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Cross cultural differences in unconscious knowledge

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ABSTRACT

Previous studies have indicated cross cultural differences in conscious processes, such that Asians have a global preference and Westerners a more analytical one. We investigated whether these biases also apply to unconscious knowledge. In Experiment 1, Japanese and UK participants memorized strings of large (global) letters made out of small (local) letters. The strings constituted one sequence of letters at a global level and a different sequence at a local level. Implicit learning occurred at the global and not the local level for the Japanese but equally at both levels for the English. In Experiment 2, the Japanese preference for global over local processing persisted even when structure existed only at the local but not global level. In Experiment 3, Japanese and UK participants were asked to attend to just one of the levels, global or local. Now the cultural groups performed similarly, indicating that the bias largely reflects preference rather than ability (although the data left room for residual ability differences). In Experiment 4, the greater global advantage of Japanese rather English was confirmed for strings made of Japanese kana rather than Roman letters. That is, the cultural difference is not due to familiarity of the sequence elements. In sum, we show for the first time that cultural biases strongly affect the type of unconscious knowledge people acquire.

1. Introduction

Nisbett and colleagues have been arguing for the last couple of decades that one's cultural background can profoundly affect cognitive processes (e.g. for reviews see Nisbett, 2003; Nisbett & Miyamoto, 2005; Nisbett, Peng, Choi, & Norenzayan, 2001). Specifically, Asians compared to Westerners take a more global rather an analytic perspective, being especially sensitive to context in conscious perception, memory, reasoning and social attributions, with Westerners often having the reverse tendency. For example, Masuda and Nisbett (2001) presented Japanese and Americans with underwater scenes. In a subsequent recognition test, Japanese recognized previously seen objects more accurately when they saw them in their original settings rather than in novel settings, whereas this manipulation had relatively little effect on Americans. Japanese tended to pay attention to the scene globally, whereas Americans focused more on foreground objects. Chua, Boland, and Nisbett (2005) found that in viewing natural scenes Americans made more saccades to focal objects than Chinese, and Chinese made more saccades to background objects than did Americans, indicating a fundamental attentional basis to the global-analytic differences between the cultures. Indeed, in ERP studies, Lewis, Goto, and Kong (2008) found in ERP studies that the cross cultural differences in attention emerge as early as 300 ms after stimulus onset.

A wealth of studies have investigated cross cultural differences in conscious processing, showing consistent

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medium to large effects for global/analytic differences. However, the question of whether unconscious processes are affected by culture remains unanswered. When exposed to structure in an environment, we can acquire unconscious knowledge of that structure, a process Reber (1967, 1989) called "implicit learning". Reber argued that some minimal level of attention was needed for implicit learning to occur (cf Jiménez & Méndez, 1999; Rowland & Shanks, 2006; Turk-Browne, Jungé, & Scholl, 2005; Whittlesea & Dorken, 1993). Thus, one might expect different attentional preferences in different cultures to lead to acquiring unconscious knowledge of different types of structures. We will test this claim using the artificial grammar learning paradigm.

Reber (1967) introduced the artificial grammar learning paradigm to investigate implicit learning. In the artificial grammar learning paradigm, people are exposed to strings of letters that, unbeknownst to participants, are generated by an artificial grammar. People are then informed of the existence of a set of rules and asked to classify new strings as rule governed or not. After 5–10 min exposure to grammatical strings people can typically classify new strings about 65% correct on average, showing people have acquired knowledge of the structure of the grammatical strings.

Dienes and Scott (2005) showed that knowledge of the structure of the training strings in artificial grammar learning can be unconscious (though for an alternative perspective see e.g. Shanks, 2005). In the test phase, after each classification, people indicated the basis of their classification judgment: A pure guess, it had no basis; intuition, it had a basis but they had no idea what it was; a rule or rules they could state if asked; or a memory of a training string or strings that the test string was similar to. Unconscious knowledge, on the approach adopted by Dienes and Scott, is knowledge one is not aware of; i.e. the conscious-unconscious distinction is taken to be a meta-cognitive one (as per the higher order theories of Dienes, 2008; Rosenthal, 2005, or Cleeremans, 2008). Thus, to establish the conscious status of knowledge, one has to determine the person's ability not just to say how the world is (e.g. whether a stimulus is present, whether a string is grammatical), but the person's ability to determine what mental state they are in. For the guess and intuition attributions, people are not aware of the structural knowledge underlying the judgment, so structural knowledge is on the face of it unconscious; for the rules and memory attributions, structural knowledge is conscious. (Scott & Dienes, 2008, 2010a, 2010b, later separated the memory attribution into familiarity, i.e. the string feels overall familiar or unfamiliar for reasons one does not know: unconscious structural knowledge, from recollection: conscious structural knowledge). Dienes and Scott (2005) showed that people largely gave guess and intuition attributions, and when they did so, they classified at above baseline levels. That is, the artificial grammar learning paradigm apparently involves the acquisition of largely unconscious knowledge. But of course, participants may not give attributions in a way that reflects underling knowledge types. Crucially, when structural knowledge was separated into conscious (rules and memory) and unconscious (guess and intuition), searching for rules and dividing attention at test affected the accuracy of conscious structural knowledge but not unconscious structural knowledge, providing evidence for the validity of the attributions for determining the conscious status of structural knowledge. That is, the attribution method appears to identify a real divide in nature, separating out knowledge qualitatively different in ways expected based on theory- an outcome that could not be guaranteed just based on the face validity of the measures nor ruled out just based on their subjective nature (see e.g. Dienes, 2008, 2012, for other evidence and discussion).

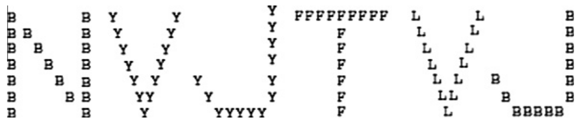

Fig. 1. An example of GLOCAL strings.

Tanaka, Kiyokawa, Yamada, Dienes, and Shigemasu (2008) showed how global vs local attention could be separated in the artificial grammar learning paradigm. They used "GLOCAL" strings (an example is shown in Fig. 1) which are chains of compound letters (Navon, 1977, 2003). A compound letter represents one large letter (i.e., a global letter) composed of a set of small letters (i.e., local letters). A critical feature of this stimulus is that while a GLOCAL string can be read as one string at the global level (NVJTVJ in Fig. 1), it can also be read as another string at the local level (BYYFLB in Fig. 1). Tanaka et al. used GLOCAL strings to investigate the role of selective attention in implicit learning. They found that when people were instructed to attend at one particular level (global or local), they learned the grammar at that level, but not at the unattended level, confirming Reber's claim of a minimal amount of attention needed for implicit learning (cf Eitam, Schul, & Hassin, 2009). Here we use GLOCAL strings for a different purpose: To explore cross cultural differences in implicit learning. Because selective attention plays an important role in implicit learning, we hypothesized that cultural differences in attention would thus affect implicit learning: Asians would learn from the global more than the local level, whereas Westerners would show a reverse or neutral bias. To determine the conscious status of the knowledge people acquired, we used the structural knowledge attributions of Scott and Dienes (2008, 2010a, 2010b).

2. Experiment 1

We modified the instructions used by Tanaka et al. (2008) in the learning session. In Tanaka et al., attention was directed to a particular level by asking the participants to write down the string at the global or local level during presentation. In the present study we wanted cultural biases to determine where attention was directed, so participants were not asked to attend to any particular level. In Experiment 3 we directed attention to just one level.

2.1. Method

2.1.1. Participants

Twenty Japanese undergraduates from Chubu University and eighteen British undergraduates from University of Sussex participated in exchange for course credit.

2.1.2. Design

A 2 × 2 mixed design was employed. The first factor was cultural group, a between participants factor. The second factor was global/local, a within participants factor.

2.1.3. Stimuli

The same two grammars and stimuli described in Tanaka et al. (2008) were used. Fig. 2 shows the grammars. Grammatical strings with a length of three to six letters were constructed from each grammar. One grammar was presented at the local level and the other at the global level. Grammar 1 versus 2 was counterbalanced across global/local levels. GLOCAL strings were presented as white uppercase letters against a black background. Small letters were used in 12-point MS Gothic font. One large letter was the height of seven small letters. Eight small letters were arranged horizontally to obtain F, J, L, and X, nine to obtain B, N, T, and Y, thirteen to obtain V, and seven to obtain Z. The height of a large letter on the screen was approximately 3.2 cm, and the width was approximately 1.8–3.0 cm. The distance between the display and the participants was approximately 60 cm.

Twenty strings following each grammar used in the test phase were composed of five or six letters. These were not GLOCAL but regular letter strings. All grammatical strings were used to construct nongrammatical strings that violated both of the grammars by placing one or two characters in nonpermissible locations. For a listing of all training and test strings, see Tanaka et al. (2008, Appendix).

Global test trials paired a grammatical string at the global level of GLOCAL strings in the training phase with a nongrammatical one. Similarly, local test trials paired a string grammatical at the local level with a nongrammatical one. There were 80 pairs in the test phase, 40 global and 40 local ones. Matching pairs of grammatical and nongrammatical strings in each type were randomized for each participant, subject to the constraint that the two strings should have the same length.

2.1.4. Procedure

In the training phase, 18 GLOCAL strings were presented individually for 6 s each. Participants were simply asked to attend to the strings. No instruction was given as to which level to attend to. Each GLOCAL string was presented six times. A mask stimulus comprising many " + " signs in the area where the GLOCAL strings were intended to be displayed was presented for the 1 s interval between presentation of GLOCAL strings.

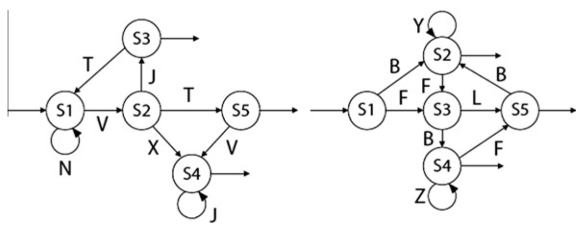

Fig. 2. Artificial grammars used in the study. On the left is grammar 1, and on the right is grammar 2.

At the beginning of the test phase, the participants were informed that each of the two levels of the training strings followed a set of rules; that two strings would be presented in the upper and lower regions of the display; and that one string in a pair was rule following and the other rule violating. The test phase consisted of two blocks: one block testing the global level and the other the local level. Half of the participants were tested on the global level grammar first and then the local; and half the other way round.

The 40 pairs were presented to each participant in a random order in each test session. A pair of strings remained on display until the participants pressed one of the two keys. The presentation of strings of a pair in the upper region was also randomized for each participant, subject to the constraint that one type of pair (i.e., the grammatical string) would be presented equally in each region.

After the judgment, the participants were asked what they based their judgment on and were asked to choose one out of the following five answers:

1. *Random responding or guessing:* Your judgment had no basis whatsoever; you could have just flipped a coin to make your judgment.
2. *Intuition*: You have some confidence in your judgment, but you have no idea why.
3. *Familiarity*: The sequence seemed familiar or unfamiliar for reasons you could not state.
4. *Recollection*: You recollected or failed to recollect seeing all or part of the sequence in the training phase.
5. *Rules*: You based the judgment on a rule or rules you could state if asked.

2.2. Results and discussion

An alpha level of .05 is used throughout. Initially we analyze overall proportion correct to determine if there was a greater global preference for Japanese rather than UK participants overall; then we look at whether there were cross cultural differences in responses specifically based on conscious knowledge (conceptually replicating previous results) and then on unconscious knowledge (the key point of the current study).

When proportion correct is broken down by attributions, some participants may have small numbers of responses contributing to conscious or unconscious knowledge. Thus, proportion correct for conscious or unconscious knowledge was calculated (for all participants who had at least one response for the relevant proportion) as (number of correct responses + 0.5)/(total number of responses + 1) corresponding to a Bayesian prior of chance performance worth just one observation (Dienes & Scott, 2005).

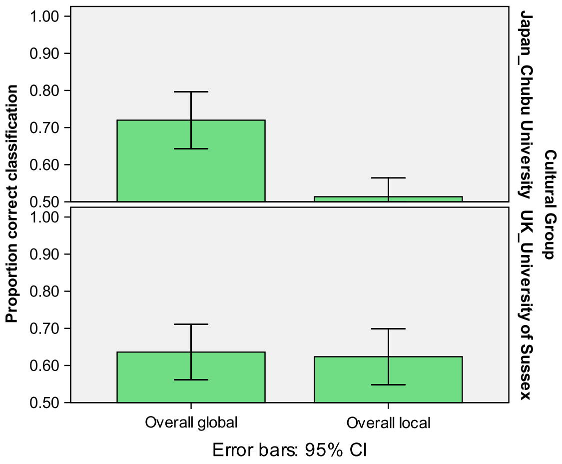

Fig. 3. Overall performance in Experiment 1.

2.2.1. Were there cross cultural differences overall?

Fig. 3 shows overall classification accuracy ignoring attributions. Japanese classified more accurately those test strings corresponding to the global rather than local grammar, $t(19) = 4.38$, $p < .0005$, $d = 0.98$, and UK people performed similarly on the global and local grammars, $t(17) = .31$, $p = .76$, $d = .07$, 95% CI [−7%, +10%]. The confidence interval for UK people is wide, so importantly the global advantage for Japanese was significantly greater than that for UK people, $t(36) = 3.09$, $p = .004$, $d = 0.97$[1]. As can be seen from Fig. 3, Japanese perform at chance on the local grammar, but extremely well on the global grammar; UK people perform above chance and similarly on both grammars.

While these results are suggestive of cultural influences on unconscious knowledge, given that responding to artificial grammars is typically based on largely unconscious knowledge, we turn to the structural knowledge attributions to confirm.

Fig. 4 shows the mean proportion of structural knowledge attributions used, according to culture and whether the global or local grammar was tested. Participants predominantly used unconscious structural knowledge attributions (random, intuition, familiarity) rather than conscious ones (recollection and rules), whether they were from Japan or the UK and in both local and global conditions. None of these proportions differed significantly between cultural groups for either global or local grammars (or averaged over both) after application of sequential Bonferroni correction (Hochberg, 1988).

Because rule attributions are used rarely, and random attributions are rare in one condition, for subsequent analyzes, all unconscious structural knowledge attributions were collapsed, and the conscious knowledge attributions collapsed, as was done by Dienes and Scott (2005) and Scott and Dienes (2008, 2010a, 2010b).

[1] This t-test is the test of the interaction between cultural group and global/local grammar.

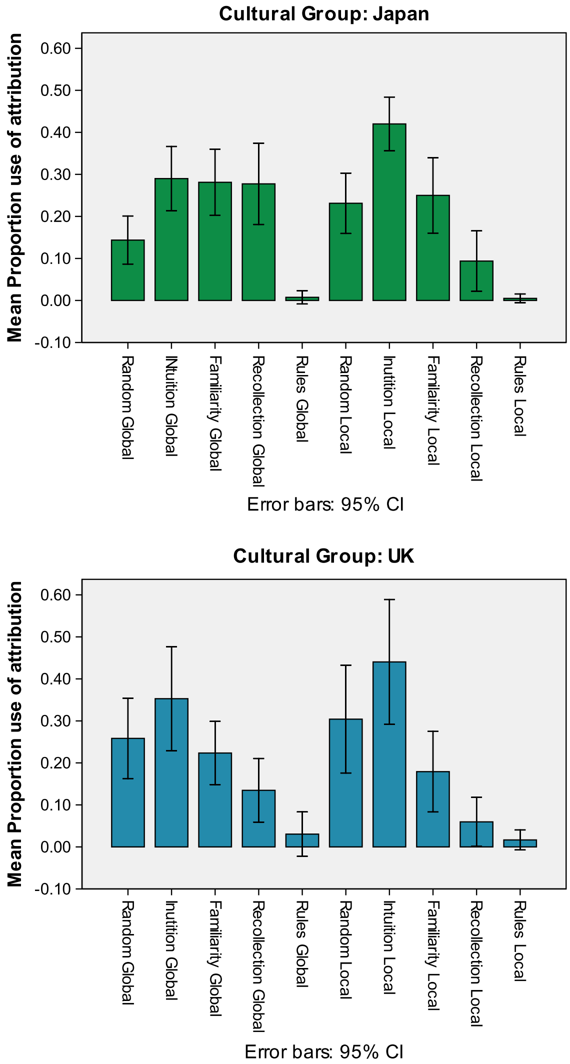

Fig. 4. Mean proportion of use of different attributions according to cultural group (top versus bottom) and global versus local grammar in Experiment 1.

2.2.2. Were there cross cultural differences in conscious knowledge?

Fig. 5 shows the classification accuracy for when people gave conscious structural knowledge attributions. It shows a conceptual replication of previous research indicating a global–local difference in conscious processing between different cultures. Specifically, Japanese classified more accurately test strings corresponding to the global rather than local grammar, $t(11) = 3.85$, $p = .003$, $d = 1.11$, and UK people performed similarly on the global and local grammars, $t(8) = .28$, $p = .79$, $d = .09$, 95% CI [−24%, +30%]. The global advantage for Japanese was significantly greater than that for UK people, $t(19) = 3.16$, $p = .004$, $d = 1.38$. As can be seen from Fig. 5, Japanese perform at chance on the local grammar, but extremely well on the global grammar; UK people perform above chance and similarly on both grammars.

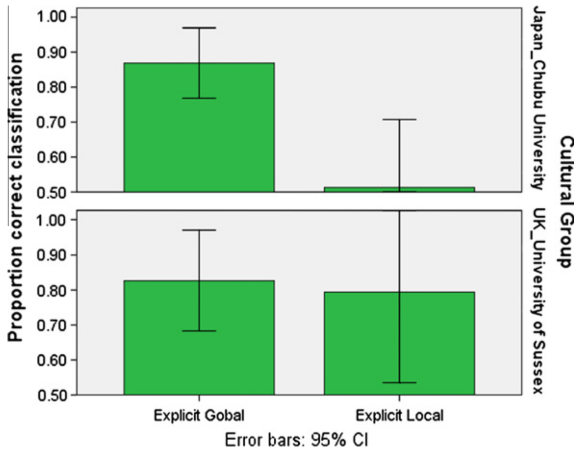

Fig. 5. Proportion correct classifications when structural knowledge is conscious in Experiment 1.

2.2.3. Were there cross cultural differences in unconscious knowledge?

Fig. 6 shows the results for when people were unaware of the basis of their judgments, i.e. structural knowledge was unconscious. These analyses provide the important novel finding of the current paper. Japanese again showed a global advantage, $t(19) = 3.79$, $p = .001$, $d = 0.85$, and UK people did not, $t(17) = -.26$, $p = .80$, $d = 0.06$, 95% CI [−8.6%, +6.7%]. Crucially, the global advantage for Japanese was significantly greater than for UK people, $t(36) = 3.47$, $p = .004$, $d = .97$. In sum, we show for the first time that unconscious knowledge reflects the global–local preferences of different cultures.

One explanation for the global advantage for Japanese rather than UK people in acquiring unconscious knowledge is in terms of an attentional *preference* rather than an ability. Miyamoto, Nisbett, and Masuda (2006) found that exposure to scenes from Japan rather than America primed attention to contextual information, no matter what the race of the participant, indicating the cross-cultural attentional bias may be quite malleable. On the other hand, a habit can become something difficult to overcome. Indeed, in the Miyamoto et al. study, differences between races remained whatever the priming condition. Further, Kitayama, Duffy, Kawamura, and Larsen (2003) found that when subjects were asked to copy a line drawn in a square onto a different sized square, Americans were more accurate than Japanese when instructed to draw the absolute length of the line independent of the size of the square but Japanese were more accurate than Americans when instructed to draw the same length of line relative to the square. That is, even when instructed to adopt a global or local style, different cultures were still somewhat bound by their habits. It thus remains open to what extent people can control their attention sufficiently to eradicate cross-cultural differences in implicit learning.

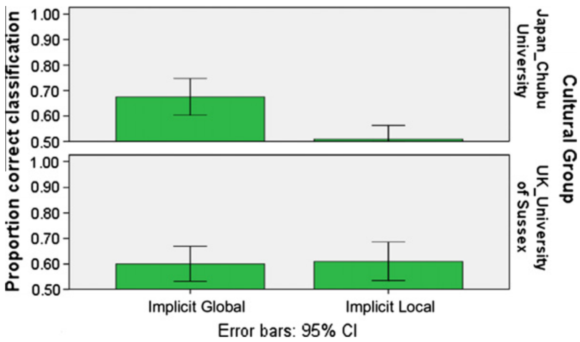

Fig. 6. Proportion correct classifications when structural knowledge is unconscious in Experiment 1.

3. Experiment 2

In order to explore the resilience of the global bias in Japanese, we ran a further group of Japanese participants in a procedure similar to Experiment 1 but in which the global level grammar consisted of all transitions between letters being equally likely, i.e. the global structure was random (and the local grammar was structured as in Experiment 1). Would randomness at the global level induce the implicit system of Japanese to search for structure at the normally unpreferred local level?

3.1. Method

3.1.1. Participants

Twenty-eight (Japanese) undergraduates from Chubu University participated in exchange for course credit.

3.1.2. Stimuli

The difference in stimuli compared to Experiment 1 was that in the training phase, stimuli were constructed so that at the global level, all transitions between letters were equally likely. In all other respects the training phase was identical to Experiment 1, i.e. the local level was structured, in just the same way as Experiment 1.

3.1.3. Procedure

The procedure was the same as Experiment 1 except that we did not test if people had learned the random structure of the global stimuli.

3.2. Results and discussion

After the training phase, and when subsequently tested at the local level, the Japanese participants performed convincing at chance, mean percentage correct 50%, $t(27) = -0.21$, $p = .84$, 95% CI [46%, 53%]. The upper limit of 53% is below the lower limit of the confidence interval for UK people learning local structure in Experiment 1, or Japanese people learning global structure in Experiment 1. That is, we can in Experiment 2 exclude learning of local structure to a high degree of sensitivity. In sum, the Japanese preference for global over local processing persisted even when structure existed at the local but not global level. In Experiment 3 we attempted to change global–local preferences more directly.

4. Experiment 3

In Experiments 3 participants were instructed to attend to just one level, global or local. To the extent that a preference for global structure is just that, a preference, such instructions should reduce cultural differences in implicit learning at the global versus local levels.

4.1. Method

4.1.1. Participants

Forty undergraduates from Chubu University and forty-two from University of Sussex participated in the experiment in exchange for course credit. Half the participants were instructed to attend at the global level and half at the local level. Thus, unlike experiment one, global/local was a between participants variable.

4.1.2. Stimuli

The same as in Experiment 1.

4.1.3. Procedure

The procedure was the same as in Experiment 1 except that half of the participants were asked to memorize just the global level of the GLOCAL strings and the other half just the local level. To encourage attention to the instructed level in the training phase, the participants were also required to write down the string just displayed when a prompt to do so was shown on the display. The prompt was presented about once in ten trials.

4.2. Results and discussion

As found by Tanaka et al. (2008), participants were considerably better at classifying strings from the attended (75%, SD = 13%) rather than the unattended grammar (52%, SD = 11%), $t(81) = 14.52$, $p < .0005$, $d = 1.96$. As classification performance for only the attended grammar was above chance, subsequent analyses are restricted to the attended grammar.

Fig. 7 shows the classification performance overall. Overall, both groups numerically show a global advantage (11% for Japanese, $t(38) = 3.25$, $p = .002$, and 7% for UK people, $t(29.3) = 1.62$, $p = .12$). Nonetheless, the global advantage for Japanese was now NOT statistically greater than for UK people, $t(78) = 0.68$, $p = .501$, 95% CI [−6.5, 14.6]. While the upper limit of the confidence interval still *allows* Japanese to have a greater global advantage than Westerners to an interesting degree, note that the Japanese global advantage over UK people in Experiment 1 was 19% (SE = 6%, within-participants) and in Experiment 3 it was 4% (SE = 5%, between participants).

The proportion of use of the different attributions over all participants was: Random 17% (SD = 19%), intuition 22% (18%), familiarity 28% (21%), recollection 30% (25%), and rules 3% (10%). As in Experiments 1 and 2, there was a predominance of unconscious structural knowledge attributions. Random, intuition, and familiarity attributions were collapsed together to represent unconscious structural knowledge and recollection and rule attributions were collapsed together to represent conscious structural knowledge.

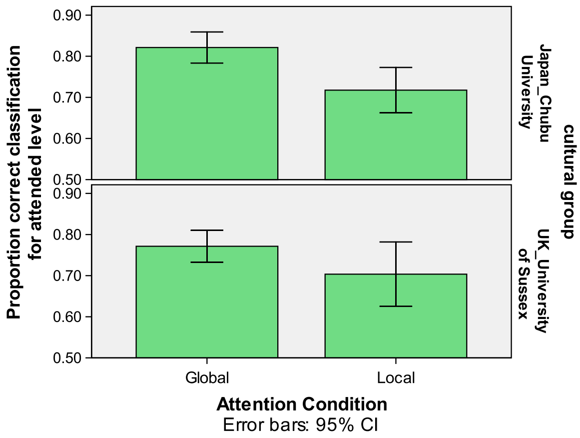

Fig. 7. Overall classification in Experiment 3.

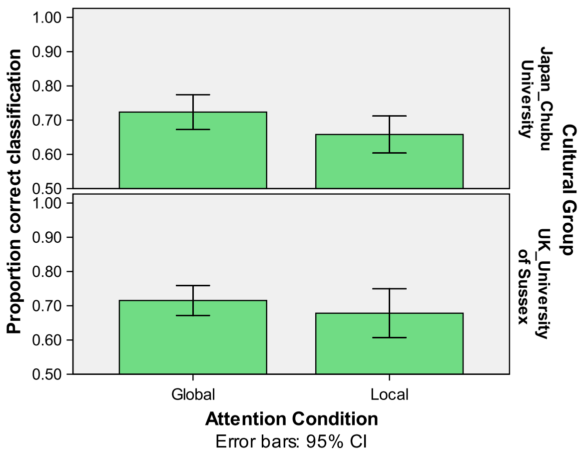

Fig. 8. Unconscious knowledge in Experiment 3.

Fig. 8 shows the global and local unconscious knowledge for both cultural groups. Both groups numerically showed a global advantage, albeit non-significant (6.5% for Japanese, $t(38) = 1.84$, $p = .07$, $d = 0.59$, and 3.7% for UK people, $t(40) = 0.93$, $p = .36$, $d = 0.28$). The global advantage for Japanese was now not statistically greater than for UK people, $t(78) = 0.53$, $p = .60$, 95% CI [−8%, 14%]. While the upper limit of the confidence interval still allows Japanese to have a greater global advantage than Westerners to an interesting degree, note that, similar to overall scores, the Japanese global advantage over UK people in Experiment 1 was 17% (SE = 6%, within-participants) and in Experiment 3 it was just 3% (SE = 5%, between participants).

When structural knowledge was unconscious, Japanese (72%, SD = 11%) classified at a similar level to UK people for global structure (72%, SD = 10%), $t(39) = 0.25$, $p = .80$, $d = 0.07$, 95% CI on difference [−6%, +7%], and Japanese (66%, SD = 12%) also performed similarly to UK people (68%, SD = 16%) on local structure, $t(39) = 0.47$, $p = .64$, $d = 0.14$, 95% CI on difference [−11%, +7%]. Again, while the confidence intervals do allow room for effects of habit undetected by these data, it is striking how well the Japanese now do on local structure, performing well above chance, $t(19) = 6.12$, unlike in the first experiment where they performed at baseline (difference between experiments for Japanese on local structure, $t(31) = 4.14$, $p < .001$, $d = 1.36$). The same pattern was found for conscious structural knowledge.

In sum, once attention was directed by instructions, the cultural groups performed similarly at the global and local levels. We conclude that the cross cultural differences in Experiments 1 and 2 are largely the result of preference; the question of a remaining ability difference is left open. (See e.g. Reber & Allen, 1978; Whittlesea & Dorken, 1993, and Eitam et al., 2009, for other demonstrations of the effect of task strategy on implicit learning.)

One possible explanation of the apparent cross cultural differences in global–local processing at the unconscious level is the claim that the Roman letters may have been more familiar to the UK rather than Japanese participants, and perhaps differences in the familiarity of stimuli induce differences in preference for global versus local processing (for effects of familiarity on overall level of implicit learning, see Scott & Dienes, 2010b). As University students, the Japanese students were very familiar with Roman letters. Nonetheless, Experiment 4 repeated the procedure of Experiment 1 but using Japanese Kana, which would be more familiar to the Japanese participants than to the UK participants.

5. Experiment 4

Exactly the same procedure as Experiment 1 was followed except that the stimuli were made from Japanese Kana.

5.1. Method

5.1.1. Participants

Sixty undergraduates from Chubu University and 57 from University of Sussex participated in exchange for course credit.

5.1.2. Design

A 2 × 2 mixed design was employed, as for Experiment 1. The first factor was cultural group, a between participants factor. The second factor was global/local, a within participants factor.

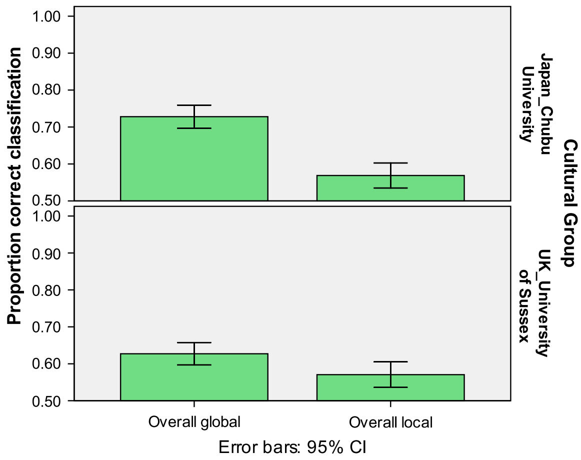

Fig. 10. Overall classification performance in Experiment 2.

5.1.3. Stimuli

The only difference in stimuli compared to Experiment 1 was that in Experiment 2 they were constructed of Kana characters, as illustrated in Fig. 7. Specifically, the Kana フ, ケ, イ, ヘ, ナ, ヨ, テ, レ, ヒ, ユ were swapped for the letters J, N, T, V, X, B, F, L,Y, and Z, respectively. Each global kana was made of 6 or 7 local kana vertically and 4 to 6 horizontally (see Fig. 9).

5.1.4. Procedure

The procedure was the same as Experiment 1.

5.2. Results and discussion

Fig. 10 shows the overall mean proportion correct classifications. Overall, Japanese again showed a global advantage, $t(59) = 7.79$, $p < .0005$, $d = 1.01$; this time UK people did as well, $t(56) = 3.00$, $p = .004$, $d = 0.40$, 95% CI [+1.9%, +9.4%]. Importantly, the global advantage for Japanese was still significantly greater than for UK people, $t(115) = 3.68$, $p < .0005$, $d = 0.63$, even with Kana stimuli, conceptually replicating Experiment 1.

The proportion of use of the different attributions over all participants was: Random 23% (SD = 21%), intuition 31% (19%), familiarity 26% (17%), recollection 17% (17%), and rules 3% (11%). That is, as in Experiments 1, there was a predominance of unconscious structural knowledge attributions. As before, random, intuition, and familiarity attributions were collapsed together to represent unconscious structural knowledge and recollection and rule

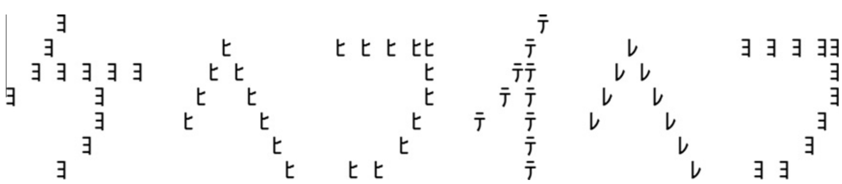

Fig. 9. Example stimulus for Experiment 4.

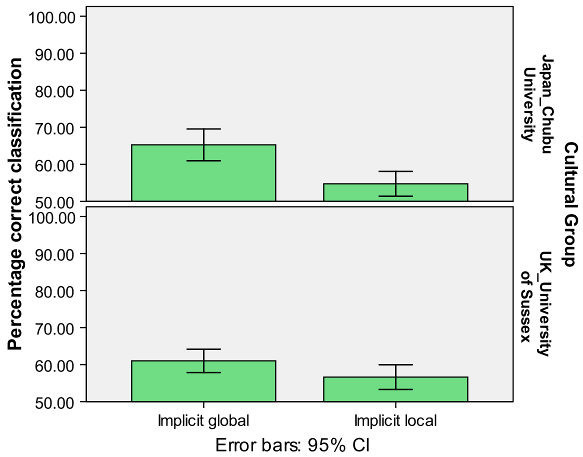

Fig. 11. Classification based on unconscious knowledge in Experiment 2.

attributions were collapsed together to represent conscious structural knowledge.

Fig. 11 shows the data for unconscious knowledge. When structural knowledge was unconscious, Japanese again showed a global advantage, $t(59) = 5.43$, $p < .0005$, $d = 0.70$, as did UK people, $t(55) = 2.16$, $p = .036$, $d = 0.29$. Again, the global advantage for Japanese was significantly greater than for UK people for unconscious knowledge, $t(114) = 2.30$, $p = .023$, $d = 0.40$, conceptually replicating the key result of Experiment 1. (A similar pattern was obtained for conscious knowledge.)

In sum, even for stimuli which were more familiar to Japanese people than for UK people, Japanese people still showed a greater global advantage than did UK people in responses based on unconscious knowledge. Taking Experiments 1 and 4 together, the greater global advantage for Japanese rather than UK people cannot be explained on the basis of the differential familiarity of the stimuli to the two cultural groups.

6. Conclusion

In the present study, we examined cultural differences in implicit learning using the artificial grammar learning paradigm with GLOCAL strings to provide independent global and local structure (for other papers investigating learning of two grammars see e.g. Mayr, 1996; Norman, Price, & Jones, 2011; Smith & McDowall, 2005; Wan, Dienes, & Fu, 2008). For the first time in investigations of cross cultural differences in global versus analytic processing, we provided evidence for the unconscious status of the relevant knowledge. In Experiments 1 and 4, Japanese participants showed a striking global advantage, performing at chance on local structure, whereas the UK participants learned similarly from both global and local levels. Importantly, this effect occurred when people were apparently unaware of the contents of the structural knowledge they had induced. Thus, cultural biases can profoundly affect the contents of unconscious knowledge and not just conscious processes. In Experiment 3, instructions to attend to each level showed Japanese were quite capable of implicitly learning at the local level, and now the different cultural groups performed similarly. Thus, controllable preferences in the allocation of attention resulted in different unconscious structural knowledge contents. The preferences are relatively robust (as shown in Experiment 2) but can be at least partially over-ridden by the direct intention to do so. When people from the East and West meet, if there seems to be some inarticulable difference in perspective, see how things look more globally or locally.

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