

LOST IN TRANSLATION: AN ENCULTURATION EFFECT IN MUSIC MEMORY PERFORMANCE

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THE PURPOSE OF THIS STUDY WAS TO TEST THE cross-cultural musical understanding of trained and untrained listeners from two distinct musical cultures by exploring the influence of enculturation on musical memory performance. Trained and untrained participants ($N = 150$) from the United States and Turkey listened to a series of novel musical excerpts from both familiar and unfamiliar cultures and then completed a recognition memory task for each set of examples. All participants were significantly better at remembering novel music from their native culture and there were no performance differences based on musical expertise. In addition, Turkish participants were better at remembering Western music, a familiar but nonnative musical culture, than Chinese music. The results suggest that our cognitive schemata for musical information are culturally derived and that enculturation influences musical memory at a structural level.

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WHILE MUSIC IS CONSIDERED TO BE A UNIVERSAL human phenomenon, a variety of social, cultural and historical influences have given rise to a wealth of unique musical forms and traditions. Increased attention to the global diversity of musical practice is evident from the current popularity of world music performers and recordings, the influence of world

music traditions on established American recording artists, and the emergence of multicultural teaching strategies and materials in school music classrooms. While a number of world music traditions have been the focus of systematic study, there are relatively few direct comparisons between listeners of different cultures and how they perceive, process, and understand musical information. By studying the responses of listeners of different cultures encountering diverse musical styles, we can begin to understand what is shared and what is not when music crosses cultural boundaries.

The largely unconscious process of acquiring culturally rooted understandings has been labeled *enculturation* (Herskovits, 1948). Enculturation is defined as the process by which a person acquires the understandings and beliefs of a particular society from infancy without any special training. Enculturation can influence our understanding of the world in a variety of ways related to our membership in a given society and our sense of identity. Much ethnomusicological research is rooted in the assumption that differences in musical understanding exist between cultural “insiders” and “outsiders,” a contrast often referred to as the *emic-etic* dichotomy (Merriam, 1990; Nettl, 1983). As Nercessian (2002) observed, “. . . in general, it is possible to ‘get to know’ the music of the Other, although one will never ‘know’ it as well as the insider, the emic, the native” (p. 25). By contrast, much music cognition research has focused on the musical properties that are deemed “universal” as investigators search for the fundamental underpinnings of musical thought and behavior. However, the great majority of the research in this area has been conducted with the music most familiar to psychologists and their participants, music based on the Western diatonic system.

More recently, researchers in cognition have begun to give attention to exploring culturally based differences in musical understanding. The goal of these studies has been to examine the role of cultural experience in shaping the development of musical understanding in different environments. Findings have supported the idea that certain aspects of our musical thinking seem to be culturally based such as melodic perception (Krumhansl, 2000, 2003; Krumhansl & Toiviainen, 2001; Krumhansl,

Toivanen, Eerola, Toiviainen, Jarvinen, & Louhivuori, 2000; Lynch, Eilers, Oller, Urbano, & Wilson, 1991; Perlman & Krumhansl, 1996; Schellenberg & Trehub, 1999), rhythmic synchronization (Drake & Ben El Heni, 2003; Drake & Bertrand, 2001; Sadakata, Ohgushi, & Desain, 2004), and affective response (Balkwill & Thompson, 1999; Gregory & Varney, 1996). Researchers have also begun to explore the role of culture in shaping neurological responses to musical information (Arikan, Devrim, Oran, Inan, Elhih, & Demiralp, 1999; Genç, Genç, Tastekin, & Iihan, 2001; Klein, Zatorre, Milner, & Zhao, 2001; Morrison, Demorest, Aylward, Cramer, & Maravill, 2003; Nan, Knösche, & Friederici, 2006; Neuhaus, 2003; Paulesu et al., 2000).

While virtually all individuals experience the music of their particular culture from birth, some go on to pursue extensive formal training in music. Music cognition research has often focused on the responses of such highly trained individuals to better understand how musical information is processed. Recently, studies have compared the responses of highly trained listeners to those of listeners with little or no formal music training to examine the role of formal training versus passive exposure in developing different kinds of musical understanding (Bigand, 2003; Bigand, Madurell, Tillmann, & Pineau, 1999; Bigand & Pineau, 1997; Bigand, Tillmann, Poulin, D'Adamo, & Madurell, 2001; Koelsch, Gunter, Friederici, & Schröger, 2000; Regnault, Bigand, & Besson, 2001). The findings indicate that so called nonmusicians can often perform as well as experts even on relatively subtle musical judgments when the task focuses on perceptions of difference rather than labeling of stimuli (e.g., interval identification). Results suggest that a considerable amount of musical knowledge is acquired passively by all members of a culture without formal instruction. Since most of these studies have been carried out with stimuli from the Western tradition, it is unclear how enculturation might interact with formal training in the development of musical understanding both within and across cultures.

In a previous fMRI study (Morrison et al., 2003) we explored the responses of Western born professional musicians and untrained controls to culturally familiar (Western) and culturally unfamiliar (Chinese) musical stimuli and English and Cantonese speech stimuli. While in the scanner, participants listened passively to a series of speech and music excerpts from both cultures. Their only instruction prior to each series of examples was to listen carefully, as they would later be asked to recognize what was heard in the scanner. This instruction served the dual purpose of focusing their attention and allowing a measure of their understanding of the stimuli. After

participants had finished scanning they were immediately given separate musical and linguistic memory tests.

Results indicated significant within-subject differences in activation based on the familiarity of the speech excerpts, but no difference based on the cultural familiarity of the musical excerpts. There was a significant between-subject difference in activation based on music training with trained listeners showing greater activation in areas associated with pitch processing. While no differences in activation were found when listening to the two musics, there was a difference in behavioral performance on the posttest measure. Both expert and novice participants were significantly better at distinguishing targets from foils with the culturally familiar musical stimuli.

Before investigating the potential contradiction between these imaging and behavioral results, we first sought to substantiate the observed difference in memory performance between culturally familiar and unfamiliar music styles. The purpose of this study was to expand on the behavioral findings of the earlier study (Morrison et al., 2003) by exploring the influence of enculturation on the musical memory performance of listeners from two distinct musical cultures. To examine possible interactions of enculturation with formal music training, we sampled trained and untrained participants from both cultures. The hypotheses were:

- (1) Participants' scores on a test of musical memory will be significantly higher for novel music of their home culture.
- (2) Responses to Western music will reflect the fact that both cultures are familiar with Western music.

An additional question was whether there would be differences in overall memory performance between musical experts and novices within each culture on either their own culture's music or on culturally unfamiliar music.

Method

Participants

To represent two subject cultures, we sampled native-born participants from the United States (US, $n = 80$) and Turkey (T, $n = 70$) with an average age of 25 years 4 months (range 15-68 years)¹ from university communities

¹The presence of participants as young as 15 years of age represents a difference in the Turkish and Western systems of higher education. In Turkey, students can begin conservatory training at a younger age. This difference did not significantly affect the average ages for the groups from each country (Table 1).

in both countries. The U.S. and Turkish participants were sampled from large public universities located in major metropolitan areas. All participants were tested in their country of residence. Participants from each culture were further sampled by music expertise to provide trained (US = 39 / T = 31) and untrained (US = 41 / T = 39) within each culture. Trained participants for both cultures were defined as individuals with at least 6 years of study in their primary performance area who were pursuing or had achieved advanced training in music leading to a collegiate degree.² Untrained participants had no more than four years of any kind of music participation.

There were differences in the breadth of training between our US and Turkish trained participants. The university curriculum at our sample site in Turkey offers an eclectic musical education to its students and includes substantial overlap with Western curricula. High school and younger students, usually starting at the age of 11 or occasionally younger, receive a French style conservatory instruction (specifically that of Gabriel Faure's and Nadia Boulanger's early 20th century Paris Conservatory) that includes solfege, theory, harmony, counterpoint, form, and analysis. In addition, students study a musical instrument. Some of them choose to study flute, oboe, violin, cello or another Western orchestral instrument, but many of them study a Turkish traditional instrument (such as *tanbur* or *saz*). While there is a conservatory orchestra comprised of Western instruments, most student performing groups are traditional style ensembles, some of them similar to the ensembles that our participants heard in the Turkish recordings used for the study.

Measurement

For this study, we were interested in measuring the impact of enculturation—the informal learning that results from being a member of a culture—on participants' ability to process music of different cultural traditions. This required a judgment task that was not culturally specific and did not demand formal music training for a successful response. One judgment task that fit these criteria was that of recognition memory;

²Due to inconsistencies between U.S. and Turkish music training systems, some of the trained Turkish participants' responses to the questionnaire were difficult to interpret. Participants often provided written descriptions of music experience rather than strictly years of participation. Such responses were translated and functionally interpreted by Dr. Beken. It should be noted that the Turkish participants' training generally included study of Western theory and performance practice.

specifically, how well a particular novel musical excerpt was remembered.

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 or organization. This is accomplished through a process of "chunking" smaller bits of information into larger units, resulting in improved speed and efficiency of both encoding and recall (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 novices, but only when information is presented in possible (rather than nonsensical) combinations. For this study we chose to test the memory performance of trained and untrained participants by asking them to listen to novel music examples from each cultural tradition and then discriminate between target excerpts taken from what they had heard previously and foils they had not heard. The premise was that if participants' schemata for music were culturally derived, then their memory performance would differ along cultural lines.

Stimuli

The musical stimuli chosen from the various cultures were matched on surface characteristics of tempo, texture, and instrument families while retaining distinct cultural identities. While it is difficult if not impossible to equate complexity cross-culturally, all of the pieces selected were ensemble works featuring wind and string instruments and with minimal internal repetition within each excerpt. For the two non-Western cultures, musicians familiar with each tradition who had also studied Western music helped to select equivalent excerpts based on comparisons with the Western examples chosen. For the Turkish and Western examples, we selected source pieces that were representative of the various musical traditions but would not be familiar to the participants (i.e., not "famous" pieces) as determined by musical experts from each culture.³ Multiple pieces from each culture were chosen as source material for

³The lack of familiarity was validated for the Western examples in a previous study with professional musicians (Morrison et al., 2003). U.S. participants in this study were asked at the end of testing to indicate on the back of their response sheets if any of the examples were familiar; none claimed any familiarity with the selections. There was not a similar informal check done during the Turkish data collection.

each condition. The stimuli were taken from professional recordings of music from three distinct musical cultures: Western art music, Turkish classical music, and Chinese orchestral music (specifically music from the Guangdong region of China). It is impossible to represent an entire culture's music through a handful of examples so we imposed certain consistent limitations. While each of these musical traditions is comprised of numerous subcultures, we chose to center on the more formal art music of each culture as an embodiment of the central structural features of each tradition. Another reason for choosing art music over folk or popular music from each culture was the need for our examples to be purely instrumental so that we avoided the confounding variable of language through lyrics.

It is difficult to codify cultural differences in musical material by merely examining differences in constituent elements such as tonality or meter. The notion of "culture" tends to be, by nature, a more holistic phenomenon. While all three traditions differ in important ways in tonal organization, rhythmic organization, tuning systems, instrumentation, and performance practice, we chose not to isolate any one of those elements in our investigation but instead to work with intact musical performances. Besides the obvious textural (Turkish heterophony and Western polyphony) and timbral (instrumentation) differences between the traditions, there are different modal systems in use. For example, while Western classical music is organized around concepts of functional harmonic structure, Turkish classical music has a highly developed theory of melodic modal system (Beken, 2004). This system determines the pitch material and general shape of a melody as well as certain stereotypical motives and other details for individual modes (or *makams*). Just as the Western examples clearly establish cadences and keys, the Turkish musical examples contain enough information to allow participants to hear the microtonal intervals (tuning systems) as well as ornamentations (pitch behavior and ornamentation patterns). The examples are also long enough to demonstrate basic modal designation (Turkish *çesmi*) in the immediate context, though large scale formal aspects of the source pieces from each culture were necessarily obscured by the shortness of the excerpted examples.

From these longer pieces (or movements of pieces) we extracted examples of approximately 30 s in length (range 25-33 s) edited to begin and end at musically sensible places as determined by musicians from each of the cultures. The examples were taken from various portions of the longer works, though none included information clearly indicative of its original location within the piece

(e.g., an extended cadence typical of the conclusion of a piece). The end result was three excerpts from each musical culture that served as the material for the listening portion of the task (see Appendix). The Western and Turkish examples represented the "first" musics of our two subject groups. The Chinese examples served as a control condition providing a musical tradition that was culturally unfamiliar to both groups. While Turkish music was likely unfamiliar to our Western participants, the same could not be said of Western music among Turkish participants. As we have previously observed (Demorest & Morrison, 2003), the international ubiquity of Western music in both the professional training and commercial media of other countries makes it a poor choice as a culturally unfamiliar music.

The materials for the subsequent memory task were taken from the same pieces of music. The six targets for each culture were 4-8 s clips that were musically sensible and extracted from the beginning and ending material of each of the three 30-s excerpts for that culture. Six foils of similar length were drawn from musically different sections of the same pieces. By choosing foils from the same source recordings we controlled for recognition strategies that might rely on differences in surface features of the recordings (e.g., recording quality, balance between the instruments) and forced participants to base their decisions on purely structural attributes of the examples used. In this way, we sought to provide the most ecologically valid representation of musical culture.

Procedure

Prior to beginning the testing sessions, all participants were given a training task to familiarize them with the testing procedure. During the training task they heard a single 30-s excerpt of a jazz selection followed by two recognition test items (one target, one foil). After the training task they were given the opportunity to ask questions.

Following training, all participants were tested on all three musical traditions and were randomly assigned to one of three orders of presentation. For example, participants in Order 1 listened to the three 30-s excerpts of Chinese orchestral music followed by the 12-item recognition test on the music from that culture; then they listened to three 30-s examples of Western music, followed by the 12-item memory test from that culture, and finally the Turkish musical examples and subsequent memory test. The pieces within each culture were always presented in the same order. For each culture participants were instructed to listen carefully as they

heard three longer excerpts and then immediately completed the 12-item recognition test. Each recognition test featured the six targets and six foils from each culture presented in a randomly determined order. Participants were given 6 s after each test item to circle either “Yes” they had heard the music earlier or “No” they had not heard the music earlier. They were instructed to respond to every item on the test even if they were not sure. All testing at both sites was done in groups of various sizes depending on the number of volunteers from a particular intact class of students. Groups were randomly assigned to a particular presentation order to distribute any order effect, and every effort was made to achieve equal representation of each subgroup within each order.

Results

Table 1 provides the means and standard deviations for the memory test scores as raw hit and false alarm rates and as adjusted d-prime (d') scores by country of origin and training. The hit and false alarm rates for various styles of music reported in Table 1 reveal virtually no difference within each musical style based on participants’ musical expertise. Conversely, the hit rates for culturally familiar music were consistently higher by country of origin with the possible exception of Turkish participants performance hearing Western music. If we compare only the hit rates of the two cultural groups for Western music (Western = .77; Turkish = .71), they do not appear to be that different. However, the different

false alarm rates (.33 and .49 respectively) suggest superior memory performance for the Western born listeners. In order to critically test these apparent differences, we converted the raw scores to D-prime (d'). D-prime 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). One limitation of d' occurs in testing situations where participants might receive a perfect score on hits and false alarms or miss every item, resulting in an infinite d' statistic. Since 47% of participants scored either 0 or 6 for hits or false alarms on at least one of the three memory tests, 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 $1/12$. The resulting adjusted d' scores for each test were used as the dependent statistic.

Table 1 also reports the value of C by subject group for all three memory tests. The C statistic measures the presence and direction of response bias. If C is positive, it indicates a conservative response bias, in this case a tendency to say “no” the test items had not been heard before; if C is negative, it indicates liberal bias or a tendency to say “yes” the item has been heard previously. All participants demonstrated a moderate response bias in the conservative direction with the Turkish participants exhibiting stronger conservative bias than their U.S. counterparts. The response tendencies for both

TABLE 1. Demographic Information and Memory Scores by Country of Origin and Expertise.

Country	Music Training		Age	Years of Training*	Chinese Music				Turkish Music				Western Music			
					Hit	FA	d'	C	Hit	FA	d'	C	Hit	FA	d'	C
US	Trained	Mean	26.97	29.22	.65	.48	.45	.18	.64	.44	.63	.11	.77	.34	1.22	.16
		N = 39	SD	6.51	11.89	.18	.24	.70	.48	.18	.20	.79	.34	.17	.18	.68
	Untrained	Mean	22.73	0.68	.57	.47	.29	.05	.64	.44	.54	.10	.77	.33	1.21	.13
		N = 41	SD	8.24	1.59	.19	.18	.76	.33	.20	.18	.82	.33	.18	.21	.84
	Total	Mean	24.80	14.59	.61	.47	.37	.11	.64	.44	.59	.10	.77	.33	1.22	.15
		N = 80	SD	7.70	16.59	.19	.21	.73	.41	.19	.19	.80	.33	.18	.20	.76
Turkey	Trained	Mean	24.68	9.10**	.65	.60	.15	.34	.79	.37	1.11	.23	.74	.50	.70	.33
		N = 31	SD	8.30	12.61	.21	.18	.69	.42	.20	.22	.89	.38	.21	.22	.98
	Untrained	Mean	27.08	0.36	.65	.58	.17	.32	.78	.36	1.13	.19	.68	.49	.54	.24
		N = 39	SD	12.43	1.18	.20	.22	.55	.51	.19	.20	.76	.40	.21	.22	.89
	Total	Mean	26.01	3.42	.65	.59	.16	.33	.78	.37	1.12	.20	.71	.49	.61	.28
		N = 70	SD	10.79	8.51	.20	.20	.61	.47	.19	.21	.81	.39	.21	.22	.93

*Years of Training = Years of private training + Years of ensemble experience

**21 complete questionnaire responses

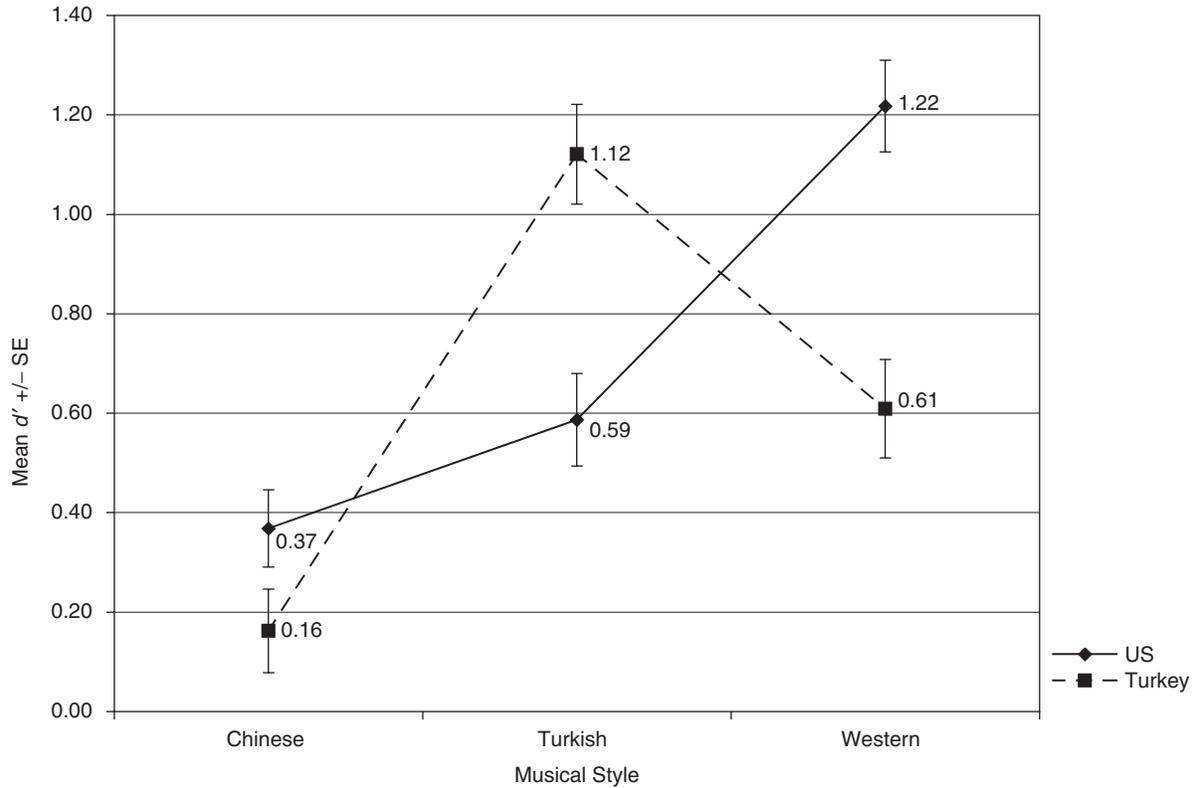


FIGURE 1. Mean memory scores by musical style and subject culture.

groups were analyzed in a repeated-measures ANOVA with C as the within-subject variable and country of origin and training as between-subjects variables. There was a significant between-subjects main effect for country indicating that Turkish participants were significantly more conservative in their responses than U.S. participants, $F(1, 146) = 9.85, p < .01$. There was no within-subject main effect for C indicating that participants' response biases were relatively consistent across all three musical cultures. There was no main effect for training and there were no significant interactions.

We used a repeated measures analysis of variance to compare participants' d' scores across each of the three culturally specific musical memory tasks. The between-subjects variables were country of origin (US, Turkey), training (expert, novice), and presentation order (1, 2, 3). The first hypothesis predicted that participants' scores would be significantly higher for novel music of their home culture. This is expressed statistically as a significant musical culture by country of origin interaction. Figure 1 illustrates the responses of the two subject groups across the three musical cultures tested. As predicted, there was a significant musical culture \times country of origin interaction, $F(2, 137) = 18.94, p < .001$. There

was also a significant main effect for musical culture across the entire sample, $F(2, 137) = 38.74, p < .001$. Pairwise comparisons of the three memory tasks for the entire sample revealed that the main effect for musical culture was the result of a significant difference in scores between Chinese music—the designated culturally unfamiliar music for both groups—and the other two musical cultures. This suggests that Chinese music did serve as an adequate control stimulus of culturally unfamiliar music for both groups.⁴

The second hypothesis predicted that Western music would be culturally familiar predicted that Turkish and Western participants. To test our prediction we performed the same repeated measures analysis of variance for each subject culture independently, yielding the same significant musical culture main effect for Turkish, $F(2, 63) = 29.48, p < .001$, and Western, $F(2, 73) = 33.12, p < .001$.

⁴Since there were no Chinese participants in the study to validate the equivalent difficulty of the examples, it is possible that the lower performance on the Chinese excerpts was a result of them being inherently more complex despite expert advice regarding the choices. The data argue against this somewhat since Western participants' performance on the Chinese and Turkish music was statistically equivalent.

The pairwise analysis of each group's responses, however, yielded a different picture. For U.S. participants the only significant difference occurred between their scores for Western music and the two unfamiliar cultures. For the Turkish participants, there were significant differences in memory performance among all three musical cultures, with scores for Turkish music highest and those for Chinese music lowest; Western music scores were in the middle and significantly different from the other two (Figure 1). This result provided partial support for the hypothesis that Western music was culturally familiar to both subject groups.

An additional question was whether there would be differences in overall memory performance between musical experts and novices within each culture on either their own culture's music or on culturally unfamiliar music. There were no significant between-subject main effects for music training and no training \times musical culture interactions.

There were no significant main effects for country of origin, but there was an unexpected within-subjects musical culture \times order interaction that was statistically significant, $F(4, 276) = 2.85, p < .05$, and a significant between-subjects main effect for order, $F(2, 138) = 3.83,$

$p < .05$. The main effect appeared to be the result of participants in Order 3 ($n = 37$) outperforming the other two orders on all three musical styles. This may be an artifact of the Order 3 group having the fewest participants though the distribution of Turkish/Western, as well as expert/novice participants was roughly proportional to the other two orders. The significant interaction was difficult to interpret. Figure 2 illustrates the memory scores for each task across the three orders. It appears that the scores for both Turkish and Chinese music remained relatively consistent across the three test orders while Western music scores show a linear increase. A Scheffé posthoc comparison revealed that the only significant difference occurred between Order 1 (CWT) and Order 3 (WTC). Since Western was the only music familiar to both subject cultures, this could either represent an order effect based on placement or a testing artifact. One would assume that if the order of presentation was a significant influence on responses to culturally familiar music then Turkish participants' responses to Turkish music should yield a similar order effect. A one-way ANOVA on Turkish participants' responses to Turkish music by presentation order yielded no such main effect.

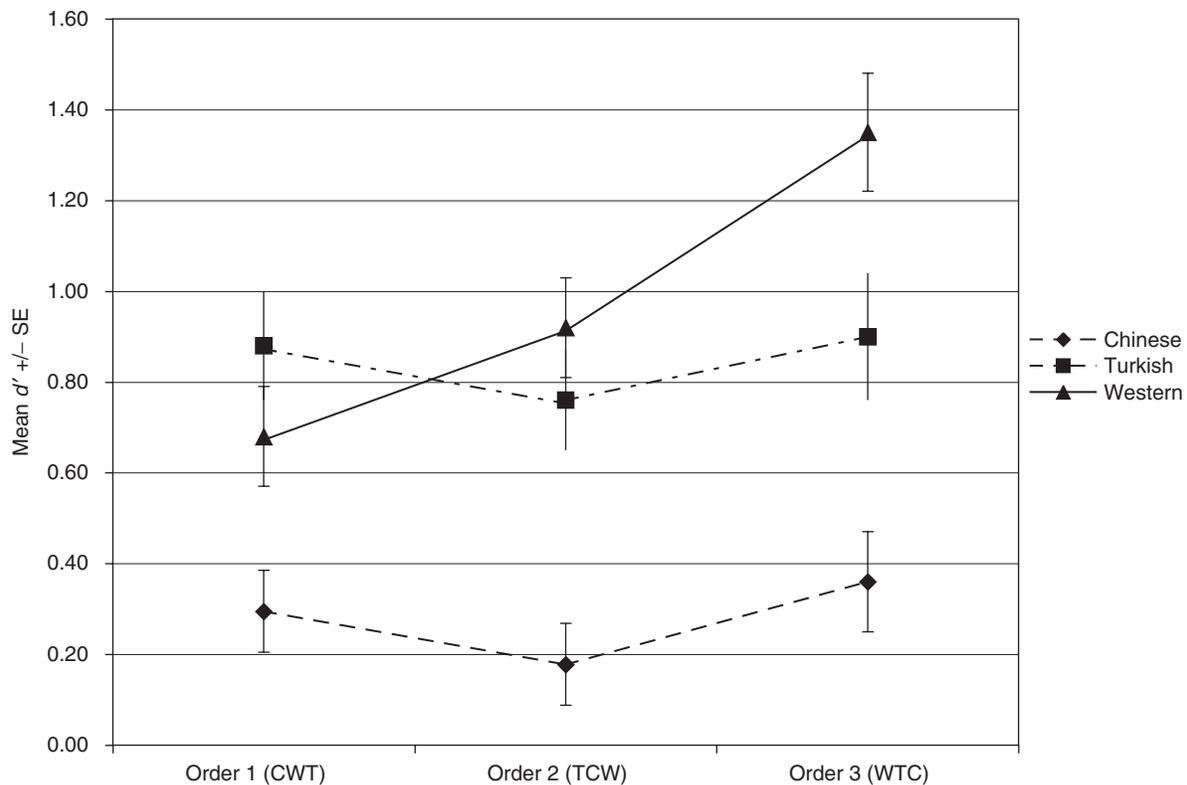


FIGURE 2. Mean memory scores by music culture and presentation order.

Discussion

The results of this study indicate that enculturation is a powerful influence on the processing and subsequent recognition of musical information. Since the dependent measure was a recognition memory task, results suggest that our cognitive schemata for musical information are culturally derived. To the extent that memory can serve as a proxy for understanding, participants' superior memory performance for novel examples of their native musical culture suggests that deeper levels of musical understanding, those that contextualize and consolidate novel musical information, cannot easily cross cultural boundaries. Ethnomusicology research has long suggested that cultural outsiders cannot understand particular musical traditions in the same way as an insider (Merriam, 1990; Nettl, 1983). It has not always been clear whether those limitations were a function of lack of familiarity with the social context of the music making or whether outsiders' lack of understanding reflected more fundamental differences in their conception of music. These results replicate the findings of the earlier imaging study (Morrison et al., 2003) with a larger and more culturally diverse sample. The findings of both studies suggest that enculturation influences musical understanding at a structural level as reflected in core cognitive processes like memory.

While these results provide strong support for the power of enculturation, they raise questions of exactly how music differs across cultures from a structural standpoint. Are the cultural differences found here a result of timbral characteristics, pitch or tuning systems, rhythmic language, performance practice or some combination of features? Are musical cultures that share a certain number of these features not subject to such an overt enculturation effect?

It is possible that differences in recognition performance found here are simply a result of exposure. That is, culturally unfamiliar music is not incomprehensible to an outsider, just novel and learned easily with sufficient exposure. This possibility is, however, contradicted by the Turkish participants' responses to Western music. While their performance was superior to that for the other culturally unfamiliar music, it was significantly lower than the recognition performance for their first music. This difference existed despite the fact that we can assume that Western music (at least popular music) has influenced and indeed comprises some of what the world hears in commercial media and despite the fact that many Turkish musicians study Western music as a part of their college training. These results suggest that while limited exposure or formal training in a second

culture may make a difference in memory performance (given the higher Western score), such variables as the quality, intensity, and timing of exposure may affect the degree to which one can move toward the perspective of a cultural insider, at least with regard to memory. Taken together with the lack of an overall difference by training, it suggests that some aspects of enculturation do not appear to be influenced by formal instruction. This has implications for music education as we consider the social and musical benefits of exposure versus training in a variety of musical cultures throughout the curriculum.

This study did not attempt to record the amount or intensity of the Turkish participants' individual exposure to Western music listening or performance, but future research should examine the impact of both listening and performance experiences on responses to culturally unfamiliar music in controlled settings. If we can find ways to deepen listeners' understandings of culturally unfamiliar music through different types of exposure we can begin to explore what it means to "know" another culture's music. It would be interesting to examine the responses of "bimusical" individuals who acquired their second music at various points in their lives to examine the role of age on the quality of acquisition.

We intentionally used intact musical examples as stimuli in this study to maximize ecological validity, leaving as many of the specific cultural features of each performance in place as possible. For that reason, it is impossible to determine which aspects of the musical structure might have contributed to differences in memory performance. Future research could explore specific musical judgments such as timbre recognition or melodic and rhythmic perception and performance and their impact on more global processes such as memory. One approach would be to compare memory responses between members of musical cultures that have more apparent similarities or common origins (e.g., between classical and jazz music). Perceived similarity was found to be consequential when listeners make preference decisions about unfamiliar musical styles (Fung, 1996) with music sounding closer to familiar styles viewed more favorably than that possessing fewer common qualities.

Another approach to isolating the musical characteristics that influence cultural responses would be to compare intact stimuli from a culture to simulated stimuli that retain only some of the musical characteristics such as timbre or tuning, to explore which musical elements tap into culturally derived schemata. In addition to behavioral studies, neuroscientific approaches may also be useful to clarify whether culturally based responses

are qualitatively different in terms of auditory processing. Once the influences of culture and training are established then we can begin to look at which differences in musical organization are most salient in musical understanding across cultures.

The question of an expert-novice difference was based on the possibility that formal music training might result in more highly developed schemata for a particular music and therefore better memory performance. This was not the case. It is important to note that the lack of difference between experts and novices was not related to any ceiling effect in the measure itself. As Table 1 illustrates, average hit and false alarm rates for culturally familiar music reveal an overall accuracy of 71-72%. Participants in all groups demonstrated a tendency to give a negative response, tending to decide that they did not hear the excerpt in question even when it was in fact a correct target, a result also reported in other music memory research (Poulin-Charronnat, Bigand, Madurell, Vieillard, & McAdams, 2004). This might indicate that listeners did not always recognize—or at least felt they did not recognize—musical information from examples previously heard rather than believing that even new musical information (foils) sounded familiar. While the strength of response bias differed across subject cultures, it remained relatively consistent within groups across all three musical cultures. This suggests that individual participants may have employed a common evaluation strategy regardless of the type of music they were hearing (cf. Demorest & Morrison, 2003).

Interestingly other memory studies have also found that expertise does not always ensure better performance (Korenman & Peynircioglu, 2004; McAuley, Stevens, & Humphreys, 2004). Korenman and Peynircioglu (2004) found that musically knowledgeable participants actually performed worse on a memory task involving familiar music with novel titles. They suggested that knowledge of the original title might have interfered with memory performance. On the other hand, Tillmann and Bigand (1998) reported better recognition of brief target phrases among individuals with music training. In this case each target was presented in advance of or immediately following each full example, thus potentially engaging different detection strategies that may have advantaged more expert listeners. As our procedure involved presenting examples and test items in separate blocks, our experts may have found that the task of choosing between excerpts heard in the listening phase and excerpts of exactly the same style from different sections of the piece did not allow them to access style-based strategies for memory. Alternatively, the presentation of

several longer musical examples followed after a relatively lengthy pause by a series of brief excerpts likely prevented expert listeners from using imagined notational strategies (i.e., envisioning a notated version of some aspect of the example) to facilitate successful recall.

The lack of an expert-novice difference also supports a growing body of research demonstrating that many musical tasks can be performed equally well by participants with and without formal training when labeling is not required. Much of the earlier research in music cognition focused on the understandings of trained listeners, perhaps with the tacit assumption that expertise was required for such judgments. More recent studies have found that informal musical experience often provides participants with the necessary knowledge to make sophisticated musical judgments (Bigand, 2003). This judgment task was not one that necessarily favored experts in that such a task would rarely if ever be encountered as part of a program of formal music training. Had we included a visual representation of the music (i.e., notation) or asked participants to reproduce what they heard in some way, our experts might have been able to use their training more effectively. The lack of difference in performance also provides something of a validation of our measure as an effective tool for measuring understanding resulting from enculturation or informal musical knowledge, without the interference of formal training. All of our participants were experts of a sort as members of their respective cultures.

It is clear from these results that any study of music cognition needs to consider the match between the culture of the listener and that of the stimulus material. Future work examining “universal” properties of music processing must include participants and musics from several distinct cultures to account for possible effects of enculturation. Research in music cognition that includes diverse musics and subject populations will provide an effective empirical complement to the qualitative work of anthropologists and ethnomusicologists and lead to a more unified view of the role of culture in shaping cognitive development in music.

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Appendix

Source Material for the Musical Stimuli

Western Excerpts

Sonata terza in C minor for treble recorder, strings and basso continuo, by Alessandro Scarlatti in *Baroque Recorder Concertos*, EMI (1987).

- Movement III. Largo

Concerto for Cello in D, by Joseph Haydn in *Cello Concertos*, EMI (1976)

- Mvmt II – Adagio

Trio Sonata in G minor, op. 2, no. 6, by Arcangelo Corelli in *Corelli Trio Sonatas*, Archiv (1986)

Turkish Excerpts

Saba Pesrevi by Osman Bey in *Mevlana Dede Efendi Saba Ayini*, 1996. Kalan Music: 42

Ussak Pesrevi by Nayi Osman Dede in *Nayi Osman Dede Mevlana Ussak Mevlevi Rite*, 2004. Çınar Music: Classical Turkish Music Collection 02

Dilkeside Pesrev by Neyzen Emin Yazici in *Kani Karaca*, Archive Series, 1999. Kalan Music: 147

Chinese Excerpts

Autumn Moon Over the Han Palace

Running Water Under Floating Clouds

Liu Qin Niang

All from: A Pick of Guangdong Music

D & I 8474 (1996)
