CULTURAL INFLUENCES ON CATEGORIZATION PROCESSES

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Chiu (1972) reported that in a categorization task, Chinese children were more likely to categorize objects based on shared relationships, whereas American children were more likely to categorize objects based on similarity. This research examines whether such findings generalize to adults and whether cultural differences would also be observed in the activation of semantic concepts. In Experiment 1, Chinese adults were equally likely to categorize based on relationships and similarity, whereas Western adults were more likely to categorize based on similarity. Analogous differences in response latencies were observed in a timed task that reflected semantic processing in Experiment 2, and to some extent in a slightly different task in Experiment 3, although differences between the two experiments suggest that the nature of the categorization task determines the extent to which cultural differences are observed. Overall, results suggest that differences in categorization styles are associated with differences in semantic activation.

Keywords: categorization; culture; semantic concepts; semantic activation; similarity; relationships; Chinese; Western

In recent years cognitive psychologists have begun to systematically explore the way that culture affects how people think about and perceive their world. As these issues receive more empirical attention, the importance of cultural influences on cognition is becoming apparent. In the current research, we examined the way that culture affects categorization. Our goal was to determine if we could observe differences in categorization styles between adults from Eastern and Western cultures and, if so, whether these differences were associated with differences in the activation of semantic representations.

Although there has been limited research on cultural differences in categorization, there are data indicating that cultural differences do exist. For example, Malt (1995) reviewed many investigations concerned with the folk classification of plants and animals (i.e., laypeople’s classification of plants and animals). Folk classifications are usually measured by asking participants to sort plants and animals into groups, and then repeatedly asking them to re-sort these groups, sometimes asking them specifically to subdivide the groups they have already created. Malt concluded that although folk classifications in other cultures often correspond strongly with the Western scientific classification system, the correspondence is not perfect (e.g., Conklin, 1957; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). She proposed that other factors, such as the significance of a particular plant or animal in a given culture, influence the kinds of categories that are formed. Numerous
anthropological studies lend support to this proposal. Diamond (1966), for example, found that the Fore peoples made very discriminating groupings for birds, which were considered valuable and were hunted by members of the culture, yet all butterflies, which were considered of little value, were grouped together into one category despite the perceptual dissimilarities among them. Similarly, Hunn (1982) noted that the Tzeltal peoples do not differentiate among butterflies but do differentiate among butterfly larvae, presumably because the larvae are an important food source and a crop pest. Consistent with this idea, Berlin (1978) noted that Aguaruna and Tzeltal peoples formed generic categories for plants that were of no utility for them, yet divisions of generic categories into more specific categories were made for those plants that were considered useful.

Norenzayan, Smith, Jun Kim, and Nisbett (2002) conducted one of the few experimental studies examining cultural differences in categorization. Based on previous research suggesting that East Asian thought is more holistic and that Western thought is more analytic (e.g., Nakamura, 1988; Nisbett, Peng, Choi, & Norenzayan, 2001), that East Asians are more influenced by contextual elements in a situation than are Westerners (Masuda & Nisbett, 2001), and that East Asians prefer dialectical resolutions more than Westerners (i.e., “middle-way” resolutions; Peng & Nisbett, 1999), Norenzayan et al. hypothesized that East Asians would rely more on intuitive, experience-based reasoning than Westerners, and that Westerners would rely more on formal, rule-based reasoning than East Asians. In one of their experiments (Experiment 2), participants were presented with two groups of four items and were asked to categorize and to judge the similarity of an additional item with respect to those groups. Participants could use two strategies when making their judgments: They could rely on a unidimensional rule by which they identified the group consisting of items that shared the same identical feature (e.g., a flower may have the exact same stem as all of the flowers in one group of four items but may have little else in common with those flowers), or they could rely on a family resemblance rule by which they identified the group that shared more features overall but that did not consist of items that shared the same identical feature (e.g., a flower may share many common features with the majority of flowers in another group of four items, such as the presence of leaves or the shape of the petals, but there may not be one feature that is shared by all items in that group).

Norenzayan et al. (2002) reported that there were no cultural differences in categorization—Western and East Asian participants were significantly more likely to give unidimensional rule-based responses than family resemblance-based responses. However, for similarity judgments, East Asian participants were significantly more likely to give family resemblance-based responses, and Western participants were significantly more likely to give unidimensional rule-based responses. These results suggest that East Asians are more likely to base similarity judgments on holistic aspects of the stimuli, and that Westerners are more likely to base similarity judgments on the individual components of the stimuli.

Similar conclusions were drawn by Chiu (1972), based on an examination of East Asians’ and Westerners’ categorization strategies. Chiu examined differences in categorization between Chinese and American children, using pictures of artifacts, plants, and animals. On each trial in the study, participants were presented with three pictures (e.g., a tire, a car, and a bus), and were asked to group the two pictures they thought best belonged together. Participants were also asked to explain their choices (e.g., “Because they are both large”). Participants’ responses were classified as descriptive-analytic (identifying similar parts of stimuli and differentiating based on those similarities; e.g., “Because they are both holding a gun”), inferential-categorical (categorizing based on inferences made about the stimuli that are grouped together; e.g., “Because they both have a motor”), descriptive-whole (identifying
whether a stimulus as a whole is similar to another whole stimulus; e.g., “Because they are both large”), and relational-contextual (categorizing based on functional and thematic relationships; e.g., “Because mother takes care of baby”). Chiu’s (1972) results showed that the American children were significantly more likely than the Chinese children to respond using descriptive-analytic, inferential-categorical, and descriptive-whole categorizations, and that the Chinese children were significantly more likely than the American children to respond using relational-contextual categorizations. Considered together, Chiu’s results suggest that Chinese children have a greater tendency to categorize by identifying relationships among stimuli, whereas American children have a greater tendency to categorize by identifying similarities among stimuli.

The results of these categorization studies (i.e., Chiu, 1972; Norenzayan et al., 2002) lend support to theories that Nisbett and his colleagues have proposed to explain differences in categorization and other aspects of cognition between East Asian and Western cultures (Choi, Nisbett, & Smith, 1997; Masuda & Nisbett, 2001; Nisbett et al., 2001; Peng & Nisbett, 1999). Central to these ideas is the claim that the Chinese engage in holistic thought and that Westerners engage in analytic thought. Holistic thought is characterized by a focus on context and environmental factors; relationships are explained with reference to how objects are related to their environment, and it is held that a part cannot be separated from the whole. Analytic thought, in contrast, is characterized by the separation of an object from its context; rules of similarity are used to differentiate objects into separate groups, and predictions about objects are made based on these categories.

Despite these differences in East Asian and Western cognitive styles, to our knowledge there have not been any studies that have examined the extent to which these differences are reflected in basic cognitive processing. Chiu’s (1972) results demonstrate that cultural differences can be observed in categorization styles, and so there is evidence for cultural differences in preferences or response styles. What is unknown is the extent to which these differences extend to the nature of the semantic or conceptual memory system on which categorization is based. Are there cultural differences in the structure, and processing, of the semantic system? In the current study, our goal was to explore these possibilities.

A great deal of research has provided support for the notion that as the semantic information about a concept is activated, other concepts that are semantically related are also activated (e.g., Collins & Loftus, 1975; Collins & Quillian, 1969; Hill, Strube, Roesch-Ely, & Weisbrod, 2002; Kiefer, 2002; Kintsch, 2000). As a result, all models of semantic or conceptual memory propose that semantic memory is characterized by a highly interconnected network structure and include mechanisms by which related concepts activate each other (e.g., Anderson, 1983; Barsalou, 1999; Burgess & Lund, 2000; Collins & Loftus, 1975; Hinton & Shallice, 1991; Masson, 1995; McRae, de Sa, & Seidenberg, 1997). This is necessary to explain, among other things, ubiquitous phenomena like semantic priming, by which the processing of a prime word (e.g., night) facilitates the subsequent processing of a semantically related target word (e.g., day). This facilitated processing is typically inferred from faster response latencies to targets following related primes (night-day) when compared to response latencies to targets following unrelated primes or neutral primes (e.g., car-day or xxx-day). The assumption is that response latencies reveal the speed, or ease, of semantic activation. Semantic priming can be observed in many cognitive tasks, including word naming and lexical decision (see Neely, 1991, for a review), semantic categorization (e.g., McRae et al., 1997), semantic relatedness judgment (e.g., Klinger & Greenwald, 1995), and picture naming (e.g., Alario, Segui, & Ferrand, 2000).
It is also known that the structure of semantic or conceptual memory is affected by experience. Information that is well learned will be represented more strongly, and activated more readily, than information that is less well learned. For example, Chi and Koeske (1983) demonstrated that for well-learned (i.e., more familiar) conceptual information, there were more connections between concepts, stronger connections between concepts, and more cohesive (organized) representations. These characteristics are thought to facilitate access to conceptual information.

With these facts in mind, Chiu’s (1972) finding that Chinese participants were more likely to categorize based on relationships suggests that, for Chinese participants, the connections between semantic representations will be based on relational information (i.e., information about thematic relations) to a greater extent than categorical information (i.e., information about similarity attributes). If true, then when Chinese individuals activate a concept (e.g., car), activation should spread more rapidly to other concepts that are associated or connected by way of relationship (e.g., tire) than to other concepts that are associated or connected by way of category knowledge (e.g., bus). Conversely, based on Chiu’s finding that Western participants were more likely to categorize by identifying similarities among objects, the expectation is that for Western participants the connections between semantic representations will be based on categorical information to a greater extent than relational information.

As a result, for Western participants, when activating the concept car, activation should spread more rapidly to concepts that belong to the same category (e.g., bus) than to concepts that share a relationship (e.g., tire). These predictions were tested in the current Experiments 2 and 3. Our first priority, however, was to determine if we could observe cultural differences in categorization styles among Chinese and Western adults, and this was addressed in Experiment 1.

**EXPERIMENT 1**

In Experiment 1, we used an untimed categorization task in an attempt to observe cultural differences in categorization styles similar to those that Chiu (1972) observed. Chinese and Western participants were presented with sets of three pictures (e.g., tire, car, bus) and were asked to select the two pictures they thought should be grouped together, and to provide an explanation for their decision. The percentage of relational responses (tire-car) and the percentage of categorical responses (car-bus) were the key data of interest. Given Chiu’s results, we expected that Chinese participants would be more likely to categorize the pictures based on relational information (e.g., tire-car), and that Western participants would be more likely to categorize the pictures based on categorical information (e.g., bus-car).

**METHOD**

**PARTICIPANTS**

Sixty-eight undergraduate students from the University of Calgary volunteered to participate in the experiment in exchange for bonus credit toward a psychology course. Participants were assigned to one of two groups based on their responses to the Cultural Background Questionnaire (see Appendix A). Those with strong Chinese cultural backgrounds were assigned to the Chinese group (n = 20), and those with strong Western cultural backgrounds
were assigned to the Western group (n = 30). The data from the remaining 18 participants were not analyzed because they did not have a strong Chinese or Western cultural background. Participants were considered to have a strong Chinese cultural background if they were of Chinese descent, if they spoke Mandarin or Cantonese, and if they indicated that they practiced Chinese culture to a great extent (i.e., if they circled 4 or 5 on a 5-point Likert-type scale asking “To what extent do you still practice the cultural traditions of your country of origin?” or, if their country of origin was Canada but their parents’ country of origin was China, “To what extent do you still practice the cultural traditions of your parents’ country of origin?” with 1 [never] and 5 [always]; the mean rating on this item was 4.05). Participants were considered to have a strong Western cultural background if they were of European descent, if they spoke only the English language, and if they indicated that they practiced Canadian culture to a great extent (i.e., if they circled 4 or 5 on a 5-point Likert-type scale asking “To what extent do you still practice the cultural traditions of your country of origin?” with 1 [never] and 5 [always]; the mean rating on this item was 5.00).

On average, Chinese participants indicated that they had spent 60.3% of their lives in Canada. Fifteen of the 20 Chinese participants indicated that English was not their native language. There were 13 females and 7 males in the Chinese group, and the mean age was 21.8. All Western participants indicated that they and their parents were born in Canada, and that English was their native language. There were 24 females and 6 males in the Western group, and the mean age was 21.5.

**STIMULI**

One hundred and fifty-three black-and-white pictures were selected for use in the experiment; 101 from Snodgrass and Vanderwart’s (1980) standardized set of 260 pictures, and 52 from Microsoft ClipArt. Each picture was of only one object. In a separate study, these pictures were shown to a different group of participants to assess the consistency with which they were named. Twenty-nine undergraduate students participated in this separate study in exchange for bonus credit toward a psychology course. Those participants were presented with a booklet of pictures and were asked to write down, on a separate sheet of paper, the first name that came to mind for each picture. A picture was used in Experiment 1 only if at least 90% of the participants agreed on its name. Using this criterion, 117 of the 153 pictures were used in Experiment 1.

The 117 pictures were divided into 39 trials, each trial consisting of three pictures. The 39 sets of three pictures are shown in Appendix B. On each trial, two of the objects were considered to be in the same category, and two of the objects shared a relationship with each other. Objects were considered to be in the same category if they shared a similar function or were of the same kind. Objects were considered to share a relationship if one depended on the other in some way to function. We avoided categorical or relational pairs that are associated with each other with exceptionally high frequency, such as doctor-nurse and bread-butter. For example, one trial consisted of pictures of a cutting board, a rolling pin, and an onion. The cutting board and the rolling pin are used for cooking and so were considered to be in the same category. A cutting board can be used to cut an onion, and so the cutting board and onion were considered to share a relationship. Another trial consisted of pictures of a pipe, a cigar, and an ashtray. The pipe and the cigar were considered to be in the same category, and the cigar and ashtray were considered to share a relationship (as are the pipe and the ashtray).
PROCEDURE

Participants were not informed of the exact purpose of the study or of the hypotheses under investigation until they were debriefed at the conclusion of their participation. Participants were first asked to complete a cultural background questionnaire (see Appendix B). The questionnaire included questions about the participants’ country of origin, the participants’ parents’ country of origin, the participants’ first language and all languages spoken, and the primary language that was spoken in the family home. In addition, as noted, the questionnaire included questions asking participants to rate the extent to which they practiced the cultural traditions of their country of origin and of their parents’ country of origin, using a 5-point Likert-type scale from 1 (never) to 5 (always).

After completing the cultural background questionnaire, participants were presented with a booklet containing 39 sets of three pictures. For each set of pictures, two of the pictures were of objects that shared a relationship with each other (e.g., tire-car), and two of the pictures were of objects that belonged to the same category (e.g., bus-car). Participants were asked which two pictures should be grouped together (“Which two pictures go together the best?”). Participants were asked to circle those two pictures and to provide a brief written explanation for their decision.

RESULTS

We excluded all responses in which the participants explained that they were grouping pictures together for reasons other than those judged to mean “the pictures shared a relationship with each other” or “the pictures belonged to the same category.” In total, 32 of the 1,950 responses (1.6% of the data) were excluded from all analyses for this reason.

The percentages of each response type (relational, categorical) were analyzed using a 2 (Cultural Group: Chinese, Western) × 2 (Type of Categorization: shared relationship, same category) mixed-model ANOVA. The mean percentages of relational responses and categorical responses for the two groups are listed in Table 1.

The most important result was the significant interaction between Cultural Group and Type of Categorization $F(1, 48) = 4.31, p < .05$, mean square error (MSE) = 1598.07. As can be seen in Table 1, for the Chinese participants, there was little difference between the percentage of pictures grouped together because they shared a relationship and the percentage of pictures grouped together because they belonged to the same category (47.7% vs. 51.7%), $t < 1$. For the Western participants, in contrast, there was a large and statistically significant difference between the percentage of pictures grouped together because they shared a relationship (29.9%) and the percentage of pictures grouped together because they belonged to...
the same category (67.8%), $t(29) = 3.47, p < .01, SE = 4.26$. As expected, given Chiu's (1972) results, the Western participants were much more likely to categorize based on categorical information. However, although the Chinese participants were expected to be more likely to categorize based on relational information, this was not the case. Instead, Chinese participants were equally likely to categorize based on relationships and on categories.

In addition to the interaction, there was a significant main effect of Type of Categorization, $F(1, 48) = 6.57, p < .05, MSE = 1598.07$. Overall, participants provided more categorical responses (e.g., bus-car) than relational responses (e.g., bus-tire), with 61.3% of the pictures grouped together because they belonged to the same category and 37.0% of the pictures grouped together because they shared a relationship. There was also a marginally significant main effect of Cultural Group, $F(1, 48) = 3.96, p = .06, MSE = 4.69$, which reflected the fact that a higher percentage of the Chinese participants’ responses could be classified as either a relational response or a categorical response (99.4%) than could the Western participants’ responses (97.7%).

**DISCUSSION**

The results of this experiment are similar to those reported by Chiu (1972). Chiu found that Chinese children were significantly more likely than American children to classify items based on a thematic or functional interdependence between the items (e.g., “Because the mother takes care of the baby”), whereas American children were significantly more likely than Chinese children to classify items based on similarities between the items (e.g., “Because mother and baby are both humans”). Our results show that Western participants were significantly more likely to group items together because they belong to the same category, whereas Chinese participants were equally likely to group items together based on their shared relationship (e.g., tire-car) and their category membership (e.g., bus-car). We speculated that the reason we did not observe a significant preference among the Chinese participants for relational pairings may be related to the demographics of these participants; that is, whereas Chiu recruited Chinese participants who were living in China, we recruited Chinese participants who were living in Canada. Thus, our Chinese group had experience living in a Western culture and might, therefore, be expected to show a blend of Chinese and Western tendencies in their responses.1 We addressed this issue in Experiment 3. In Experiment 2, we turned to the major issue at hand, whether there were differences in the activation of semantic concepts consistent with the cultural differences in categorization observed in Experiment 1.
EXPERIMENT 2

In this experiment, we used a picture-priming task to assess the activation of semantic concepts in participants from Western and Chinese cultures. Participants were shown a prime picture (e.g., tire) for 500 ms, and then a target picture that was either related or unrelated to the prime picture (i.e., car, or elephant). Participants responded by indicating whether the objects in the prime and target pictures were related (yes or no), as quickly and as accurately as possible. Each participant was shown a series of trials during the experiment, the critical trials being those in which the prime and target were relationally related (e.g., tire-car) and those in which they were categorically related (e.g., bus-car).

We also included repetition trials (e.g., car-car) to provide a common baseline with which to compare responses. Like the relational trials and the categorical trials, the repetition trials required a yes response (because the prime and target were related by virtue of being identical), and because the prime and target were identical, yes responses could be made very quickly. The repetition trials also were useful because they allowed us to determine if there was a group difference in the perceived difficulty of the task; that is, if the Chinese and Western participants differed with respect to the difficulty they experienced in this task. If, for example, the Chinese participants found the task more difficult, then their responses on all of the trials, including the repetition trials, would be slower than those of the Western participants. Conversely, the absence of a group difference on the repetition trials would indicate that the two groups found the task to be of similar difficulty.

If there were differences in the activation of semantic concepts between individuals from Western and Chinese participant groups, then there should be corresponding differences in the pattern of response latencies. Given the interaction observed in Experiment 1, in which Chinese participants were equally likely to choose relational and categorical pairs, and Western participants were more likely to choose categorical pairs, it was predicted that for Chinese participants the response latencies would be equivalent for relational pairs and for categorical pairs, whereas for Western participants the response latencies would be faster for categorical pairs than for relational pairs. Such findings would indicate that relational and categorical associations are equally salient for Chinese participants, whereas categorical associations are more salient for Western participants.

METHOD

PARTICIPANTS

One hundred and thirty-three undergraduate students from the University of Calgary volunteered to participate in the experiment in exchange for bonus credit toward a psychology course. The data from 48 participants were excluded from all analyses because they did not have a strong Chinese cultural background or a strong Western cultural background. Of the 85 participants included in the analyses, 45 had a strong Chinese cultural background and 40 had a strong Western cultural background (criteria for determining the “strength” of cultural background were the same as those employed in Experiment 1).

On average, participants in the Chinese group indicated that they had spent 69.7% of their lives in Canada. In addition, when asked to rate the extent to which they practiced Chinese culture, the average response of participants in the Chinese group was 4.13 on a scale from 1
Seven of 45 Chinese participants indicated that English was their native language. There were 35 females and 10 males in the Chinese group, and the mean age was 20.2. All Western participants indicated that they and their parents were born in Canada, and that English was their native language. Their average rating of the extent to which they practiced Canadian culture was 5.00. There were 29 females and 11 males in the Western group, and the mean age 20.9.

STIMULI

There were 78 trials of prime and target pictures. Thirty nine of these trials were trials that required a yes response; the other 39 trials were trials that required a no response. The yes trials consisted of stimuli from Experiment 1. Recall that in Experiment 1, participants were shown three pictures on each trial. For Experiment 2, two of these pictures were used as primes, and the other picture was used as the target. Thus, one of the primes shared a relationship with the target, and one of the primes belonged to the same semantic category as the target. Of the 39 experimental trials, 13 trials consisted of relational prime-target pairs (e.g., tire-car), 13 trials consisted of categorical prime-target pairs (e.g., bus-car), and 13 trials were repetition trials (e.g., car-car). Repetition trials were created by presenting the same target picture as the prime and the target. Three versions of the experimental trials were created, such that the relational prime for a given target appeared in one version, the categorical prime for that same target appeared in a second version, and the repetition prime for the target appeared in a third version. Presentation of the three versions was counterbalanced across participants.

The 39 no trials consisted of prime and target pictures that were selected from Snodgrass and Vanderwart’s (1980) standardized set of 260 black-and-white pictures. The prime and target for each no trial were unrelated (e.g., airplane-elephant). The same unrelated trials were shown to all participants.

PROCEDURE

As in Experiment 1, participants were not informed of the purpose of the study until the end of the experiment. Participants were first asked to complete the Cultural Background Questionnaire used in Experiment 1 (see Appendix A). Participants then began the priming task. Participants were seated in front of a 17-inch Sony Trinitron monitor controlled by a Macintosh G3 microcomputer. The timing and presentation of stimuli was controlled by PsyScope experimental software (Cohen, MacWhinney, Flatt, & Provost, 1993). The distance between the participant and the computer monitor was approximately 40 cm, and the monitor was positioned so that pictures were presented at the participant’s eye level. Prime pictures, visual masks, and target pictures all measured 3 cm × 3 cm on the computer screen.

Each trial began with the presentation of a fixation marker (*) in the center of the display for 2000 ms. The fixation marker was then erased, and the prime picture was presented for 500 ms. The prime was replaced by a visual mask (a random array of black blobs on a white background) displayed for 60 ms, and following the mask there was a 100-ms blank interval. Following the blank interval, the target picture was presented at the center of the display and remained in the display until the participant responded. The participant’s task was to decide, as quickly as possible, whether the objects in the prime and target pictures were related to each other. Responses were made by pressing either the left button (labeled no) or the right
button (labeled yes) on a PsyScope response box. The 78 experimental trials were randomized separately for each participant.

Prior to the experimental trials, participants completed nine practice trials and were provided with verbal feedback if they responded incorrectly to any of the practice items. Before the practice trials began, participants were instructed that sometimes the pictures would be related to each other, and that sometimes they would be completely unrelated.

RESULTS

For the response latency analyses and the error analyses, trials on which yes response latencies were less than 250 ms or greater than 2500 ms (1.3% of trials) were removed. For the response latency analyses, trials on which response errors were made (8.5% of trials) were also removed. The response latency data and the error data were submitted to separate 2 (Cultural Group: Chinese, Western) × 2 (Type of Relationship: categorical pairs, relational pairs) mixed-model ANOVAs. The mean response latencies and the mean percentage of errors are listed in Table 2.

In the response latency analysis, the interaction between Cultural Group and Type of Relationship was significant, \(F(2, 166) = 12.16, p < .001, MSE = 9625.45\). As predicted, Chinese participants responded equally as fast to categorical pairs and relational pairs, \(t < 1\), whereas Western participants responded significantly faster to categorical pairs, \(t(39) = 2.42, p < .05, SE = 16.97\). The main effect of Type of Relationship was also significant, \(F(2, 166) = 176.52, p < .001, MSE = 9625.45\), with response latencies being slowest for the relational pairs (825 ms), slightly faster for the categorical pairs (802 ms), and very fast for the repetition pairs (569 ms). There was also a main effect of Cultural Group, \(F(1, 83) = 6.74, p < .05, MSE = 90629.82\), as, overall, the response latencies of the Chinese participants (781 ms) were slower than those of the Western participants (683 ms). However, as can be seen in Table 2, for the repetition trials there was virtually no difference in response latencies between the Chinese and the Western participants, \(t < 1\). This indicates that the two groups could respond equally quickly in this baseline condition of the task, implying that the task difficulty was equivalent for the two groups.

In the error analysis, the interaction between Cultural Group and Type of Relationship was not significant, \(F < 1\), nor was the main effect of Cultural Group, \(F < 1\). Consistent with the response latency analysis, there was a main effect of Type of Relationship, \(F(2, 166) = 71.41, p < .001, MSE = 83.82\), with the largest error rate for the relational pairs (18.8%), smaller error rate for the categorical pairs (9.8%), and the smallest error rate for the repetition pairs (1.7%).

DISCUSSION

In Experiment 1, Western participants were more likely to categorize based on similarities (i.e., using shared category membership) than on relationships, whereas Chinese participants were equally likely to categorize based on relationships and on similarities. The results of Experiment 2 indicate that a similar pattern of effects can be observed when assessing semantic processing using response latencies. Specifically, Western participants responded faster to categorical pairs than to relational pairs, whereas for Chinese participants the latencies to categorical pairs and to relational pairs were essentially equivalent. These findings
suggest that there was a cultural difference in the activation of semantic concepts. It appears that Chinese participants were equally as fast at activating concepts that share a relationship as they were at activating concepts that belong to the same category, whereas Western participants were faster at activating concepts that belong to the same category than they were at activating concepts that share a relationship. These findings suggest that, for Chinese participants, relationship information is equally as salient as category information, whereas for Western participants, category information is more salient than relationship information.

Recall that, given the results of Experiment 1, we predicted that the Chinese participants in Experiment 2 would not respond faster to relational pairs than to categorical pairs because the Chinese participants in our sample had been immersed in Western culture for some period of time. Thus, our assumption was that the Chinese participants in Experiments 1 and 2 had internalized, to some degree, a Western style of thought. However, Chinese participants who are less influenced by Western culture may respond faster to relational pairs than to categorical pairs. To test this prediction, for Experiment 3 we recruited Chinese participants from the Chinese Student Association at the University of Calgary. The Chinese Student Association comprises mostly students from China who have spent little time in North America. As a result, many of the participants in Experiment 3 were less influenced by Western culture than were the participants in Experiments 1 and 2, as they had spent (on average) a greater percentage of their lives living in China.

One other issue we addressed in Experiment 3 was the correspondence between the speeded task used to assess semantic processing and the untimed categorization task used in Experiment 1. More specifically, a difficulty comparing the results of Experiments 1 and 2 was that the decision component of the task used in Experiment 1 was different from the decision component of the task used in Experiment 2; that is, the task used in Experiment 1 involved looking at three pictures and deciding which two of the pictures should be grouped together, whereas the task used in Experiment 2 required participants to look at two pictures in sequence and to decide if the two pictures were related; there was no third picture to reject. One has to be cautious when making any conclusions about the semantic processing involved in the categorization task used in Experiment 1 when the task designed to examine that semantic processing (in Experiment 2) involved a different kind of decision. Accordingly, in Experiment 3, we created a categorization task that was more similar to the task used in Experiment 1 but which still required a speeded response and thus provided information about the speed of semantic processing.

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**TABLE 2**

<table>
<thead>
<tr>
<th>Cultural Group</th>
<th>Relational Pairs&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Categorical Pairs&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Repetition Pairs&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Relational Pairs</th>
<th>Categorical Pairs</th>
<th>Repetition Pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>885 (196)</td>
<td>881 (275)</td>
<td>576 (115)</td>
<td>18.5 (15.8)</td>
<td>10.4 (11.0)</td>
<td>1.1 (2.8)</td>
</tr>
<tr>
<td>Western</td>
<td>764 (197)</td>
<td>723 (174)</td>
<td>561 (146)</td>
<td>19.1 (13.7)</td>
<td>9.1 (9.4)</td>
<td>2.9 (5.4)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Tire-Car.
<sup>b</sup> Bus-Car.
<sup>c</sup> Car-Car
EXPERIMENT 3

The categorization task used in this experiment involved the presentation of a target picture (e.g., car) along with two alternatives (e.g., tire, bus). Participants were asked to decide, as quickly as possible, which of the two alternatives they thought best belonged with the target picture. One of the alternatives shared a relationship with the target picture (e.g., tire), and the other belonged to the same category as the target picture (e.g., bus). Thus, like the task used in Experiment 1, participants grouped together pictures they thought belonged together; however, unlike Experiment 1, this was a speeded task, and response latencies were recorded. Analysis of these response latencies provided insight into the processing that occurs as individuals from Chinese and Western cultures make semantic decisions about stimuli.

For response latencies, based on the results of Experiment 2, we expected that Western participants would respond significantly faster when choosing alternatives that belonged to the same category as the target picture than when choosing alternatives that shared a relationship with the target picture. On the other hand, it was not clear whether Chinese participants would respond faster when choosing relational alternatives or whether they would respond equally as fast when choosing relational alternatives and categorical alternatives. If the degree of exposure to Western culture has an impact on response latencies in this task, then Chinese participants in Experiment 3 may respond faster when choosing relational alternatives. If, however, the degree of exposure to Western culture has no effect, or if we have not successfully manipulated the degree of exposure to Western culture, then the Chinese participants in Experiment 3 might respond equally as fast to relational and categorical alternatives.

For response selections (categorical or relational), as in Experiment 1, we expected that Western participants would choose significantly more alternatives that belonged to the same category as the target picture. However, again, for the Chinese participants the prediction is not as straightforward. On one hand, the Chinese participants in Experiment 3 may respond like the Chinese participants in Experiment 1, choosing alternatives that share a relationship with the target picture equally as often as alternatives that share a category with the target picture. On the other hand, because the Chinese participants in Experiment 3 had less exposure to Western culture than the Chinese participants in Experiment 1, they may respond like Chiu’s (1972) participants, choosing more alternatives that share a relationship with the target picture than alternatives that share a category with the target picture.

METHOD

PARTICIPANTS

Sixty undergraduate students from the University of Calgary volunteered to participate in the experiment in exchange for bonus credit toward a psychology course. Another 28 participants were recruited from the Chinese Student Association at the University of Calgary and were each paid $15.00 for their participation. The data from 21 participants were excluded from all analyses because they did not have a strong Chinese cultural background or a strong Western cultural background. Thirty-two participants had a strong Chinese cultural background, and 35 participants had a strong Western cultural background (the criteria used for
determining the “strength” of cultural background were the same as those employed in Experiments 1 and 2).

On average, Chinese participants had spent 29.8% of their lives in Canada (the Chinese participants in Experiment 1 had spent an average of 60.3% of their lives in Canada and the Chinese participants in Experiment 2 had spent an average of 69.7% of their lives in Canada). When asked the extent to which they practiced Chinese culture (using the same instrument used in Experiments 1 and 2), the Chinese participants’ average response was 4.12 on a scale from 1 to 5. None of the Chinese participants indicated that English was their native language. There were 16 females and 17 males in the Chinese group, and the mean age of the participants was 27.7. All Western participants indicated that they and their parents were born in Canada, and that English was their native language. Their average rating of the extent to which they practiced Canadian culture was 5.00. There were 21 females and 14 males in the Western group, and the mean age was 22.4.

STIMULI

The stimuli in this experiment were the same 39 sets of three pictures used in Experiments 1 and 2. One picture was considered the “target picture” (e.g., car), and the other two pictures were considered “alternatives.” The relational alternative shared a relationship with the target picture (e.g., tire), and the categorical alternative belonged to the same category as the target picture (e.g., bus). The two alternatives appeared above the target picture, and two versions were created such that the relational alternative appeared on either the right side or the left side of the target picture in one version and on the opposite side in the other version. Presentation of these versions was counterbalanced across participants. All participants saw relational and categorical pictures in the right and left positions above the target pictures.

PROCEDURE

As in Experiments 1 and 2, participants were not informed of the purpose of the study until the end of the experiment. For the categorization task, each trial began with the presentation of a fixation marker (+) at the center of the video display for 1000 ms. The fixation marker was then erased and replaced by a target picture, also presented at the center of the display. After 500 ms, the pictures of the two alternatives were presented above the target picture, such that all three pictures were visible on the screen, and participants were asked to decide, as quickly as possible, which of the two alternatives “went together the best” with the target picture. Participants were instructed to press the left button on a PsyScope response box placed in front of them if they thought the picture on the left went together the best with the target picture, and to press the right button if they thought the picture on the right went together the best with the target picture. The pictures remained on the computer screen until participants made their response. The experimental trials were presented in a different random order for each participant. Prior to the experimental trials participants first completed five practice trials.

RESULTS

We used a different method to identify and exclude outliers than we used in Experiment 2, as there was much more variability in the response latencies from this task (no doubt because
there are no “correct” or “incorrect” responses). Responses with latencies faster than 250 ms or slower than three standard deviations above the mean were excluded from the response latency analyses. A total of 2.2% of the data were excluded by this procedure (all response latencies greater than 6133 ms). The response latency data and the selection proportions (i.e., the proportion of relational responses and the proportion of categorical responses) were analyzed using 2 (Cultural Group: Chinese, Western) × 2 (Response Alternative: relational, categorical) mixed-model ANOVAs. The mean response latencies and the mean selection percentages for the two groups are shown in Table 3.

In the analysis of the response latencies, the interaction between Cultural Group and Response Alternative was not statistically significant, F < 1. Nonetheless, given the magnitude of the within- and between-group variability and the consequent reduction in statistical power, we performed the same individual comparisons as we did in Experiment 2. These comparisons revealed that, for the Chinese participants, there was no difference between the response latencies for relational choices and the response latencies for categorical choices, t < 1, whereas the Western participants responded significantly faster when selecting the categorical alternative than when selecting the relational alternative, t(34) = 2.31, p < .05, SE = 59.04. Note that this is the same pattern of response latencies that was observed in Experiment 2. There was also a main effect of Cultural Group, F(1, 65) = 16.38, p < .001, MSE = 991972.52, as, overall, the Western participants responded significantly faster than the Chinese participants (1470 ms vs. 1967 ms). There was no main effect of Response Alternative, F(1, 65) = 1.62, p = .21, MSE = 181591.48.

In the analysis of the selection data, there was no interaction between Cultural Group and Response Alternative, no main effect of Response Alternative, and no main effect of Cultural Group (all Fs < 1). Contrary to our expectation, and unlike the situation in Experiment 1, Western participants did not choose the categorical alternative more often than the relational alternative (t < 1). For Chinese participants, there was no difference between the percentage of relational choices and the percentage of categorical choices (t < 1), which is consistent with the results of Experiment 1.

**DISCUSSION**

The pattern of effects observed in the response latency data in this experiment replicated the pattern of effects observed in the response latency data of Experiment 2; that is, in both experiments, Chinese participants’ response latencies were no different when selecting categorical alternatives (e.g., bus-car) than when selecting relational alternatives (e.g., tire-car), whereas Western participants’ response latencies were faster when selecting categorical alternatives than when selecting relational alternatives. These findings support the interpretation outlined earlier— for Chinese participants, relationship information is equally as salient as categorical information, whereas for Western participants, categorical information is more salient than relationship information. Western participants appear to more readily activate concepts that belong to the same category than concepts that share a relationship. Like the results of Experiment 2, these results suggest that relational and categorical associations are more salient for Western participants than for Chinese participants.

As noted, the Chinese participants in Experiment 3 had less exposure to Western culture than the Chinese participants in Experiment 2, and although it was predicted that the Chinese participants in Experiment 3 would be faster when selecting relational alternatives than when selecting categorical alternatives, this was not, in fact, the case. One interpretation of
The results of Experiment 3 also revealed no preferences for categorical or relational alternatives for either Western or Chinese participants. Thus, unlike the results of Experiment 1, there were no cultural differences in categorization choices in this experiment, even though the decision participants were asked to make was very similar to the decision they were asked to make in Experiment 1. An explanation for this finding is offered in the General Discussion.

**GENERAL DISCUSSION**

The purpose of the current study was to investigate cultural differences in the activation of semantic concepts. In Experiment 1, Chinese and Western participants were asked to look at sets of three pictures and to decide which two pictures of each set best belonged together. Chinese participants were equally likely to group items together if they shared a relationship (e.g., tire-car) and if they shared a category (e.g., bus-car), whereas Western participants were more likely to group items together if they belonged to the same category. These results are similar to Chiu’s (1972) findings that American children are more likely to classify items together if they are more similar to each other, and that Chinese children are more likely to classify items together if they share a relationship. Our results indicate that significant cultural differences in categorization behavior can still be found among undergraduate students who are attending a North American university.

The purpose of Experiment 2 was to determine whether the cultural differences found in Experiment 1 could also be observed when assessing semantic processing. Participants completed a priming task in which they were presented with a prime picture and then with a target picture and were asked to decide whether the prime and target pictures were related. Western participants responded faster to categorically related pairs than to relational pairs, whereas Chinese participants responded equally fast to categorical and relational pairs. These results suggest that, for the Western participants, concepts that belong to the same category are activated faster than concepts that share relationships with each other, and that for Chinese participants concepts that belong to the same category are activated equally as fast as concepts

<table>
<thead>
<tr>
<th>Cultural Group</th>
<th>Response Latencies</th>
<th>Selection Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relational</td>
<td>Categorical</td>
</tr>
<tr>
<td>Chinese</td>
<td>1993 (1013)</td>
<td>1941 (978)</td>
</tr>
<tr>
<td>Western</td>
<td>1338 (473)</td>
<td>1202 (457)</td>
</tr>
</tbody>
</table>

a. Tire-Car.
b. Bus-Car.
*p < .05.
that share relationships with each other. These cultural differences in the activation of semantic concepts were consistent with the cultural differences in categorization observed in Experiment 1.

Because the Chinese participants in Experiment 2 had considerable experience with Western culture, we hypothesized that Chinese participants with less exposure to Western culture might respond faster to relational pairs than to categorical pairs, as would be expected given Chiu’s (1972) results. In addition, we speculated that task differences between Experiments 1 and 2 limited the conclusions that could be drawn about cultural differences in semantic processing. To investigate these issues, for Experiment 3 we recruited Chinese participants who had less exposure to Western culture than the Chinese participants in Experiments 1 and 2, and we created a categorization task that included a decision component similar to the decision component of the task used in Experiment 1.

The results of Experiment 3 revealed that, as was the case in Experiment 2, Western participants were significantly faster when choosing categorical alternatives, whereas Chinese participants responded equally as fast when choosing categorical and relational alternatives. Thus, contrary to our prediction, Chinese participants with less exposure to Western culture did not respond faster to relational associations than to categorical associations. In addition, although we predicted that Chinese participants would be equally likely to group relational picture pairs and categorical picture pairs, and that Western participants would be more likely to group categorical picture pairs, neither Chinese nor Western participants exhibited any preference for categorical or relational alternatives.

The latter result begs the question: If we observed differences in semantic processing in Experiment 3, why did we not observe corresponding differences in response selection? Both tasks (the untimed task used in Experiment 1 and the timed task used in Experiment 3) involve activation of the semantic representations for the pictured objects, and a decision process by which those objects are compared. Our suggestion is that the selection effects may depend on other aspects of the task context; in particular, whether there is time pressure. In an untimed task, such as the task used in Experiment 1, participants take the time to fully consider all three objects in a given trial. Consequently, the differences in semantic network associations emerge in the decisions that participants make when categorizing objects, as there is enough time for the activation of semantic associations for all three objects in a trial to affect reasoning processes and the assessment of which of the three objects go together best. However, in a timed task, such as the task used in Experiment 3, participants are under pressure to respond. Under those circumstances, they may not fully consider all three objects on a trial. Instead, they may activate the meaning of the target object, and then focus on one of the alternatives, as it seems highly unlikely that they could activate the meanings of both alternatives simultaneously. Given the time pressure involved, and given that both alternatives are in some way related to the target object, we think participants would almost always choose the alternative they considered first. As a result, the Chinese group and the Western group produced roughly equal selection proportions for categorical and relational object pairs. Nonetheless, the cultural differences in semantic activation emerged in the speed with which participants made that selection.

We also suggest that this strategy of selecting the first alternative considered may have been more prevalent among the Western participants. Two facts support this possibility. First, when one compares the selection results from Experiments 1 and 3, it is apparent that the change lies in the Western participants’ responses: In Experiment 1, Western participants showed a preference for categorical pairs; however, in Experiment 3, Western participants showed no such preference. In contrast, the selection results for Chinese participants in
Experiments 1 and 2 were virtually identical. This suggests that, to respond quickly, Western participants selected more relational pairs in Experiment 3, thereby eliminating a difference between relational and categorical pairs in the selection data. Second, Western participants responded significantly faster than Chinese participants in Experiment 3; however, this latency difference was not evident for repetition pairs in Experiment 2, which precludes the possibility that Chinese participants were slower because they were unfamiliar with the task or in some other way found the task more difficult. Instead, we suggest that Chinese participants were more likely than Western participants to consider both alternatives in Experiment 3, whereas Western participants were more likely to select the first alternative they considered. The possibility of cultural differences in response strategies under time pressure should be investigated more systematically in future research.

Of course, the results from the current study do not rule out the possibility that a different group of Chinese participants would respond faster to items that share a relationship with each other than to items that share a category. All of the participants in the current study were living in Canada and were, therefore, likely to be more familiar with Western culture than would participants living in China. In addition, our sample included Chinese individuals who chose to spend time in a Western country to pursue a postsecondary education and may not be representative of Chinese individuals more broadly. Despite these limitations, our experiments provide additional support to the finding that there are cross-cultural differences in how Chinese and Western individuals conceptualize and categorize the world, and that these differences are associated with the activation and processing of semantic concepts.

APPENDIX A
Cultural Background Questionnaire

What is your age?
What is your sex?
Were you born in Canada?
If not, what is your country of origin?
How long have you lived in Canada?
On a scale from 1 to 5, to what extent do you still practice the cultural traditions of your country of origin?
1 2 3 4 5
Never Always
What is your parents’ country of origin?
If they are from a country other than Canada or the United States, to what extent do you practice the cultural traditions of your parents’ country of origin (on a scale from 1 to 5)?
1 2 3 4 5
Never Always
Is English your first language?
If not, what is your first language?
How long have you spoken English?
How many languages do you speak?
If you speak more than one language and you have not yet listed them all, please list them here.
What is the primary language spoken in your family’s home?
APPENDIX A
Stimuli Used in Experiments 1, 2, and 3

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3.

4.

5.
APPENDIX A (continued)

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20.
APPENDIX A (continued)

21. 

22. 

23. 

24. 

25. 
APPENDIX A (continued)

26.

27.

28.

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30.
NOTE

1. Another interpretation of the results for the Chinese participants in Experiment 1 is that these participants were not familiar with the items and so were responding at chance, in which case the percentage of relational pairings and categorical pairings would be expected to be about the same (approximately 50%, as was observed). We were able to rule out this possibility by examining a subset of the trials where chance responding would lead to a different outcome: that is, as previously noted, there were 18 trials in which there were two pairs of objects that shared a relationship (cigar-ashtray and pipe-ashtray) but only one pair that shared the same category (cigar-pipe). For these trials, this created a greater opportunity to categorize objects together that shared a relationship, and if the Chinese participants were responding at chance on these trials, then the expected ratio of relational pairings to categorical pairings would be 67% to 33%. Instead, the observed ratio of relational pairings to categorical pairings for Chinese participants was 43% to 57%. Thus, although chance responding would have produced substantially more relational pairings than categorical pairings, there were, in fact, slightly more categorical pairings than relational pairings. This result indicates that the Chinese participants were not responding at chance throughout the experiment.

REFERENCES


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