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When Is Perception Top-Down and When Is It Not? Culture, Narrative, and Attention

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Abstract

Previous findings in cultural psychology indicated that East Asians are more likely than North Americans to be attentive to contextual information (e.g., Nisbett & Masuda, 2003). However, to what extent and in which conditions culture influences patterns of attention has not been fully examined. As a result, universal patterns of attention may be obscured, and culturally unique patterns may be wrongly assumed to be constant across situations. By carrying out two cross-cultural studies, we demonstrated that (a) both European Canadians and Japanese attended to moving objects similarly when the task was to simply observe the visual information; however, (b) there were cultural variations in patterns of attention when participants actively engaged in the task by constructing narratives of their observation (narrative construction). These findings suggest that cultural effects are most pronounced in narrative construction conditions, where the need to act in accordance with a culturally shared meaning system is elicited.

Keywords: Culture; Attention; Eye tracking; Narrative construction; Communication; Instruction; Situated cognition; Discourse

1. Introduction

For over two decades, the field of cultural psychology has examined the issue of mutual constitution between culture and the human psyche (e.g., Bruner, 1990; Markus & Kitayama, 1991; Shweder, 1991). Research investigating cultural variation in attention provides some of the most important contributions to the field, showing that members of East Asian cultures tend to be more attentive to contextual information than members of North American cultures (e.g., Chua, Boland, & Nisbett, 2005; Kitayama, Duffy, Kawamura,

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& Larsen, 2003; Masuda & Nisbett, 2001, 2006). These researchers also maintain that such cultural variation in attention is likely a product of culturally shared thinking styles: East Asians' *holistic thought* and North Americans' *analytic thought* (Nisbett, 2003; Nisbett & Masuda, 2003; Nisbett, Peng, Choi, & Norenzayan, 2001).

Although previous cross-cultural studies have provided convincing evidence of the influence of culture on visual attention, it still remains unclear whether one's culturally unique patterns of attention are static across all situations or are more likely to be activated under particular conditions—such as when people are required to construct narratives in social situations. There has been increased theoretical interest in examining the point of convergence between culturally similar and culturally unique psychological processes (Norenzayan & Heine, 2005; Richerson & Boyd, 2005). Thus, it is necessary to carefully scrutinize the relationship between cultural effects and the conditions in which visual attentional processes take place; otherwise, the potential similarity of visual attention across cultures is obscured, and simultaneously it may be wrongly assumed that culturally unique patterns of attention are unchangeable once they are internalized. If people internalize culturally unique patterns of attention in static form, culture should influence visual attention regardless of stimuli or task conditions. However, if people activate different patterns of visual attention according to different situations, the magnitude of cultural variations in attention should be different across conditions.

This issue directly relates to attention strategies used in information processing. Posner (1980) suggested two possible organizations of attention: endogenous versus exogenous—also described in terms of top-down, goal-driven attention versus bottom-up, stimulus-driven attention (e.g., Chun & Wolfe, 2001). For example, previous studies using eye-tracking measures have shown a robust effect of visual saliency, such that objects with abrupt movements capture one's voluntary visual attention (e.g., Abrams & Christ, 2003; Simola, Kuisma, Oorni, Uusitalo, & Hyona, 2011), yet this effect is minimized when tasks involve goal-oriented behaviors (e.g., Henderson, Williams, Castelhano, & Falk, 2003), suggesting the task-contingent nature of visual attentional processes (Betz, Kietzmann, Wilming, & König, 2010; Yarbus, 1967).

This top-down aspect of attention is particularly important for understanding the influence of culture on behaviors. In situations where stimulus saliency is relatively high and induces bottom-up attention, people across various cultures should attend to the salient and vivid stimuli in a similar manner. However, when individuals' attention is top-down, we should expect cross-cultural variation in patterns of attention, because individuals interpret the situation in a culturally meaningful manner.

There is both empirical and theoretical support for this assumption. For example, strong cultural effects on decision-making have been empirically demonstrated, especially when people engage in top-down information processing by explaining the reasons for their decision (e.g., Briley, Morris, & Simonson, 2000); and Jerome Bruner (1990) theorized the narrative perspective of culture and mind, maintaining that narrative is an essential part of human thought. According to Bruner, members of a given cultural community construct, maintain, and are influenced by cultural meaning systems through social

exchange in the form of narratives (Bruner, 1990; Mattingly, Lutkehaus, & Throop, 2008).

To further examine the role of narratives on human attention and to demonstrate the existence of both culturally unique and culturally similar patterns of attention, we conducted two cross-cultural studies. We modified a series of underwater vignettes developed by Masuda and Nisbett (2001), by increasing the saliency of focal objects (e.g., intensifying the colors and adding quick movements using Adobe Flash; see Fig. 1).[1] Participants were asked to either simply observe the vignettes (Study 1) or construct narratives about their observations (Study 2). We hypothesized that both cultural groups would be similarly attentive to the actively moving objects in the passive condition, thus demonstrating object-oriented attention (Study 1). By contrast, we hypothesized that they would construct narratives in a way that is shared by other members of their own culture; hence, interpretation of and attention to the visual stimuli would be different across cultures when narratives were constructed (Study 2).

2. Study 1

2.1. Method

2.1.1. Participants and apparatus

Thirty-five European Canadian students (20 females; M_{age} = 18.5) at University of Alberta and 34 Japanese students (18 females; M_{age} = 18.9) at Kobe University participated in the study. As a measure of visual attention, bilateral eye movements were recorded using a Tobii 1750 eye tracker with Tobii Studio™ 2.1 software. We used the Tobii Studio fixation filter to determine gaze fixations and analyzed the total duration of gaze fixations in areas of interest (AOI).[2]

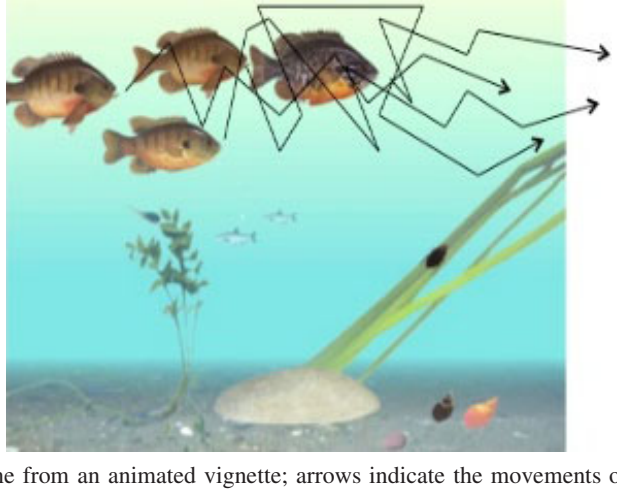

Fig. 1. Scene from an animated vignette; arrows indicate the movements of focal fish.

2.1.2. Materials and procedure

The stimuli included eight underwater vignettes, each about 25 s in length; different types of salient fish (focal fish); and contextual information such as seashells and aquatic vegetation (background). The location of the background and focal fish were counter-balanced: Four vignettes showed focal fish at the top and the background at the bottom, and another set of four vignettes reversed the location of focal fish and the background. Two AOI were defined, each for the focal fish area and the background area. Because the manipulation of the location of objects did not significantly influence patterns of eye movements, we merged the results of the eight experimental trials.

The animated underwater vignettes were displayed at a resolution of 1,024 × 768 pixels on a 17-inch (43 cm) monitor. A chin and forehead rest placed 15 inches (38.1 cm) away from the monitor was used to standardize the viewing distance and minimize head movements. All sessions started with a standard 5-point calibration task, followed by stimulus presentation in random order. In this passive observation condition, participants were asked to observe some videos as a part of the experiment, but no further specific instructions were given to the participants.

2.2. Results and discussion

We conducted a 2 (Culture: Canadian vs. Japanese) × 2 (Area: Focal Fish vs. Background) ANOVA on the total duration of gaze fixations, with culture as a between-subjects variable and area as a within-subject variable. As expected, the results yielded a significant main effect of area, $F(1, 67) = 741.65$, $p < .001$, $\eta^2 = .917$, and no effect of culture, $F < 1$. The effect of area × culture interaction was not significant, $F(1, 67) = 2.13$, $p = .15$ (Fig. 2). Thus, the results of Study 1 demonstrated that patterns of eye movements did not differ across cultures during passive observation, and that both European Canadian and Japanese participants paid more attention to the focal fish area where fish made salient movements.

3. Study 2

3.1. Method

3.1.1. Participants and materials

Thirty-one European Canadian students (18 females: $M_{age} = 19.4$) at the University of Alberta and 35 Japanese students (21 females; $M_{age} = 18.5$) at Kobe University participated in the study. The materials and eye-tracking apparatus used in Study 2 were exactly same as the ones used in Study 1.

3.1.2. Procedure

In order to activate participants' culturally specific top-down processing, we asked them to construct narratives about their observation. Before observing the vignettes,

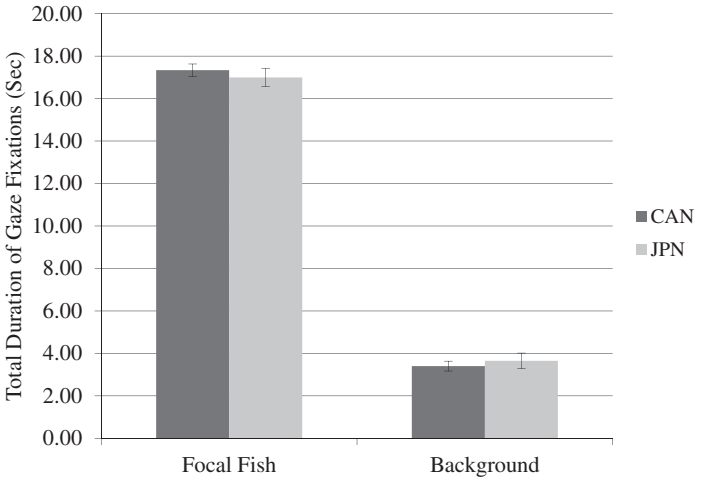

Fig. 2. The mean total duration of fixation to focal fish and background areas across cultures in Study 1: Passive observation condition.

participants were given the following instruction: "After the end of the video, please describe it in as much detail as possible for one full minute." This instruction was translated from English to Japanese and then back-translated (Japanese instruction: "*Video no shuuryougo, 1 hunteidode, video ni tsuite kuwasiku setsumeishitekudasai*"). Example descriptions given by Canadian and Japanese participants are presented in the Appendix. Stimuli were presented in random order after the standard 5-point calibration task.

3.1.3. Coding

Participants' narratives about their observation were coded using the coding schema developed by Masuda and Nisbett (2001). In this coding, an utterance was defined as the smallest unit of meaningful speech (roughly equivalent to a word). For example, an English sentence such as "Red fish was swimming around" was categorized into the following components: "red" = color-foreground information; "fish" = object-foreground; "was swimming around" = behavior-foreground. Also, a Japanese sentence such as "Aoi Mizu No Naka Wo Sakana Ga Oyoide Imashita" was categorized as follows: "*Aoi*" (blue) = color-background information; "*mizunonaka*" (under the water) = object-background; "*Sakana ga*" (fish) = object-foreground; "*Oyoide Imashita*" (was swimming) = behavior-foreground. English and Japanese data were coded in their own languages, in order to maintain the participants' original meanings. Two English–Japanese bilinguals coded verbal descriptions in the original languages, and intercoder agreements for English and Japanese descriptions (αs = .98 and .96, respectively) were high.

3.2. Results and discussion

As predicted, a 2 (Culture: Canadian vs. Japanese) × 2 (Area: Focal Fish vs. Background) ANOVA revealed a main effect of area, $F(1, 64) = 890.01$, $p < .001$, $\eta^2 = .933$,

and a main effect of culture, $F(1, 64) = 6.48$, $p < .05$, $\eta^2 = .092$ in patterns of eye movements (Fig. 3A). These main effects were qualified by the effect of area × culture interaction, $F(1, 64) = 19.65$, $p = .001$, $\eta^2 = .235$. Planned comparison analyses revealed that European Canadians fixated to the focal fish area significantly longer than did Japanese, $F(1, 85) = 25.67$, $p < .001$, while Japanese fixated to the background area significantly longer than did European Canadians, $F(1, 85) = 9.84$, $p < .01$. Thus, although both European Canadians and Japanese paid more attention to salient objects than the background, this effect was modulated by culture.

Did the range of attention differ across cultures? We computed the trajectory of gaze fixations while taking the average distance between each gaze fixation during stimuli observation, with the assumption that a larger value in gaze trajectory would indicate a wider coverage of the visual scene. The results showed that the average gaze trajectories were not statistically different between European Canadians ($M = 257.18$, $SD = 33.96$) and Japanese ($M = 251.36$, $SD = 35.96$), $t(64) < 1$, suggesting that the range of attention was similar across cultures. Therefore, we concluded that the critical differences in patterns of attention are not due to the range of attention, but to the attentional duration to particular AOI (e.g., Japanese allocated their attention to the background for longer periods than did European Canadians).

Using the coding schema developed by Masuda and Nisbett (2001), we analyzed participants' description of their observations by counting the number of utterances regarding focal fish and background objects.[3] A 2 (Culture) × 2 (Area) ANOVA demonstrated that the total number of utterances did not differ across cultures, $F(1, 64) = 2.72$, *ns*, but there was a main effect of area, $F(1, 64) = 154.58$, $p = .001$, $\eta^2 = .707$. This main effect was qualified by a significant interaction between area and culture, $F(1, 64) = 36.95$, $p = .001$, $\eta^2 = .366$. As predicted, European Canadians mentioned more focal fish than did Japanese, $F(1, 125) = 26.97$, $p = .001$, whereas Japanese mentioned more background objects than did European Canadians $F(1, 125) = 7.17$, $p = .01$ (Fig. 3B).

Next, we analyzed which objects were mentioned first by participants in both groups. According to the coding used in Masuda and Nisbett (2001), we focused on the first sentence of each video description and coded whether the focal and background objects were mentioned in that first sentence. Participants were presented with eight movies in total; thus, each participant could receive a maximum of eight points for focal objects and another set of eight points for background objects. For example, a sentence such as "The color of the ocean was blue" was coded as one point for the background information. Similarly, "There were three fish swimming around" was coded as one point for the foreground information. Other sentences such as "The fish was swimming in the ocean" and "In the ocean, the fish was swimming" were both equally coded as one point for the foreground and one point for the background information. Although some researchers suggest that the first mentioned topic in a sentence by Japanese and English speakers tend to be different (e.g., Tajima & Duffield, 2012), the current coding method would cancel out such linguistic differences across two groups tested in the study. Consistent with previous findings (Imada, Carlson, & Itakura, 2013; Masuda & Nisbett, 2001), European Canadians ($M = 4.93$, $SD = 2.54$) mentioned more focal objects first than did Japanese participants

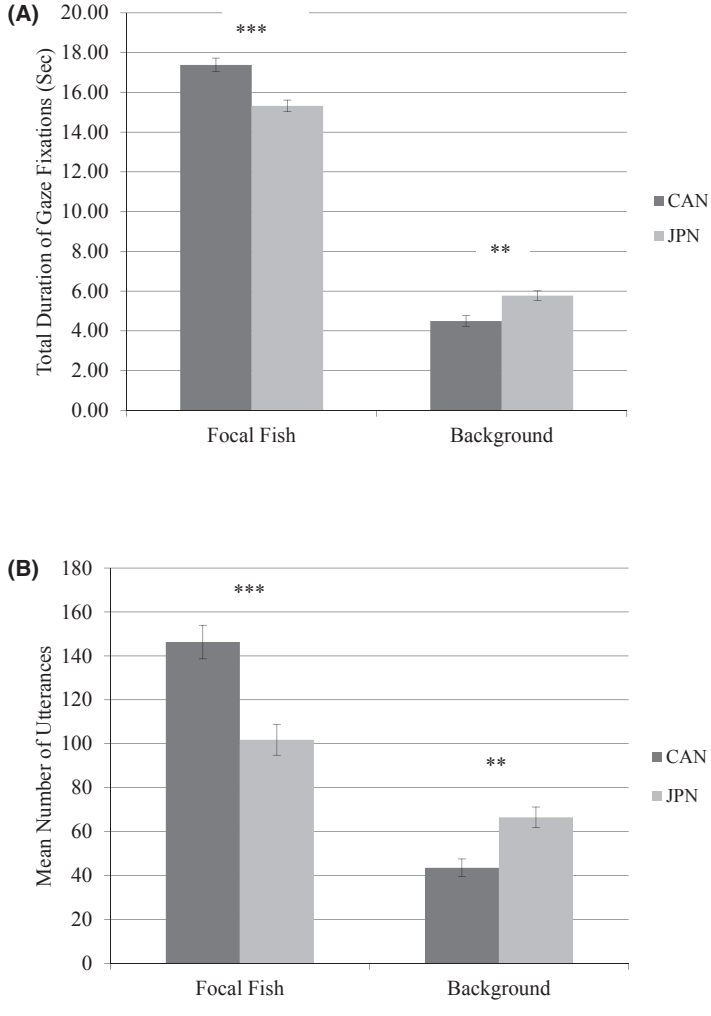

Fig. 3. (A) The mean total duration of fixation to focal fish and background areas across cultures in Study 2. (B) The mean number of utterances referring to focal fish and background in verbal description across cultures in Study 2: Narrative construction condition (**$p < .01$, ***$p < .001$).

($M = 3.09$, $SD = 2.72$), $t(64) = 2.85$, $p < .01$. In contrast, Japanese ($M = 4.57$, $SD = 2.76$) mentioned the background far more frequently at first than did European Canadians ($M = 2.74$, $SD = 2.32$), $t(64) = 2.92$, $p < .01$.

What is the relationship between narrative construction and patterns of attention? To further examine the relationship among culture, narrative, and attention, we composed context sensitivity indices by subtracting the total gaze fixation time to focal fish from the total gaze fixation time to the background, and by subtracting the number of descriptions about focal fish from the number of descriptions about background. As predicted, the index for context-sensitive visual attention was positively correlated with the index for the context-sensitive narrative constructions, $r = .61$ ($N = 66$) $p < .001$.[4] Next, we

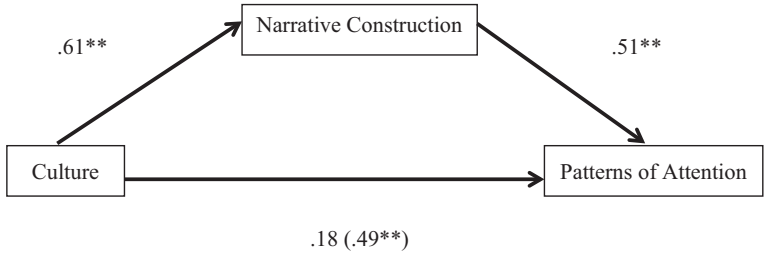

Fig. 4. Mediation effects of (A) eye movements on narrative construction and (B) narrative construction on patterns of eye movement (**$p < .01$).

conducted a mediational analysis to further examine the underlying mechanism of cultural variation in visual attention, using a nonparametric bootstrapping mediational analysis (Hayes, 2009; Preacher & Hayes, 2008). We found that narrative construction fully mediated the effect of culture on patterns of attention (Fig. 4). Based on 1,000 resamplings, this indirect effect was statistically significant ($b = 2.09$; 95% CI = .92, 3.65), suggesting that constructing narratives in culturally meaningful ways does indeed mediate the cultural effects on attention.[5]

Finally, in order to closely examine the effect of instruction, we combined data from Studies 1 and 2 and conducted a 2 (Culture) × 2 (Area) × 2 (Instruction: Study 1 vs. Study 2) ANOVA. The analysis revealed a significant 3-way interaction, $F(1, 126) = 5.59$, $p < .02$, $\eta^2 = .042$. This finding confirmed that the effect of culture was most significant in the narrative construction condition, as demonstrated in that the Culture × Area interaction in Study 2 was significant, $F(1, 161) = 11.42$, $p < .001$, even when we used the pooled error from the 3-way interaction. On the other hand, this Culture × Area interaction was not significant, $F(1, 161) < 1$, *ns*, when participants passively observed the scene under the ambivalent instruction condition in Study 1. Further simple effect analyses indicated that compared to the Japanese participants in Study 2, Japanese participants in Study 1 were more likely to attend to the salient focal fish, $F(1, 161) = 14.78$, $p < .001$, to the same extent as European Canadian participants in Study 1, $F(1, 161) < 1$, *ns*. By contrast, European Canadian participants' attention to the focal fish area did not differ with respect to instruction, $F(1, 161) < 1$, *ns*, suggesting that their pattern of attention to the focal fish were similar across experimental instructions. Attention to the background area increased in the narrative construction condition compared to the passive observation condition for both European Canadians, $F(1, 161) = 6.13$, $p < .05$, and Japanese, $F(1, 161) = 23.76$, $p < .001$, and a relatively small amount of attention was allocated to the background area similarly across cultures in the passive observation condition, $F(1, 161) < 1$, *ns*.

4. General discussion

Because we designed the stimuli to induce object-oriented attention from passive viewers, the patterns of attention without narrative instructions were similar across cultures

(Study 1). However, when participants constructed narratives about what they had observed (Study 2), attentional patterns differed across cultures even when visual scenes included highly salient objects. Where do these differences in attention come from? Cultural psychologists maintain that in a given society, narratives and practices historically inform a set of meaning systems (i.e., a worldview), and that a culturally specific thinking style (an epistemological way of understanding phenomena in the world) develops based on such culturally defined worldviews (e.g., Nisbett, 2003). It has been argued that North Americans' patterns of attention are influenced by their unique social and historical background, which can be traced back to ancient Greek and traditional Western meaning systems. This type of attention is characterized by the emphasis on the identification of each object's stable properties, which is independent of context. Alternatively, East Asians' patterns of attention, influenced by ancient Chinese meaning systems, prioritize a holistic understanding of the complexity and interrelatedness among objects, emphasizing context rather than objects' properties (Cromer, 1993; Hamilton, 1930/1973; Munro, 1969, 1985; Nakamura, 1964/1985). Our experiments support this assumption and add new knowledge by showing that such cultural influences are particularly apparent when narrative construction is involved.

4.1. Implications for culture and cognition research

This study is important for three reasons. First, to our knowledge, this is the first study to directly examine the role of narrative construction in the effects of culture on visual attention. Our findings are given credence by previous research that illustrated the importance of understanding the role of communication and shared reality in cultural differences in various behaviors (e.g., Chiu, Gelfand, Yamagishi, Shteynberg, & Wan, 2010; Lau, Chiu, & Lee, 2001). Bruner (1990) suggested that through social transactions in a given cultural context, narratives are formed in accordance with the cultural meaning system. The current findings are consistent with the assumption that the activation of shared meanings through narrative constructions is central to understanding the effect of culture.

Second, the current findings are in line with the "New Look" approach, which asserts that perception is significantly modified by expectations, values, emotions, needs, and other factors (Bruner, 1957; Kitayama et al., 2003). They are also consistent with Chun and Wolfe's (2001) assertion, which maintains that learned visual experience pertaining to contextual factors shapes the way individuals allocate attention. Identifying the detailed steps of top-down processes is beyond the scope of the current research; however, our findings suggest that cultural effects on attention should be discussed within a framework of endogenous, top-down, and goal-driven processes.

Third, in the condition where narrative construction was required, we identified positive relationships between narrative construction and patterns of attention. Although previous findings suggested the existence of cultural variation in patterns of attention, the magnitude of the cultural effect has been debated (Chua et al., 2005; Rayner, Li, Williams, Cave, & Well, 2007). We maintain that this inconclusiveness is a result of each

study using its own stimuli, so that the magnitude of the effect can be compared only indirectly. This insufficiency leads the audience to think of cultural effects in an all-or-nothing manner, in terms of either psychological universals (while obscuring the substantial effect of culture on human attention) or psychological relativism (ignoring the stimulus-driven aspects of the results). However, researchers have recently begun to take a balanced view to overcome this dichotomous framework (Norenzayan & Heine, 2005). By taking the balanced view, we demonstrated substantial cultural variations in patterns of attention due to participants' engagement in narrative construction, as well as similar patterns of attention due to the stimulus-driven aspects of the task.

4.2. Limitations and future research

Despite the above implications, the current studies had several limitations. First, we intentionally created stimuli with salient objects that would attract people's attention. For this reason, although we successfully depicted changes in attentional strategies among Japanese, European Canadians' attention patterns in Study 1 (where we assumed that they would engage in bottom-up processing) and in Study 2 (where we assumed that they would engage in top-down processing) did not quantitatively differ from each other. Future studies should create stimuli that direct people's attention not to the main object but to the background, and examine whether European Canadians attenuate their attention to the background and intensify their attention to the main objects when they engage in the narrative task, in which they activate their analytic thinking style.

Secondly, we did not fully rule out an alternative interpretation, which is the effect of language. Language is considered as one of the most influential factors that direct attention. Various psycholinguistic studies examining the influence of language structure on attention have found that, compared to speakers of East Asian languages, English speakers tend to use focal objects and figure-oriented descriptions for both syntactical and pragmatic reasons. For example, recent findings suggest that in Japanese, the ground information is incorporated into the verb (Göksun, Hirsh-Pasek, & Golinkoff, 2010; Göksun et al., 2011; Ikegami, 1981), which may lead Japanese speakers to be sensitive to the contextual information. On the other hand, in English, Talmy (2000) pointed out that "the Figure has syntactic precedence over the Ground" (p. 334), indicating that the focal and figurative information is more salient, and it is prioritized over the ground information syntactically.

In addition, while attempting to tease apart the effects of language and culture on visual attention, Tajima and Duffield (2012) reported that Japanese speakers were more likely than Chinese and English speakers to mention the ground information before the figure information. These researchers maintain that differences in the descriptions during a scene perception task are due to differences in linguistic construction, and not due to variations in culturally defined worldviews. Other studies, however, have demonstrated that language and culture interactively influenced cognitive processes. For example, by manipulating the language spoken by bilingual participants, several studies reported both effects of culture and language on attention (e.g., Ishii, Reyes, & Kitayama, 2003; Ji,

Zhang, & Nisbett, 2004). Although this issue is beyond the objectives of the current research, as the syntactical order of the foreground and background in a single sentence was not reflected in our coding schema, future research should further examine how the first words in a sentence may influence the speaker's attention.

In fact, as the linguistics relativity hypotheses are being reexamined (e.g., Boroditsky, 2003; Lucy, 1992), research on the relationship among culture, language, and cognitive processes is of interest to many researchers (e.g., Imai & Masuda, 2013; Kashima & Kashima, 1998). While language plays an important role in both constructing narratives and transmitting cultural values, culture also provides the context in which language is developed and acquired. A systematic investigation of the link between culture and language would be an important topic for future research. Finally, related to the previous limitation, our data do not allow us to fully examine the relationship among narrative constructions, cultural meaning systems, and attention. For example, future studies could test whether one's attention toward a specific area of the scene is intensified, or whether one's narrative becomes more cultural specific after being primed with cues that evoke the dominant meaning system of a given society. Such research will require a more sophisticated design that directly examines causal relationships among these variables.

Taken together, however, our findings illustrate the importance of narrative in understanding cultural variations in attention. Constructing narratives activate shared cultural meaning systems, thereby resulting in cross-cultural variation in patterns of attention during scene observation, even when the stimuli include highly salient objects. We suggest that future research should examine under what situations cultural variation is observed in cognitive processes.

Acknowledgments

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Notes

1. We conducted a pilot study to ensure that members of both cultural groups would perceive the active objects as highly salient to a similar degree. In order to examine participants' natural eye movements, we asked 33 Japanese university students (19 females; M_{age} = 20.1) and 31 European Canadian students (15 females; M_{age} = 19)

to watch vignettes as part of the calibration. The results confirmed that this new set of stimuli indeed served our research purpose, and demonstrated that the focal fish were perceived as highly salient, $F(1, 62) = 944.63$, $p < .001$, $\eta^2 = .938$, and there was no significant cultural variation.

2. The Tobii Studio fixation filter determines a fixation based on the eye's angular velocity. Saccades that did not reach the velocity threshold of 40 pixels were disqualified as gaze fixations. This cutoff was the minimum unit, because of the constraints of the 60 Hz data-sampling rate of the Tobii 1750.
3. We excluded 18 accounts (10 from Canadian samples and 8 from Japanese samples) from the analyses because these accounts mentioned neither focal nor background information first.
4. The results of independent correlational analyses suggest that for Japanese there was a significant correlation between number of background utterances and fixation duration to the background area, $r = .351$ ($N = 35$), $p < .05$, but this association was not significant for European Canadians, $r = .255$ ($N = 31$), *ns*. The results of Fisher's *r*-to-*z* transformation test, however, indicated that the associations between the number of utterances and the fixation duration were not different across cultures, $Z < 1$, *ns*. The relationship between the number of utterances for the focal fish and the fixation duration to the focal fish area did not reach significance for European Canadians, $r = .322$ ($N = 31$), $p = .077$, nor for Japanese, $r = .285$ ($N = 35$), *ns*.
5. The value of the reversed mediating effect suggests that the patterns of attention mediating cultural difference in narrative construction were also significant ($b = 22.67$; 95% CI = 8.73, 40.33), and they partially mediate the standardized path coefficient from culture to narrative construction (before, $\beta = .61$, $p < .001$, vs. after, $\beta = .40$, $p < .001$). These results suggest that the effect of narrative construction mediating cultural effect on visual attention is stronger than the reverse.

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Appendix: Example descriptions from Canadian and Japanese participants. The slushes divide the sentence into utterances as used for coding.

1. An example description of the video from a European Canadian participant. There were four/fish/that went/from the left side to the right side.
2. An example description of the video from a Japanese participant. *Kawanonakade/hidaritenohoukara/ookina/sakanaga/oyoidekimashita*. (English translation: In the river/from the left/large fish/were swimming.)