PERCEPTION AND RESPONSES TO SCHEMATA IN DIFFERENT CULTURES: WESTERN AND ARAB MUSIC

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ABSTRACT

The basic variables of rules of organization, form, and cognitive activity (including memory) are, as we know, *difference* and *similarity* (with attention to salience/non-salience as well). But what is considered different? What is similar or even identical? What influences these perceptions?

In this paper we shall attempt to answer these questions by experimenting on responses to selected pieces of music representing different cultures (Western and Arab). We will focus on characteristics of the schemata that form the basis of the tradition in question, the listeners' cultural background and knowledge base, and cognitive constraints. Our purpose is to gain a better understanding of the significance of the various schemata, perception of them, and responses to them. Various aspects of each of these subtopics have been researched before, but they have not all been studied together with our research objectives in mind.

1. ASSUMPTION

1. Every style (of a culture, period, or even composer) is characterized by the selection of schemata manifested in the various stages of musical activity: "raw material" (e.g., intervals, scales, meters, and rhythmic patterns), rules of composition, and rules of performance. The specific (unconscious) selection of schemata reflects the aesthetic ideal of a period or culture, subject to psychoacoustic and cognitive constraints (Cohen and Granot 1995). One of the characteristics of the aesthetic ideal is the type of complexity and directionality (momentary/ overall; clear/unclear) (Cohen 1994).

2. Listening to music (perception and response) and memory of music, like other cognitive activities, take place with constant reference to schemata that are formulated unconsciously in our minds at an extremely young age (e.g., Donchin and Coles 1986; Leman 1995). Therefore listeners will not respond to details of music based on schemata that are unfamiliar to them. An event that is considered salient due to deviation from expectations (one of the causes of salience [Meyer 1956]) regarding schemata specific to a particular culture will not be perceived as salient by listeners who are not familiar (even unconsciously) with the schemata. This will affect the perception of difference or similarity (Tversky 1977).

3. Part of the ability to respond to music is expressed in the form of skill at uncovering the schemata, which may be extremely well hidden. This ability, which is very useful to memory (Boltz 1991; Bertz 1995; Chaffin and Imreh 1997), is influenced by learning (Gardner 1982), which increases awareness of the schemata, and by mathematical aptitude.

4. Musical schemata may be either "learned" or "natural." The "learned" ones (e.g., scales and rhythmic patterns) are hardly known outside the realm of music and are culture-dependent—although not necessarily arbitrary (e.g., Balzano 1980; Agmon 1989). The "natural" schemata are rules of organization that are meaningful and familiar to us from outside the realm of music (e.g., contours, degree of definability, and operations). The ones that are relevant to the present study are those that affect the type of directionality: contours (e.g., Dowling 1978; Huron 1997), degree of definability (Cohen and Wagner 2000), and kinds of operations (Cohen and Dubnov 1997).

5. Some of the differences between the two selected cultures are as follows: Western music has overall directionality with complexity; an interval system with maximum coherence; the option of harmonic schemata; maximum separation between parameters (meter and rhythm, scales and other characteristics, composition and performance, etc.); and many binary aspects and kinds of contrast on various levels. Arab music has a strong focus on the moment; more intervals with less coherence; numerous predetermined relationships; multiple basic schemata such as scales and predetermined rhythmic patterns; and few contrasts.

2. METHOD

Subjects: A total of 55 subjects, aged 20–30 (37 Westerners and 18 Arabs), with various amounts of music education. The Arabs have not studied music formally and have not been exposed to Western music, but some of them sing regularly in a choir and the others play an instrument. The Westerners are either students in a general college or in a music academy, where the level of music education is higher.

The material examined: The Western musical material included 33 patterns. The patterns were played by a computer in the timbre of a piano and related only to the pitch factor, with constant duration. Most of them were monophonic and had between five and seven events (only seven are long, with 12 or 19 notes). The patterns were based on some learned schemata (scales [major/minor] and harmonic patterns) and natural schemata (texture, contour types, expected/unexpected, and operations within the pattern), which could be simple or complex (to the point of randomness), long or short. These were divided into six categories, differentiated by directionality. Thirty pairs of these patterns were selected for comparison, and 20 patterns were selected to be sung.

The relationship between the schemata in the pair may be "different" (from different categories), "identical," or "similar" (the difference comes from various operations [contrast, including majorization/minorization; shift, expansion/reduction; fusion/split]). The simplest category of pairs consists of patterns

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based on a simple, standard schema—a broken chord followed by a series of seconds going in the opposite direction. The operation may be shift (chord inversion, register change) or contrast (convex/concave, major/minor).

The Arab material included 15 patterns belonging to four categories; 16 pairs were used for comparison and seven patterns were selected for singing. The patterns were played on the *'ud*—living phrases with rhythm and clear beats but no clear meter. The categories were differentiated by *maqāmāt*, *maqām* motives, and length. The operations in "similar" patterns were shifts, addition of ornamentation, and changes in rhythm. "Identical" patterns were not performed exactly the same way.

In addition, the material studied included numerical patterns—20 series of numbers (6–9 in each) in five categories of schemata, including randomness.

The task: In the mathematical section, subjects were told to repeat the entire pattern (a series of numbers) in writing after viewing it for 25 seconds. In the musical section there were three tasks: (1) to compare the patterns in each pair and note whether they were very different, similar, or identical; (2) to explain in writing how they were similar or different and to specify the strategy used; (3) to repeat a selection of 20 patterns by singing them. In both music and mathematics subjects had to specify the strategy used.

3. SELECTED FINDINGS

The "errors" caused by flaws in musical memory (in the three experimental tasks) were found to be influenced to varying degrees by all of the factors investigated. Some of them are as follows:

1. Natural principles in the patterns that facilitate musical memory among all the subjects: brevity, convexity (as opposed to concavity), clear differences, clear structure, a small number of simple operations (e.g., shift is simpler than contrast), and little "competition" between parameters or schemata. In singing, most of the errors were "corrective"—in the direction of simpler directional or symmetrical schemata. A high correlation was found between the number of errors and the categories (fig. 4).

2. The general effect of musical culture and knowledge, as expressed by the number of errors (figs. 1–4): Among Westerners: music academy < college; among Arabs: play an instrument < sing; for Western music: Westerners < Arabs; for Arab music: Arabs < Westerners. For example, for Westerners singing Western music the average percentage of errors was 26.5% among the academy students versus 53% among the college students; in comparing patterns, the average among the academy students was 6.3%, as opposed to 9.3% among college students. Each cultural group (Arab or Western) was found to be more sensitive to differences in *its own* music. This is reflected in the direction of errors: different ↔ similar ↔ identical. For example, Arabs' errors in Arab music were especially likely to be in the direction of greater difference, whereas in Western music the errors were in the direction of greater similarity. (Studying music makes us aware of what our minds unconsciously knew and heightens our sensitivity to small differences.)

3. Some effects of culture-specific characteristics: *separation* (not common in Arab music) (in fig. 1); *minuscule events* that focus on the moment and are not typical of Western music (fig. 2); *harmony* (nonexistent in Arab music) (fig. 3); the operation of *contrast* (not common in Arab music; patterns related by "retrograde" and even by "inversion" were considered by Arabs to be very different, not similar).

4. The effect of mathematical aptitude, with a significant correlation found between errors in music and in mathematics. Furthermore, a correlation was found between the responses regarding the type of strategy used to remember musical patterns and the strategy used to remember series of numbers. The significant correlation may attest either to the effect of mathematical aptitude on analytical activity in music or to the effect of musical activity on mathematical ability or both (further research is needed). In any case, it bolsters the arguments regarding the importance of the analytical aspect of musical activity.

4. CONCLUSION

Further research is required, but already the experimental findings support the hypothesis regarding the sources of the influences on musical perception and memory and on various responses to music, by means of the perception of sameness and difference. The findings (not all of which are presented here) show that the differences between responses to different patterns represent ways in which the following are realized: differences between the subjects' level of music education; differences between the degree of directionality of the patterns and types of relationships (clear/unclear) between the patterns in the pairs; relationships between musical and mathematical activity; and culture-dependent differences that reflect the aesthetic ideal. The study sheds additional light on the meanings of the natural and learned schemata, the ways in which they are realized, and possible competition between them, and reinforces the assumption that the relationship between perception of types of directionality and complexity (which is an important component of the aesthetic ideal) and the "selected" schemata of a particular style is more than mere convention.

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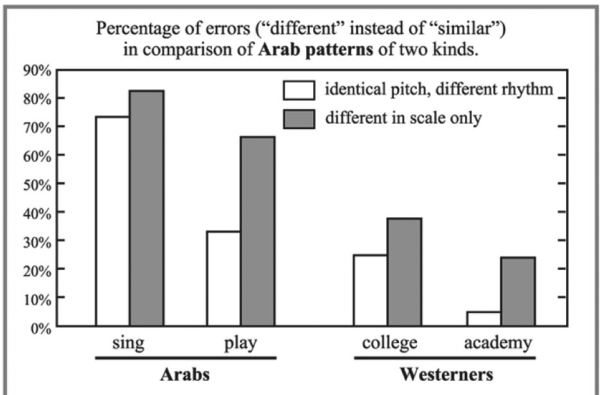

Figure 1: Effect of culture and separation between components

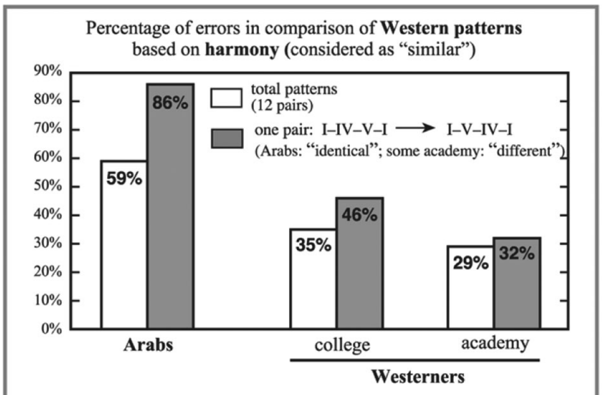

Figure 3: The effect of learned schemata and culture

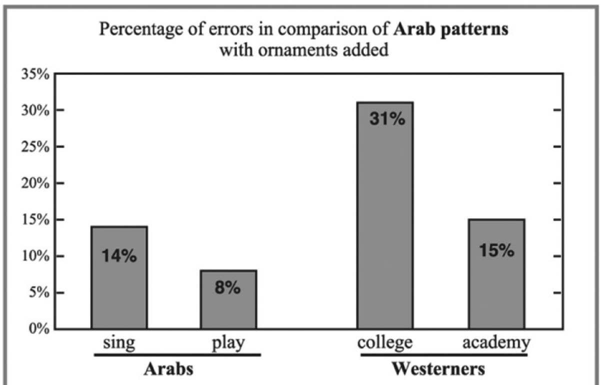

Figure 2: The effect of minuscule momentary events, culture and knowledge

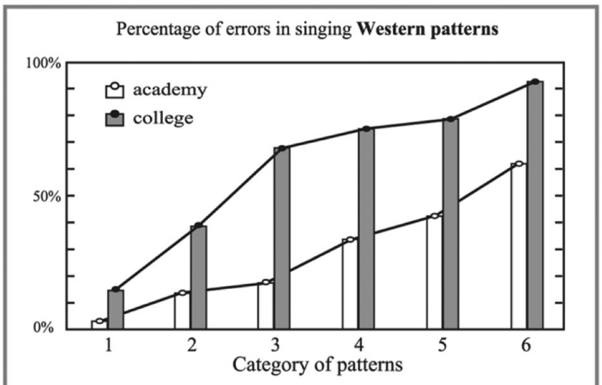

Figure 4: The effect of category of patterns and knowledge (task 3)

Details of Figure 4:

The six categories arranged hierarchically by errors and degree of directionality

	No. of notes per pattern	Characterization of the patterns	Remarks about Errors
1	5-6	Broken chord followed by seconds in the opposite direction	• Concave > convex
2	7	Harmonic patterns with broken chords, ascending or descending, in different inversions	• Inversion > basic position • Descending > ascending • "Corrective" error
3	6	Internal splits with sequence	• Non-salient note > salient
4	12, 19	Long and divided: (a) into six links of trichords with sequence; (b) into two convex curves for a chord and for seconds	• Various kinds of reduction • "Corrections" in the direction of symmetry
5	7	No directionality, zigzag with large intervals	• Shifts of seconds, not of the opening notes and peaks
6	12-14	Deviations from a directional schema a: I-V-IV-I b: I-V-I and leading tones	• "Corrective" errors in various directions

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