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Enculturation Effects in Music Cognition

The Role of Age and Music Complexity

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The authors replicate and extend findings from previous studies of music enculturation by comparing music memory performance of children to that of adults when listening to culturally familiar and unfamiliar music. Forty-three children and 50 adults, all born and raised in the United States, completed a music memory test comprising unfamiliar excerpts of Western and Turkish classical music. Examples were selected at two levels of difficulty—simple and complex—based on texture, instrument variety, presence of simultaneous musical lines, and clarity of internal repetition. All participants were significantly better at remembering novel music from their own culture than from an unfamiliar culture. Simple examples from both cultures were remembered significantly better than complex examples. Children performed as well as adults when remembering simple music from both cultures, whereas adults were better at remembering complex Western music. The results provide evidence that enculturation affects one's understanding of music structure before adulthood.

Keywords: *enculturation; music memory; cross-cultural listening; music complexity; elementary listeners*

The dated view of children as receptacles that are waiting to be filled by a teacher's wisdom has been replaced by an awareness of not only the personal history that each child brings to class but also the impact of the environment on a child as he or she grows up. When children first enter the music classroom in kindergarten, they already have had numerous and varied experiences with music (Campbell, 1998). Their musical worlds have been shaped through interactions with parents, peers, television and other media, and society at large.

Current curricular practices reflect both an awareness of students' individual music knowledge and a desire to acquaint students with the world's array of musical

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traditions. The National Standards recommend that "those who construct arts curricula attend to issues of ethnicity, national custom, tradition, religion, and gender, as well as to the artistic elements and aesthetic responses that transcend and universalize such particulars" (Consortium of National Arts Education Associations, 1994, p. 14). Such language appears to approach contextual elements (e.g., custom) as being variable and specific to a given tradition while identifying artistic and aesthetic elements as being stable and applicable across traditions. As such, this raises the following question: Contextual elements aside, do children cognitively interact with diverse music traditions in similar ways? How might children's musical interactions be mediated by their cultural environment?

The conscious and unconscious acquisition of culturally fixed understandings has been labeled *enculturation* (Herskovits, 1948). Musical enculturation is the natural development of music schemata—rule-based frameworks within which an individual interprets what he or she perceives—through the shaping influences of the environment. Merriam (1964) noted, "Concepts and behaviors must be learned, for culture as a whole is learned behavior, and each culture shapes the learning process to accord with its own ideals and values" (p. 165). Ethnomusicologists stress the importance of examining music within its cultural context because the "proper approach to a musical subject includes sociological issues of human behavior, values, taste, historical perspective and language of the discipline" (Hood, 1971, p. 287).

The examination of culturally specific musical understandings has long been the province of ethnomusicologists and anthropologists. More recently, researchers have begun to investigate culturally based differences in musical understanding through the methods of cognitive psychology. By including musical material and participants from non-Western cultures, researchers have found that several aspects of musical thinking may be culturally based, including melodic perception (Krumhansl, 2000, 2003; Krumhansl et al., 2000; Krumhansl & Toiviainen, 2001; Lynch, Eilers, Oller, Urbano, & Wilson, 1991; Perlman & Krumhansl, 1996; Schellenberg & Trehub, 1999), rhythmic synchronization (Drake & Ben El Heni, 2003; Drake & Bertrand, 2001), written description (Morrison & Yeh, 1999), and affective response (Arikan et al., 1999; Balkwill & Thompson, 1999; Gregory & Varney, 1996). Researchers in cognitive neuroscience have also begun to examine ways in which culture might affect neurological responses to music (Arikan et al., 1999; Genç, Genç, Tastekin, & Iihan, 2001; Klein, Zatorre, Milner, & Zhao, 2001; Morrison, Demorest, Aylward, Cramer, & Maravilla, 2003; Nan, Knosche, & Friederici, 2006: Neuhaus, 2003; Paulesu et al., 2000).

A significant challenge in studying cross-cultural musical understanding lies in developing an operational definition of *musical understanding*. Music cannot be translated like a spoken language (Byron, 1995). Unlike language interpretation, it is perfectly acceptable for a music listener to construct a much more idiosyncratic interpretation of what is heard. A listener may even decide whether the sound was, in fact, music. How then can we compare the responses of cultural insiders and outsiders to musical material in an objective way?

Memory research has demonstrated that human beings' memory capacity is greater when they are presented with information that is structured in an internally logical way, fitting expected norms of usage and organization. This feat is accomplished through a process of chunking smaller bits of information into larger units, thereby resulting in improved speed and efficiency (Miller, 1956). Recent research on expertise has demonstrated that expert memory performance in areas such as chess and bridge (Charness, 1989; Gobet & Simon, 1998) is significantly better than that of novices but only when the information is presented in possible, rather than nonsensical, combinations. This finding suggests that memory performance can be one effective measure of musical understanding—that is, how sensible content is to certain groups.

The authors of a series of studies has begun to examine questions about enculturation and musical understanding by using memory response and brain activation as measures of comprehension. The neurological study of spoken language has shown distinct activations for first, or native, language when compared to an unfamiliar language (Schlosser, Aoyagi, Fulbright, Gore, & McCarthy, 1998). Morrison et al. (2003) looked for an analogous response to "first music," with musically trained and untrained Western-born adults listening to culturally familiar (Western) and unfamiliar (Chinese) music while undergoing an fMRI scan. Although there were significant differences in activation based on participants' music training, there were no differences in activation while listening to culturally familiar and unfamiliar music. In contrast to this lack of activation difference, a postscan memory test found significant differences in performance by culture. Listeners were more successful remembering novel music from their own culture than from a foreign culture.

More recently, Demorest, Morrison, Beken, and Jungbluth (2008) tested the cross-cultural musical understanding of musically trained and untrained adults from two countries (United States: $n = 80$; Turkey: $n = 70$) to explore the influence of enculturation on music comprehension. Participants listened to music examples from Western, Turkish, and Chinese music traditions. Trained and untrained listeners remembered novel music of their native culture significantly better, with expertise having no significant effect. Turkish participants were also significantly better at remembering Western music than Chinese music, thereby suggesting a secondary enculturation effect for Western music.

Although such findings appear to substantiate the impact of enculturation among adult listeners, it remains unclear to what extent children may demonstrate similar differential response in music memory. Knowledge of the way in which young listeners respond to culturally unfamiliar music may assist music educators when incorporating world music into children's formal music-learning experience. More directly, it would begin to shed light on the informal processes by which young people become insiders in a musical culture. The purpose of this study was to replicate and extend findings from previous studies in music enculturation by (a) measuring the music memory performance of children as they listen to simple and complex music from familiar and unfamiliar cultures and (b) comparing children's

performance to adult performance. Specifically, the research questions were as follows:

1. Would memory performance for children and adults be better for their home culture (Western music) than for an unfamiliar culture (Turkish music)?
2. Would enculturation effects vary, depending on the complexity of the music stimuli?
3. Would there be any overall difference between the performance of adults and children on the memory task?

Method

Participants ($N = 93$) were fifth-grade children ($n = 43$) and college-age adults ($n = 50$) all born and raised in the United States. Each participant completed a musical and cultural background questionnaire to determine the primary culture in which he or she was raised. Because previous research in cross-cultural musical understanding (Demorest et al., 2008) revealed that music experience is not a significant variable, adults were sampled from musically trained and untrained populations. All the elementary students had received classroom music instruction typical of U.S. general music curricula.

Elementary students' music memory may be affected by the complexity of music stimuli. Previous research has suggested that elementary students are less successful discriminating multiple rather than single music parameters (Sims, 1995) and so give greater attention to obvious and concrete features rather than implicit structural features (Costa-Giomi, 2003). Given the task used in this study, overly complex music stimuli could have resulted in poorer performance among the elementary participants, thus obscuring any effect attributable to enculturation. To account for this potential confound, we selected two sets of music stimuli, one simple and one complex, representative of a familiar culture (Western classical music) and an unfamiliar culture (Turkish classical music). We selected Turkish culture as the unfamiliar music culture because of its distinctive use of timbral, modal, and textural material, as well as its use in previous research (Demorest et al., 2008). The complex stimuli from both cultures were the same as those used in an earlier study (Demorest et al., 2008); they consisted of instrumental ensemble performances matched for surface characteristics of tempo, texture, and instrument families. Simple stimuli comprised unaccompanied solo performances of classical guitar and *ud* (a plucked string instrument found in Turkish, Arab, and Persian cultures) that featured internal melodic and harmonic repetition.[1] To avoid the possibility of participants' familiarity with any of the pieces, we chose examples that were obscure and rarely heard and performed, as determined by expert performers in each tradition. All examples were taken from professional digital recordings, were approximately 30 s in length (range: 25–33 s), and were edited to begin and end at musically sensible places.[2] Examples were burned onto a CD for study presentation.

After completing the background questionnaire, all participants completed a training task to become familiar with the testing procedure. During the task, they heard one excerpt of a jazz piano piece, followed by two memory-test items (one target, one foil). Participants indicated on an answer sheet (circling *yes* or *no*) whether they thought each test item had been previously heard as part of the longer excerpt. After the training task, participants were given the opportunity to ask questions.

Participants were randomly assigned to hear either simple ($n = 46$) or complex ($n = 47$) stimuli and then tested on both music cultures. All participants were tested in groups by a researcher. Examples were played on a high-quality portable CD player. Participants heard the Western excerpts and test items first, followed by the Turkish excerpts and test items. This procedure allowed only the unfamiliar culture to benefit from practice effects, if any were present. For each testing procedure, participants were instructed to listen carefully as three longer excerpts were played, followed immediately by a 12-item memory test. The memory test featured six targets of 4 to 8 s in length (taken from the longer excerpts) and six foils of 4 to 8 s in length (taken from musically different sections of the same pieces). By selecting targets and foils from the same pieces, we controlled for recognition strategies that relied on low-level features of the recordings (e.g., recording quality, type and number of instruments used), thus forcing participants to base their decisions as much as possible on high-level structural aspects of the music (e.g., melodic and harmonic content). Each item was followed by 5 s of silence to allow time for participants to circle their response (*yes*/*no*) on the answer sheet. Target and foil items for each culture were mixed and then presented in a random order, determined before burning the stimulus CDs. All procedures were carried out with approval of and in accordance with the university's institutional review board.

Results

To control for response bias on the forced-choice task, participants' responses were converted to *d*-prime (*d'*), which is a standard test statistic for recognition memory because it controls somewhat for response bias by measuring the proportion of hits (correctly identified targets) to false alarms (incorrectly identified foils).[3] One limitation of *d'* occurs in testing situations where participants might receive a perfect score on hits and false alarms or miss every item, thereby resulting in an infinite *d'* statistic. Because the number of test items was relatively small, there were several perfect scores (six hits with no false alarms) or scores of zero within each test; so, we adjusted all *d'* scores using a procedure from Macmillan and Creelman (1991) in which all perfect scores (*p* value of 1) were adjusted by subtracting $1/2n$ from their *p* value—in this case, $1 - 1/12$. All *p* values of zero were adjusted by adding the value $1/2n$, or 1/12. Table 1 reports the adjusted *d'* scores by group and condition

Table 1
d-prime Scores and *C* Values by Condition

		Simple		Complex	
		Western	Turkish	Western	Turkish
Children	d'	1.92	1.28	0.84	0.51
	C	–0.23	–0.08	0.14	–0.04
Adults	d'	1.71	1.38	1.36	0.33
	C	–0.19	0.10	–0.06	0.09

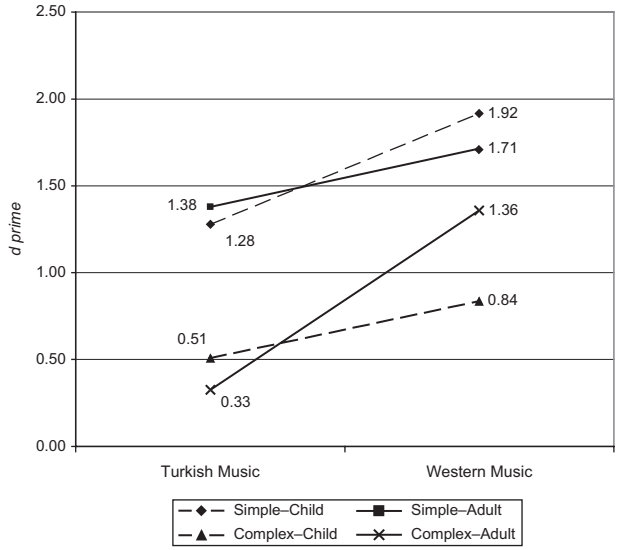
with the corresponding *C* values.[4] Using adjusted *d'* as the statistic, data were analyzed in a repeated-measures analysis of variance, with music culture as the within-subject variable and age group and complexity condition as between-subject variables.

A significant within-subject effect for music culture, $F(1, 89) = 32.52$, $p < .001$, partial $\eta^2 = .27$, indicated that the memory performance of U.S.-born children and adults was superior for novel music from their home culture. There was also a significant between-subjects main effect for music complexity, $F(1, 89) = 34.16$, $p < .001$, partial $\eta^2 = .28$, indicating that the simple examples were easier to remember overall. There were no significant interactions of music culture with age or complexity alone, but there was a significant three-way interaction, $F(1, 89) = 6.07$, $p = .016$, partial $\eta^2 = .06$, which can be seen in Figure 1. Although the small effect size suggests a minimal contribution to the overall variability, this interaction appears to be largely attributable to adults' better performance at remembering complex Western examples. To further explore the comparison of responses between adults and children, we used two repeated-measures analyses of variance to compare participants' responses in the complex condition separate from those in the simple condition. In the complex condition, we observed a significant Age × Culture interaction, $F(1, 45) = 5.03$, $p = .03$ (uncorrected), partial $\eta^2 = .10$; there was no such interaction for responses in the simple condition. This lends support to our interpretation that the original three-way interaction was the result of a stronger enculturation effect for adults in the Western music–complex condition. Otherwise, children performed as well or better than adults on the music memory tasks regardless of complexity.

Discussion

The purpose of this study was to determine whether elementary students would demonstrate the same differentiation between memory for culturally familiar and

Figure 1
Memory Performance for Adults and Children by Musical Culture and Complexity Level



unfamiliar music as that observed among adults. We also intended to examine whether this effect would be mitigated by a high or low degree of music complexity. Regarding our first research question—whether memory performance for both age groups would be better for culturally familiar music—results demonstrated significant differences in memory test scores attributed to music culture. Adults and children were more successful remembering Western music rather than Turkish music. These results call for an expansion of the enculturation effect reported in previous work with adults (Demorest et al., 2008; Morrison et al., 2003) to include children in the upper elementary grades. Whatever influence culture has on our schemata for music, it would appear that such influence is present well before adulthood.

Our second research question sought a possible interaction between the complexity of the music stimulus and the influence of enculturation. Such an interaction could occur if simpler musical material, even if culturally unfamiliar, allowed listeners easier access to salient structural features and thus facilitated more effective encoding and recall than that of complex music. Conversely, a music stimulus that was too simple might not require sufficient memory load to benefit from culturally based schemata, thus obscuring the effect. This proposed interaction was generally

not supported by the data. Although adult and elementary-age listeners were significantly more successful remembering the simple music examples overall, a pronounced advantage for culturally familiar music was evident at both levels of complexity.

These findings expand the application of the enculturation effect to stimuli of differing complexity, a consequential result given the memory-based nature of the dependent measure. As such, we can argue that overly complex music—even in a familiar style—may obscure fundamental structural information and offer too saturated a stimulus for a listener to organize and process. In cases of culturally unfamiliar music, this situation would be compounded by the operation of organizational principles largely or entirely unknown to the listener. Difficulty in recall in such a case may be as attributable to unreasonably high memory demand as to structural unintelligibility. However, our results demonstrating significantly worse memory performance even for simple music materials suggest that the effect of stimulus complexity is independent of the influence of enculturation. In addition, the presence of an enculturation effect for simpler music stimuli suggests that cultural differences in musical organization may be present in even the simplest music examples. Although no music from the children's repertoire was used in this study, because of the confounding presence of text (typical of most music of that genre), results of both groups for the less complex music suggest that enculturation may influence the understanding of even the simplest music forms from a culture.

There is one alternative explanation for the superior memory performance on Western music. Because all participants heard the Western music examples before the Turkish ones (to eliminate any possible benefit of training), such an order could create a priming effect in which culturally based music schemata were primed by hearing the culturally familiar music first. Results of earlier research argue against this interpretation, however. Two previous studies using the same task (Demorest et al., 2008; Morrison et al, 2003) presented stimuli in a variety of orders and found no memory benefit for the culture presented first.

Finally, we sought to determine whether adults would perform better than children on this memory test. We found no significant effect of age, though adults did demonstrate greater success on memory for complex Western music, thus suggesting that a combination of culture and complexity can produce age-related response patterns. Given that the ability to decipher music information appears to be age dependent (Costa-Giomi, 2003; Sims, 1995), the greater disparity between complex Western and complex Turkish memory scores among adults may represent not simply increased or more sophisticated knowledge of music in general but a richer knowledge of the musical structures and expectations unique to their cultural traditions. From a methodological perspective, these results also suggest that a recognition memory task can be a valid means of gathering data from a variety of listener groups.

The presence of a clear enculturation effect among the fifth-grade participants in this study indicates that culture-specific schemata for musical structure are formed relatively early. Fine music discrimination skills and basic pattern recognition develop as early as infancy and progress to larger and more complex culturally dependent units (e.g., scales) during early childhood (Saffran, Johnson, Aslin, & Newport, 1999; Trehub, Cohen, Thorpe, & Morrongiello, 1986). Perhaps encultured listening strategies may be in place well before formal music instruction begins, a question to be addressed in future research. Likewise, it would be useful to investigate the relative contribution of family music practices and interactions mediated by children's unique social environments as compared to those provided in the formal context of the music classroom. Regarding the latter, the question becomes, are there approaches to instruction that can alter students' comprehension responses, particularly in the younger grades? For example, the use of music featuring stylistic characteristics more similar to Western music may facilitate an easier transition to less-familiar-sounding music traditions—an approach reflecting patterns of music preference observed by Fung (1996). However, use of markedly unfamiliar musical styles may encourage interactions with culturally unfamiliar music on its own terms rather than through translation—or mistranslation—of familiar-sounding features. The question remains, how does world music instruction influence children's schema development for music?

These findings also have implications for our approach to educating the many students from non-Western cultures who are present in American classrooms. Although only U.S.-born students were tested in this study, previous research (Demorest et al., 2008) found an enculturation effect for non-Western adult listeners. It is reasonable to suggest that non-Western children may not be able to process Western music, at least initially, as successfully as they can music of their home culture.

If children do have a cultural bias in their musical understanding, it has implications for the procedures and outcomes of world music instruction in elementary school. Previous research has reported that adults and children demonstrate a preference for music of their own culture (Demorest & Schultz, 2004; Flowers, 1980; Fung, 1996; Morrison & Yeh, 1999; Shehan, 1981). This finding has been explained in part by the strong relationship between preference judgments and familiarity (Hargreaves & Castell, 1987; Heingartner & Hall, 1974; Shehan, 1985; Siebenaler, 1999). Although students' music preferences may influence their motivation to learn the music of other cultures, it is unlikely that preference alone would affect children's ability to learn such material. Our results suggest that culturally unfamiliar music may present challenges to students' understanding as well as their preferences. Future research should explore whether students' music schemata, like their preferences, can be altered with concentrated exposure to music of another culture (Heingartner & Hall, 1974; Shehan, 1985). In this way, further research into children's culturally based musical understandings can help us to refine our curricular approaches to ensure the maximum benefit of such instruction to children's musical development.

Notes

1. All audio stimuli can be heard at http://jrm.sagepub.com/supplemental.

2. We are indebted to Münir Nurettin Beken of the University of California, Los Angeles, for his assistance in choosing and editing the Turkish music examples.

3. The *d'* statistic represents the difference between the *z* score associated with rate of hits and the *z* score associated with rate of false alarms. A larger positive *d'* indicates good discrimination between items previously encountered and those newly introduced. See Neath and Surprenant (2003, pp. 200-204) for a detailed explanation of the development of *d'* and how it is calculated.

4. *C* is the mean of *z*–hits and *z*–false alarms. It a measure of response tendency, with zero indicating no bias and with a negative *C* value indicating that participants were more likely to say that they had heard the example before (Snodgrass & Corwin, 1988).

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