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Culture and cognition

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In this paper, we review the latest developments in cultural influences on attention, perception, categorization, memory and cognitive heuristics. We then explore the origin of these cultural differences, and highlight the implications of such culture-specific thinking styles for people's judgment and decision-making processes. We conclude this review by discussing some of the future research directions to further advance our understanding in culture and cognition.

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Introduction

In the last three decades, cultural psychology has made great progress investigating the influences of cultural factors on cognition. In this paper, we, firstly, review the latest developments in cultural influences on attention, perception, categorization, memory and cognitive heuristics, secondly, explore the origin of these cultural differences, thirdly, highlight important implications of these culture-specific cognitions for judgment and decision making, and lastly, discuss future research directions.

Cultural influences on cognition

Culture shapes how people attend to the environment, perceive others, memorize and learn information, and make judgments. Witkin and Berry [1] reviewed cross-cultural studies on psychological differentiation and proposed that one's eco-cultural environment shapes individuals' field dependence — the degree to which the perception of an object is affected by contextual factors surrounding the object. In particular, the field-dependent perceptual mode is associated with tight social structure and sedentary agricultural ecological settings, whereas the field-independent perceptual mode is associated with loose social structure and mobile hunting ecological settings. Later in the 1990s, Richard E. Nisbett and colleagues [2,3] proposed one of the most influential theoretical frameworks on culture and cognition, which argues that European North Americans tend to think analytically, focusing on the focal object and its features, whereas East Asians (e.g. Chinese, Japanese and Koreans) tend to think holistically, focusing on the context and relationships between the focal object and its context. Across various attention tasks, such as the rod-and-frame task and the framed-line task, East Asians tend to consider the whole perceptual field and show greater sensitivity to relational and contextual elements, whereas European North Americans tend to focus on the target object without much concern for its context [4–7]. For example, when asked to describe what they had seen in underwater scenes, Japanese were more likely than Americans to mention the background objects [4].

Cultural differences in attention contribute to differences in perception. While tracking multiple moving objects amidst otherwise identical distractors, Americans outperformed Asians by successfully tracking more objects on average, presumably due to their greater tendency to focus on the focal objects and ignore irrelevant contextual objects [8]. When asked to identify a prototypic face, Japanese were more likely than Americans to use overall resemblance instead of feature matching [9]. In a person perception task, Americans showed more primacy effect — being influenced more by the initial information before learning details about a target person's behaviors, whereas Japanese paid attention to the overall information more evenly [10]. Thus, compared to (North American) analytic thinkers, (East Asian) holistic thinkers are more likely to perceive things as a whole, and less likely to attend to focal targets.

These cultural differences in holistic vs. analytic attention are also evident in some of the cultural products and people's self-presentation displays. Consistent with Masuda *et al.* [11], Chinese Facebook users from Hong Kong, Singapore and Taiwan were more likely to deemphasize their faces, show lower intensity in facial expressions, and highlight their surrounding context in their profile pictures than their American counterparts [12]. Reflecting their preference for context-rich cultural products, East Asians not only produced more information-rich designs in conference posters and web pages than North Americans, but were also faster than North Americans in processing information-rich designs [13]. In fact, such cultural differences are already observable in Grade 2 children's artwork: Japanese children showed more context-oriented visual attention style by drawing the horizon higher and including more information in their drawings than Canadian children [14].

Related to context sensitivity, another feature that distinguishes holistic from analytic thinking is how people categorize objects. Holistic thinkers tend to categorize objects based on their thematic and contextual relationships (e.g. group 'monkey' with 'banana' together because monkeys eat bananas), whereas analytical thinkers tend to categorize objects based on similarities in features and taxonomic commonalities (e.g. group 'monkey' with 'panda' because both are mammals [15]). Such differences in categorization can affect memory performance. Specifically, analytical thinkers, in this case Canadians, outperformed Chinese in memory for categorically processed information [16], whereas Chinese outperformed Canadians in memory for contextual information [17]. A consistent picture is also seen when examining memory errors among Americans and Turks — with the latter being relatively more holistic: Americans made more categorical based memory errors than Turks by falsely recalling words that were categorically related to the prompt or target words (e.g. recalling 'banana' or 'fruit' when the prompt or target word was 'pear' [18•]). Research has also found that multitasking decreased analytical thinkers' memory recognition but not holistic thinkers' [19]. Holistic thinkers' memory advantage while multitasking is likely due to their increased breath of visual attention.

Cultural differences in holistic vs. analytic reasoning are also revealed in cognitive heuristics — mental shortcuts people take while making judgment and decisions. For example, North Americans were more likely than Chinese to expect cause and effect to correspond in magnitude (i.e. a small cause leading to a small effect and a large cause leading to a large effect), demonstrating a stronger representative heuristic. This cultural difference, however, disappeared when North Americans were primed to think holistically [20•]. Meanwhile, Chinese were more likely than North Americans to appreciate and understand the phenomenon of regression toward the mean — extreme deviations from the mean will likely move closer to the average if the events were to happen or be measured a second time [21]. For example, compared to North Americans, Chinese expected a greater improvement in an athlete's performance following poor prior performance, and a greater decline in an athlete's performance following good prior performance, assuming that the athlete had invested the same effort and time to each performance.

Finally, culture also shapes how people perceive, use and value time and temporal information. When making predictions and decisions, East Asians, who are more holistic than North Americans, attend to a wider breadth of temporal information [23,24]. Accordingly, East Asians, compared to North Americans, put less weight on the most immediate information [22,23], perceive the past [24] and future [25] as more relevant and connected to the present, and remember the past better [24]. Additionally, Chinese value the past more than the future due to a stronger past orientation, whereas North Americans value the future more than the past due to their relatively stronger future orientation [26•].

Understanding origins of cultural differences in cognition

Demonstrating cultural differences in cognition is not enough: cultural psychologists have always been intrigued by the origins of cultural differences (for review, see [27]). Various theories pertaining to differences in philosophy [28], linguistics [29], ecology [1,30–32], and social economic systems [2,33] have been put forward. One theory that has received much support is the social interdependence or social orientation hypothesis, which posits that social orientation, such as interdependence and independence, can account for the cultural differences in cognitive styles [34]. Specifically, an interdependent social orientation, which emphasizes the interconnectedness among individuals in a society, promotes holistic thinking, whereas an independent social orientation, which emphasizes the uniqueness and self-reliance of the individual in a society, promotes analytic thinking [3,34,35]. In the meantime, social orientation itself may originate from ecology, socialization, financial wealth, and historical or human-made threats associated with social tightness, among other factors [33,36–39].

Supporting evidence comes from findings that cultures or communities that differ in social orientation (interdependence vs. independence) also tend to differ in cognitive styles (holistic vs. analytic) [40,41]. For example, by examining participants from the same national, geographic, ethnic, and linguistic regions who differ in social interdependence, researchers found that Turkish farmers and fishermen, whose community emphasizes harmonious social interdependence, are more holistic than Turkish herders, whose community emphasizes social independence and individual decision making [42]. Likewise, recent research has shown that Chinese in rice-growing areas are more interdependent and more holistic than Chinese in wheat-growing areas, presumably because growing rice requires more social coordination and interdependence than growing wheat [43•]. Note, however, evidence that social orientation and cognitive thinking styles correlate at the cultural group level does not necessarily imply correlation at the individual level, as cultural differences 'are not always reducible to individual differences' [44•].

Further evidence comes from priming research, where a particular cultural cue is used to automatically and implicitly activate the relevant cultural mindset or the respective culture-specific cognitive style. Research reveals that priming interdependence can lead to holistic thinking, whereas priming independence can lead to