Verbal Labels Affect Holistic and Analytic Thinking Styles in Native English Speakers

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Abstract

Holistic and analytic thinking styles are well-documented in cultural psychology. However, recent studies suggest that language potentially mediates the influence of culture on thinking styles. The overarching goal of this study is to examine how verbal labels impact people's thinking styles. Study 1 sought to examine whether thinking styles in a classic triad task could depend on verbal or pictorial formats. Although we observed a significant correlation between performance in verbal and picture triad tasks, more participants were classified as holistic thinkers with a verbal compared to a picture triad task. In Study 2, we examined whether participants could shift their thinking styles in the verbal triad task after being primed to focus on categorical associations. We found that females were influenced by this prime and displayed more analytic thinking. Our results suggest that language can influence thinking styles and that thinking styles are context-dependent.

Keywords: thinking style; verbal label; categorical association; relational association; gender difference; cultural difference

Introduction

Our cultural context shapes our interactions with the world and dictates the way we visualize, process, and utilize information. For example, holistic and analytic modes of thought differs across cultures (Miyamoto, Nisbett, & Masuda, 2006), with people from East Asian, collectivistic cultures typically exhibiting holistic thought and people from Western, individualistic cultures exhibiting analytic thought (Ji, Zhang, & Nisbett, 2004; Senzaki, Masuda, & Ishii, 2014).

Holistic thought associated with an East Asian perspective is primarily dictated by context and relational cues. In this style of thinking, people are more likely to attend to background information and relationships, viewing the system as a whole rather than a sum of its parts (Nisbett & Miyamoto, 2005). For example, in the classic narrative task, participants view an image of a fish bowl and describe what they see in as much detail as possible for one minute (Sensaki, Masuda, & Ishii, 2013). Holistic thinkers, in this task, are more likely to name background or environmental objects like "under the water." Analytic thought, in comparison, is characterized by attention to foreground information and discriminating/categorical qualities (Nisbett & Miyamoto, 2005). In the narrative task, analytic thinkers are therefore more likely to name foreground objects like "fish" and describe their properties and movements.

Previous research has predominantly focused on collectivist and individualist cultural differences in different thinking styles, and factors that could explain the culturally-bounded phenomenon (Kit-Fong-Au, Dapretto, & Song, 1994; Boroditsky, 2001). For instance, researchers have examined the role that environment plays in perception, exposing participants to images of cityscapes (Miyamoto, Nisbett, & Masuda, 2006). These researchers found that images of Japanese cities were more ambiguous and contained more elements than images in American scenes, presumably priming participants to attend more carefully to context. Indeed, when primed with images of a Japanese city, both American and Japanese participants were more likely to think holistically.

In addition to environmental differences, language might also play a role. For instance, in one study, researchers examined whether thinking styles influence attention and awareness. To test this, participants were shown the classic fish bowl vignette, and researchers used an eye-tracking device to measure eye fixation patterns. East Asian and Western participants showed nonsignificant differences in looking patterns (Senzaki, Masuda, & Ishii, 2013). However, the emergence of holistic and analytic thoughts occurred when participants were asked to describe the scene, where East Asian participants were more likely to name background and environmental information than Westerners did. Since differences were only observed when participants were asked to describe the image, researchers suggested language as a mechanism for divergent thinking styles.

Language differences could explain sub-cultural differences as well. Two studies (Rhode, Voyer, & Gleibs, 2016; Senzaki, Masuda, & Ishii, 2001) found differences even between two collectivist cultures. Korean participants thought more holistically than Chinese participants did when

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presented with the narrative task. Researchers proposed that these varying degrees of holistic thinking might be related to the syntactic differences in the participants' native languages, noting that English sentences were mostly head-initial and Korean were mostly head-final. This "head-initial/head-final" judgment refers to verb/noun positioning, with head-initial language leading with the noun followed by the verb, and head-final language leading with the verb followed by the noun. This hypothesis suggests a primacy effect, with speakers being drawn to whatever aspect of the sentence is placed first. English, therefore, as a head-initial language, would mention the subject first in a sentence, priming its speakers to attend to focal objects, whereas Korean, as a head-final language, would mention the subject last in a sentence, priming its speakers to attend to context and the relationship between objects. Since Chinese alternates between head-initial and head-final languages, Chinese speakers showed a lesser degree of holistic thinking than Korean speakers. Results from other studies support the idea that language properties could associate with the measured thinking styles across individuals, situations, cultures, and even subgroups within the same culture (Ji, Zhang, & Nisbett, 2004; Liu, Chung, McBride-Chang, & Tong, 2010; Talhelm et al., 2014).

So far, the literature has suggested thinking styles as a static characteristic of members of a culture, and unique features of language could foster a certain type of thinking style over a long-term exposure. Little is known how language could potentially influence thinking styles as a contextual factor from moment to moment. For example, studies have used tasks with categorical or relational associations of concepts to measure holistic and analytic thinking styles. One influential study constructed triads with both a categorical and relational choice. Participants were asked to choose the two words that were most closely related (e.g. *policeman*, *postman*, and *uniform*). If the participant grouped *policeman* and *postman,* this would be categorical, indicating an analytic choice, whereas *policeman or postman* grouped with *uniform* would be relational, indicating a holistic choice (Ji, Zhang, Nisbett, 2004).

However, ample studies have shown that the strength of categorical and relational associations can vary across pictorial and verbal formats (Vivas, Manoiloff, García, Lizarralde, & Vivas, 2019; Hines, Czerwinski, Sawyer, & Dwyer, 1986; Bruno et al., 2020; Roelke et al., 2018). In general, pictorial stimuli yield a stronger categorical association based on semantic feature overlaps, whereas verbal stimuli yield stronger relational associations based on word associations. Consequently, the verbal triad could "benefit" relational associations more whereas the pictorial triad could "benefit" categorical associations. Therefore, it is possible that the measured thinking style could be dependent on the format of the triad task.

Furthermore, categorical associations could be manifested in the verbal labels of object names. For example, some semantic categories are emphasized in their names, such as "berry (e.g., strawberry, blueberry, raspberry, etc.)" and "nut (e.g., walnut, hazelnut, etc.)". Having these verbal labels in object names could potentially emphasize the categorical associations of concepts, influencing the thinking styles in different ways. On the one hand, since the categorical association is related to analytic thinking in the triad task, highlighting the categorical information could lead to more analytic thinking (a direct influence). On the other hand, highlighting the categorical information via verbal labels of object names could potentially promote a focus on similarities of objects, a feature of the holistic thinking style (an indirect influence). Anecdotal evidence is in alignment with this argument. Specifically, this feature is extremely pervasive in some Asian languages, such as Mandarin Chinese, but not so much in Western languages such as English. Chinese names of objects commonly include the category label alongside the noun, such as the verbal label "flower (花)" in "rose-flower (玫瑰花)", "daisy-flower (雏菊花)", and "peony-flower (牡丹花)". Potentially, having this language feature in Mandarin Chinese promotes a focus on overall similarities of objects, fostering holistic thought in Chinese speakers.

The overarching goal of this study is to examine how language might impact thinking styles, by using verbal labels to create different contexts when measuring people's thinking styles. Study 1 sought to examine whether thinking styles measured in a classic triad task could be shifted using verbal labels instead of pictures. Given the evidence that relational associations are stronger in verbal format, we anticipated that people would show more holistic thinking when tested with verbal format in comparison to pictorial format. Study 2 aimed to examine whether participants could shift their thinking styles measured by the verbal triad task, after being verbally primed to focus on categorical associations of objects. Two potential outcomes were predicted according to two competing hypotheses (direct vs. indirect). If the effect of verbal labels is direct (i.e., participants implement the primed categorical association directly in the triad task), we would expect that the categorical labels in object names would make people focus on the categorical associations of words, and choose categorical associations more (i.e., analytic thinking). However, if the effect of verbal labels is indirect, we would anticipate that exposure to these category labels in object names could make people focus on the overall similarities of objects, and they would show a shift to holistic thinking and choose more relational associations. In addition, we explored potential gender differences in measured thinking styles since studies have shown that females and males could differ in their analytic skills and intuitive-analytic thinking (Aarnio & Lindeman, 2005; Sladek, Bond, & Phillips, 2010).

Study 1

In the first study, we used a classic triad task paradigm to assess thinking styles of individuals across pictorial and verbal formats. We aimed to show (i) large individual

differences in thinking styles even within a group of native English speakers; and (ii) when the thinking style was assessed by the verbal format, people could demonstrate different thinking styles compared to the pictorial format.

Methods

Participants. A total of 80 participants (M_{age} = 19.61 years old, SD = 3.70; 53 females) were included in this study. One participant who did not fill out the demographic information was excluded from the following data analysis. All participants were native English speakers and they did not report known neurological or psychological disorders. All participants were taking introductory psychology classes and received course credit for their participation in this study. The study was approved by the IRB panel at Santa Clara University.

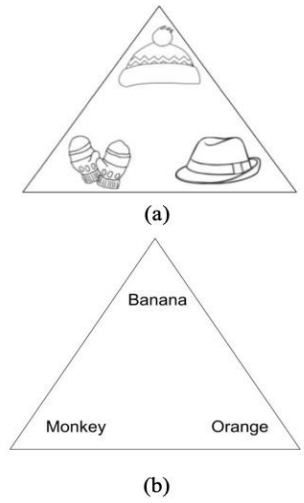
Stimuli and Tasks. This study included a series of tasks that were used to assess thinking styles and were commonly reported in the literature. The first task was the triad task adapted from Ji, Zhang, and Nisbett (2004) with both pictorial and verbal formats (see Figure 1). Each of these triads had a target image or word at the top with two candidates, either images or words, at the bottom of the triad. The participants were then asked which candidate image or word (left or right) they believed went best with the target at the top. Both candidates were related to the target, however, one candidate was relationally associated with the target (suggesting a holistic thinking style), and the other candidate was categorically associated with the target (suggesting an analytic thinking style).

As shown in Figure 1a, the pictorial triad had a target image being a "winter hat". If the participant chose "mittens," their answer would be coded as a relational association (i.e., holistic thinking) because "winter hat" and "mittens" are often found in the same context (i.e., cold weather). If the participant chose "fedora" it would be considered as a categorical association (i.e., analytic thinking) because "fedora" and "winter hat" would both fall under the category "hats". In Figure 1b, the triad task was in the verbal format with a target word "banana" and two candidate words "monkey" as a relational association and "orange" a categorical association. Nineteen verbal triads and 16 pictorial triads were created, and the left/right positions of categorical and relational candidates were counterbalanced across triads. Verbal and pictorial triads were nearly identical, but the total number of triads differed for two reasons. We firstly excluded triads using words with explicit category labels (e.g., "winter hat" might bias people to choose the other hat, "fedora," so this triad was only used in pictorial format). Also, it is hard to create matching pictorial triads for some objects, so we excluded those.

We also included a narrative task in this study which was adapted from Sensaki, Masuda, and Ishii (2013). In this task, participants were presented with 6 images in random order that contained focal objects and background scenes for 15 seconds. After 15 seconds, the participants were then asked to describe the scene in 3-5 sentences to the best of their memory. Due to space limitations, we refrain from presenting the data of this task in the current paper.

Procedures. All the tasks were created and presented to the participants online via Qualtrics. Participants first read the instructions and gave their consent to the study, and then completed all tasks to assess their thinking styles. Half of the participants received one version of this study, completing the verbal triad task first, then the narrative task, and finally the pictorial triad task. The second half of the participants received a counterbalanced version, in which they completed the pictorial triad task first, then the narrative task, and lastly, the verbal triad task. The trials of all tasks were randomized across individuals. All participants completed a short survey to gather information about their

Figure 1: Examples of the pictorial (a) and verbal (b) formats of the triad task.



age, gender, language experiences, and whether they noticed the purpose of the study. The whole study took about 30 minutes to complete, and none of the participants reported knowing these tasks for assessing their thinking styles.

Analysis. All data were recoded and analyzed using RStudio. For both triad tasks, a categorical association choice ("orange for banana") was coded as 1 and a relational association choice ("monkey for banana") was coded as 0. Thus, higher scores (close to 1) on the triad tasks suggested more categorical choices/a more analytic thinking style whereas lower scores (close to 0) implied more relational choices/a more holistic thinking style. We first calculated the correlation between the scores in pictorial and verbal triad tasks to examine intra-individual consistency in these two tasks. Then we classified each individual in each task as categorical/analytic or relational/holistic based on a cutoff of 0.5. Individuals with a score higher than 0.5 were considered

categorical/analytic and those with a score equal to or lower than 0.5 were considered relational/holistic. We then examined the frequency of individuals who were considered as categorical/analytic in the pictorial triad task but categorized as relational/holistic in the verbal triad task. Last, we examined the effect of gender on exhibiting analytic or holistic thinking in both triad tasks.

Results and Discussion

First of all, participants scored 0.38 (*SD* = 0.23) in pictorial triad task and 0.37 (*SD* = 0.17) in verbal triad task on average, surprisingly suggesting that these participants chose more relational associations in both tasks and could be considered more holistic thinkers. As seen in Figure 2, we found a significant correlation between the scores of the pictorial triad task and the verbal triad task, indicating some consistency of measuring thinking styles across the two formats, $r(78) = .46$, $p < .001$. However, it is also evident that there were large individual differences in both tasks as the scores ranged almost from 0 to 1 across individuals.

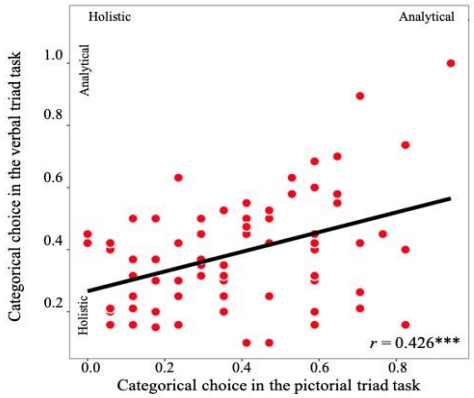


Figure 2: Significant correlations between the scores in pictorial and verbal formats of the triad task.

In addition, individuals who scored low on the pictorial triad task rarely scored high on the verbal triad task (top left corner), but those who scored high on the pictorial format could score low or high in the verbal format. Further analysis using 0.5 as a cutoff showed that 11 individuals considered as analytic (chose more categorical associations) in the pictorial format also stayed in the same category in the verbal format, but 14 of them became holistic (chose relational associations) in the verbal format. By contrast, 51 were considered holistic in the pictorial format and stayed in the same category, but only 4 became analytic in the verbal format (see Table 1). A chi-square test revealed a significant difference in the frequency distribution, $\chi^2(1) = 15.218$, $p < .001$. These results showed that when tested with the verbal triad task, more individuals from the analytic category would be considered holistic, but fewer individuals from the holistic category would be considered analytic. Therefore, thinking styles of individuals could become more holistic when verbal versus pictorial labels were used.

Last, we did not find gender differences in their scores in either the pictorial or verbal triad tasks. For the pictorial format, females scored 0.41 (*SD* = 0.24) and males scored 0.32 (*SD* = 0.21), $t(78) = 1.69$, $p = 0.095$.For the verbal format, females scored 0.41 (*SD* = 0.19) and males scored 0.35 (*SD* = 0.13), $t(78) = 1.51$, $p = 0.134$. Therefore, although females tended to choose categorical associations slightly more, they did not differ statistically significantly.

Table 1: Frequency of participants classified into different thinking styles, depending on format of the task

		Verbal triad task	
		Categorical (Analytic)	Relational (Holistic)
Pictorial triad task	Categorical (Analytic)	11	14
	Relational (Holistic)	4	51

Study 2

In this study, we aimed to test whether using verbal labels that emphasized categorial associations of concepts could shift participants' thinking styles measured by the verbal triad task. As seen in Study 1, more participants were categorized as holistic thinkers with the verbal compared to the pictorial triad task. Thus, in this study, we chose the verbal format instead of the pictorial format to further examine the impact of verbal labels in participants' choices of categorical or relational associations in the triad task.

Methods

Participants. A total of 23 participants (M_{age} = 19.39 years old, *SD* = 0.94; 15 females) from the undergraduate participant pool participated in this study for course credit. These participants did not participate in Study 1, and had no known neurological or psychological disorders. This study was also approved by the IRB panel at Santa Clara University.

Stimuli and tasks. In this study, we used object names with the category label attached as primes. We chose three different semantic categories, namely, "fruit", "nut", and "ball" for their high frequency and familiarity to native English speakers. For each category, we chose three object names as a prime set, and three object names as a control set. For instance, "blueberry", "raspberry", and "strawberry" were used as the prime set for the fruit category, (as a subordinate category of fruit; "berry"), and "mango", "peach" and "grape" were used as the control set as other fruits without a verbal label emphasizing the categorical associations. For all the prime sets, they shared a verbal label (i.e., "-berry", "-nut", and "-ball") in their names to indicate a specific category, and this emphasis on categorical associations was not present in the control set. In this study,

each prime and control set was presented twice, resulting in a total of 12 trials (6 in the prime condition and 6 in the control condition). In addition, 24 unique verbal triads with the same structure as in Study 1 were created and used to assess thinking styles after participants were exposed to the verbal prime or control sets.

In each trial, participants were asked to complete a shopping task (e.g., buy some fruits). In this shopping task, they saw 6 words in succession, and they were required to click "Yes" or "No" to decide whether they needed to buy these items. Of these 6 words, 3 were from the same category for shopping (i.e., fruit) and 3 were distractors, such as "wine", "beef", and "chocolate" (Figure 3). In the control condition, the control set ("mango", "peach", and "grape") of the same category (i.e., fruit) were intermixed with the same 3 distractors. After they finished the shopping task, they were asked to complete a short verbal triad task as in Study 1 with only 2 triads in sequence.

Procedure. All tasks were created in Qualtrics and completed online. Participants first read the instructions and gave their consent to the study, and then completed all 12 trials of shopping tasks and verbal triad tasks in a self-paced manner. All 12 trials were randomized across individuals, so all participants finished both prime and control conditions. At the end, participants completed a demographic survey. The entire study took about 30 minutes to complete.

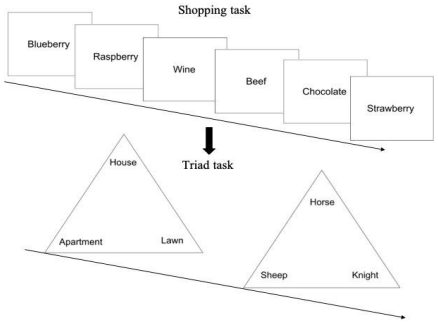


Figure 3: Experimental procedure of shopping and triad tasks used in Study 2 (an example of the prime condition).

Analysis. Since we were mostly interested in the immediate priming effects of verbal labels on measured thinking styles, we focused our analysis on the 1st verbal triad in the current analysis. Results using the 2nd verbal triad are available upon request. We coded the responses to the verbal triad task in the same way as in Study 1. A categorical association choice was coded as 1 and a relational association choice as 0. We first examined whether the measured thinking styles were shifted under the prime condition using a paired-samples *t*-test. Then, we used a mixed-effect ANOVA to explore whether the priming effect was different for females and males.

Results and Discussion

As predicted, the paired-samples *t*-test revealed a significant difference between the prime (M = 0.58, SD = 0.27) and control (M = 0.40, SD = 0.25) conditions on the verbal triad task, $t(22) = 3.11$, $p = 0.005$, suggesting that individuals chose more categorical associations after being primed with verbal labels which emphasized the categorical information of a semantic category. Furthermore, we also observed a significant interaction between the condition (prime vs. control) and gender (female vs. male) in the mixed-effect ANOVA, $F(1,21) = 6.43$, $p = 0.019$, suggesting a differential priming effect for females and males (see Figure 4). Post-hoc tests revealed that females shifted into more categorical choices (i.e., analytic thinking style) in the prime condition (M = 0.67, SD = 0.26) compared to the control condition (M = 0.39, SD = 0.29), $t(14) = 4.80$, $p < .001$, but there was no significant difference in males between the prime condition (M = 0.42, SD = 0.24) and the control condition (M = 0.42, SD = 0.20), $t(7) = 0$, $p = 1.00$. These results suggest that people's thinking styles measured by the verbal triad task were highly context-dependent. Even when people were only briefly exposed to the verbal labels highlighting the categorical information, their choices in the task to assess thinking styles were significantly shifted to the categorical associations immediately afterward. Interestingly, this effect was present in females but not in males. Results from Study 2 further confirmed that verbal labels could have a direct and immediate effect on measured thinking styles.

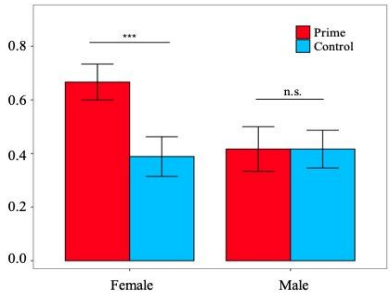


Figure 4. Condition*Gender Interaction on Thinking Styles.

General Discussion

The different thinking styles, namely, analytic vs. holistic, have been long associated with Western and East Asian cultures, respectively. Our findings from two studies have provided some preliminary evidence that thinking styles of native English speakers, especially when measured by verbal formats, are highly variable across individuals and context-dependent. In Study 1, we showed large individual differences in thinking styles, and when measured with a verbal format, more individuals became holistic thinkers from analytic thinkers compared to when measured with a pictorial format. In Study 2, we used an experiment to demonstrate that exposure to verbal labels highlighting the categorical associations would lead participants, especially females, to prefer categorical candidates in the verbal triad task. These findings converge on the idea that thinking styles can be variable instead of static, and language can impact thinking styles of individuals from moment to moment.

Results from Study 1 and Study 2 may seemingly be contradictory since Study 1 suggested that people became more holistic thinkers with the verbal triad task whereas in Study 2, participants were shifted to analytic thinkers after being primed with verbal labels. However, they actually converge on the observation that language could impact thinking styles, but the exact direction depends on the feature of the verbal information and the contexts. The triad tasks in Study 1 assess relative strength of categorical and relational pairs of images or words, resembling word association and semantic priming (Ross et al., 2007; Shelton, & Martin, 1992). Previous meta-reviews have pointed out that both semantic and relational associations could lead to a priming effect, but the semantic association depends on feature overlaps of objects whereas the relational association is also influenced by word association in text (Lucas, 2000; Huchison, 2003). In addition, a previous study has shown that the semantic priming effect is stronger in the verbal than pictorial formats (Koivisto & Revonsuo, 2000). Therefore, when the triad task was implemented in a verbal format, the relational association became "boosted" so people chose the relational candidates more compared to the pictorial format.

In Study 2, we primed people to focus on the categorical associations by using names that highlighted the categorical information. Specifically, the verbal labels like "berry", "nut", and "ball" in the prime condition made the shopping task easier to the participants if they looked for the verbal similarity. This verbal similarity would then further promote a focus on the category similarity. Consequently, participants were potentiated for the categorical association in the triad task. Thus, the influence of the verbal labels was directly "translated" into the triad task, and people tended to continue focusing on the categorical associations and chose the categorical candidates more, resulting in a shift to analytic thinking. The different results of Study 1 and Study 2 could also partially, if not all, result from the task instructions. In Study 1, we instructed participants to find candidate word/picture that goes "together" with the target word, indicating an emphasis on relationships; however, in Study 2, the shopping task required participants to "sort/separate" items, promoting some analytical processes. Nevertheless, this possibility still points to the factor that thinking styles can be viable and influenced by language. Therefore, although the influence of verbal labels shifted people's thinking styles in the opposite directions in Studies 1 and 2, they both manifested the potential impact of language on measured thinking styles.

It is worth noting that our findings mostly showed the short-term effects of language on thinking styles, since the verbal labels only created task-specific contexts when measuring thinking styles. At most, our results suggest that language could influence thinking styles and explain cultural differences in thinking styles (Rhode, Voyer, & Gleibs, 2016; Ji, Zhang, & Nisbett, 2004). In particular, we want to focus on the results from Study 2. One motivation for Study 2 came from the observation that categorical associations are prevalently emphasized in Mandarin Chinese, so this feature in Mandarin Chinese could potentially cultivate a focus on the overall similarity of object categories, fostering a holistic thinking style. In contrast to this hypothesis, we did not observe that people became more holistic thinkers after being primed with categorical information. Instead, we found that categorical information made females in our sample more likely to use analytic thinking. Hence, in a Western sample, categorical information might have a direct effect, because it makes people (females, at least) focus on the primed category and its distinctiveness from other categories more. In non-Western samples, we might find that categorical information might have an indirect effect (possibly leading to more holistic thinking), because people in non-Western cultural contexts could potentially see the interconnectedness (rather than the distinctiveness) with other categories. To be sure, our finding does not necessarily mean that emphasizing categorical information in language does not have a long-term effect in fostering a holistic thinking style. Future research should implement training studies across different cultures to test this hypothesis.

Interestingly, our Study 2 observed that females, more than males, are influenced by the verbal labels during the verbal triad task. First of all, this cannot be attributed to the fact that females are generally more susceptible to categorical associations, since there was no difference in the control condition in Study 2 and no difference in both pictorial and verbal triad tasks in Study 1. Although there were some studies showing gender differences in thinking styles, we do not have a strong theory to explain the gender differences observed in the current study. We could only speculate that females may be more receptive to verbal information than males, given some evidence on gender differences in verbal skills (Wei et al., 2012; Hyde, & Linn, 1988; Eriksson et al., 2012). One caveat is that our sample size in Study 2 was small and unbalanced in gender so future studies should examine the potential gender differences with a larger and balanced sample.

There are a couple of limitations of the current studies. First, due to the global COVID-19 pandemic, both studies were conducted online so the testing environment (e.g., noise, timing, etc.) and the attentional state of participants were not controlled. Since the studies were self-paced, the priming influence in our Study 2 could vary across individuals. Future studies should conduct the experiments in a more controlled environment. Second, we only focused on a young adult sample in a Western culture so the generalizability of the current findings awaits the tests from future studies examining different ages and cultures.

In conclusion, our research provided some new evidence that verbal labels could influence thinking styles measured in the triad task. The way language might influence thinking styles however (i.e., whether it is direct or indirect), might depend on the language context. Our results add on the evidence that language could mediate the impact of culture on thinking styles. More importantly, thinking styles should be considered a contextually-dependent concept which could vary across individuals, tasks, and cultures.

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