to make a frame choice and reveal the reason why they chose the frame.

Method

Participants One hundred and fifty Japanese ($M_{age} = 44.44$, $SD_{age} = 8.28$) participated in this experiment. They were recruited via a website and randomly assigned to one of the two groups (low or high reference point group).

Tasks, materials, and procedure We conducted three tasks: a priming task, a frame choice task, and a reason description task. In the priming task, participants were presented with one of the pictures shown in the Appendix and asked to estimate how much water was in the glass. For this task, the instruction was: "The glass with 500ml capacity contains some water. Please estimate how much water the glass has." After finishing the estimation, participants were presented with a picture of the glass (see the bottom panel in Appendix) and asked to choose the frame that naturally described the content of water. The instruction was:

> Here, a glass with 500ml capacity in front of you is filled with 250ml water as in the picture. What is the most natural way to describe the glass now?

Participants were asked to choose one of the two frames: "The glass is half full" or "The glass is half empty." The instruction did not reveal anything about the relationship between the two pictures (i.e., the picture presented in the priming task and the picture in the frame choice task). Thus, the picture presented in the priming task was an irrelevant reference point to infer the previous amount of water in the glass used in the frame choice task. After the frame choice, participants were asked to reveal why they chose the frame.

Results and discussion

First, we checked whether the manipulation of the priming task worked as we expected. The means of estimation of water were 87.6 ($SD = 73.7$) and 457.1 (SD = 65.6) for low and high reference points, respectively. These estimations significantly differed ($t(148) = 32.5$, $p < .001$, $d = 5.30$). Thus, the priming task successfully worked as we expected.

The middle panel of Figure 1 shows the result of frame choice. It was found that participants in the low reference point group chose the full frame more than those in the high reference point group ($\chi^2(1) = 4.61$, $p < .05$, $h = 0.38$). This result was consistent with the prediction of the reference point hypothesis, indicating that the task-irrelevant reference point affected the frame choice.

As in Experiment 1, we examined whether choice reason was consistent with the reference point hypothesis for frame choices that were in accordance with its prediction. The accordance rate of the two evaluators was 100%. The middle panel of Figure 2 shows the proportions of reference point–based frame choice reason. We found that none of the participants stated that their choices were based on the reference point (i.e., irrelevant prime), suggesting that they did

[1] We evaluated the choice reason results using the same procedure in Experiments 2 and 3.

not notice the effect of the irrelevant reference point on frame choice.

Taken together, we found that the task-irrelevant reference point presented in the priming task affected frame choice. More importantly, we also found that none of the participants reported its effect. These results indicated that although participants chose a frame based on some reason, they did not report the effect of the irrelevant reference point, which represents a lack of awareness about its effect (Payne, Brown-Iannuzzi, & Loersch, 2016).

Experiment 3

In Experiment 2, we showed that a task-irrelevant reference point affected the subsequent frame choice. While presenting the irrelevant reference point (i.e., priming task), participants were asked to estimate the amount of water. Thus, a numerical estimation of the amount of water might have played the role of a reference point, thereby affecting the frame choice.

Previous studies have shown that a precedent numerical stimulus, or *anchor*, affects subsequent numerical estimation (e.g., Tversky & Kahneman, 1974). Thus, the priming task in Experiment 2 (i.e., the numerical estimation of the amount of water in a glass) might have affected the subsequent frame choice because of the precedent numerical estimation. In Experiment 3, during the presentation of the task-irrelevant reference point, participants were asked to indicate their preference. That is, they did not have to give any numerical estimation in the priming task. We examined whether the task-irrelevant reference point affected the frame choice in the procedure wherein numerical estimation was not required.

Participants Two hundred and forty Japanese (M_{age} = 46.85, SD_{age} = 8.23) participated in this experiment. They were recruited via a website and randomly assigned to one of the two groups (low or high reference point group).

Tasks, materials, and procedure We conducted the same tasks following the same procedure as in Experiment 2. However, we conducted a different priming task. In Experiment 3, participants were presented with one of the pictures shown in the Appendix and were asked how much they liked it. They revealed their preference with "I like," "Neither like nor dislike," or "I don't like." Thus, unlike the procedure in Experiment 2, participants were not asked to make a numerical estimation, but were only asked to indicate their preference for the picture.

Results and discussion

First, we examined whether there was a difference in preference for pictures between the two groups. Proportions of preference for "I like," "Neither like nor dislike," and "I don't like" were 0.095, 0.776, and 0.129 for the low reference point group, and 0.274, 0.613, and 0.113 for the high reference point group, respectively. There was a significant difference in preference for pictures between the two groups ($\chi^2(2) = 12.72$, $p < .01$, $\varphi_c = 0.16$). Unexpectedly, participants in the high reference point group preferred the picture more than those in the low reference point group (we discuss the effect of preference on frame choice later).

The right panel of Figure 1 shows the result of frame choice. It was found that participants in the low reference point group chose the full frame more than those in the high reference point group ($\chi^2(1) = 7.57$, $p < .01$, $h = 0.38$). This result was consistent with the prediction of the reference point hypothesis. As in Experiment 2, the task-irrelevant reference point affected the frame choice. Note that, as we mentioned above, participants were not asked to make numerical estimations in the priming task. Thus, these results indicated that it was not the difference in numerical estimation, but the change in the amount of water from the picture in the priming task to that in the frame choice task that was the influencing factor for the difference in frame choice.

As described above, preference for pictures unexpectedly differed between the two groups. We examined whether the preference was related to frame choice. Figure 3 shows the frame choice as a function of preference for a presented picture in the priming task. We found that preference for pictures did not significantly affect frame choice ($\chi^2(2) = 0.244$, $p = .89$, $\varphi_c = 0.02$), indicating that the significant difference in frame choice between the two group did not derive from the difference in preference for the presented pictures.

As with our previous experiments, we examined whether choice reason was consistent with the reference point hypothesis for frame choices that were in accordance with its prediction. The accordance rate of the two evaluators was 97.9%, and inconsistencies were resolved between them. The right panel of Figure 2 shows the proportions of reference point–based frame choice. Six participants (two from the low and four from the high reference point group; in total 4%) stated that their choices were based on the presented picture in the priming task (e.g., "In the comparison of the picture presented before, the amount of water increased. The amount of water has changed into the full direction, so it means that the content of glass has become full"). However, most participants did not state the effect of

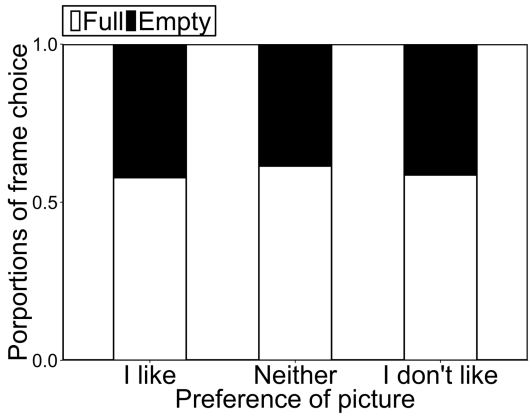

Figure 3. Results of frame choice in Experiment 3 as a function of preference for the pictures presented in the priming task.

the task-irrelevant reference point on their frame choice.

Taken together, the results of Experiment 3 were basically consistent with those of Experiment 2. It was found that the task-irrelevant reference point presented in the priming task affected frame choice. Thus, the findings in both Experiments 2 and 3 indicated that, regardless of the kinds of priming tasks (i.e., whether or not participants were asked to make numerical estimations), the task-irrelevant reference point affected the subsequent frame choice. Furthermore, as in Experiment 2, although participants chose a frame based on some reason, they did not report the effect of the irrelevant reference point.

General discussion

We conducted three behavioral experiments and examined the following two issues: First, we examined the reasons that participants reported for their frame choice. Second, we examined whether task-irrelevant reference points (in the present study, we used the priming paradigm) affected frame choice. We found that when a reference point was task-relevant (i.e., when the content of the target glass for the frame choice task changed from the reference point), the reference point affected participants' frame choices, and participants stated that they made the frame choice based on the reference point. This result suggests that when a task-relevant reference point is presented, frame choice based on the reference point is made with explicit reason. More importantly, we also found that a task-irrelevant reference point, which was presented in the priming task, affected the frame choice and that participants did not realize its effect.

The present findings have important implications for the following two points. First, the effect of reference points on frame choice is highly robust, and even irrelevant reference points can affect frame choice behaviors. As we discussed, reference points play an important role in people's judgments and decision making. Our findings indicate that reference points widely affect people's cognitive processes. Second, a speaker may choose a frame based on factors of which s/he is not aware. Previous studies have shown that chosen frames can become important linguistic cues by which listeners can infer background information such as situational shifts (e.g., difference in the amount of water) or speakers' trust (Keren, 2007; Sher & McKenzie, 2006). Such effective inferences can be achieved since listeners understand linguistic rules (e.g., when speakers prefer "full" frames) and make inferences based on the rules. However, our findings imply that speakers may be affected by the irrelevant information in the communicative situation without being aware of its effect. Thus, in future research, it is necessary to examine whether listeners can distinguish the informativeness of linguistic cues (e.g., whether a speaker's choice is based on a relevant or an irrelevant frame) to achieve effective communication.

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Appendix: Pictures presented in Experiments 2 and 3.

Experiment 2.
The left (right) picture was presented to the low (high) reference point group.

Experiment 3.
The left (right) picture was presented to the low (high) reference point group.

Picture presented in the frame choice task in Experiments 2 and 3.