Dimensions of Holistic Thinking:

Implications for Nonsocial Information Processing Across Cultures

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Word Count: 15,744

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This research was supported by grant no. 452813 and grant no. 23500218 from Research Grant Council of the Hong Kong Special Administrative Region, China.

The exceptionally detailed and constructive comments and suggestions by several reviewers (often far beyond the call of duty) have contributed greatly to the quality of this article.

Abstract

Representatives of Asian and Western countries often differ in terms of both their social orientation (e.g., collectivism vs. individualism) and their thinking style (holistic vs. analytic). The disposition to think of oneself in relation to others or to the collective to which one belongs appears similar to a more general holistic thinking style (the disposition to think of elements of a stimulus in relation to one another or their context), suggesting that they may have similar roots. Nevertheless, the low correlations among measures of these characteristics (e.g., Na et al., 2010) indicate that holistic thinking might be multidimensional. To obtain a clearer picture of this multidimensionality, we constructed a procedure that could be used both to assess and to induce three different styles of cognitive processing that reflect different aspects of holistic thinking: specifically, the tendencies (a) to respond to the configuration of a stimulus as a whole without regard to the elements that compose it, (b) to think about stimulus elements in relation to their context, and (c) to think about stimulus elements in relation to one another. Indian, Hong Kong Chinese, North American, and British participants differed in their tendency to use these types of thinking. Moreover, priming these different styles of holistic thinking experimentally affected the performance of only those cognitive tasks that required these thinking styles. Finally, although cultural groups differed spontaneously in their performance of tasks to which different types of holistic thinking were relevant, experimentally inducing these thinking styles eliminated these between-culture differences in performance. Such differences were generally unrelated to measures of social orientation typically used to distinguish representatives of Western and Asian countries.

Keywords: culture; processing strategies; holistic processing; individualism-collectivism; independence-interdependence

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The values and behavior that distinguish members of different cultural groups (e.g., North Americans and East Asians) have been investigated extensively (for reviews, see Chiu & Hong, 2013; Kitayama & Cohen, 2010; Nisbett, Peng, Choi, & Norenzayan, 2001; Shavitt, Cho, & Barnes, 2017; Wyer, Chiu, & Hong, 2009). Some studies have examined how representatives of different cultures differ in their social orientation (e.g., the tendency to think of oneself as independent of, or in relation to, others). Another series of studies has identified cultural differences in the thought processes that underlie nonsocial judgments and behavior (e.g., the disposition to treat elements of a stimulus configuration either independently or in relation to their context). Because differences in the perception of one's relationship to other persons appear to parallel more general differences in thinking style, one might speculate that processing information in both social and nonsocial domains is conceptually related and has a common root. Although this possibility has often been proposed (Markus & Kitayama, 1991; Nisbett, 2003; Varnum, Grossmann, Kitayama, & Nisbett, 2010), it has, however, not been strongly confirmed empirically. In this article, we conceptualize some of the reasons for this lack of support and suggest a strategy for examining them empirically.

Cultural differences in thinking style have been investigated extensively by Richard Nisbett (2003) and his colleagues (e.g., Nisbett, Peng, Choi, & Norenzayan, 2001; Nisbett & Norenzayan, 2002; Norenzayan, Choi, & Peng, 2007). They have identified cultural differences in the performance of a wide variety of cognitive and perceptual tasks that can be interpreted as indications of holistic thinking, that is, the disposition to focus on a configuration of stimulus elements as a whole and to consider the elements in relation to their context (Nisbett et al., 2001). Members of Asian countries are generally more inclined to

engage in this type of thinking than Westerners are (for evidence, see Nisbett et al., 2001; Norenzayan et al., 2007).

This difference has its parallel in studies of cultural differences in social orientation; that is, the disposition to view oneself in relation to others and the groups to which one belongs or, alternatively, as a unique and independent person. These different orientations have been characterized as collectivism and individualism, respectively (Hofstede, 1980; Triandis, 1995) or as interdependence and independence, respectively (Markus & Kitayama, 1991). Although collectivism and interdependence are more predominant in Eastern countries than in Western ones, substantial variation exists in collectivism both between Eastern countries and among the individuals within them (Oyserman, Coon, & Kemmelmeier, 2002). Further, the effects of situationally priming individualism and collectivism do not depend appreciably on individuals' cultural background (Oyserman & Lee, 2008). This suggests that although such orientations can be chronic, transitory situational factors can override these cultural differences.

Although the similarity between social orientation and holistic thinking gives rise to the speculation that similar thinking processes underlie behavior in both social and nonsocial domains, this possibility has been called into question by Na et al. (2010). In an analysis of performance on 10 tasks that have commonly been used to assess differences in holistic thinking (e.g., Norenzayan, Choi, & Nisbett, 2002), Na et al. (2010) found that although members of Asian and Western countries differ in their mean levels of performance on these tasks (see Nisbett et al., 2001), the within-country correlations among these measures are very close to zero. Furthermore, 10 different measures that distinguish between Asians' and Westerners' individualism and collectivism were also uncorrelated within each cultural group.

Na et al.'s (2010) findings do not necessarily disconfirm the possibility that holistic thinking has its roots in socially learned styles of information processing. In fact, Na et al. (2010) challenged the validity of generalizing the behavioral constructs that distinguish cultural groups to individual differences because "groups and individuals differ in a host of potentially relevant ways" (Na et al., 2010, p. 6195; e.g., biological entities, needs and desires). However, a more precise specification of holistic thinking styles and their antecedents might permit their relationship to measures of social orientation to be detected.

Our research was directed to this end. Our objective was not to dimensionalize traditional measures of social orientation, but rather to show that these measures do not predict the different types of holistic thinking that predominate in different cultural settings. We first provide a conceptual analysis of the components of both social orientation and holistic thought and their variation over cultural groups. In doing so, we suggest that holistic thinking as typically defined (Nisbett, 2003; Nisbett et al., 2001) is multidimensional and that existing measures of social orientation (e.g., Gardner, Gabriel, & Lee, 1999; Singelis, Triandis, Bhawuk, & Gelfand, 1995) are not sufficiently diagnostic to identify relationships of social orientation to thinking style that might exist. Second, we describe a new method for assessing differences in thinking style and inducing these differences experimentally, and show (a) that chronic cultural differences exist in the use of these thinking styles and (b) that the experimental induction of the thinking styles can have systematic effects on the performance of tasks that involve holistic processing. Finally, we show that although members of different cultures differ in their performance of these tasks, experimentally inducing tendencies to engage in different styles of thinking can decrease or eliminate these cultural differences. In combination, our findings indicate that holistic thinking is multidimensional and that the thinking styles that compose it vary across cultures. Traditional measures of social orientation do not well predict this variation.

After a brief review of the possible antecedents of cultural differences in social orientation and thinking styles, we first consider research on different measures of social orientation and discuss their implications. We then elaborate the different processes that underlie holistic thinking and describe a procedure for both assessing and inducing these processes. Finally, we report four studies that use the procedure to identify both chronic cultural differences in thinking style and their relation to different aspects of holistic processing.

Theoretical Background

Antecedents of Thinking Style and Social Orientation

The disposition to think analytically or globally can sometimes be influenced by objectively irrelevant events that occur in the course of everyday experience. For example, choosing among alternatives in an unrelated situation can affect both the self-reported tendency to engage in analytical thinking and actual task performance (Savani, Stephens, & Markus, 2017). However, chronic differences in thinking style exist as well. These differences could be traceable in part to all kind of intellectual traditions that characterize Asian and Western civilizations. As Nisbett (2003; Nisbett et al., 2001) noted, Western thought has been largely influenced by the philosophy of ancient Greece, which emphasizes the detachment of objects from their surroundings. In contrast, Asian thought is exemplified by Confucianism, which emphasizes harmonious relations of individuals and objects to one another and their environment. This difference could be reflected in many aspects of culture, including aesthetic preferences (Masuda, Gonzalez, Kwan, & Nisbett, 2008; see Oishi et al., 2014, for an analysis of other differences in the intellectual traditions that pervade Asian and Western cultures). However, between-country variation can exist in the countries that compose these cultural groups (e.g., Miyamoto, Knoepfler, Ishii, & Ji, 2013).

Cultural differences in information processing might be rooted in the value societies place on personal goals and interpersonal relationships (Oyserman, Sorensen, Reber, & Chen, 2009). In collectivistic societies, interpersonal relationships are particularly important and can stimulate a tendency to think of oneself as connected to others. This tendency is often reflected in child-rearing practices (Miller, Fung, & Koven, 2007; Miller, Wiley, Fung, & Liang, 1997; see also Oishi et al., 2014; Tamis-LeMonda, Wang, Koutsouvanou, & Albright, 2002). For example, Taiwanese children are typically encouraged to use other persons as standards of comparison and to perceive negative behaviors as character deficits that need to be corrected in order to fulfill the expectations held by others (Miller et al., 1997). In addition, they are expected to behave benevolently toward members of the groups to which they belong and to take others' interests into account (Wong & Wyer, 2016). Although North American children can also have these concerns, they are more commonly encouraged to perceive themselves as unique individuals and to evaluate themselves independently of others. As a result of these different socialization practices, members of Asian countries are often more inclined than Westerners to both (a) think of themselves as part of a group or collective (Triandis, 1995), and (b) evaluate their behavior in terms of its implications for others as well as for themselves (Markus & Kitayama, 1991). To the extent that these dispositions are reflected in nonsocial as well as social behavior, they could be manifested in global and relational thinking, respectively.

However, a conceptual analysis of individualism and collectivism (Tamis-LeMonda et al., 2008; Wang & Tamis-LeMonda, 2003) indicates that the values associated with these orientations are not incompatible and that parental child-rearing practices can often encourage both. A desire for autonomy and self-actualization, for example, which is associated with individualism, does not preclude a desire for connectedness to one's family or allegiance to the groups to which one belongs (e.g., athletic teams). Socialization practices

in a given cultural group could therefore encourage both orientations, depending on the situation at hand (Oyserman et al., 2009).

Obviously, these child-rearing practices and the social orientations that might result from their use are not restricted to Asian and Western countries.[1] These orientations can coexist in a given culture and among individual members of the culture (Oyserman, 2017; Oyserman et al., 2009; Tamis-Lemonda et al., 2008). Thus, individualistic and collectivistic orientations are evident in both Asian and Western cultures, differing only in their relative predominance (Oyserman et al., 2009).

Be that as it may, the preceding discussion suggests that the antecedents of social orientation and the antecedents of thinking styles might be similar. Varnum et al. (2010) provided a compelling analysis of this similarity. They documented the close parallel between differences in thinking style and differences in social orientation both between and within cultures. For example, Russians are more interdependent than Americans are, and also show more holistic thinking in categorization and reasoning tasks (Grossmann, 2009). Russians are also more interdependent than Germans are (Naumov, 1996) and, correspondingly, show more contextual processing in visual attention tasks (Medzheritskaya, 2008). Within-culture differences in social orientation and thinking style are also parallel. For example, Northern Italians both are more independent than Southern Italians (Martella & Maass, 2000) and perform more analytically on categorization tasks (Knight & Nisbett, 2007). Despite these findings, however, direct evidence of the relationship between social orientation and thinking style has not been strongly confirmed empirically.

[1] A meta-analysis of measures of individualism and collectivism (Oyserman et al., 2009) indicated that although European Americans are appreciably more individualistic than Hong Kong Chinese, the differences between Americans and representatives of other Asian countries (Indians, Koreans, and Japanese) are relatively low. Although Americans were typically less collectivistic than both Hong Kong Chinese and Indians, they were actually more collectivistic than Japanese, and did not differ from Koreans.

Measures of Social Orientation

Differences in individualism and collectivism could be either chronic or situationally induced. Chronic differences have been inferred from the use of first-person plural pronouns in a sentence construction task (Gardner, Gabriel, & Lee, 1999; Uz, 2014), the inclusion of others in the conception of oneself (Aron, Aron, & Smollan, 1992), the spontaneous mention of relations with others in a self-description task (Cousins, 1989; Markus, Mullally, & Kitayama, 1997), and questionnaire measures of values and attitudes (Singelis, Triandis, Bhawuk, & Gelfand, 1995; Triandis, 1995). Differences in individualism and collectivism, which are often referred to as "cultural mindsets" (Oyserman, et al., 2009), can be induced situationally by calling people's attention to their cultural identity (Hong, Morris, Chiu, & Benet-Martínez, 2000; Briley, Morris, & Simonson, 2005), stimulating them to think about similarities between themselves and others rather than differences (Trafimow, Triandis, & Goto, 1991), performing a task as members of a group rather than as individuals (Briley & Wyer, 2001), and leading them to use either first-person singular or first-person plural pronouns (Oyserman et al., 2009).

Several analyses of these measures, however, suggest that individualism and collectivism are not opposite ends of a continuum but rather are multidimensional. Oyserman, Coon, and Kemmelmeier (2002) found that individualism was inferred from seven different values (independence, personal goals, uniqueness, competitiveness, privacy, self-knowledge, and direct communication), whereas collectivism was inferred from eight values (relatedness, belonging, duties and obligations, social harmony, seeking close others' advice, working with a group rather than individually, respect for authority, and a disposition to present oneself differently in different contexts).

Further evidence of this multidimensionality was suggested by Triandis and Gelfand's (1998) factor analysis of the items that compose the Singelis et al. (1995) scale. This analysis

yielded four orthogonal factors (see Table 1) that were assumed to reflect differences in combinations of values along two dimensions, individualism-collectivism and horizontal-vertical. However, the orthogonality of these factors indicated that individualism and collectivism are not opposite poles of a single bipolar dimension. Rather, each construct has two components that are unrelated to one another. Items loading on two of these factors, labeled *horizontal collectivism* and *horizontal individualism*, reflect a disposition to value group membership versus independence, respectively (see Table 1). In contrast, items loading on a third factor (*vertical collectivism*) reflect a subordination of one's own interests to those of others, whereas items loading on the fourth factor (*vertical individualism*) reflect competitiveness and doing things better than others). A similar analysis by Briley and Wyer (2001) identified five factors, two of which were similar to vertical collectivism and vertical individualism, and found that Hong Kong Chinese scored higher than North Americans on *both*. This suggests that although members of Asian countries are disposed to think of themselves in relation to others, this tendency can be both positive (in the case of social connectedness) and negative (in the case of competitiveness).

Although cultures differ in the degree to which individualistic and collectivistic orientations are emphasized, this difference does not account for the low within-culture correlations among measures of these constructs (Na et al., 2010). This could be due in part to variation in idiosyncratic features of the measures. For example, Brewer and Chen (2007; see also Tamis-LeMonda et al., 2008) noted that identification with a collective and feelings of obligation can depend on whether the collective includes oneself, family and friends, or groups to which one belongs. Measures of individualism-collectivism might often be unrelated unless these differences are taken into account. Another contributor to the low correlations was recognized by Na et al. (2010). That is, although two behavioral tasks may both be prominent in a given cultural milieu, performances of the tasks are likely to vary in

strength among individuals, depending on the extent to which they have been reinforced in their immediate social environment.

A theoretical explanation of Na et al.'s (2010) findings can be found in Kitayama and colleagues (Kitayama, Park, Sevincer, Karasawa, & Uskul, 2009). They note that members of a given cultural group might have the same "cultural mandate." That is, members of a society could have the same ideals and general goals and could be encouraged to engage in behavior and practices that facilitate the attainment of these goals. However, these goals might be attained by engaging in several different courses of action, each of which is situation specific and idiosyncratic. Thus, a given individual might perform different goal-relevant behaviors in different situations, and different persons might perform different goal-related actions in the same situation. (For a more general conceptual analysis of goal systems, which recognizes the functional equivalence of different actions in pursuit of a common goal, see Kruglanski et al., 2002.) The actions that occur in pursuit of a given objective could, therefore, be uncorrelated across individuals and situations. In the context of the present research, several different behaviors (e.g., conforming to another's opinion, cooperating in pursuit of a group goal) might be effective in fulfilling the same mandate (collectivism), depending on the situation at hand. To this extent, representatives of a given culture could have the same mandate but the particular situation-specific behavior of one person to fulfill this mandate might be unrelated to the behavior of another (for further discussion of this possibility, see Oyserman, 2017).

This possibility is consistent with a comprehensive survey of independence and interdependence in 33 different European and Asian countries (Vignoles et al., 2016). This research suggested that although members of these countries differed in independence and interdependence, the manifestation of these characteristics varied substantially over domains

of experience (e.g., defining oneself, making decisions, looking out for oneself, communicating with others, and dealing with conflicts).

Thinking Style and Task Performance

As we noted earlier, the disposition to think of oneself as independent or to evaluate oneself in relation to others might exemplify more general styles of thinking that govern responses to nonsocial stimulus information. When individuals encounter a complex stimulus, they could engage in a number of steps (e.g., Fiske & Neuberg, 1990; Meeren, van Heijnsbergen, & de Gelder, 2005). They might first respond to the stimulus as a whole. Then, their attention might be drawn to the individual elements that compose the configuration. Finally, they might consider the relation of these elements either to the configuration as a whole or to one another. These considerations imply at least four different processes. Moreover, responses to a stimulus might involve more than one of these processes. (For example, one must identify the individual elements of a configuration before considering their relationship to one another or their context.) Nevertheless, individuals might be disposed to devote more cognitive energy to one type of processing than to others.

These different emphases are embodied in a general conceptualization of holistic and analytic processing (Nisbett, 2003). *Holistic* thinking is conceptualized as "an orientation to the context or field as a whole, including attention to relationships between a focal object and the field [and a reliance on] experience-based knowledge rather than abstract logic" (Nisbett et al., 2001, p. 293). In contrast, *analytic* thinking refers to "a detachment of the object from its context, [a] tendency to focus on attributes of the object [in order] to assign it to categories…a preference for using rules about categories to explain and predict…behavior [and the] decontextualization of structure from content…" (Nisbett et al., 2001, p. 293). Thus, analytic thinking is characterized by a tendency to focus on individual aspects of stimuli independently both of one another and of the context in which they occur. These

considerations suggest at least three ways in which holistic thinking differs from analytic processing, each of which has been identified in comparisons between members of Western and East Asian countries.

Global versus local processing. Members of Asian countries are more inclined than those of Western countries to process information globally instead of focusing on individual features (McKone et al., 2010). For example, they are more likely than Westerners to group stimuli on the basis of their family resemblance rather than on the basis of a specific feature they have in common (Norenzayan et al., 2002). This tendency might reflect a general disposition to respond to a stimulus configuration as a whole without considering the individual features that compose it. In contrast, local processing is a disposition to think about individual features of a stimulus configuration independently of other features or their context. Such local processing is conceptually similar to a "separation mindset" (Oyserman et al., 2009).[2]

The disposition to engage in global versus local processing varies across cultures. Japanese are relatively more likely to categorize configurations of features (e.g., human faces) on the basis of global criteria than on the basis of their similarity in specific features (Miyamoto, Yoshikawa, & Kitayama, 2011). Chinese Americans are more likely than European Americans to interpret Rorschach cards in terms of global criteria rather than individual features (Abel & Hsu, 1949). These findings suggest that members of Asian countries think more globally than members of Western countries do.

However, a developmental study by Oishi et al. (2014) found evidence that Japanese children are generally *less* disposed to focus on global features of stimuli than American children are. In addition, Japanese participants process information at a more local level in

[2] As we elaborate presently, local processing can be conceptualized as a common pole of dimensions pertaining to both global processing (Choi, Koo, & Choi, 2007; McKone et al., 2010) and relational processing (e.g., Oyserman et al., 2009).

verbal tasks (e.g., Maass, Karasawa, Politi, & Suga, 2006; Miyamoto et al., 2013). As Oishi et al. (2014) speculated, this difference could be attributed to the educational philosophy that pervades Japanese society, which emphasizes attention and memorization of details. However, Japanese adults use more behavioral descriptions and fewer global traits in describing others than Westerners do (Maass et al., 2006), suggesting that the relative difference in local versus global processing persists into adulthood. Miyamoto et al. (2013), however, also found that Japanese construed behavior at a more local level than Americans did, whereas Chinese construed behavior at a more global level than Americans. Thus, general conclusions concerning cultural differences in global processing are elusive.

Item-context relational processing. Members of Asian countries are more likely than those of Western countries to think about stimuli in relation to the context in which the stimuli appear (Kitayama, Duffy, Kawamura, & Larsen, 2003). Thus, they perform more poorly than Westerners when attention to contextual features is likely to interfere with performance, but they perform better than Westerners when sensitivity to the context facilitates performance. A series of studies by Masuda and Nisbett (2001) suggests this possibility. Participants viewed vignettes of fish swimming in a pool with different stationary objects in the background. Japanese participants were more likely than Americans to recall the contextual features of the stimuli. Moreover, their later recognition of the focal objects was greater when the objects were presented in the same context in which they had appeared, whereas Americans' recognition was unaffected by the context. Analogous cultural differences in attention to context are also evident in aesthetic preferences (Masuda et al., 2008).

Item-item relational processing. Members of East Asian countries are likely to describe themselves in terms of their relationship with others (e.g., "I am a brother"), whereas Westerners often tend to describe themselves in terms of personal attributes ("I am friendly;"

Cousins, 1989; Markus et al., 1997). Moreover, members of Asian countries are relatively more likely to group objects on the basis of thematic relations rather than membership in an abstract category (Ji, Zhang, & Nisbett, 2004). Thus, for example, members of Asian countries typically group a woman with a baby and a notebook with a pen, whereas those of Western countries are more inclined to group a woman with a man and a notebook with a magazine. Also, Miyamoto, Yoshikawa, and Kitayama (2011) showed that members of Asian countries are more likely than those of Western countries to notice differences in the relations among parts of a face (e.g., the distance between eyes).

Summary

Although both global and relational processes are embodied in the definition of holistic processing noted earlier (Nisbett et al., 2001), they are conceptually distinct (Kimchi, 1992). Furthermore, existing measures of social orientation (Singelis et al., 1995; Gardner et al., 1999) might not well predict these processes. In the present research, therefore, we had three objectives: (a) to isolate the different processes that underlie holistic thinking, (b) to identify cultural differences in the use of these processing strategies and explore their relation to more traditional measures of social orientation (e.g., individualism-collectivism), and (c) to show that cultural differences in the disposition to employ these strategies account for differences in the performance of tasks that are used to assess holistic thinking.

Because the tasks used to assess differences in thinking style differ in many ways, their low intercorrelations might be attributed in part to method variance and not to the constructs being assessed. To minimize this problem, we constructed a single task that could be used both to infer and to induce tendencies to process information in ways that appear to characterize holistic processing, thereby allowing cultural differences in the performance of different measures of holistic processing to be interpreted in terms of these tendencies. Specifically, we asked people to view a series of paintings that could be evaluated in each of

four ways: by focusing on the individual elements of a painting independently of one another (local processing), by evaluating the painting as a whole without considering its individual features (global processing), by considering the elements of the painting in relation to the whole (item-context relational processing), or by considering the elements in relation to one another (item-item relational processing).

As noted earlier, applications of these processing strategies are not mutually exclusive; responses to a complex stimulus could involve more than one type of processing. We nevertheless expected that individuals would differ in the relative strength of their tendencies to employ these strategies. In evaluating this possibility, we often used local processing (a tendency to consider the stimulus elements independently of one another) as a baseline to which the tendencies to engage in global and relational processing were compared.

An initial study showed that spontaneous tendencies to employ these criteria differed among four different cultural groups (India, Hong Kong, Great Britain, and the United States) but were only weakly related to traditional measures of individualism-collectivism. A second study indicated that experimentally inducing these strategies influenced performance on holistic processing tasks to which the strategies were particularly relevant but did not affect performance on other tasks. A third study, which involved chronically accessible processing strategies, yielded conclusions similar to the second study. A fourth study indicated that members of two different cultures (India and the United States) differed in their performance of tasks that are assumed to involve holistic processing; however, situationally priming participants to use a task-relevant processing strategy overrode the effect of chronic cultural differences that were otherwise evident.

In combination, our findings indicate that holistic thinking is actually a mix of at least three fairly independent types of processing. Members of Asian and Western countries who

differ in their disposition to engage in these types of processing also differ in their performance of tasks that require them. However, although the thinking styles we assessed are components of holistic thinking, they are not highly correlated with common measures of social orientation (individualism-collectivism or independence-interdependence). We discuss the implications of these findings further after reporting our results.

Study 1

To provide an indication of the processing strategies that distinguish individuals with different cultural backgrounds, we constructed a single task to which each of four processing strategies could be applied. This study was approved by the *Survey and Behavioural Research Ethics Committee* at the Chinese University of Hong Kong (Ref no. 452813). Participants were representatives of four different countries (the United States, Great Britain, Hong Kong, and India) whose members were likely to differ in individualism and collectivism (Oyserman et al., 2009). We asked the participants to judge a set of five paintings that could potentially be evaluated using one of the four processes described earlier (local, global, item-context relational, and item-item relational). After judging the paintings, participants reported the extent to which they had used each of these strategies. Although participants could obviously report using more than one criterion, we expected them to use one criterion more than others, and that the nature of the criterion they predominantly used would depend on their cultural background.

In addition, we assessed participants' social orientation. Based on previous research (Hofstede, 2001), we expected that participants from the United States and Great Britain would be the most individualistic, that Indian participants would be the most collectivistic, and that bicultural Hong Kong Chinese participants would fall between these extremes. These data allowed us to compare cultural and individual differences in social orientation to differences in the processing styles.

Method

All procedures for this and each subsequent study were conducted in accordance with APA ethical standards. Procedures were approved by the Behavioral Research Ethics Committee at the authors' institution.

We recruited participants from four countries: the United States, Great Britain, Hong Kong, and India.[3] Following Faul, Erdfelder, Lang, and Buchner (2007), we performed power analysis to estimate the sample size using G*Power, with $\alpha = .05$, $\beta = .10$, Cohen's $d = .5$ (i.e., a medium effect size; Cohen, 1988), and with culture as the independent variable. The results revealed the minimum sample size to be 232, and we recruited 480 participants in total (120 participants per country). Participants were told we were interested in how lay persons evaluate paintings by artists from the late 19th century. On this pretense, they were asked to form impressions of five paintings in much the same way they would if they encountered the paintings in a museum or art gallery. The paintings, shown in Figure 1**,** differed considerably in both content and style. However, each painting contained a large number of features, and thus could potentially be judged by employing any of the four strategies noted earlier. We asked participants to use their own strategy in forming their impressions and to indicate how well they liked these paintings.

Participants were shown each of the five paintings in sequence and reported their impressions of it along a scale from 1 (*not at all favorable*/*not like at all*) to 11 (*very favorable*/*like very much*; rs > .83, ps < .001). Then, after viewing all the paintings, the

[3] An additional country, Japan, was particularly likely to differ from other countries in social orientation and holistic processing (Nisbett et al., 2001; Oyserman et al., 2009). Unfortunately, an insufficient number of Japanese participants were available online to permit a consideration of this possibility. In this study and the subsequent studies, Hong Kong refers to Hong Kong Special Administrative Region of the People's Republic of China.

participants were asked to reflect on the criteria they had used to evaluate the paintings and to indicate the extent to which they had made their evaluations by:

a. "*focusing on the details of each painting – that is, the quality of the specific persons and objects shown, each considered in isolation*,"
b. "*forming an overall impression of each painting as a whole without focusing on its individual features*,"
c. "*focusing on the way in which the different persons and objects in each painting are related to one another*," and
d. "*focusing on the way in which each person or object in the painting is related to the overall context in which they are embedded*."

Participants reported the extent to which they had used each strategy on a scale from 1 (*not at all*) to 11 (*very much*). Participants' reported use of these strategies were interpreted as indications of their disposition to engage in local, global, item-item relational and item-context relational processing, respectively.

Note that although this interpretation has face validity, it assumes participants can (to some extent) report the mental processes that underlie their judgments and decisions. As Nisbett and Wilson (1977) noted, however, accurately reporting mental processes is not always the case (Wilson, 1994; for a comprehensive review of the conditions in which individuals correctly report the antecedents of their behavior, see Petty, Briñol, Tormala, & Wegner, 2007). We nevertheless expected that between-country differences in participants' reported use of these strategies would reflect differences in their actual disposition to engage in them. We discuss this issue in more detail after the results are reported.

Social orientation. After participants had completed the painting-judgment task, they completed a 22-item measure of individualism-collectivism employed by Triandis and Gelfand (1998; Singelis et al., 1995). Items loading on each of the four factors identified by

Triandis and Gelfand (1998) are shown in Table 1.[4] Responses were reported along a scale from -5 (*totally disagree*) to +5 (*totally agree*). Responses to the items in each set were averaged (αs > .70).

As we noted earlier, Triandis and Gelfand (1998) interpreted the items loading these factors as *horizontal individualism* (e.g., "I am a unique individual," "One should live one's life independently of others"), *horizontal collectivism* (e.g., "It is important to maintain harmony within my group," "To me, happiness depends on the happiness of those around me"), *vertical individualism* (e.g., "It is important to me that I do my job better than others," "Winning is everything"), and *vertical collectivism* (e.g., "I would sacrifice an activity that I enjoy very much if my family did not approve," "Before taking a major trip, I consult with most members of my family").

Second, participants performed a sentence construction task similar to that employed by Gardner et al. (1999). They were given 32 sets of five words, and were asked to indicate four of the words that would make a sentence. In 16 items, the sentences required the use of either first-person singular pronouns (I, me, my, mine) or first-person plural pronouns (we, us, our, ours). Sample items included "feel we I happy very" and "give to it us me." The other 16 items were fillers. The number of sentences in which participants used a first-person plural pronoun in each version was averaged and used as an index of their collectivism.

Results

Correlational analyses. Two preliminary sets of correlational analyses were performed. First, we correlated responses along the four subscales identified by Triandis and Gelfand (1998); see Table 1. As noted earlier, the items pertaining to horizontal collectivism (HC) and horizontal individualism (HI) fit traditional conceptions of collectivism and

[4] A preliminary factor analysis of responses to this measure yielded four orthogonal factors identical to those identified by Triandis and Gelfand (1998) and shown in Table 1.

individualism, respectively, and appear to reflect opposite ends of a disposition to think about oneself as part of a group. The items composing the other two scales (VC and VI), on the other hand, reflect a disposition to behave either cooperatively or competitively toward others and, therefore, can be used to explore the construct of interdependence ("a pervasive attentiveness to the relevant others in the social context;" see Markus & Kitayama, 1991, p. 225).

Correlational analyses confirmed these interpretations. The correlation between horizontal individualism (HI) and horizontal collectivism (HC) was significant but low (r = -.11, n = 480, p < .05); this was true within each cultural group separately, ranging from -.19 (Great Britain and Hong Kong) to -.22 (the United States). We therefore used the difference between HC and HI as an index of participants' level of collectivism versus individualism. However, the correlation between vertical individualism (VI) and vertical collectivism (VC) was positive (r = .40, p < .01); this was also true within each cultural group, ranging from .22 (Great Britain) to .38 (India). We therefore used the sum of VC and VI as a proxy to explore cultural differences of interdependence. (As will be seen, this procedure was justified by analyses of VC and VI separately, which showed that they vary similarly over cultural groups; see Table 3.)

The mean within-culture correlations among these measures, the I/we index of collectivism, and the four indicators of processing style inferred from the painting task, are shown in Table 2. These correlations are generally low. Item-context relational processing was correlated .18 with global thinking and .33 with item-item relational processing, implying that the three global/relational processing strategies do not reflect a single construct (Voorhees, Brady, Calantone, & Ramirez, 2016). All other correlations among the four indicators of processing style were negligible.

Moreover, the measures of social orientation we considered were also uncorrelated with both one another and the four indicators of processing style.

Cultural differences in social orientation. Despite the low within-culture correlations among indices of social orientation, between-culture differences in these indicators of social orientation were significant. These differences are summarized in the first section of Table 3. Between-cell comparisons indicate that Asian (Indian and Hong Kong) participants scored higher in collectivism than Western (American and British) participants did, as inferred from both responses to the I/we task (M = 6.87, SD = 3.25 vs. M = 5.78, SD = 2.74; $F(1, 478) = 15.73$, $p < .001$, $\eta^2 = .032$) and the difference between HC and HI (M = 0.38, SD = 1.90 vs. M = -0.86, SD = 2.13; $F(1, 478) = 37.03$, $p < .001$, $\eta^2 = .072$). Although these difference scores varied across cultural groups as we expected, analyses of each component separately (see Table 3) indicated that these differences were largely attributable to differences in HC. Indians were just as high in horizontal individualism as Americans were.

Asians (Indian and Hong Kong) scored relatively higher than Westerners (American and British) in the interdependence index (M = 14.29, SD = 3.67 vs. M = 11.53, SD = 2.68; $F(1, 478) = 88.96$, $p < .001$, $\eta^2 = .157$). Note that this difference was also evident in analyses of VI and VC separately (see Table 3), confirming our speculation that both measures reflect a disposition to think of self in relation to others, either positively (in the case of VC) or negatively (in the case of VI).

Cultural differences in processing strategy. Participants' reports of the processing strategies they used are summarized in the second section of Table 3. A repeated-measures analysis showed that pooled over cultural groups, participants in general were most likely to report using a global processing strategy (M = 8.88, SD = 2.01), followed by a disposition to evaluate individual features in relation to their context (M = 7.86, SD = 2.53). They were

least disposed to consider items in relation to one another (M = 7.59, SD = 2.45) and to engage in local processing (M = 7.28, SD = 2.64). The overall difference in the reported use of these strategies was significant ($F(3, 1428) = 48.51$, $p < .001$, $\eta^2 = .092$).

However, the interaction of processing strategy and culture was also significant ($F(9, 1428) = 16.63$, $p < .001$, $\eta^2 = .095$), indicating that the relative disposition to report using each of the four processing strategies depended on participants' cultural background. Within-country differences indicate that, as noted earlier, all participants reported a greater disposition to use a global strategy than to use a local one. However, although Western (British and American) participants reported using a local strategy more than a relational one, Asians (Indian and Hong Kong) participants reported using a relational strategy more than a local one.

Between-culture comparisons of self-report measures can be difficult to interpret as they are potentially biased by extraneous differences scale usage and response bias (Harzing, 2006; Harzing, Brown, Köster, & Zhao, 2012; Lee, Jones, Mineyama, & Zhang, 2002). To minimize the effects of these biases, we used each group's reported use of local processing as a baseline in comparing their use of global and relational strategies. The last section of Table 3 summarizes the difference between each group's reported use of global and relational processing with the group's reported use of local processing as baseline. These differences indicate that relative to their reported use of a local strategy, Indian and Hong Kong participants reported being more likely to engage in both global and relational processing than British and Americans were, whereas the latter two groups did not differ from one another.

Discussion

The painting-judgment task was successful in distinguishing four different processing strategies that representatives of Western and Asian countries might be chronically disposed

to use. Moreover, cultural differences in the use of these strategies parallel differences in social orientation. That is, Indian and Hong Kong participants, who were both more collectivistic and more interdependent than Westerners, reported being much more likely to process information either globally or relationally than to employ a local processing strategy. American and British participants, who had a relatively individualistic social orientation, were less inclined than Asians to report engaging in either global processing or relational processing (relative to local processing).

Our findings confirm Na et al.'s (2010) conclusion that although cultural differences exist in aggregated measures of social orientation, individual differences in responses to these measures are uncorrelated, suggesting that the measures are multidimensional. It could also suggest that social orientation measures tap different manifestations of a more general construct (e.g., a cultural mandate; see Kitayama et al., 2009). The negligible correlations between social orientation measures and the processing dispositions inferred from the painting-judgment task might also be interpreted in this manner.

Conclusions regarding a general cultural difference in global processing should be qualified, however. As we noted earlier, several studies (i.e., Maass et al., 2006; Oishi et al., 2014) indicate that Japanese are less inclined to engage in global processing than European Americans are. Moreover, Hong Kong Chinese did not differ from either British or Americans in global processing *per se* but reported a lower disposition to engage in local processing than other groups. To the extent that global and relational processing are both indications of holistic thinking[5], this suggests that although members of Asian countries

[5] We acknowledge that, as mentioned earlier, the literature is mixed on whether global processing should be considered orthogonal to holistic processing (Maass et al., 2006; Miyamoto, et al., 2013; Oishi et al., 2014). Our findings add to this literature by suggesting that the traditionally defined "holistic processing" in a certain culture can be characterized by a subset of its dimensions (rather than all of them).

report a generally greater inclination to think holistically than Westerners do, the particular type of holistic thinking they employ varies across cultures.

Some caution should nevertheless be taken in interpreting cultural differences in processing style. As we noted earlier, our interpretation assumes that participants are able to report accurately the strategy they employed, and this might not always be the case (Nisbett & Wilson, 1977; Wilson, 1994). Moreover, cultural differences in the reported use of these strategies might be influenced in part by an attempt to comply with culture-based expectations for the thinking style they perceive to predominate in their social environment. This possibility cannot be entirely dismissed. As we shall see, however, the results of Study 4 indicate that cultural differences in participants' reports of the processing strategies they use are associated with differences in their performance that require these strategies. These results provide some confidence that our interpretation of participants' self-reports is justified.

Study 2

The generally low correlations among the processing strategies assessed by the painting-judgment task suggest that the strategies are relatively independent. If this is so, and if holistic processing involves the use of these strategies, inducing individuals to use one of the strategies should increase their performance of the particular tasks that involve this strategy without affecting their performance of tasks to which the strategy is irrelevant.

To examine this possibility, we used the painting-judgment task to prime the use of each of the processing strategies we assumed to be associated with holistic processing. Research on the impact of behavioral mindsets (Wyer & Xu, 2010; Wyer, Xu, & Shen, 2012) indicates that performing a goal-related behavior in one situation activates concepts associated with this behavior and that these concepts, once accessible in memory, influence the strategy individuals employ while pursuing an unrelated goal in a later situation. (For the

use of priming procedures to induce culture-relevant processing strategies, see Briley & Wyer, 2001; Hong et al., 2000; Mourey, Oyserman, & Yoon, 2013; Oyserman & Lee, 2008; Oyserman et al., 2009; Wolgast & Oyserman, 2019.) Based on this research, we hypothesized that priming participants to use a particular strategy when performing the painting-judgment task would activate a tendency to use the strategy in performing later tasks to which it is applicable but would not affect the performance of other holistic processing tasks to which the strategy is irrelevant. However, suppose a holistic thinking style is a unitary disposition that encompasses these more specific strategies. Then, priming one manifestation of this general thinking style might influence the performance of tasks that require other manifestations of holistic processing as well.

Participants were first induced to use local, global, item-context relational or item-item relational processing in the course of performing the painting-judgment task. Then, each participant performed two tasks that (a) have been used in previous research to infer differences in holistic processing but (b) varied over conditions in the applicability of the particular strategy that was primed. If holistic thinking is a unitary construct that involves both global and relational processing, the effects of inducing individuals to engage in either type of processing should generalize across the tasks we administered. In contrast, we expected the effects of priming to be specific to tasks for which the strategy being primed was particularly relevant.

Method

This study had a 4 (priming condition) × 3 (processing task type: global vs. item-context relational vs. item-item relational) between-subjects design. We conducted power analyses to estimate the sample size with $\alpha = .05$, $\beta = .10$, Cohen's $d = .5$ (i.e., a medium effect size; Cohen, 1988) for a factorial design (Faul et al., 2007). The results revealed the

minimum sample size to be 286. We eventually recruited 297 Hong Kong undergraduate students for a gratuity of USD5, and assigned them randomly to these conditions.

Priming task. Participants were first exposed to the pictures employed in Study 1. They were told that "…people use many different criteria to evaluate paintings, and their evaluations can differ from the evaluations made by experts and art critics simply because they use different criteria in judging them. We are interested in whether people's evaluations of a painting would be the same as experts' evaluations if they use the same criteria that the experts use…" The remaining instructions depended on the criteria that participants were encouraged to use.

In the *local* priming conditions, participants were told that art critics typically evaluate a painting by focusing on each person and object portrayed in isolation without thinking about the painting as a whole. In the *global* priming conditions, they were told that art critics typically form an overall impression of a painting as a whole without focusing on its individual features. In the *item-context relational* priming conditions, they were told that art critics typically focus on the way in which objects in a painting are related to the context in which they are embedded. And in the *item-item relational* priming conditions, they were told that experts focus on the way in which the persons or objects in a painting are related to one another. With this preamble, participants viewed each of the five paintings and indicated how well they liked them along two scales from 1 (*not at all favorable*/*not like at all*) to 11 (*very favorable*/*like very much*). Participants then reported the extent to which they had used each of the four strategies in evaluating the paintings along a scale from 1 (*not at all*) to 11 (*very much*).

Then, after performing the priming task, participants were told that the remaining studies were unrelated to the first one and, on this pretense, they were asked to perform one of three pairs of tasks described below. After doing so, they completed the I/we sentence

construction task and the Triandis and Gelfand (1998) measure of individualism-collectivism as in Study 1 (HC: α = .71; HI: α = .70; VC: α = .70; VI: α = .79).

The tasks in each pair, one of which was verbal and the other of which was visual, have been used to distinguish between holistic and analytic processing in other studies. However, we expected their performance to depend on the type of strategy that was primed (either global, item-context relational, or item-item relational processing). The tasks pertaining to each type of processing are described briefly as follows. (Detailed descriptions of all of the tasks we administered and the instructions for administering them are provided in the Supplemental Materials.)

Global versus local processing tasks. Two tasks were expected to involve global processing. The verbal task was similar to that employed by Trope and Liberman (2000) to infer high versus low levels of construal. Participants were told that the experiment was concerned with how college students made everyday life decisions. On this pretense, they were given two choice tasks, one concerning a job and the other pertaining to renting an apartment. In each case, one choice alternative was described in terms of three favorable global features (e.g., high intrinsic job interest, a large living space, etc.) and three unfavorable situation-specific features (e.g., unattractive job training, high moving expenses, etc.). The second alternative was described in terms of unfavorable global features and favorable situation-specific features. Participants' relative preferences for the alternatives were reported along an 11-point bipolar scale and were subsequently recoded using numbers from 1 to 11, where higher numbers reflect greater preference for the alternative with favorable global features. Responses were averaged and used as an indication of the relative weight attached to global versus local criteria.[6]

[6] Although previous research has shown that global (local) processing is associated perceptually with a conceptually higher (lower) level of construal (Förster, 2012; Förster &

The second, visual task was adapted from materials developed by Navon (1977) and used to infer different processing styles by Kühnen and Oyserman (2002). Participants were told the task determined how quickly people can identify different aspects of a physical stimulus. They were then given 16 trials. On each trial, they first saw a target letter followed by two figures, each figure consisting of a large letter composed of small ones (e.g., a big "H" composed of small "V"s) and were asked in each case to indicate the figure in which the target letter was located. In half of the trials, the target matched the large letter of one of the test figures and in the other half of the trials, it matched the small letters in one of the figures. The difference between the time required to identify small letters and the time required to identify a large letter was used as an indication of the relative tendency to focus on global characteristics of a stimulus rather than individual features.

Item-context relational processing (context-sensitive) tasks. The verbal processing task was conceptually similar to that employed by Masuda and Nisbett (2001), but was adapted to verbal information processing by Hedden et al. (2000; see Nisbett et al., 2001). Hedden et al. (2000) found that presenting words in the context of an irrelevant background picture facilitated Asians' later memory for them but did not affect Westerners' memory. Based on Hedden et al.'s (2000; Hedden, 2015, personal communication) procedure, we constructed 20 stimuli, 10 of which consisted of a word on a white background and 10 of which consisted of a word surrounded by an irrelevant background picture (a landscape or people interacting). (In the latter stimuli, words were presented in a small white box to ensure they would be clearly distinguishable.) After exposure to the stimuli and an interpolated task, participants were asked to recall the words. The difference between the number of words recalled when they were surrounded by a picture and the number of words recalled when they

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Dannenberg, 2010; Liberman & Förster, 2009a, 2009b), we acknowledge that the use of the specific construal level task in the current research as a measure of global processing is based more on a commonly agreeable assumption than on a repeatedly verified conclusion.

were surrounded by empty space was used as an indication of sensitivity to item-context relatedness. (An ambiguity in interpreting performance on this task will be discussed presently.)

The second, visual task was the absolute-judgment version of the framed-line task developed by Kitayama et al. (2003). Participants were told that the task concerned visual perception. This version of the task consisted of five trials. The first page of each trial showed a square with a line drawn in it of a length that varied across trials. A second page showed a blank square of a different size, and participants were asked to draw a line of the same length as the line in the first square. The mean error of estimating this length (the mean absolute difference between the length of the line that participants drew and the actual length of the line) was used to infer the influence of context on their responses.

Note that in a second version of this task, participants were asked to draw a line in the test square that is the same *relative* length as the line in the first square. In this case, errors of estimation reflect an inability to use the context effectively. In most applications of this task both relative and absolute versions are employed. However, because we were interested in participants' tendency to use the context in making judgments and not their ability to do so, the relative judgment version seemed less appropriate for our purposes.

Item-item relational processing tasks. The verbal task, which was developed by Ji et al. (2004), was used to determine the tendency to think about items in relation to one another. The task ostensibly concerned how people "group things together." Participants were given 18 sets of three words, eight of which were targets and the rest of which were fillers. The eight target sets were: (a) magazine/pen/notebook, (b) letter/stamp/telegraph, (c) professor/middle school/university, (d) spoon/soup/knife, (e) dragon fly/bee/flower, (f) parcel/postman/policeman, (g) beer/water/fish, and (h) water lily/rose/pond. Thus, participants could choose words on the basis of their taxonomic category membership (e.g.,

magazine and notebook, in the first item listed above) or their thematic relationship (e.g., pen and notebook). The number of sets in which participants grouped items in terms of their thematic relationship was used as an index of their sensitivity to the relatedness of the items to one another.[7]

The visual index of item-item relational processing was used by Kühnen and Oyserman (2002). Participants were shown a picture with 28 randomly arranged objects (e.g., house, moon, and train track) within a 7 in. × 7 in. square, and were told to "try to remember what you see." After studying the array for 90 seconds, they were given a blank 7 × 7 sheet of paper and asked to write down the name of each item they could remember in a location as near as possible to the location in which it had been presented. Recall accuracy was assessed by dividing the paper into 49 cells and scoring a response as "correct" if it fell into the same cell as the original. The number of correctly recalled items was used as an index of sensitivity to item-item relatedness.

Summary. To summarize, one pair of tasks was expected to assess global processing; a second pair was expected to assess item-context relational processing; and the third pair, item-item relational processing. Moreover, one task in each pair (specifically, the construal level, word memory, and thematic grouping tasks) primarily involved semantic processing and the other (specifically, the Navon, framed-line, and location memory tasks) primarily involved visual information processing.

In some tasks, however, more than one factor could influence performance. In the word memory task, for example, we assumed (following Hedden et al., 2000; Nisbett et al., 2001) that an increase in the recall of the words when they were presented in context would

[7] We acknowledge that responses to the last two items listed (e.g., beer/water/fish) might be interpreted as a reflection of item-context relational processing (e.g., "a fish is found in water") rather than item-item relational processing ("a fish swims in water"). However, a homogeneity analysis of the eight items indicated the Cronbach's α was less when the items were eliminated (.671) than when they were retained (.681).

indicate a tendency to think about the words in relation to the context, and thus to use the context as retrieval cues. On the other hand, the context in which the words were embedded might distract people from focusing on the words, and decrease performance. Thus, a difference in the performance on the word memory task could result from either or both factors. Furthermore, performance on the location memory task could be facilitated by memory of the position of the items in relation to the array as a whole as well as memory of their position in relation to one another. In both cases, however, the effects of priming different processing strategies were expected to indicate which processing predominated in the conditions we investigated.

Results

Manipulation check, main study. Participants were consistently more likely to report using a processing strategy when it was primed than when it was not; for local processing, $M = 7.66$, $SD = 1.84$ vs. $M = 6.43$, $SD = 2.19$; $F(1, 295) = 18.28$, $p < .001$, $\eta^2 = .058$; for global processing, $M = 8.46$, $SD = 1.62$ vs. $M = 7.58$, $SD = 1.84$; $F(1, 295) = 14.16$, $p < .001$, $\eta^2 = .046$; for item-context relational processing, $M = 7.53$, $SD = 1.89$ vs. $M = 6.65$, $SD = 2.00$; $F(1, 295) = 11.29$, $p = .001$, $\eta^2 = .037$; and for item-item relational processing, $M = 8.04$, $SD = 1.86$ vs. $M = 6.68$, $SD = 2.33$; $F(1, 295) = 20.26$, $p < .001$, $\eta^2 = .064$.

Manipulation check, follow-up study. Some caution should be taken, however, in interpreting the manipulation check items. That is, these items explicitly described participants' processing styles in words similar to those employed in the manipulation, thus introducing a potential experimental demand. We therefore conducted a post-test to provide a better indication of the manipulation's effectiveness. We preregistered the design and analysis plans for this study (AsPredicted #49946).

Specifically, we recruited 385 participants from the same subject pool used in the main study and randomly assigned them to one of four processing style conditions (local,

global, item-context relational, and item-item relational). Participants first performed the painting-judgment task under conditions identical to those employed in the main study. Then, after rating some unrelated filler items, they completed an open-ended thought-listing task in which they wrote down any thoughts that spontaneously came to mind when thinking about how they processed the paintings. Two independent coders assigned all of the thoughts generated by the participants to one of five categories: *local* (thoughts and feelings focusing on the details of each painting), *global* (thoughts about their impressions of each painting as a whole), *item-context* (thoughts about how each person or object in the painting fit into the overall context in the painting), *item-item relational* (how different persons and objects were related to one another) and "other." All disagreements were resolved through discussion. For each processing strategy, the ratio of the number of thoughts falling into the primed category to the total number of processing style thoughts served as the manipulation checks.

Participants were more likely to generate thoughts about a processing strategy when it was primed than when it was not: in the case of local processing, $M = .28$, $SD = .24$ vs. $M = .17$, $SD = .20$; $F(1, 383) = 22.19$, $p < .001$, $\eta^2 = .055$; in the case of global processing, $M = .37$, $SD = .21$ vs. $M = .20$, $SD = .22$; $F(1, 383) = 44.90$, $p < .001$, $\eta^2 = .11$; in the case of item-context relational processing, $M = .26$, $SD = .25$ vs. $M = .10$, $SD = .17$; $F(1, 383) = 46.74$, $p < .001$, $\eta^2 = .11$; and in the case of item-item relational processing, $M = .29$, $SD = .27$ vs. $M = .10$, $SD = .19$; $F(1, 383) = 52.70$, $p < .001$, $\eta^2 = .12$. (The results were the same if the absolute number of each type of thoughts was used as the manipulation check.) Thus, although these data do not completely rule out the effects of experimental demands, they strengthen our assumption that our priming manipulation was effective. In addition, since the procedures allowed participants sufficient time to reflect the processing strategies (Nisbett & Wilson, 1977; Wilson, 1994), we believe these results were less susceptible to, although could not totally eliminate, concerns on the accuracy of participants' self-reported mental processes.

Social orientation. Measures of social orientation are summarized in Table 4 as a function of priming conditions. These measures did not depend on priming (Fs < 2.45, ps > .120), and were mostly unrelated to the performance of the six experimental tasks.

The effects of priming on the performance of each task are summarized in the last three sections of Table 4. Global and local processes are opposite ends of a single dimension. Moreover, relational processing necessarily requires an identification of the individual elements of a stimulus before their relationship to others is evaluated. For this reason, and also to simplify the interpretation of our results, we treated the local priming condition as a baseline relative to which the effects of priming global and relational processing could be compared. (The failure to include a "no prime" control condition prevented the independent effect of local processing to be evaluated in this experiment. However, this limitation was eliminated in Study 4.) Differences between the task performance in global and relational processing conditions and the performance in local processing conditions are summarized in Table 5. These differences are noteworthy in several respects.

Global versus relational processing. Priming a tendency to think globally increased the use of a global judgment criterion on the performance of both the Navon letter-identification task and the construal level task. However, it had no effect on the performance of tasks that required attention to features of a stimulus in relation to one another (i.e., the location memory and thematic grouping tasks). In contrast, priming item-item relational processing had a positive effect on the performance of the latter tasks but not the former ones.

Item-context relational priming. Priming a tendency to focus on items in relation to their context affected performance on tasks that involved global processing (the Navon letter-identification task and the construal level task) in much the same way that global priming affected it. However, priming a tendency to focus on items in relation to their context also influenced the tendency to group stimuli on the basis of their thematic relationship. In

combination, these results suggest that priming a tendency to think about items in relation to their context had two effects. That is, it increased both (a) sensitivity to the global features of a stimulus and (b) a tendency to think relationally.

The effect of priming on the performance of context-sensitive tasks was less straightforward. Priming either a tendency to focus on global criteria or a tendency to think relationally increased the impact of context as inferred from performance of the framed-line task. However, the effect of this priming on memory for words in context was quite different. As we noted earlier, a consideration of the words in relation to their context could increase performance, as Hedden et al. (2000) found. On the other hand, attention to the overall configuration could be distracting and decrease memory for the individual items relative to conditions in which the contextual features were not present. In fact, priming a global processing *decreased* memory for words that were presented in a context, suggesting that it led participants to focus on the overall configuration rather than the focal stimulus. In contrast, priming item-context relational thinking had no effect on word memory. If the latter priming increases both a focus on the overall configuration and relational thinking, the two effects could offset one another.

Correlation and regression analyses. The preceding results indicate that inducing the different processes associated with holistic thinking produces systematic differences in task performance. However, they do not address the ambiguities identified by Na et al. (2010), who found that although aggregated data suggested a relationship between social orientation and thinking style, the intercorrelations among these measures were negligible. The present findings confirm this conclusion. The correlation between scores on the two measures of global processing (the Navon and construal level tasks) was significant but low (r = .26, p = .007), and the correlations between the two measures of context sensitivity and between the two measures of item-item relational processing were even lower (r = .01, p =

.942 and $r = .15$, $p = .136$, respectively). Moreover, the measures of social orientation that we considered were significantly correlated with task performance in only two of 18 cases: the correlation between the I/we task and the Navon letter-identification task ($r = .39$, $p < .001$) and the correlation between interdependence and the construal level task ($r = -.29$, $p = .003$). In contrast, the correlations between task performance and the self-reported use of the four processing strategies when performing the painting task were frequently significant, as shown in the top half of Table 6. These correlations suggest that performance of a task often involves the use of more than one strategy.

To clarify these effects, a step-wise regression analysis was conducted on the performance of each task as a function of the four types of processing. These analyses, which are summarized in the top half of Table 7, confirm our assumptions concerning the strategies involved in performing each task, but indicate that other strategies sometimes contribute to performance as well.

For example, the performance of tasks that we assumed to require global processing (the Navon task and the construal level task) was positively related to the use of a global processing strategy, but negatively if at all, to the use of item-item relational processing (the tendency to think about individual features in relation to one another). In contrast, performance of tasks that required item-item relational processing (the location memory task and the thematic grouping task) was associated positively with the use of item-item relational processing ,but negatively if at all, with the use of global processing. The performance of context-sensitive tasks (the framed-line task and the word memory task) was positively correlated with the tendency to think about items in relation to their context. However, although the performance of the framed-line task was also positively associated with the tendency to engage in global processing, performance of the word memory task was related negatively to this tendency. We speculated that although priming item-context relational

processing could facilitate memory for words that are embedded in a context (Hedden et al., 2000), a tendency to think about the overall configuration could have a distracting effect, and these processes could offset one another. The directionally different effects of global processing and item-context relational processing identified in regression analyses are consistent with this conjecture.

Discussion

Study 2 provides evidence that priming global processing and priming item-item relational processing activated different processing strategies that affected performance on the particular tasks to which these strategies were applicable. Moreover, these effects generalized over visual and verbal modalities. In contrast, priming a tendency to think about features in relation to their context had more widespread effects, not only inducing a relational processing strategy but also sensitizing individuals to contextual features independently of other considerations. Nevertheless, these findings indicate that the thinking styles assessed by these tasks do not fall along a single dimension. Rather, they reflect different types of processing that are not strongly related to one another. The processes induced by performing the painting-judgment task had no effect on measures of social orientation. Nevertheless, these processes were often significantly correlated with the performance of the tasks that required their use.

The evidence that priming a tendency to think globally affected the performance of global processing tasks (e.g., the Navon task) but not tasks that require thinking of stimuli in relation to one another (e.g., the location memory task), whereas priming item-item relational processing influenced performance of the latter tasks but not the former, confirms the distinction between global and relational processes. This distinction is noteworthy in light of Kühnen and Oyserman's (2002) finding that priming a collectivistic social orientation using a version of the I/we task influenced the performance of *both* the Navon letter-identification

task and the location memory task. Other research by Oyserman and colleagues (Oyserman, Sorensen, Reber, & Chen, 2009), in which conceptually similar priming was used, also found that priming influenced both global and item-item relational processing. This suggests that although these two types of holistic processing are independent, collectivism as activated by the I/we task or its conceptual equivalents induces a tendency to engage in both types of processing.

Study 3

An ambiguity in evaluating the analyses in Study 2 arises from the fact that participants' processing strategies in the study were assessed immediately after these strategies were experimentally induced. Therefore, the correlations among performance measures and processing strategies could be partially the result of demand compliance. To confirm the findings of Study 2 in which processing strategies were experimentally induced, in Study 3 we assessed participants' processing styles and their task performance in two separate sessions. We expected that by temporally separating the assessment of participants' chronic processing dispositions from their performance of tasks to which these dispositions were relevant, the effects of demand compliance would be minimized. Moreover, this procedure provided insight into the causal influence of participants' chronic processing styles on their task performance.

Method

One hundred and eighteen Hong Kong undergraduate students participated for a course credit. They were informed that this study would be conducted in two sessions one week apart. In session one, participants' chronic disposition to employ each of the four processing strategies (i.e., local, global, item-context relational, and item-item relational) were assessed using the same painting-judgment task employed in Study 1. Then, 100 (84.7%) of the participants who had completed the first session returned for the second

session one week later. (This attrition rate is common for studies involving two parts; see Zhou & Fishbach, 2016.) In this session, each participant performed all six of the tasks employed in Study 2 in a counterbalanced order.

Results and Discussion

The intercorrelations among the performances of six tasks were generally low, with one exception: the correlation between framed-line task performance and construal level task performance was significant but low ($r = .19$, $p = .050$). All other intercorrelations among performance of the six tasks were nonsignificant ($|r|$s $< .13$, ps $> .204$), consistent with Na et al.'s (2010) findings and the results of Study 2.

On the other hand, the raw correlations between task performance and the chronic use of the four processing strategies were frequently significant and had a pattern virtually identical to that observed in Study 2 (see the bottom half of Table 6). To clarify the effects, we conducted step-wise regression analyses using the performance of each task as the dependent variable, and all four chronic processing strategies as the independent variables. The results generally well replicated the findings of the regression analyses in Study 2. As shown in the bottom half of Table 7, a chronic disposition to employ a particular processing strategy significantly influenced performance of the two tasks that involved the use of this strategy but were inconsistently related to the performance of other tasks. That is, the disposition to engage in global processing predicted the performance on global processing tasks (the Navon task and the construal level task), whereas the disposition to engage in local processing decreased it. The disposition to engage in item-context relational processing influenced performance on the framed-line task and the word memory task, and the disposition to engage in item-item relational processing influenced performance on both the location memory task and the thematic grouping task.

The similarity between the results of this study and those observed in Study 2 suggest that the processing styles we considered have similar effects on the performance of tasks that require them, regardless of whether the processing styles are chronic or situationally induced.

Study 4

Study 2 showed that inducing these processing strategies experimentally had different effects on the performance of tasks to which the strategies were relevant, and these effects were replicated when chronic processing strategies were assessed (Study 3). In combination, these results suggest the possibility that cultural differences in the performance of different types of tasks are a reflection of chronic differences in the disposition to employ these strategies. However, we expected that the effects of situationally priming these processing strategies might override these chronic differences.

Method

To evaluate this possibility, we used both Indians (who reported a strong collectivistic orientation in Study 1 (Table 3) and North Americans (who were strongly individualistic). Members of these cultures also differed substantially in the strategies they reported using in the painting-judgment task (Study 1). The design and procedures used in this study are similar to those of the main study in Study 2 with two exceptions. First, the study was conducted on MTurk, thus requiring a modification of the procedures used to assess performance on some of the tasks we administered. Second, in Study 2, we used the local priming condition as a comparative standard in evaluating other types of priming. To evaluate the effects of priming using a more natural baseline, a no-priming control condition was added. Thus, participants were assigned to cells of a 2 (cultural group) × 5 (priming condition) × 3 (task condition) between-subjects design. We conducted power analyses to estimate the sample size with $\alpha = .05$, $\beta = .10$, Cohen's $d = .25$ (i.e., a smaller estimated effect size than previous studies, give that this study involved both cross-cultural comparison

and processing strategy priming; Cohen, 1988) for a factorial design (Faul et al., 2007). The results revealed the minimum sample size to be 1230. We eventually recruited 1556 participants – 770 North Americans and 786 Indians (the cultural groups that differed most widely in their reported use of the processing strategies in Study 1).

Participants in the four priming conditions (local, global, item-context relational, and item-item relational) first performed the painting-judgment task under instructions identical to those employed in the main study of Study 2. In a fifth, control condition, participants evaluated the five paintings without being given instructions on how to do so. Participants then performed one of the three sets of tasks employed in Study 2. The ostensible purpose of these tasks was the same as in the earlier studies. However, the procedures for administering the three visual processing tasks were modified to make them compatible with the restrictions imposed online.

Navon letter-identification task. Rather than using response times to assess the tendency to use global processing strategies (i.e., in Studies 2 and 3), participants were given 16 figures, each showing a big letter composed of small ones (e.g., a big "H" composed of small "V"s) and were asked in each case to indicate the letter to which the figure was more similar. The number of trials on which they chose the large letter was used as an index of global processing (i.e., a higher score indicates a greater tendency to rely on a global processing strategy).

Framed-line task. Participants performed a version of the framed-line task consisting of five trials. As in Study 2, the first page of each trial showed a square with one line drawn in it. A second page showed three squares of a different size and a line that was either shorter, the same length, or longer than the line shown in the square on the first page, for participants to choose. The number of trials in which participants made an incorrect choice was used as an index of sensitivity to item-context relatedness.

Location memory task. Participants were shown a picture with 28 simple items, and were given 90 seconds to learn them, as in Study 2. Then, after performing an unrelated task, they were given a picture in which the objects were replaced by blanks. The participants were then asked to write the names of the objects that had been shown in the blank locations. The number of correct items (in terms of both name and location) was used as an index of sensitivity to item-item relatedness.

The other three tasks were identical to those administered in the previous studies.

Results

Manipulation check. As in Study 2, participants in each priming condition consistently reported greater use of the primed processing strategy (Fs > 27.33, ps < .001).

Based on the results of Study 1, we expected that (a) Indians would be chronically disposed to process information both more globally and more relationally than Americans would, and (b) these different types of processing would influence the performance of tasks involving them. However, we also expected that situationally priming the use of different processing strategies might override the effects of a chronic disposition to use them.

Table 8 shows performance on each task as a function of culture and priming conditions. These data were evaluated in two orthogonal analyses. The first analysis compared the effect of culture pooled over the four priming conditions with its effect in the control conditions. The second analysis compared the effect of the different types of priming and control conditions.

Cultural differences in task performance. In the first analysis, we pooled over the four priming conditions and compared the performance of Indians and North Americans under these conditions with their performance in control conditions. These differences are summarized separately for each task in Table 9. With one exception, the interaction of culture and priming (vs. control) conditions was significant and indicated that although cultural

differences were evident in the absence of priming, inducing a specific processing strategy decreased or eliminated this difference. Specifically, Indians in control conditions showed significantly more global processing than North Americans on both the Navon letter-identification task (M_{diff} = 1.48; F (1, 100) = 4.58, p = .035, η^2 = .044) and the construal level task (M_{diff} = 1.35; F (1, 100) = 12.71, p = .001, η^2 = .113); they were significantly more influenced by context on the framed-line task (M_{diff} = 0.76; F (1, 102) = 9.96, p = .002, η^2 = .089), better able to remember the location of figures in an array (M_{diff} = 0.84; F(1, 103) = 3.54, p = .063, η^2 = .034), and more likely to use thematic relatedness as a basis for grouping (M_{diff} = 1.79, F(1, 103) = 16.43, p < .001, η^2 = .138). When specific processing strategies were primed, however, these differences were either reduced to non-significance or, in some cases, even reversed. The interaction of culture and priming [present vs. absent] was at least marginally significant in each of these cases, Fs > 3.49, ps < .062.

One exception occurred. Indians' performance of the word memory task in the control condition was not influenced significantly more by context than the Americans' performance (1.31 vs. 0.88; F(1, 102) = 1.20, p = .276) was. Moreover, priming did not affect this difference significantly (0.89 vs. 1.08; F(1, 521) = 0.76, p = .383). In fact, the difference in this condition is directionally consistent with the effect of culture observed by Hedden et al. (2000; Nisbett et al., 2001). It is possible that, in the present study, Indians' chronic disposition to use contextual features as retrieval cues was sufficiently strong to override the distracting effects of context that was suggested by the results of Study 2.

Priming effects on task performance. The second set of analyses compared the effect of the different types of priming on task performance. A preliminary analysis of performance on each task separately as a function of culture and the four priming conditions yielded no interactions involving culture; in each case, Fs < 0.85, ps > .469. Thus, as we

speculated, priming effects on processing overrode the effects of chronic cultural differences, and this was true regardless of the type of priming or the type of task being performed.

The effects of priming on the performance of each task can be seen more clearly in Table 10, which summarizes the difference between performance in each priming condition and performance in the control condition. The pattern of these data is very similar to that observed in Study 2 (see Table 5). The following conclusions, drawn on the basis of the earlier study, were replicated.

1. Priming global processing significantly increased the tendency to focus on global criteria in both the Navon letter-identification task and the construal level task. However, it had no effect on either location memory or the tendency to group objects according to their thematic relationship. In contrast, priming item-item relational processing improved location memory and increased the tendency to group objects according to their thematic relationship. However, it did not affect the tendency to focus on global criteria.
2. Item-context relational priming, like global priming, increased the tendency to use global criteria for judgment when performing either the Navon letter-identification task or the construal level task. Unlike global priming, however, it also significantly increased the use of thematic relations as a basis for grouping.
3. Priming global processing and priming relational processing both increased the influence of context on judgments in the framed-line task.
4. Item-context relational priming had little influence on the impact of context on word memory. However, priming global processing, which induced individuals to focus on contextual features but not individual items, had a negative impact on word memory, consistent with the results of Study 2. These results could reflect the opposite effects of global processing and item-context relational processing on

performance of this task, as suggested by the regression analyses reported earlier (see Table 7).

Discussion

In the absence of priming, our results confirmed the cultural differences in holistic processing that have been identified in earlier research. That is, Indians and North Americans differed significantly in their performance on five of the six tasks we considered, and their difference in performance on the sixth task, although not significant, was directionally consistent with that observed by Hedden et al. (2000). However, situationally priming the different processes that underlie performance on these tasks eliminated these cultural differences. Moreover, the effects of priming different processing strategies indicated that the strategies did not reflect a unitary thinking style.

These effects clarify the nature of cultural differences in information processing. Both this study and Study 2 indicated that priming a global processing strategy influenced the tendency to use global criteria as a basis for judgment but did not affect performance on tasks that reflected sensitivity to inter-item relationships. In contrast, priming a tendency to focus on the relations of objects to one another influenced sensitivity to inter-item relationships but not the use of global criteria as a basis for judgment. Yet, Indians and North Americans differed chronically in their performance of *both* types of tasks. In combination, these results indicate that cultural differences that are often assumed to reflect a unitary style of processing might actually result from the use of quite different processing strategies.

Other aspects of our findings are noteworthy. For example, Hedden et al. (2000) found that presenting words in the context of an irrelevant picture facilitated Asians' memory of the words. A similar difference, although not significant, was evident in the present study (see Table 9). When participants were primed to use a global processing strategy, however, the effect of context on memory in this task was due primarily to its distracting influence on

performance (see Table 4), apparently overriding the facilitating effect of thinking about items in relation to their context.

General Discussion

Our research has both specific implications for an understanding of the different components of holistic processing and the antecedents of these components and more general implications for culture-related differences in thought and behavior. We will summarize these implications in turn.

Dimensions of Holistic Thinking

Although a holistic thinking style has been postulated to underlie cultural differences in the performance of many different tasks (Norenzayan et al., 2007), these differences are not the result of variation along a single dimension. We isolated three different components of holistic thinking: (a) a focus on global characteristics of a stimulus independently of the features that compose it, (b) a consideration of individual features of a situation in relation to their context, and (c) a consideration of features of a stimulus in relation to one another. These self-reported processing strategies varied across cultural groups (Studies 1 and 4) and among members within a culture (Study 3), and inducing the processing strategies experimentally predictably affected performance on specific measures of holistic processing (Study 2). Moreover, although cultural differences occurred in the performance of these tasks, experimentally inducing processing strategies that were relevant to their performance eliminated any impact that the cultural differences in processing otherwise had (Study 4).

Although inducing a tendency to focus on the global features of a stimulus increased participants' performance of tasks that involved attention to such features, it had no effect on their performance of tasks that involved thinking about items in relation to one another. In contrast, priming a tendency to think about items of a stimulus in relation to one another increased the use of this strategy in performing tasks for which these types of thinking were

particularly relevant but did not influence tasks that involved global thinking. Thus, the two types of processing had independent effects. Nevertheless, members of Asian countries scored higher than those of Western countries on *both* types of tasks. These cultural differences in performance of the tasks were the result of different processes.

Our research further distinguished between two types of relational processing: a consideration of features of a stimulus in relation to one another and a consideration of stimulus features in relation to their context (for a similar distinction, see Kimchi, 1992). Self-reported tendencies to use these two processing strategies are not highly correlated (r = .33; see Table 2; Cohen, 1988). Our measures of these tendencies were therefore useful in diagnosing the different types of thinking that potentially underlie task performance. As we pointed out earlier, for example, performance on the location memory task (Kühnen & Oyserman, 2002) could potentially be facilitated by thinking about the individual items in relation to their context as well as by thinking about them in relation to one another. However, priming item-item relational processing influenced performance on the task but priming item-context relational priming did not. This suggests that item-item relational processing was the primary contributor to performance on this task. Regression analyses of performance on this task as a function of self-reported processing strategies (Table 7) confirm this conclusion.

The performance of some tasks might, of course, be influenced by more than one type of processing, the effects of which could offset one another. For example, the effect of context on word memory could be the result of either item-context relational processing (which would presumably facilitate performance) or a tendency to focus on the context independently of individual features (which would decrease performance). Although Hedden et al. (2000) found that the former process predominated, this was not the case in our studies. However, regression analyses (Table 7) indicated that performance on the word memory task

was in fact correlated positively with item-context relational processing, consistent with Hedden et al.'s (2000) finding, but was correlated negatively with global processing. Thus, the effects of the two processing strategies may offset one another.

Holistic Thinking versus Social Orientation

Members of Asian and Western countries often differ in their perceptions of themselves and their relationship to others (Triandis, 1995; Markus & Kitayama, 1991; Chiu & Hong, 2013). They also differ in their processing of nonsocial information (Nisbett, 2003; Nisbett et al., 2001; Norenzayan et al., 2007). Nevertheless, Na et al.'s (2010) findings, that the indices of holistic thinking and measures of social orientation are virtually uncorrelated within a given culture, present a rather pessimistic picture of the ability to characterize cultural differences in thinking style in terms of a common use of dimensions and to account for them in terms of more general differences in social orientation. In contrast, the picture conveyed by our research is somewhat more optimistic. We found that holistic thinking is a composite of several independent processing styles, the effects of which depend on the specific task that requires their use. These processing styles vary across cultures. Moreover, the processing styles are reflected in the performance of a single task to which they all might apply.

Although our findings help to understand why specific measures of holistic processing are uncorrelated, they do not explain the failure for measures of social orientation to be related either to one another or to the styles of thinking identified in the painting-judgment task. Although members of the Asian and Western countries we considered differed in their scores on both sets of measures, the tendency to think of oneself as a member of a collective was unrelated to the tendency to engage in either local or global processing. Moreover, it was also uncorrelated with the tendency to engage in relational processing.

As Kitayama et al. (2009) suggested, however, measures of social orientation may reflect the existence of different "cultural mandates" that are fulfilled in a number of specific ways that are functionally equivalent but empirically unrelated. The manifestation of these mandates might vary not only across individuals but also across cultures, as reflected by the differences between Asians in global processing. This conclusion is also consistent with a conceptualization proposed by Kashima (2009). Noting that (a) Oyserman et al. (2002) identified seven different domains of "individualism" and eight different domains of "collectivism," and (b) the definition of these constructs appears to differ across cultural groups (Rhee, Uleman, & Lee, 1996), Kashima (2009) argued that individualism and collectivism (or, for that matter, independence and interdependence) should not be considered direct determinants of behavior. Rather, they should be viewed as *interpretive* constructs that provide conceptual coherence to sets of behaviors although the behaviors themselves are not directly related either to specific measures of the constructs or to one another. Cultural mandates postulated by Kitayama et al. (2009) might exemplify such constructs. That is, interdependence and independence might be useful conceptual tools in characterizing a set of behavioral dispositions that are prominent in a particular society, even though the behaviors are manifested by different members of the society, and the constructs themselves have less clear representation in the members' cognitive system.

Although cultural differences in processing may be linked to differences in the various components of holistic thinking, the factors that give rise to these differences remain elusive. As Oyserman et al.'s (2009, 2017) analyses suggested, individualism and collectivism vary widely across countries within both Asia and the West. Although the countries we considered in our research were limited, our results testify to this variation. That is, Indians not only were more disposed to engage in global processing and relational

thinking than were members of Western cultures but also were more disposed to do so than Hong Kong Chinese were.

Chronic between-country differences in information processing are presumably attributable to social learning and are consequently traceable to country-specific differences in socialization. As we noted earlier, these differences might result in part from philosophical and intellectual orientations that pervade different societies (Nisbett, 2003) and from differences in child-rearing practices (Miller et al., 2007; Oishi et al., 2014). Tamis-LeMonda et al. (2008) provide a conceptualization of the social norms and child-rearing practices that might underlie differences in thinking style. To the best of our knowledge, an analysis of the different social norms that pervade individual countries has not been attempted.

It is important to note that the effects of chronic differences in thinking style can be overridden by the effects of transitory situational factors, as Study 4 indicates (see also Oyserman et al., 2009). Thus, although it is clearly important to understand the idiosyncratic characteristics of socialization practices that give rise to different types of thinking, a more general analysis of situational determinants of thinking may be a prerequisite to this understanding. Simply characterizing cultures in terms of individualism-collectivism or independence-interdependence may not be sufficient to attain this objective. An alternative approach has been employed by Chiu, Hong and others (for a review, see Chiu & Hong, 2013). In their research, individuals are unobtrusively exposed to symbols of their own or of a different culture, thus priming a more general body of culture-related knowledge that can affect a variety of social and nonsocial judgments and behavior (cf. Hong, Morris, Chiu, & Benet-Martínez, 2000; for reviews, see Hong, 2009; Chiu & Hong, 2013). This approach allows a multiplicity of culture-related factors to act in concert, consequently influencing judgments and behavior in a manner that is not captured by any single dimension.

There is another possible reason why existing measures of social orientation fail to predict general differences in thinking style. Although these measures reflect stable characteristics of personality, they may not reflect differences in *process.* Explicitly telling participants to use "we" rather than "I" in an unrelated task affected performance on the location memory task, which requires relational processing (Kühnen & Oyserman, 2002; Oyserman et al., 2009). This instruction could lead participants to think consciously about themselves as members of a group. The spontaneous use of these pronouns, however, might not reflect a chronic disposition to do so.

Similar considerations might suggest that the effects of people's cultural identity on their behavior might not be evident unless individuals become conscious of this identity, for example, by exposing them to cultural icons (see Hong et al., 2000) or to situations that stimulate the retrieval and use of culture-related norms and values (Briley, Morris, & Simonson, 2000). In our research, however, chronic cultural differences in holistic processing were evident even though participants' cultural identity was not called to their attention (see Study 1). This suggests that the processing differences we identified are applied spontaneously, whereas the use of culture-related knowledge as a basis for judgment occurs only if this knowledge is situationally activated. Further research might examine this possibility.

Further Considerations

The impact of the different processing strategies that we identified could potentially underlie several cultural differences in social judgment and behavior. Förster and Dannenberg (2010) reviewed abundant evidence that priming a tendency to process information globally influences the abstractness of the concepts applied to stimuli in socially relevant judgment tasks. Moreover, a common focus of research on social attribution (Kelley, 1967) has been on the difference between attributions of behavior to characteristics of the

actor or, alternatively, to features of the situational context in which the behavior occurs (Jones & Nisbett, 1972). In fact, several studies (Morris & Peng, 1994; Choi, Nisbett, & Norenzayan, 1999) show that members of Asian countries are more inclined to make situational attributions than North Americans are. Although these attributional differences could reflect a general difference in collectivism (Markus & Kitayama, 1991), they seem more likely to be a manifestation of item-context relational processing in particular.

A related cultural difference has been found in individuals' regulatory focus (Higgins, 1997, 1998), as reflected in the relative emphases placed on the positive or negative consequences of a behavioral decision. A promotion focus, or a tendency to focus on positive consequences rather than negative ones, theoretically results from a discrepancy between one's self-perception and what one would like to be ideally, whereas a prevention focus, or an emphasis on negative consequences, results from a discrepancy between one's self-perception and one's perception of how others would like one to be. Förster and Higgins (2005) primed global and local processing using a version of the Navon task and found that global processing stimulated a promotion focus whereas local processing activated a prevention orientation. Our evidence that Westerners, who process information more globally, are also more promotion focused (Briley, Morris, & Simonson, 2000, 2005; Lee, Aaker & Gardner, 2000; Lee & Semin, 2009) is consistent with this finding.

Some caution should be taken in overgeneralizing the cultural differences observed in this article. In comparing Asian and Western cultural representatives, we restricted our consideration to Indian and Hong Kong Chinese. As others (Rhee et al., 1996; Bond & Cheung, 1983) have pointed out, members of Asian countries can vary widely in thinking styles of the sort that we have investigated, as evidenced by the differences we observed between Indians and Hong Kong Chinese. In most of the studies reported by Nisbett and his colleagues (Nisbett et al., 2001; Norenzayan et al., 2007), Japanese participants were used as

exemplars of the Asian culture. However, the implications of comparisons between Japanese and Hong Kong Chinese individuals' social judgments have been inconsistent (Bond & Cheung, 1983). Future investigations of cultural differences in global and relational processing may need to use Japanese participants in order to ensure meaningful comparisons with Nisbett et al.'s (2001) findings. For a related issue, although India is traditionally categorized as a country with a collectivistic culture (Hofstede, 1980; Triandis, 1995; Verma & Triandis, 1998), India's collectivistic score has become milder in recent years (hofstede-insights.com, 2020). In this regard, future research is needed to generalize our findings to more representative collectivistic countries.

In our research, we were concerned primarily with the dimensionalization of holistic thinking. In order to attain a complete picture of the relationship between thinking style and social orientation, however, it will be necessary to identify the dimensions of social orientation that traditional measures provide. Oyserman et al.'s (2002) analysis of the different factors that underlie individualism and collectivism is a step toward attaining this objective. However, further work at both the conceptual and empirical levels could profitably be directed to this end.

Context of the Research

Previous research has found cultural differences in both social orientation (e.g., collectivism vs. individualism) and thinking styles (holistic vs. analytic). Although these differences appear to be in parallel and to have a common root, the low correlations among measures of these characteristics (Na et al., 2010) challenge this possibility and imply that holistic thinking as traditionally defined might be multidimensional. The objective of the current research is to construct a procedure to both assess and induce several processing strategies expected to capture different manifestations of holistic thinking. Our findings indicate that these strategies include global thinking (i.e., thinking of the configuration of a

stimulus as a whole), item-context relational thinking (i.e., thinking of stimulus elements in relation to their context), and item-item relational thinking (i.e., thinking of stimulus elements in relation to one another). Such differences in processing strategies were found to be reflected in cross-cultural comparisons (Indian, Hong Kong Chinese, North American, and British participants) of cognitive task performances, and could be induced through a painting-judgment task. These differences were typically unrelated to measures of social orientations. Theoretically, our research contributes to a more in-depth understanding of the nature of traditionally defined holistic thinking. Empirically, we developed a novel methodological tool to assess and induce various processing strategies under the umbrella of holistic thinking. To attain a complete picture of the relationship between thinking style and social orientation, future research is needed (1) to generalize our findings to representatives of other countries with different cultural backgrounds, and (2) to identify the dimensions of social orientation that traditional measures provide.

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Table 1

Scales of Individualism/Collectivism (Triandis & Gelfand, 1998)

Horizontal Collectivism (HC)
The well-being of my coworkers is important to me.
It is important to maintain harmony within my group.
I feel good when I cooperate with others.
My happiness depends very much on the happiness of those around me.
To me, pleasure is spending time with others.
Horizontal Individualism (HI)
I often do "my own thing."
One should live one's life independently of others.
I prefer to be direct and forthright when discussing with people.
I am a unique individual.
What happens to me is my own doing.
When I succeed, it is usually because of my abilities.
I enjoy being unique and different from others in many ways.
Vertical Collectivism (VC)
I would do what would please my family, even if I detested that activity.
We should keep our aging parents with us at home.
I would sacrifice an activity that I enjoy very much if my family did not approve.
Before taking a major trip, I consult with most members of my family.
Vertical Individualism (VI)
It annoys me when other people perform better than I do.
It is important to me that I do my job better than others.
When another person does better than I do, I get tense and aroused.
Winning is everything.
I enjoy working in situations involving competition with others.
Some people emphasize winning; I am not one of them.

Table 2

Mean Within-Culture Intercorrelations Among Processing Strategies and Social Orientation—Study 1

	Local	Global	Item-context relational	Item-item relational	I/We task	HC-HI	VC+VI
Local	--						
Global	-.02	--					
Item-context relational	.06	.18*	--				
Item-item relational	.00	.04	.33*	--			
I/We task	.00	-.01	.08	.04	--		
Collectivism (HC-HI)	.03	-.06	-.05	-.02	-.02	--	
Interdependence (VC+VI)	.04	.03	.09	.09	-.05	.11	--

Note: *$p < .05$, **$p < .01$.

Table 3

Cultural Differences in Social Orientation and Processing Style—Study 1

	Cultural Background				
	United States	Great Britain	Hong Kong	India	*F*
Social orientation					
I/We task	5.73[a] (2.78)	5.84[ab] (2.71)	6.51[bc] (3.26)	7.23[c] (3.21)	6.46**
Collectivism (HC-HI)	-1.11[a] (2.23)	-0.60[b] (1.99)	0.27[c] (1.68)	0.50[c] (1.29)	14.89**
HC	7.52[a] (1.86)	7.53[a] (1.80)	8.06[b] (1.65)	9.23[c] (1.35)	31.80**
HI	8.63[a] (1.27)	8.13[b] (1.23)	7.79[b] (1.53)	8.73[a] (1.51)	8.06**
Interdependence (VC+VI)	11.59[a] (2.83)	11.46[a] (2.52)	12.31[b] (3.23)	16.27[c] (2.93)	74.21**
VC	5.62[ab] (2.23)	5.77[bc] (1.86)	6.18[c] (2.33)	8.74[d] (1.68)	61.32**
VI	5.98[ab] (1.68)	5.69[bc] (1.59)	6.13[a] (1.77)	7.53[d] (1.85)	27.17**
Processing Style					
Local	7.88[a] (2.33)	8.26[a] (2.36)	6.23[b] (2.63)	6.76[b] (2.72)	17.00**
Global	8.76[a] (2.31)	8.85[a] (1.70)	8.38[a] (2.08)	9.52[b] (1.73)	7.06**
Item-context relational	7.18[a] (2.53)	6.98[a] (2.64)	8.27[b] (2.59)	8.98[c] (1.75)	18.38**
Item-item relational	7.05[a] (2.49)	7.18[a] (2.52)	7.31[a] (2.52)	8.83[b] (1.77)	15.04**
Differences relative to local processing					
Global	0.88[a] (3.01)*	0.59[a] (2.65)*	2.14[b] (3.47)**	2.77[b] (3.12)**	13.53**
Item-context relational	-0.70[a] (3.09)*	-1.28[a] (2.86)**	2.04[b] (3.76)**	2.23[b] (3.15)**	38.02**
Item-item relational	-0.83[a] (3.30)*	-1.08[a] (3.23)**	1.08[b] (3.79)*	2.07[c] (3.14)**	24.31**

Note: HC = horizontal collectivism; HI = Horizontal individualism; VC = Vertical collectivism; VI = vertical individualism.

I/We task score = NO. of first-person plural pronouns used.

Cells in each row with different superscripts differ at $p < .05$.

*$p < .05$, **$p < .01$.

Table 4

Effects of Priming Processing Strategies on Social Orientation and Task Performance—Study 2

	Priming condition				*F*
	Local (n = 71)	Global (n = 78)	Item-context relational (n = 79)	Item-item relational (n = 69)	
Social orientation					
I/we task	4.06 (2.45)	4.72 (2.38)	4.94 (2.45)	4.14 (2.29)	2.45
Collectivism (HC-HI)	1.34 (1.73)	0.98 (1.90)	0.77 (1.73)	1.26 (1.69)	1.67
HC	8.99 (1.18)	8.97 (1.11)	8.89 (1.19)	9.08 (1.06)	.32
HI	7.66 (1.20)	7.99 (1.67)	8.13 (1.34)	7.82 (1.26)	1.64
Interdependence (VC+VI)	13.41 (2.74)	13.67 (2.76)	14.16 (2.51)	14.01 (2.45)	1.24
VC	7.01 (2.07)	7.17 (1.82)	7.29 (1.29)	7.13 (1.50)	.31
VI	6.39 (1.58)	6.51 (1.70)	6.87 (1.59)	6.88 (1.65)	1.68
Global tasks					
Navon task	-388.86^{a} (450.50)	121.73^{b} (406.94)	118.71^{b} (427.04)	-455.42^{a} (177.08)	19.58**
Construal level task	5.02^{a} (2.95)	7.38^{b} (2.63)	7.62^{b} (2.99)	6.19^{ab} (2.87)	4.36**
Context-sensitive tasks					
Framed–line task	0.87^{a} (0.78)	1.49^{b} (1.01)	1.54^{b} (0.65)	1.38^{b} (0.63)	3.70*
Word memory task	1.13^{a} (1.55)	-0.68^{b} (2.44)	1.18^{a} (2.28)	0.86^{a} (1.46)	4.76**
Item-item relational tasks					
Location memory	8.76^{a} (3.23)	8.86^{ab} (4.36)	8.13^{a} (4.74)	11.84^{b} (4.59)	3.25*
Thematic grouping	4.08^{a} (1.83)	3.87^{a} (1.92)	4.82^{b} (2.19)	4.80^{b} (1.66)	4.82**

Note: Standard deviations are given in parentheses. Cells in each row with different superscripts differ at $p < .05$.

*$p < .05$, **$p < .01$.

Table 5

Effects of Global, Item-Context Relational, and Item-Item Relational Priming Relative to Local Priming—Study 2

	Priming Condition		
	Global	Item-context relational	Item-item relational
Global tasks			
Navon task (visual)	510.59**	507.57**	-66.56
Construal level task (semantic)	2.36*	2.60*	1.17
Context-sensitive tasks			
Framed line task (visual)	0.62*	0.67*	0.51*
Word memory (semantic)	-1.81*	-0.05	-0.27
Item-item relational tasks			
Location memory (visual)	0.10	-0.63	3.08*
Thematic grouping (semantic)	-0.21	0.74*	0.72*

Note: *differs from local priming condition at $p < .05$

**differs from local priming condition at $p < .01$

Table 6

Intercorrelations Between Processing Strategies and Task Performance —Study 2 and Study 3

	Measured Processing Strategies			
	Local	Global	Item-context relational	Item-item relational
Study 2				
Navon task	-.30**	.28**	.31**	-.28**
Construal level task	-.34**	.38**	.24*	-.10
Framed-line task	-.31*	.21*	.27**	.26*
Word memory task	.27**	-.24*	.18	.13
Location memory	-.21*	-.20*	-.02	.24*
Thematic grouping	.10	-.23*	.26**	.33**
Study 3				
Navon task	-.28**	.27**	.18	-.30**
Construal level task	-.25*	.31**	.15	.05
Framed-line task	-.21*	.34**	.31**	.18
Word memory task	.25*	-.21*	.25*	.13
Location memory	-.15	-.16	-.10	.20*
Thematic grouping	.03	-.03	.18	.26**

Note: *$p < .05$, **$p < .01$

Table 7

Standardized Regression Weights Based on Step-Wise Multiple Regression of Task Performance as a Function of Processing Strategies—Study 2 and Study 3

	Measured Processing Strategies			
	Local	Global	Item-context Relational	Item-item relational
Study 2				
Navon task	-.22	.20	.28	-.29
Construal level task	-.32	.36	(.11)	(.03)
Framed-line task	(-.18)	.23	.29	(.19)
Word memory task	.23	-.20	.20	(.15)
Location memory	-.26	-.20	(-.20)	.24
Thematic grouping	(.02)	(-.04)	(.08)	.18
Study 3				
Navon task	-.19	.22	.20	-.32
Construal level task	-.19	.26	(.11)	(.07)
Framed-line task	(-.14)	.31	.27	(.12)
Word memory task	.23	-.20	.30	(.06)
Location memory	(-.17)	(-.17)	(.07)	.20
Thematic grouping	(-.01)	(-.04)	(.13)	.26

Note: Beta-weights in parenthesis are not significant at $p < .05$

Table 8

Effects of Priming Processing Strategies on Task Performance by Indians and North Americans—Study 4

	Priming Condition				
	Local	Global	Item-context relational	Item-item relational	Control
Navon task					
North Americans	13.09[a] (3.89)	15.07[b] (2.67)	15.54[b] (1.09)	13.83[a] (3.50)	13.48[a] (3.82)
Indians	13.65[a] (3.47)	15.27[b] (1.51)	15.34[b] (1.86)	14.15[a] (2.83)	14.96[b] (3.12)
M	13.37[a] (3.68)	15.18[b] (2.11)	15.44[b] (1.51)	14.00[a] (3.15)	14.21[a] (3.55)
Construal level task					
North Americans	6.37[a] (2.24)	7.63[b] (1.89)	7.03[b] (2.17)	5.88[a] (2.29)	6.13[a] (1.82)
Indians	6.55[a] (2.67)	7.49[b] (2.44)	7.61[b] (2.30)	6.70[a] (2.41)	7.48[b] (1.99)
M	6.46[a] (2.45)	7.55[b] (2.20)	7.31[b] (2.24)	6.32[a] (2.38)	6.79[a] (2.01)
Framed-line task					
North Americans	1.78[a] (1.31)	2.50[b] (1.33)	2.68[b] (1.37)	2.46[b] (1.45)	1.86[a] (1.23)
Indians	1.92[a] (1.17)	2.91[b] (1.21)	2.74[b] (1.13)	2.59[b] (1.12)	2.62[b] (1.25)
M	1.85[a] (1.24)	2.70[b] (1.28)	2.71[b] (1.23)	2.52[bc] (1.30)	2.21[c] (1.29)
Word memory					
North Americans	1.70[a] (1.53)	0.29[b] (2.25)	0.93[c] (1.86)	1.07[c] (1.86)	0.88[c] (2.32)
Indians	1.08[a] (1.86)	0.11[b] (2.04)	1.15[a] (1.68)	0.90[a] (2.14)	1.31[a] (1.63)
M	1.38[a] (1.73)	0.20[b] (2.14)	1.05[a] (1.76)	0.99[a] (1.98)	1.08[a] (2.03)
Location memory					
North Americans	3.14[a] (2.56)	2.69[a] (3.28)	3.04[a] (3.41)	4.20[b] (2.71)	2.62[a] (3.18)
Indians	2.04[a] (3.58)	2.28[a] (2.95)	2.45[a] (3.22)	3.59[b] (3.19)	3.47[b] (3.05)
M	2.54[a] (3.19)	2.49[a] (3.12)	2.74[a] (3.31)	3.89[b] (2.93)	3.04[a] (3.13)
Thematic grouping					
North Americans	4.33[a] (2.63)	4.69[a] (2.35)	5.46[b] (2.30)	6.14[c] (2.05)	4.46[a] (2.49)
Indians	5.49[a] (2.36)	5.19[a] (2.10)	6.31[b] (1.60)	6.46[b] (1.63)	6.24[b] (1.95)
M	4.98[a](2.53)	4.93[a] (2.23)	5.90[b] (2.01)	6.30[b] (1.85)	5.32[a] (2.39)

Note: Standard deviations are given in parentheses.

Cells in each row with different superscripts differ at $p < .05$.

Table 9

Cultural Differences in Processing Under Priming and Control Conditions—Study 4

	Priming			Control		
	United States	India	*Diff*	United States	India	*Diff*
Global tasks						
Navon task	14.36 (3.13)	14.59 (2.63)	0.23	13.48 (3.82)	14.96 (3.17)	1.48*
Construal level task	6.72 (2.23)	7.09 (2.49)	0.37	6.13 (1.81)	7.48 (1.99)	1.35*
Context-sensitive tasks						
Framed-line task	2.35 (1.40)	2.54 (1.21)	0.19	1.86 (1.23)	2.62 (1.25)	0.76**
Word memory	0.98 (1.96)	0.80 (1.97)	-0.18	0.88 (2.32)	1.31 (1.63)	0.43
Item-item relational						
Location memory	3.26 (3.08)	2.59 (3.26)	-0.68	2.62 (3.18)	3.47 (3.05)	0.84
Thematic grouping	5.20 (2.41)	5.89 (1.99)	0.69	4.46 (2.49)	6.24 (1.95)	1.79**

Note: *$p < .05$, **$p < .01$.

Table 10

Differences Between the Effects of Priming Local, Global, Item-Context Relational, and Item-Item Relational Processing and Control Condition—Study 4

	Priming condition				
	Local	Global	Item-context relational	Item-item relational	*F*
Global tasks					
Navon task (visual)	-0.84[a]	1.07[b]*	1.23[b]*	-0.21[a]	13.32**
Construal level task (semantic)	-0.33[a]	0.76[b]*	0.52[b]*	-0.47[a]	7.18**
Context-sensitive tasks					
Framed line task (visual)	-0.36[a]*	0.49[b]*	0.50[b]*	0.31[b]	10.54**
Word memory (semantic)	0.30[a]	-0.88[b]**	-0.03[a]	-0.09[a]	7.42**
Item-item relational					
Location memory (visual)	-0.49[a]	-0.54[a]	-0.29[a]	0.86[b]*	4.41*
Thematic grouping (semantic)	-0.34[a]	-0.39[a]	0.58[b]*	0.98[b]**	9.98**

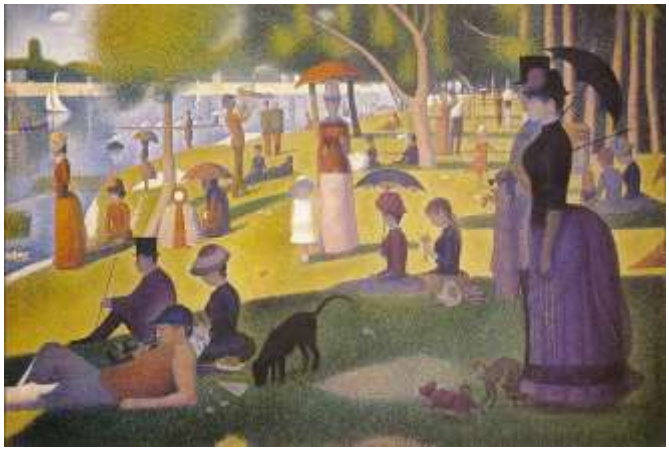
Note: Cells in each row with different superscripts differ at $p < .05$.

*$p < .005$, **$p < .001$

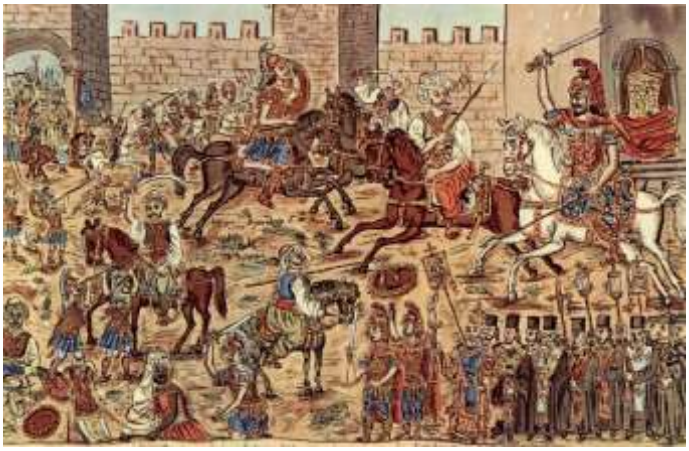
Figure Caption

Figure 1. Paintings Used in Studies 1-4 to Assess/Induce Processing Strategy

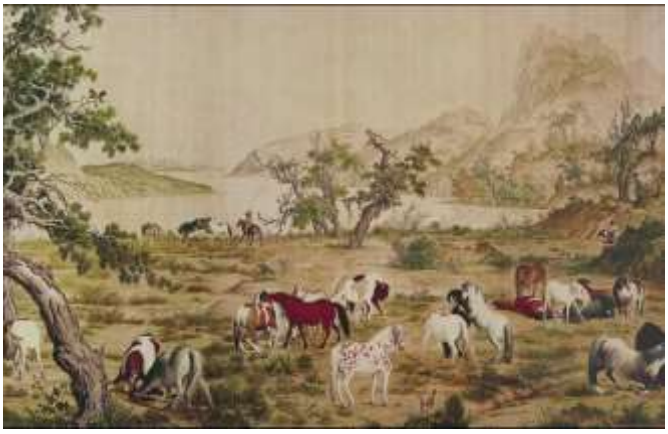
Sunday Afternoon on the Island of la Grande Jatte
By George Seurat



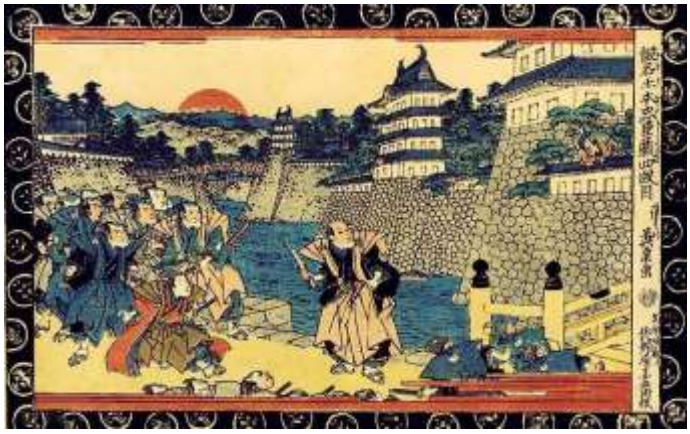
Constantine Palaiologos
By Theophilos Hatzimihail



Wrangler
By Giuseppe Castiglione



Harakiri of the Chushingura Keisai
By Keisai Eisen



The Bridge
By François Boucher