論　説

Does Order of Presentation Affect the Focus of Comparison?: An Empirical Study of Eye-Tracking Data†

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ABSTRACT

Based on eye-tracking data on hypothetical digital cameras, we empirically tested the validity of the proposition that a more recently shown alternative becomes the focus of comparison. The results by and large supported the proposition; however, unclear points remain to be investigated.

1. INTRODUCTION

This paper deals with one of the propositions that explain bias in consumer evaluation and choice. According to Tversky's mapping model (1977), a comparison is a mapping process from a focal object to a non-focal object and has a seemingly trifle factor in which the object that becomes the focus influences the perception of similarity between them. If object A has more unique features than object B, similarity would increase by making B the focus of comparison. Tversky argued that this is because mapping remains more intact when people proceed from B to A than from A to B. Houston, Sherman, and Baker (1989) extended this mapping model from the sphere of similarity perception to that of preference. They found that when people compare two alternatives that have unique positive (negative) features, the focused alternative becomes more (less) advantageous because people pay more attention to the unique positive (negative) features of the focused alternative. They also argued that order of presentation influences which alternative becomes the focus. Specifically, they assumed that a more recently shown alternative becomes the focus of comparison because the process of comparison begins when the second alternative is presented. Houston et al. used data on six choice categories and reported supporting choice results for their hypotheses. Several other studies support their mapping model (Sanbonmatsu, Kardes, & Gibson (1991), Dhar & Simonson (1992), Kardes & Sanbonmatsu (1993), Hodges (1998), Mantel & Kardes (1999), Brunner & Wänke (2006), Sütterlin, Brunner, & Opwis (2008), Abe, Okuse, Mitomi, & Moriguchi (2015)). However, further validation of their model requires testing the validity of the

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proposition that “the second alternative becomes the focal alternative” because the reasoning that mapping starts upon presentation of the second alternative does not necessarily rule out the possibility of reverse mapping from the first alternative to the second one. A plausible accounting of reverse mapping would be that people might focus on the relatively familiar first alternative. Thus, validation of Houston et al.’s model should accompany a test of its key proposition that the second alternative becomes the focus. This paper attempts to shed light on this point.

Three existing studies have dealt with the validity of this proposition. Dhar and Simonson (1992) used think-aloud protocol data on a cassette player and typewriter. Their results are inconclusive in the sense that on average they found only a small and insignificant increase in the number of thoughts on the focal alternative.

Abe et al. (2015) used internet survey data to investigate this proposition. Their participants were shown two travel plans. After making their choice, the participants provided the reason for their choice in free answer form. They found that the participants related more about the alternative that was shown later, indicating that they processed and memorized more information about the second alternative than that of the first alternative. Therefore, their finding supports the proposition that the second alternative becomes the focus of comparison.

Sütterlin et al. (2008) used eye-tracking data in which participants compared two sequentially presented job options. In the second option, they found significantly longer gazing time and number of eye fixations on unique features than on shared features, whereas they did not find the same pattern in the first option. Their finding provides strong support for the proposition given that gazing time and number of eye fixations are more direct measures of the amount of information intake. We should also recognize that their result was obtained under experimental situations that made it difficult to detect any statistically significant differences. In Sütterlin et al.’s experiment, total gazing time for each of the job options was set at 30 s. Their result indicates that even within a set time of 30 s, participants disproportionately gazed upon the unique features of the second option.

Similarly to Sütterlin et al. (2008), the present study used eye-tracking data. However, we investigated participants’ eye movements across two alternatives, in which the second alternative was presented while the first alternative was shown on the left side of the screen. This allowed for analysis of eye movements when the two alternatives were being compared, which was not done in Sütterlin et al.’s experiment. In addition to gazing time and number of eye fixations, we also analyzed the direction of eye movement. We also allowed participants to view each of the monitoring screens at their own pace because this made the experimental task closer to a real choice situation.

2. HYPOTHESES

If the second alternative becomes the focal alternative, eye-fixation time on the second alternative is expected to be longer than that on the first alternative (***Hypothesis 1a***). However, note that this difference could also be due to the fact that participants had already processed information on the first alternative. Therefore, confirmation of this time difference alone would not strongly support the idea that the second alternative is being focused upon. Regardless, the time difference can be considered as a first-step necessary condition for the mapping model. Similarly, difference in attention can be measured by the number of eye fixations (***Hypothesis 1b***).

Hypothesis 1: Total time (number) of eye fixations on the second alternative is longer (more) than that on the first alternative.

According to the mapping model, if eye movement data are collected, participants are expected to gaze at information on the unique attributes of the second alternative longer than that of the first alternative. The same tendency would not occur in the case of the first alternative because it is not being focused upon. Again, note that the abovementioned memory factor possibly accounts for this tendency.

Hypothesis 2: People tend to gaze at information about unique attributes of the second alternative, but this tendency does not occur for unique attributes of the first alternative.

Focus on the unique features of the second alternative possibly accompanies eye movement from there to the counterpart information of the first alternative. However, in terms of the unique features of the first alternative, this tendency would be weak or nonexistent due to the lesser amount of attention the first alternative receives. Compared with ***Hypothesis 2***, this hypothesis is highly speculative because it presumes that the participant's attention to the unique features of the second alternative will ensue in one-way horizontal eye movement. The participant's vertical (alternative-based) eye movements rather than horizontal (attribute-based) movements could blur the clear manifestation of this expected eye movement. Furthermore, we should remember that our habitual left-to-right eye movement in reading might counter our hypothesized movement from right to left. Therefore, support for this hypothesis would provide very strong evidence in the sense that the tendency manifests despite these impeding factors. Another advantage of testing this direction of eye movement is that it is thought to be independent of the memory effect mentioned above. Hence, we developed Hypothesis 3 as follows:

Hypothesis 3: Attribute-based horizontal eye movement from the unique attribute of the second alternative to the first alternative manifests more than that of the reverse direction. But this does not happen to the unique attribute of the first alternative.

3. DATA COLLECTION

The authors used an eye-tracking device (Tobii 60 Hz; https://www.tobiipro.com) for data collection. Following a brief explanation of the task, the participant was seated in front of an eye-tracking system that resembled a notebook-type PC. The data collection process did not involve requirements such as the use of head-movement restraints or a helmet. The participant simply watched and typed their answer choices in response to questions that presented two alternatives presented on a monitor, similar to using a notebook PC. After the calibration process, information about a hypothetical digital camera A or B was randomly displayed on the screen. The screen showed instructions and information about four attributes and the name of digital camera A or B. The participant read the information on the screen at their own pace.

(First Screen, Appendix I)

A digital camera depicted below (domestic maker, price 26,000 yen) is being sold.

Digital Camera A

Image quality	*19 megapixels*
Image stabilizing	*5 directions*
Continuous shooting	*6 frames p.s.*
Waterproof	*No*

Please move to the next screen when you are ready.

On the next screen, the first digital camera appeared on the left side and the second digital camera on the right side. After reading information about the two alternatives at their own pace, participants made their choice.

(Second Screen, Appendix II)

Both digital cameras are domestic made and sold for 26,000 yen.
Which camera would you choose?

Digital Camera A		Digital Camera B	
Image quality	*19 megapixels*	*Image quality*	*20 megapixels*
Image stabilizing	*5 directions*	*Image stabilizing*	*no*
Continuous shooting	*6 frames p.s.*	*Continuous shooting*	*6 frames p.s.*
Waterproof	*No*	*Waterproof*	*20 meters*

The unique feature of digital camera A was its image stabilizing function that reduced image blur due to camera shake, and that of digital camera B was its waterproof function. The number of attributes given was set to four for both digital cameras. The screen was divided into five areas of interest (AOI) of the same size (camera maker and four attributes). Similarly, the next screen was divided into ten AOIs. The time that a participant's eye movements stayed within an AOI was used to test ***Hypotheses 1a*** and ***2***. The number of eye fixations within an AOI was also counted and used to test ***Hypothesis 1b***. Eye movement from one AOI to another was used to test ***Hypothesis 3***. As a conventional technical definition, time within an AOI less than 66 ms was dropped from our data. One hundred twenty-three students participated in the data collection at Waseda University and Tobii Technology Japan. Of the 123 participants, 114 (men, *n*=61; women, *n*=53; average age, 21.2 years) were included in our analyses. The sequence of the digital cameras presented to the participants was randomly determined. The subsample size of the sequence presenting digital camera A before digital camera B was 58. We named this sequence "A to B." The size of the sequence B to A was 56.

4. RESULTS

Figure 1 shows the mean amount of time the participants (n=58) gazed at information about the four attributes in sequence A to B. Average gazing time on the four attributes of camera B was 4.19 s, which was significantly larger than that of camera A (3.23 s; paired t=−3.53; p=0.001). Thus, in sequence A to B, ***Hypothesis 1a*** was supported. Figure 2 shows the mean amount of time participants (n=56) gazed at information about the four attributes in sequence B to A. On average, the participants gazed at the second alternative (A) for 4.51 s and at the first alternative (B) for 3.09 s. This difference was significant (paired t=5.91; p=0.000). Thus, ***Hypothesis 1a*** was supported in both sequences. The participants gazed at the second alternative longer than the first alternative, regardless of sequence order.

Figure 1

Average Gazing Time in Sequence A to B; n=58

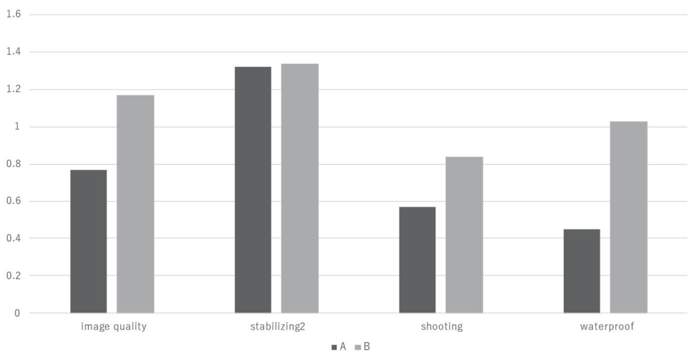
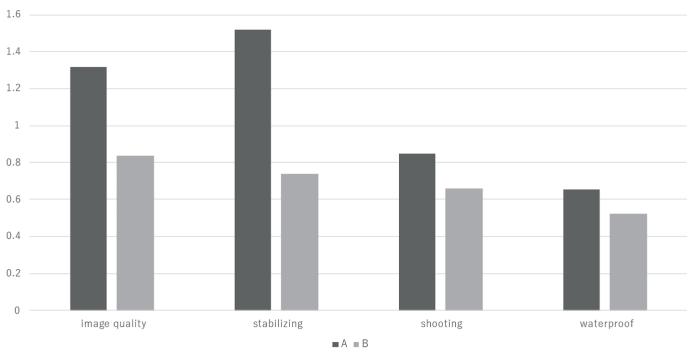


Figure 2

Average Gazing Time in Sequence B to A; n=56



A paired t-test was conducted on the average number of eye fixations. In sequence A to B, average number of eye fixations on camera A was 21.81 and that on camera B was 24.33. Significance was at the 0.10 level ($t=-1.77$; $p=0.083$). In sequence B to A, the average number of eye fixations on camera B was 19.63 and that on camera A was 24.30. Significance was at the 0.001 level ($t=4.26$, $p=0.000$). ***Hypothesis 1b*** was supported in both sequences. The number of eye fixations was larger in the second alternative in both sequences.

To test ***Hypothesis 2***, we conducted a paired t-test on gazing time on waterproof function between camera A and camera B, and found a significant difference (0.47 s vs. 0.98 s; $t=-5.218$; $p=0.000$). This finding indicates that the gazing time on the information showing that camera B had a waterproof function was longer than on the information showing that camera A did not have such function. However, there was no significant difference in participants' gazing time in relation to the image-stabilizing function between the two cameras (1.25 s vs. 1.30 s; $t=-0.324$; $p=0.747$). This indicates that in sequence A to B, the positive unique feature of the second alternative attracted participants' attention, whereas the positive unique feature of the first alternative did not bring about any significant difference. Thus, ***Hypothesis 2*** was supported in sequence A to B.

The same tendency was observed in sequence B to A. The unique feature of the second alternative (image-stabilizing function) attracted participants' attention (1.98 s vs. 0.90 s; $t=7.507$; $p=0.000$), whereas the unique feature of the first alternative (waterproof function) did not attract participants' attention (0.57 s vs 0.63 s; $t=-0.578$; $p=0.565$). Therefore, ***Hypothesis 2*** was supported in both sequences.

To test ***Hypothesis 3***, we made a switching matrix of the AOI for each participant to indicate from which AOI to which AOI eye gaze moved. A non-parametric sign test was conducted to test whether the participants' eye movements were random (null hypothesis) or not (alternative hypothesis). We briefly explain the measurement of eye gaze movement. In the case where eye movement was from the direction of the unique feature of the second alternative to the absence of it in the other first alternative, the participant was considered positive, and movement in the reverse direction was considered negative. Some participants moved their eyes back and forth horizontally between the two AOIs that contained the information on the unique features. In such cases, if the number of eye movements from A to B was larger than that from B to A, the participant was counted as a case that showed A to B movement. If eye movement between the two AOIs was zero or equal, the participant was counted as neutral.

In sequence A to B, with regard to camera B's unique feature of waterproof function, 13 of the 58 participants were positive, 13 were negative, and 32 were neutral. Thus, no tendency was found and the first half of ***Hypothesis 3*** was not supported.

To test the second half of ***Hypothesis 3***, we focused on camera A's unique feature of image-stabilizing function. In sequence A to B, 17 of the 58 participants were positive, 15 were negative, and 26 were neutral. Therefore, the results of the sign test were not significant at the 0.10 level. Note, however, that the results are in line with the second half of ***Hypothesis 3***. Thus, in the case of sequence A to B, only the second half of ***Hypothesis 3*** was supported.

We conducted the same sign test in sequence B to A with regard to the unique feature of the second alternative, which was the stabilizing function, and found that 22 of the 56 participants were positive, 10 were negative, and 24 were neutral. This was marginally significant at the 0.10 level (two-tailed), thus

Table 1 Results of Paired *t*-Test

Average gazing time			
Pattern 1 (A=>B) n=58		Pattern 2 (B=>A) n=56	
camera A	3.23 sec.	camera A	4.51 sec.
camera B	4.19 sec.	camera B	3.09 sec.
$t=-3.53$	$p=.001$	$t=5.91$	$p=.000$
Average number of eye-fixations			
Pattern 1 (A=>B) n=58		Pattern 2 (B=>A) n=56	
camera A	21.81 times	camera A	24.30 times
camera B	24.33 times	camera B	19.63 times
$t=-1.77$	$p=.083$	$t=4.26$	$p=.000$
Average gazing time			
Pattern 1 (A=>B) n=58		Pattern 2 (B=>A) n=56	
Waterproof		Waterproof	
camera A	.47 sec.	camera A	.57 sec.
camera B	.98 sec.	camera B	.63 sec.
$t=-5.22$	$p=.000$	$t=-.58$	$p=.565$
Pattern 1 (A=>B) n=58		Pattern 2 (B=>A) n=56	
Image Stabilizing		Image Stabilizing	
camera A	1.25 sec.	camera A	1.98 sec.
camera B	1.30 sec	camera B	.90 sec.
$t=-.32$	$p=.747$	$t=7.51$	$p=.000$

the first part of ***Hypothesis 3*** was supported. To test the second half of ***Hypothesis 3***, we focused on the unique feature of the first alternative, which was the waterproof function, and found that 18 participants were positive, 6 were negative, and 32 were neutral. Contrary to the second half of ***Hypothesis 3***, significance was at the 0.05 level. Therefore, in sequence B to A, only the first part of ***Hypothesis 3*** was supported. Overall, the results of the sign test in ***Hypothesis 3*** were mixed. In terms of unique features, ***Hypothesis 3*** was supported with regard to the image-stabilizing function but was not supported with regard to the waterproof function.

5. DISCUSSION AND CONCLUSION

Both ***Hypotheses 1*** and ***2*** were supported by our study results. The participants gazed longer at and paid more attention to the later-shown alternative than to the first-shown alternative (***Hypothesis 1***). Also, they gazed longer at the unique function of the second alternative than its counterpart in the first alternative, but this difference did not occur between the unique function of the first alternative and its counterpart. These results support the notion of the mapping model, which presumes that the unique features of the second alternative are focused upon (***Hypothesis 2***). Unlike the study by Sütterlin et al. (2008), our participants compared two alternatives that were presented side by side on the same screen, which provides further supportive evidence to the mapping model. However, as pointed out in the hypothesis-building section, clearance of ***Hypotheses 1*** and ***2*** does not rule out the possibility that these results are caused by the memory effect.

The test results for ***Hypothesis 3*** were mixed. Several external factors might make it difficult to discern the predicted tendency. One factor is the participants' vertical eye movements. The participants engaged more in vertical information processing. In our data ($n=114$), the average number of horizontal eye movements was 6.25, that of vertical eye movements was 10.0, and the rest was 2.53. To the extent that participants process information vertically (alternative–wise), the direction of comparison effect becomes less apparent (Mantel & Kardes 1999), with eye movements less a reflection of which alternative is being focused upon.

The idiosyncratic nature of unique features might be related to the results. ***Hypothesis 3*** was supported by the image-stabilizing function but not by the waterproof function. The five-direction image-stabilizing function is a relatively new feature and requires viewers to exert some effort in information processing. As a result, this particular function might attract attention, especially as a unique feature of the second alternative. In contrast, the waterproof function might be easy to comprehend and did not require horizontal comparison, even though it might not be a negligible feature when it is available in the non-focal alternative. Greater consideration should have been given to ensuring no possible involvement of idiosyncrasies of the unique features.

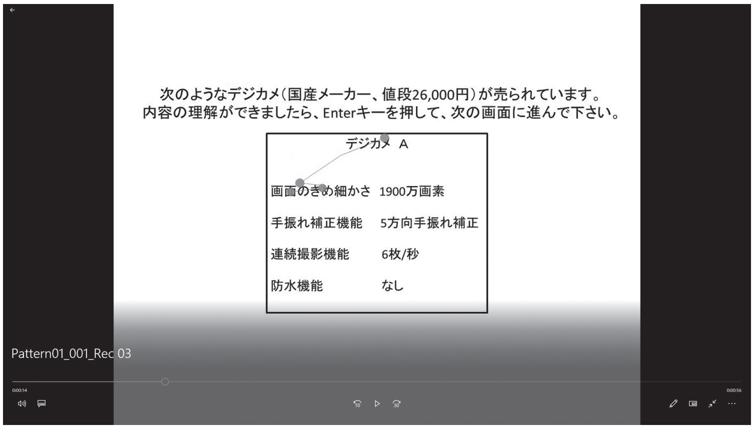
In conclusion, this study confirmed that people gaze longer at the second alternative than the first alternative, and, more importantly, they focus on the unique feature of the second alternative. However, this study did not confirm that this comparison process accompanies eye movements from the direction of the unique feature of the second alternative to the counterpart of the first alternative. Future studies need to further test the validity of the proposition that the second alternative becomes the focus of comparison.

Although this study has provided only moderate support for the proposition that presumes that an alternative shown later becomes the focus of comparison, the practical implications for marketing are significant. For instance, when a salesperson has two items to offer a customer, the seemingly trifle matter of which item to present first might not become a negligible factor. Specifically, the alternative that is presented later becomes a little advantageous (vs. disadvantageous) when each of the alternatives has unique positive (vs. negative) features.

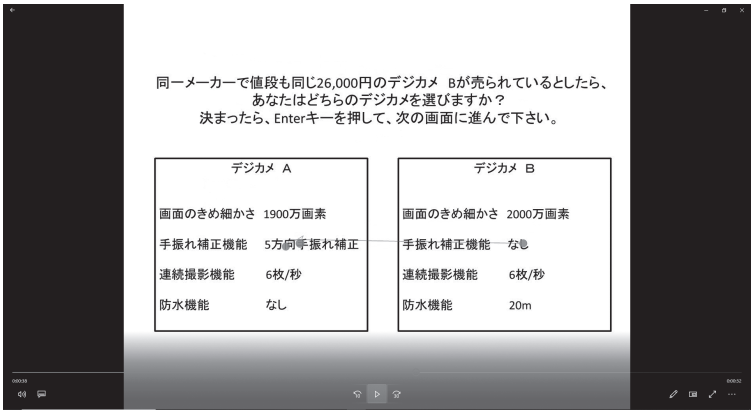
Another practical scene in which this proposition might become relevant is marketing research (Abe & Okuse, 2018). Research questionnaires often present two alternatives between which participants are asked to provide their preferences. However, care must be taken to remove the effect caused by this proposition. Researchers should randomly distribute two questionnaire versions with different orders of presentation of two alternatives to remove any order effects.

6. APPENDIX

Appendix I



Appendix　II



REFERENCES

Abe, S., & Okuse, Y. (2018), “Direction of Comparison Effect and Consumer Research: From General to Specific Implications,” *Behaviometrika*, 45, 211−220.

Abe, S., Okuse, Y., Mitomi Y., & Moriguchi T. (2015), “The Second Option Looks Better: Choice of Travel Plans to Kyoto,” *Proceedings of the International Conference of Asian Marketing Associations*, 37–48.

Brunner, T. A., & Wänke, M. (2006), “The Reduced and Enhanced Impact of Shared Features on Individual Brand Evaluations, “*Journal of Consumer Psychology*, 16 (2), 101−111.

Dhar, R., & Simonson, I. (1992), The Effect of The Focus of Comparison on Consumer Preferences,” *Journal of Marketing Research*, 29 (November), 430–440.

Hodges, S., D. (1998), “Reasons for The Referent: Reducing Direction of Comparison Effects,” *Social Cognition*, 4, 367−390.

Houston, D.A., Sherman, S.J., & Baker, S.M. (1989), “The Influence of Unique Features and Direction of Comparison on Preferences," *Journal of Experimental Social Psychology*, 25, 121–141.

Kardes, F. R., & Sanbonmatsu, D.M. (1993)), "Direction of Comparison, Expected Feature Correlation, and The Set-size Effect in Preference Judgment," *Journal of Consumer Psychology*, 2(1), 39–54.

Mantel, S. P., & Kardes, F. R. (1999), "The Role of Direction, Attribute-based Processing, and Attitude-based Processing in Consumer Preference," *Journal of Consumer Research*, 25, 335–352.

Sanbonmatsu, D. M., Kardes, F.R., & Gibson, B.D. (1991), "The Role of Attribute Knowledge and Overall Evaluations in Comparative Judgement," *Organizational Behavior and Human Decision Processes*, 48, 131–146.

Sütterlin, B., Brunner, T.A., & Opwis, K. (2008), "Eye-tracking the Cancellation and Focus Model for Preference Judgements," *Journal of Experimental Social Psychology*, 44, 904–911.

Tversky, A. (1977), "Features of Similarity," *Psychological Review*, 84, 327–353.

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