JRME 1984, VOLUME 32, NUMBER 1, PAGES 35-47

An inverted-U theory of the relationship between the subjective complexity of and liking for different musical pieces was developed. The theory was then used to derive some predictions about the effects of repetition on liking for pieces of music of different styles chosen to represent contrasting levels of objective complexity. These predictions were tested in two experiments. The first experiment was a short time-scale study in which two pieces ("easy-listening" music and avant-garde jazz) were played to subjects three times during a single session. The second experiment involved repetition over 3 weekly sessions, as well as four times within sessions, of three pieces (popular, classical, and avant-garde jazz). The results of both experiments were interpreted as broadly supporting the inverted-U model although there were some surprising exceptions. These exceptions occurred when functions relating familiarity and liking were compared between musical styles, and they were tentatively explained in terms of attitudinal stereotyping.

David J. Hargreaves, *University of Leicester, England*

The Effects of Repetition on Liking for Music

The question of how the repeated playing of pieces of music affects people's liking for them has practical as well as theoretical implications. An understanding of the effects of "plugging" of pop songs on the radio, for example, would have clear significance for record companies and broadcasters, as well as for advertisers. Many songs in the pop charts gain in popularity with repeated playing by disc jockeys, rise to a peak, and then quickly decline. Presumably there is a critical point, somewhere before the peak occurs, at which further plugging ceases to have any positive effect. The shape of this popularity curve can be described as an inverted U. Our Aesthetics Research Group at Leicester University, England, has made extensive use of such inverted-U functions in theoretical discussions of aesthetic preferences and of cyclical vogues and fashions (see Sluckin, Hargreaves, & Colman, 1982, 1983). Wiebe's (1940) study is one of the few in the literature to attempt any kind of controlled study of the effects of radio plugging on liking for music.

For reprints of this article, contact David J. Hargreaves, Aesthetics Research Group, Department of Psychology, the University of Leicester, LE1 7RH, England.

The author would like to thank Ian Cockerill, Helen Dodd, and Linda Hargreaves for help with data collection.

The "repeated exposure" paradigm has been used quite extensively in laboratory studies of aesthetic preferences. R. B. Zajonc, in particular, has employed it in investigations of his hypothesis that there exists a positive relationship between the "mere exposure" of stimuli and subjects' liking for them (see Zajonc, 1968). Zajonc's investigations have largely used visual stimuli, although Heingartner and Hall (1974) interpret the results of two experiments in which children and adults were repeatedly exposed to excerpts of Pakistani music as evidence in support of Zajonc's hypothesis. Our own research, which has not employed this paradigm so far, has led us to interpret such "mere exposure" effects as part of a more comprehensive inverted-U theory of the relationship between familiarity and liking, which is obtained when the familiarity variable is sampled appropriately (see Sluckin, Colman, & Hargreaves, 1980).

Our review of the literature on novelty and aesthetic preferences (Sluckin, Hargreaves, & Colman, 1983) includes a detailed account of laboratory studies of the effects of repetition of music, as well as a discussion of two main ways in which the inverted-U hypothesis can be applied to musical appreciation. The first of these concentrates on likes and dislikes for given pieces at a given point in time and draws on the work of Davies (1978) and Heyduk (1975). The basis of the argument is that liking for a piece is at its maximum at an optimum, intermediate level of *subjective complexity,* and subjective complexity is a function of the objective characteristics of the piece as well as of the musical experience and sophistication of the listener. If subjective complexity is too low, as in the case of a highly experienced subject listening to a very simple piece, liking will be low; if it is too high, as in the case of a naive subject listening to a very complex piece, liking will also be low.

The second type of inverted-U function is that which describes patterns of liking for the same piece at different points in time, such as in the case of songs in the pop charts mentioned earlier. Our review of the repetition studies, which have largely used real-life musical material and relatively naturalistic listening conditions, led us to conclude that "no consistent findings emerged. . . . These studies used a variety of different samples of subjects, types of music, experimental procedures, and methods of analysis" (p. 263). Lundin's (1967) earlier review of the area was less pessimistic than this, and led him to conclude that "Although our studies do not show complete agreement, certain trends are evident in regard to the pleasant-unpleasant function of the stimulus with repetition and familiarity of the stimulus" (p. 176). The five trends Lundin describes can all be interpreted in terms of the two inverted-U functions, with variations in the peaking of the curves for different types of music. One such trend, for example, is that "Popular music tends to read the maximum of pleasantness at an early repetition, whereas classical selections reach their affective height with later performance" (p. 176).

The aim of the present research was to test some predictions derived from these two different forms of inverted-U theory about the likely effects of repetition of different styles of music. The two interdependent

stimulus variables under investigation were *complexity* and *familiarity* and a distinction can be made between the *objective* and *subjective* components of each of these. The *objective complexity* of the stimuli was varied by using pieces of music that are typical of different styles. A Beethoven symphony, for example, could be shown to be more complex than a nursery rhyme; sophisticated computer-based techniques have been developed for the content analysis of different aspects of musical themes (Simonton, 1980). Given roughly equivalent levels of sophistication in a group of listeners, the relative levels of *subjective complexity* of two pieces of music should correspond to some degree with those of objective complexity. The *objective familiarity* of different pieces can be manipulated directly by repeated exposure, and this should produce roughly equivalent changes (i.e., increases) in rated levels of *subjective familiarity* if the pieces were initially unfamiliar to the same degree.

The crucial point is that the increases in objective and subjective familiarity that occur with repetition also have the effect of lowering levels of subjective complexity; Heyduk (1975) explored this interaction between the two variables in his demonstration that "the expected functions relating experience to preference may be derived from the functions relating complexity to preference" (p. 85). In summary, the proposal is that objective complexity and objective familiarity can be manipulated to produce changes in subjective complexity, and that these can predict levels of liking according to the inverted-U hypotheses outlined earlier. If the initial level of subjective complexity of a piece is higher than the subject's optimum level, repetition will tend to increase liking for it as its complexity will be reduced, and move nearer to the subject's optimum level. If the initial level is too low, however, further exposure will tend to decrease liking for the piece, as its subjective complexity will move even further away from the optimum level. Such a model may be able to explain how musical preferences evolve and change over long periods of time.

In the present research, pieces were employed from four contrasting musical styles that were hypothesized to differ in objective complexity level: pop, "easy listening," classical, and avant-garde jazz. The prediction was that the first and second of these would be less complex than the third and fourth. Two problems inherent in this approach are that the precise levels of complexity are unknown, and that musical "styles" are arbitrarily defined, culture bound, and ever changing. Edmonston (1969) tried to avoid these problems by using extremely unfamiliar Indian music; some researchers have employed nonmusical tone sequences (e.g., Vitz, 1966), and Heyduk (1975) suggested a compromise in which realistic-sounding piano pieces were specially composed to represent differing degrees of chordal and rhythmic complexity. Nevertheless, it was felt that the advantages of a naturalistic approach outweighed those of a strictly experimental one in this case (see discussion by Sluckin, Hargreaves, & Colman, 1983).

A further potential problem is the question of whether listeners react to an individual piece of music or whether they treat the piece as an exemplar of the musical style it represents, and make judgments about

the style rather than the piece per se. It was decided to minimize the possible effects of this problem by selecting pieces that were typical of a given style and yet were so obscure that the probability of any subjects having heard any of them before would be exceedingly low.

One issue that remains unexplained in music repetition studies concerns the time scale: Verveer, Barry, and Bousfield (1933) are the only researchers to distinguish between what they term *continuous repetition* and *repetition at intervals*. This distinction is analogous to that between massed and distributed practice in skills research. Verveer et al. found that repeated playing of "jazz selections" *within* testing sessions (continuous repetition) tended to produce an increase in pleasantness ratings (on a 20-point scale) that rose to an affective peak at some optimal level of familiarity and then declined; this is a clear inverted-U effect. After an intervening interval of 1 week, however (repetition at intervals), the pleasantness ratings rose again; the 1-week interval had the effect of reviving liking for the pieces. Verveer et al. point out that apparently discrepant results obtained by other investigators may be reconcilable in terms of this distinction. The present research therefore employs both techniques.

Experiment 1 is a short time-scale study using continuous (i.e., within-session) repetition only with two pieces (easy-listening music and avant-garde jazz); Experiment 2 is larger in scale, using both types of repetition with three pieces of music (pop, classical, and avant-garde jazz).

EXPERIMENT 1

Method

Subjects. These were 59 adults drawn from three different groups. Two groups (n = 16 and 22) were adult education students attending Saturday schools on "Psychology and Music"; the third was a group of psychology undergraduates (n = 21). The sample was therefore fairly heterogeneous with respect to age, educational background, and musical experience, and consisted of approximately equal numbers of males and females.

Musical material. This consisted of two tape-recorded extracts lasting approximately 1 minute each. The first, chosen to represent avant-garde jazz music, was taken from *Milk Teeth,* by A Touch of the Sun. The second was identified easy-listening music, used to fill in between programs on BBC Radio 4. These pieces were chosen to be clearly representative of the avant-garde jazz and easy-listening styles and to be so little-known that it would be highly unlikely that any of the subjects would ever have heard either of them before.

Design and procedure. Each subject group was scheduled to meet for a class lasting approximately 3 hours, with a 1/2-hour break: the experiment was incorporated into these sessions so that the subjects heard both extracts three times. They were played together in the same order (avant-garde, then easy listening) at the beginning of the class, approxi-

mately half-way through, and then again at the end. Subjects were asked to rate each extract on two 5-point scales after each playing, and it was made clear that they were free to change their ratings during the course of the experiment. The scales were for liking, ranging from 1 (strongly dislike) through 3 (neither like nor dislike) to 5 (strongly like) and familiarity, ranging from 1 (very unfamiliar) through 3 (neither familiar nor unfamiliar) to 5 (very familiar).

RESULTS

The ratings on each scale were subject to two-way analyses of variance with both "piece" and "playing" as within-subjects factors. The summary tables appear in Table 1, and the interactions are shown in Figure 1.

Table 1
The effects of repetition ("playing") on subjects' ratings of pieces ("piece") for liking and familiarity; F ratios from two-way analyses of variance, Experiment 1.

Variable		Liking			Familiarity		
	df	Mean square	*F*	*p*	Mean square	*F*	*p*
Playing	2, 116	.27	1.03	*ns*	7.09	32.68	<.001
Piece	1, 58	54.58	13.44	<.001	311.37	178.86	<.001
Playing × piece	2, 116	.99	4.18	<.05	2.51	11.36	<.001

DISCUSSION

The strong main effects of "piece" in the analyses show that the easy-listening piece was rated as more familiar by the subjects, and that it was liked more by them overall. The first result confirms that the pieces selected did possess markedly different levels of familiarity, and the second suggests that the easy listening piece was closer to the subjects' optimum level of subjective complexity throughout the experiment. Although there was no significant change in the liking ratings of the pieces over the three playings, the familiarity ratings rose consistently for both, as might be expected for initially unfamiliar stimuli that are repeatedly exposed.

Both "piece by playing" interactions are statistically significant; Figure 1a, for liking, shows that this provides support for the optimal subjective complexity model. The initially very unfamiliar and subjectively complex avant-garde piece shows a steady rise over the three playings, but presumably still does not reach the optimal level. The easy-listening piece, on the other hand, has a lower initial level of subjective complexity; liking for it increases from the first to the second playing, and then declines to a final, lower level in the third. Although the time scale is very short, this can tentatively be interpreted as an inverted-U effect.

Figure 1a

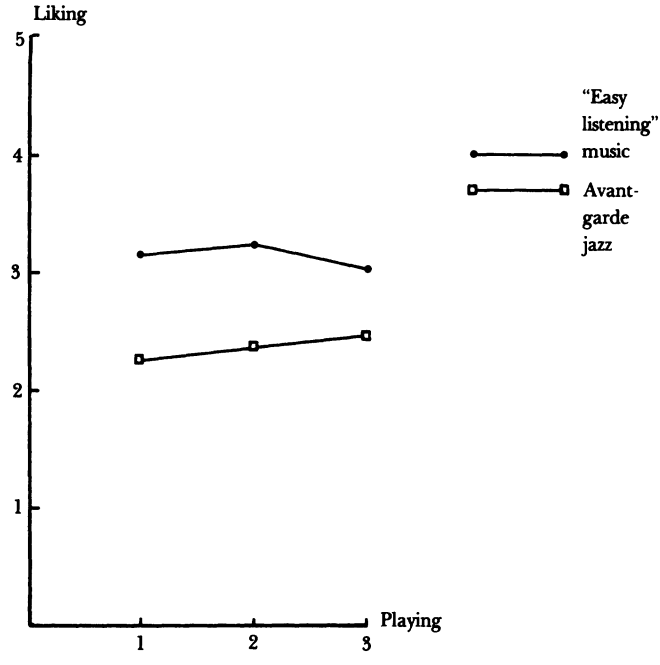


Figure 1b

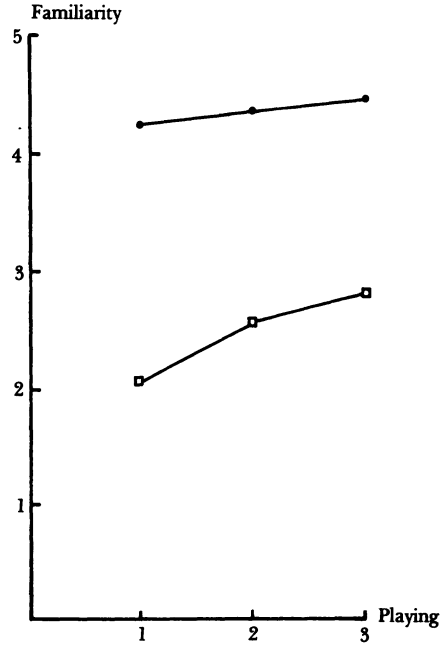


Figure 1. The effects of repetition on ratings of liking (Figure 1a) and familiarity (Figure 1b), Experiment 1.

Figure 1b shows that in the case of the familiarity ratings, the significant interaction arises because the increase for the better-liked easy-listening piece is slow and consistent, whereas that for the avant-garde piece is much sharper, especially between the first and second playings. The small-scale nature of this experiment means that the findings are likely to be limited in their generality, although they are broadly in line with our theoretical predictions. The second experiment therefore extends the scope of the investigation by using more pieces, more repetitions of each within sessions, 7-point rather than 5-point scales; and by introducing repetition at intervals alongside continuous repetition.

EXPERIMENT 2

Method

Subjects. There were 40 undergraduate arts, science, and social science students, ranging in age from 18 to 22 years, with equal numbers of males and females. They were randomly selected in terms of musical training and experience.

Musical material. Three 1-minute extracts were selected to represent different musical styles. The extract of avant-garde jazz used in Experiment 1 was used again here; pop music was represented by an extract from "Call Me," from *Cut Above the Rest,* by The Sweet, and classical music was represented by an extract from the first movement of Béla Bartók's *Second Piano Concerto.* As in Experiment 1, these pieces were selected to be clearly representative of their respective styles and to be relatively obscure.

Design and procedure. Subjects were assembled in groups numbering approximately 5 to 10 for three separate testing sessions held at 1-week intervals. In each session, which lasted approximately 20 minutes, the three extracts were played four times each. To check that the order of playing would have no systematic effect on the ratings, two tapes were prepared on which the 12 stimuli were recorded in different random orders. These orders were determined by the use of random number tables; half the subjects were randomly assigned to listen to Tape A, the other half to Tape B, and each half heard the same tape on all three testing sessions. The 12 stimuli were separated by 10-second intervals on each tape; subjects were asked to rate each stimulus on two 7-point scales during these intervals, and it was made clear that they were free to change their ratings during the course of the experiment. The scales were 7-point versions of those used in Experiment 1, and thus ranged from 1 (strongly dislike) to 7 (strongly like), and from 1 (very unfamiliar) to 7 (very familiar).

RESULTS

To investigate potential playing order effects, the mean liking and familiarity ratings given by the subjects in the Tape A and Tape B

groups to each of the 12 stimuli were calculated for each testing session separately. Product-moment correlations were then calculated between these 36 mean scores of the two playing order groups; the coefficients were .957 and .919 for the liking and familiarity ratings respectively. Since both of these are significant at well beyond the .001 level, it was concluded that playing order had no systematic biasing effect on subjects' ratings and subsequent analysis was carried out on the data for all 40 subjects combined.

The ratings on each scale were subjected to three-way analyses of variance, with "week," "playing," and "piece" all as within-subjects factors. The summary tables appear in Table 2 and the interactions are shown in Figure 2.

DISCUSSION

Perhaps the most striking feature of the interaction graphs for the liking ratings in Figure 2a are the clear separations between the three pieces. The pop music piece was liked best, the classical piece second, and the avant-garde piece least on all 12 occasions; the main effect for "piece" is statistically significant. The main effect for "week" shows that there was a significant overall rise in liking for all three pieces, and the significant "week by piece" interaction indicates that these patterns of change between weeks were not uniform. Further inspection of Figure 2a shows that the avant-garde piece remained at a low level of liking throughout; this runs counter to the predictions of the inverted-U theory. The theory predicts that initial levels of liking should be low, as the subjective complexity of the piece should be well above the optimum level for most subjects; and that repetition should produce a reduction in subjective complexity, with a corresponding increase in liking.

The ratings of the other two pieces do conform to the predictions of the inverted-U theory: in each case, there was a rise during the first and second weeks, and a subsequent decline during the third. If it can be assumed that the classical piece is of greater complexity than the popular one, it follows that the ratings of the latter should peak earlier and decline more rapidly than those of the former, and that the two curves should intersect. The fact that this did not occur may mean that the initial assumption about the complexity of the two pieces is incorrect; or it may be the result of a strong preference for pop music on the part of our undergraduate student subjects. Whatever the explanation, it is quite surprising that the effect was maintained over 12 playings.

Generally speaking, the "week" effects (those of repetition at intervals) were stronger than the "playing" effects (those of continuous repetition). There was no significant main effect for "playing," nor was there a significant "playing by piece" interaction, although the "week by playing" interaction reached significance at the .05 level. This can be interpreted as further support for an inverted-U theory explanation of these results; the patterns of change within sessions differed between the 3 weeks in that a general rise in ratings in the first 2 weeks contrasted with a general fall in the third.

Table 2 shows that in the case of the familiarity ratings, all main effects and two-way interactions were significant; only the three-way interaction failed to reach the .05 level. There is little to be gained by interpreting all these results individually; Figure 2b shows that the familiarity ratings for all three pieces reach a ceiling after a negatively accelerating rise over the 12 playings. The striking feature of these curves is that the separation between the three pieces precisely matches that for the liking ratings; the popular piece is rated as most familiar, the classical piece as second, and the avant-garde piece as least familiar, on all 12 occasions. The fact that subjects rated the latter piece as between five and six on the familiarity scale on average, on all playings during week 3, makes it even more surprising that its liking ratings remained so low throughout.

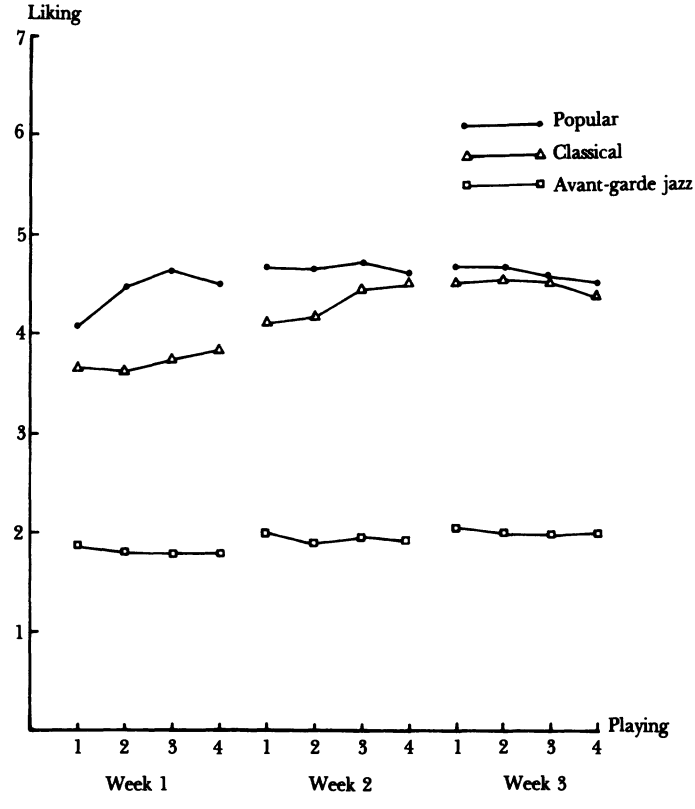
GENERAL DISCUSSION

Generally speaking, the results of the two studies taken together show that the changes in patterns of liking for the experimental pieces that occurred as a result of repetition did conform to the inverted-U subjective complexity hypothesis outlined in the abstract. The notable exception to this was the avant-garde piece: its ratings rose in Experiment 1, but showed no change in Experiment 2, even though the latter involved many more repetitions. It may be possible to account for this difference between the studies in terms of the modal preferences of the two subject groups—the subjects in Experiment 1 were more heterogeneous and possibly more musically sophisticated than those in Experiment 1—although the rise in liking ratings of the avant-garde piece in

Table 2
The effects of repetition within ("playing") and between ("week") testing sessions on subjects' ratings of pieces ("piece") for liking and familiarity; F ratios from three-way analyses of variance, Experiment 2.

Variable	*df*	Liking			Familiarity		
		Mean square	*F*	*p*	Mean square	*F*	*p*
Week	2, 78	19.78	8.75	<.001	854.10	96.38	<.001
Playing	3, 117	.59	2.33	*ns*	90.29	89.61	<.001
Piece	2, 78	964.39	65.12	<.001	193.62	37.24	<.001
Week × playing	6, 234	.63	2.82	<.05	21.03	18.39	<.001
Week × piece	4, 156	4.85	2.84	<.05	12.42	10.25	<.001
Playing × piece	6, 234	.54	1.56	*ns*	.97	2.21	<.05
Week × playing × piece	12, 468	.51	1.65	*ns*	.59	1.53	*ns*

Figure 2a



Experiment 1 was small in any event.

There was no strong evidence of any consistent "recovery" effects of the type found by Verveer et al. (1933) between weeks in Experiment 2; the inverted-U curves were manifested across all 12 playings of the popular and classical pieces rather than within testing sessions. The statistical significance of these inverted-U-shaped patterns of change with time was shown by the interactions between piece and repetition in both studies (i.e., "piece by playing" in Experiment 1 and "week by piece" in Experiment 2) in the absence of a significant main effect for "playing" (i.e., within sessions) in either study.

The strongest common effect, however, was that for "piece" in both experiments; although repetition can change levels of liking *within* different musical styles, it seems that the rank order of preferences *between* styles cannot be changed. We must temper any "aesthetic" explanation of this with the knowledge that a subject's very first ranking of the piece may reflect a preference that is consistent through subsequent ratings. Nevertheless, the clear correspondence between the ratings of familiarity and liking with respect to the different pieces leads to the tentative speculation that although inverted-U functions relating

Figure 2b

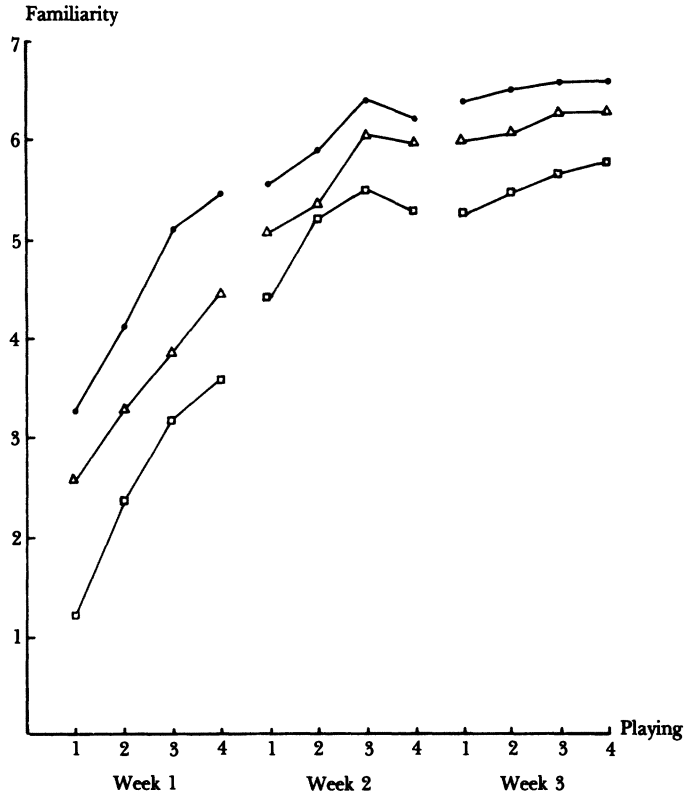


Figure 2. The effects of repetition on ratings of liking (Figure 2a) and familiarity (Figure 2b), Experiment 2.

familiarity and liking for music may operate (a) over time, with given pieces, and (b) between pieces within given musical styles or genres, they do not cross the boundaries between different styles. Subjects seem to maintain watertight divisions between what they perceive as being different styles, such that one would predict a simple positive correlation between familiarity with and liking for a range of different representative pieces.

This could simply reflect the commonsense notion that people listen most to the styles of music they like best. It could be a result of the stereotyping of preferences for styles, which I have referred to elsewhere as "musical prejudice" (Hargreaves, 1982). Such stereotyping could explain some of the unexpected results of our two studies. The persistent dislike of the avant-garde piece among subjects in both studies, for example, and the consistently high liking ratings of the pop music piece (which would be regarded by many experts as simple and banal) in Experiment 2 could both be accounted for in these terms. To

try to disentangle inverted-U effects, which seem to predominate within styles, from stereotyping effects, which are more likely to operate between them, remains a complex and fascinating task.

Any progress achieved along these lines would have clear implications for music education. The inverted-U theory could be used to make predictions about the probable effects of listening training on pupils' liking for and eventual appreciation of particular pieces of music. Whether such training produces increases or decreases in liking will depend upon the relationship between the characteristics of the pieces and those of the pupils, as described earlier in the review of literature. It would seem reasonable to propose that there is an optimal level of discrepancy between the objective complexity of a given piece, and its corresponding level of subjective complexity in the listener. Training pupils to listen to pieces possessing this optimal level of discrepancy would maximize the likelihood of an increase in liking; of moving along the rising part of the inverted-U curve toward its peak. This proposal, and its practical implications, could be discussed at length—but it would be inappropriate to do so here. It is much more difficult to specify how stereotyping effects should be dealt with by music educators. Maybe the awareness of their existence and their investigation along the lines of the present research is an important first step.

REFERENCES

Davies, J. B. (1978). *The psychology of music.* London: Hutchinson.

Edmonston, W. E. (1969). Familiarity and musical training in the esthetic evaluation of music. *Journal of Social Psychology, 79,* 109–111.

Hargreaves, D. J. (1982). Preference and prejudice in music: a psychological approach. *Popular Music and Society, 8,* 13–18.

Heingartner, A., & Hull, J. V. (1974). Affective consequences in adults and children of repeated exposure to auditory stimuli. *Journal of Personality and Social Psychology, 29,* 719–723.

Heyduk, R. G. (1975). Rated preference for musical composition as it relates to complexity and exposure frequency. *Perception and Psychophysics, 17,* 84–91.

Lundin, R. W. (1967). *An objective psychology of music.* 2nd ed. New York: Ronald Press Co.

Simonton, D. K. (1980). Thematic fame and melodic originality in classical music: a multivariate computer-content analysis. *Journal of Personality, 48,* 206–219.

Sluckin, W., Colman, A. M., & Hargreaves, D. J. (1980). Liking words as a function of the experienced frequency of their occurrence. *British Journal of Psychology, 71,* 163–169.

Sluckin, W., Hargreaves, D. J., & Colman, A. M. (1982). Some experimental studies of familiarity and liking. *Bulletin of the British Psychological Society, 35,* 189–194.

Sluckin, W., Hargreaves, D. J., & Colman, A. M. (1983). Novelty and human aesthetic preferences. In J. Archer and L. Birke, (Eds.) *Exploration in animals and humans.* London: Van Nostrand.

Verveer, E. M, Barry, H., & Bousfield, W. A. (1933). Changes in affectivity with repetition. *American Journal of Psychology, 45,* 130–134.

Vitz, P. C. (1966). Affect as a function of stimulus variation. *Journal of Experimental Psychology, 71,* 74–79.
Wiebe, G. (1940). The effect of radio plugging on students' opinions of popular songs. *Journal of Applied Psychology, 24,* 721–727.
Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology,* Monograph Supplement, *9*(2), Part 2.

November 18, 1983