
Effects of Musical Soundtracks on Attitudes toward Animated Geometric Figures

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We investigated the effects of musical soundtracks on attitudes to figures in a short animated film. In a preliminary study and in the main experiment, subjects saw the film accompanied by one of two soundtracks or with no soundtrack, or they heard one of the two soundtracks alone. In the main experiment, Semantic Differential judgments on Activity and Potency dimensions, obtained for the music, predicted effects of the soundtracks on corresponding ratings of the film as compared to ratings in a no soundtrack condition. As well, ratings on the Activity dimension of the film characters themselves were altered by the soundtracks. It is hypothesized that congruent auditory and visual structure directs the encoding of particular visual features of the film. In addition, associations generated by the music provide a context for the interpretation of the action in the film. As a result, stimulus features and concepts that are initially encoded as disjunctive conjoin in perception and memory.

MUCH of the recent progress in music cognition research concerns the representation of structural relations. A few researchers, however, have promoted the importance of investigating the affective and connotative aspects of musical information as well (e.g., Makeig, 1982). Research of the latter type has often attempted to elicit evidence for a particular emotion or connotation associated with a musical stimulus (Levi, 1982; Makeig & Balzano, 1982; Trehub, Cohen & Guerriero, 1986). Other research has investigated the effects of music on physiological responses (see Thayer & Levenson, 1983 for review). The present research takes a less direct approach and examines how music affects the attitudes toward and meaning of a short film.

Music and film complement each other in the type of information each can portray. Whereas music can provide specific emotional information, it lacks the ability of film to depict specific actions (Musselman, 1974). The experimental study of both music and film may seem to be a more difficult

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problem than the consideration of music alone but, in fact, may highlight aspects of music overlooked when the auditory modality is in isolation.

The film selected for this study was the 2-min abstract animation of Heider and Simmel (1944) that elicits a predictable interpretation by almost all viewers. In the film, three figures, a large triangle, a small triangle, and a small circle, move in and about a rectangular enclosure that opens and closes via a hinged line segment. The relations among the moving shapes elicit specific attributions of personality (e.g., the large triangle is typically referred to as being aggressive). A similar process may apply in musical listening situations, in that certain relations among tones in the music bring to mind connotative attributes (Levi, 1982; Meyer, 1956); for example, both musical and human stimuli can generate impressions such as warm, gentle, or aggressive. Heider (1958), following Kohler (1929), also pointed out that the structural descriptions of the dynamics of music (e.g., *accelerando* and *crescendo*) are fitting descriptions of social action. The following work investigates the role of connotative and structural information provided by musical soundtracks upon the stereotypic judgments in the Heider and Simmel film. A preliminary study is briefly reported providing an introduction to both the methodology and the basis for the subsequent main experiment.

Preliminary Study

Thayer and Levenson previously investigated the effects of two different soundtracks on psychophysiological responses to a stressful film and obtained evidence for the efficacy of music in manipulating the stressfulness. The preliminary study was designed to test the hypothesis that two musical passages that are attributed significantly different meanings will, when used as musical soundtracks for a film, differentially influence meaning of the film. The last 2 min of the *Adagio* and *Allegro Marcato* movements of *Symphony No. 5* by Prokofiev were selected as contrasting soundtracks for the Heider and Simmel film.

METHOD

Subjects and Instructions

Twenty-five students from the Introductory Psychology volunteer subject pool were randomly assigned to one of five conditions ($N = 5$): *Adagio-Film*, *Allegro-Film*, *Film Only*, *Adagio Only*, and *Allegro Only*. Subjects were told that first they would listen to music/watch a short film and then would fill out a questionnaire about what they had heard/seen. They were given standard instructions for completing the rating scales found in the questionnaire as outlined below for the five conditions.

Experimental Conditions

Music–Film

In the two experimental (Adagio–Film, Allegro–Film) conditions, the film with music was presented twice in succession on a video monitor. Playback was carried out on a video recorder. All music had been recorded on equipment in a professional recording studio.

On the questionnaire, subjects first were asked to describe what happened in the film, and to supply adjectives describing the large and small triangles, the circle and, finally, the music. Then they assessed each figure and the music on 13 rating scales. The ratings are the main concern in this article. The bipolar rating scale items are indicated in Figures 1, 2, and 3. On the basis of intuition, the bottom of the scale represents the member of each pair most appropriate to Allegro music, for example, *sad/happy*, *cowardly/brave*. (Provoker/provoked was excluded from the music questionnaire.)

Control Conditions

Film Only

The film was presented twice. Subjects filled out a questionnaire on the film identical to that for the Music–Film conditions.

Music Only

In both Adagio Only and Allegro Only conditions, subjects heard one of the film soundtracks played twice with the picture screen of the monitor blackened. The subjects then completed the questionnaire, which began by asking if the music reminded the subject of a situation or story and to describe it if so. The remainder of the procedure was identical to that for the music portion of the Music–Film conditions.

RESULTS

Music

Stories

The stories produced under the Music Only conditions were idiosyncratic and varied from a description of the note patterns, to past experiences in playing or hearing music, to statements of emotions, and sometimes a partial or complete narrative.

Ratings¹

The two pieces of music received different ratings. As seen in Figure 1, collapsing the data over all subjects who heard the music and over the first

1. The rating data for music and film were submitted to statistical analyses such as will be reported in the main experiment. For present purposes, the report of the results of the preliminary study is descriptive and graphic. Complete analyses are available from the second author.

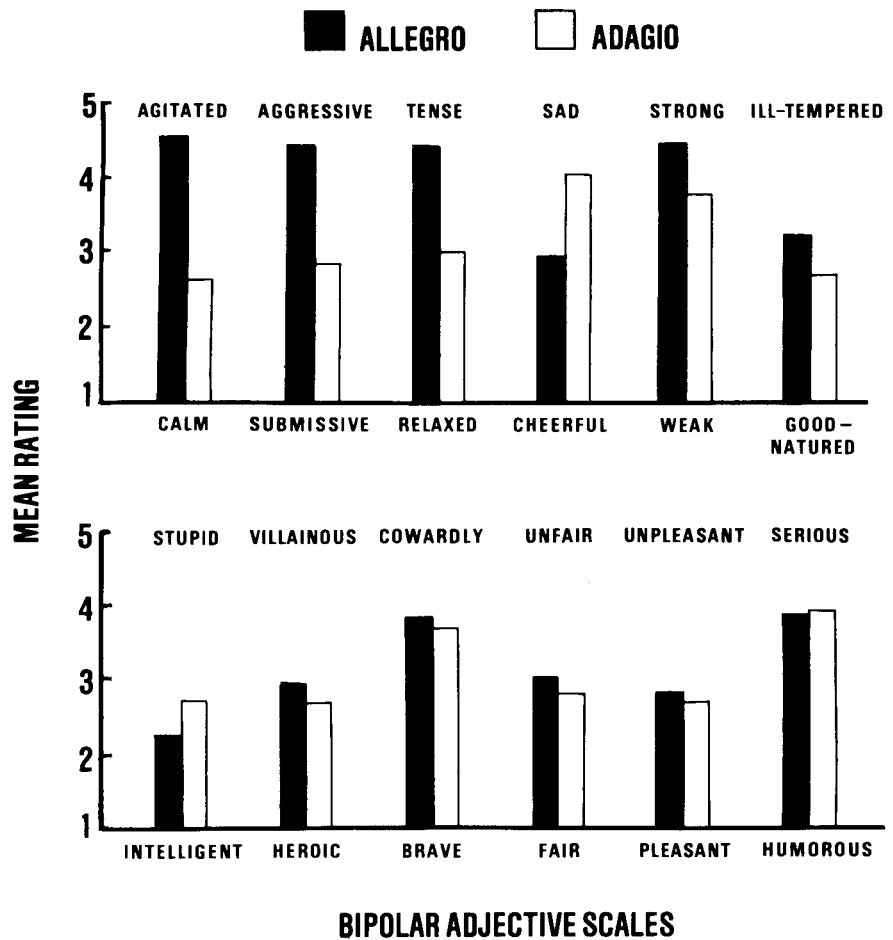


Fig. 1. Mean ratings of the musical soundtracks for the bipolar adjective scales for Adagio and Allegro music conditions.

and second questionnaire, the Allegro music is rated as more agitated, aggressive, and tense than the Adagio music but less cheerful. Both pieces were judged similarly on some categories, for example, pleasantness and bravery.

As shown in Figure 2 ratings of the music depended to some extent on whether the music was presented with or without the film; for example, the presence of the film led to more humorous, unpleasant, fair, and villainous ratings.

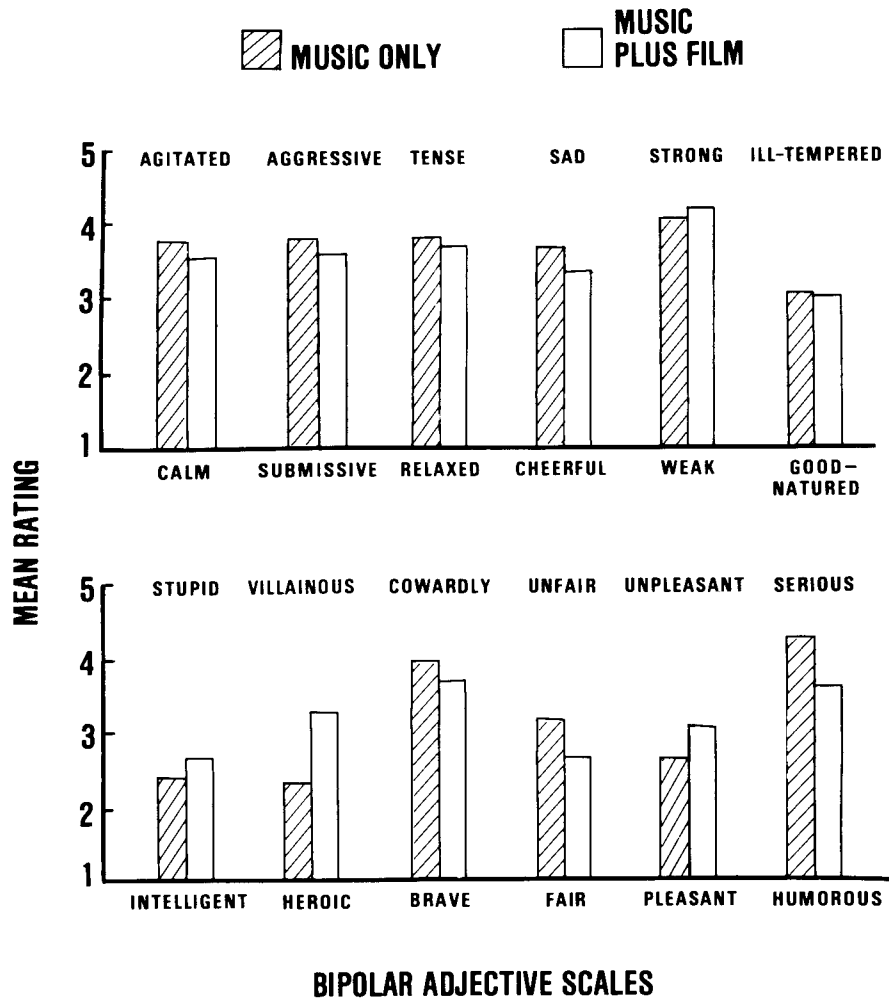


Fig. 2. Mean ratings of the musical soundtracks for the bipolar adjective scales for Music-Only and Film plus Music conditions.

Film

Stories

In contrast to the Music Only conditions, stories produced under all film conditions were very similar. It is reported typically that a pair of friends (the small triangle and the circle) are antagonized by a “bully” (large triangle) who is failing to achieve his goal takes out his anger by destroying his home.

Ratings of Film Elements

Collapsing over the three conditions of soundtrack, as shown in Figure 3 the large triangle has higher values for all but two dimensions. The circle is attributed greatest weakness and submissiveness. Inspection of the data separately for the three soundtrack conditions revealed differences in the rating of the figures for the calm–agitated category. Figure 4 illustrates the mean rating on the calm–agitation dimension for the three film figures under each of the film/music conditions. The Adagio condition produced lower mean ratings of agitation for both large triangle and small circle, but higher mean ratings for the small triangle when compared with the Allegro soundtrack and control condition. The relative calm–agitation ratings for the small triangle and circle reverse under the Allegro and control condition.

DISCUSSION

The music ratings indicated that the two musical soundtracks differed in meaning, justifying the use of these materials for investigation. With respect to the animated film, in general, the stereotypic meaning attributed to figures observed by Heider and Simmel was replicated. Different ratings on the calm–agitation dimension of the film figures under the soundtrack conditions suggest effects of the music on the meaning of the film characters. This idea is further bolstered by the fact that the category in which the two types of music differ most (calm/agitated) is the same as that for which the interaction between figure judged and soundtrack condition appeared. This observation encouraged further study of the direct effects of soundtracks on meaning.

Experiment

Judgment on an individual rating scale is not as reliable an indicator of meaning as the average of judgments on a number of related categories. Bipolar adjective pairs within a set of related rating scales often display correlational tendencies and this has led to the examination of three broad categories: Evaluative (e.g., good/bad), Potency (e.g., weak/strong), and Activity (e.g., active/passive) (Osgood, Suci, & Tannenbaum, 1957). Tannenbaum (1956) compared the effects of music and silence on the overall ratings of a theatrical production. Music was found to increase the judgments of the Potency and Activity of the production, where judgments were summed from three bipolar adjective pairs for each of the three dimensions examined. The main experiment in this report was carried out using this

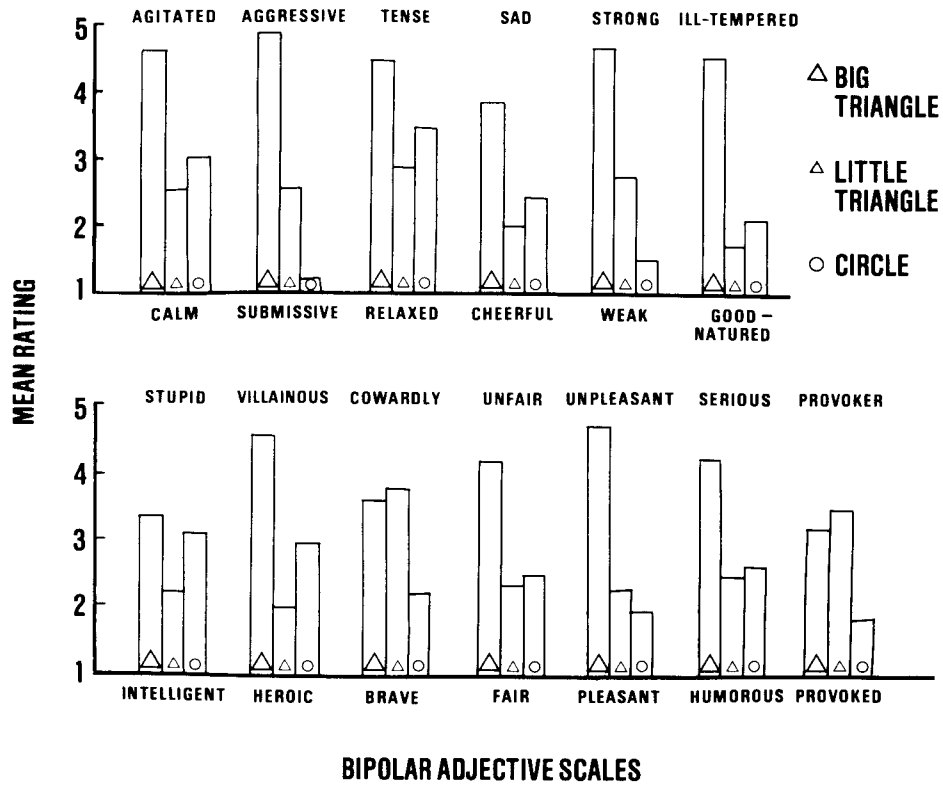


Fig. 3. Mean ratings of the large triangle, small triangle, and the circle on the bipolar adjective scales.

technique to determine effects of music on the meaning of the film. Following from the preliminary work, the investigation explored the relation between the dimensions of difference in two soundtracks and the dimensions on which meaning in the film is altered, thus, testing the hypothesis that two soundtracks that differ on a particular dimension will influence the judgments of meaning of a film on that dimension.

Two contrasting but structurally similar musical accompaniments were composed for use in the study. The previous scaling instrument was refined so as to allow more precise exploration of effects on the Evaluative, Potency, and Activity dimensions. Each of the three dimensions were represented by four bipolar adjective scales resulting in a 12-item scale shown in Table 1. A questionnaire for the film overall was included.

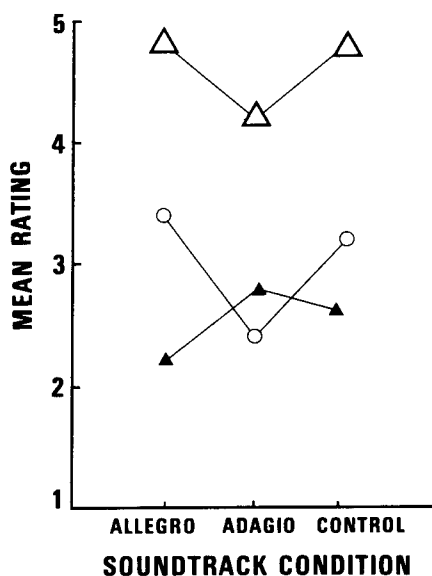


Fig. 4. Mean rating on the calm-agitation dimension for the three film characters as a function of the Allegro, Adagio, and Control soundtrack conditions.

TABLE 1
Semantic Differential Scale Items

Evaluative Dimension	Potency Dimension	Activity Dimension
nice/awful good/bad beautiful/ugly pleasant/unpleasant	weak/strong powerless/powerful submissive/aggressive small/large	calm/agitated passive/active quiet/restless fast/slow

METHOD

The apparatus was the same as that of the preliminary experiment. The scores, composed by one of the experimenters (S.M.), were performed on piano and recorded directly onto the soundtrack of the videotape of the film. Both pieces incorporated three main "themes" used at specific points in the film. As shown in Figure 5, the first theme (a) accompanied the introduction of the large triangle, the second theme (b) was presented when the large triangle contacted the smaller triangle, and the third theme (c) accompanied the "chase" between the large triangle and the other two figures around the rectangular enclosure. One piece, designated the "Weak Music" used a major key played at a moderate uniform tempo. Except for the cadence at the end, this version had a single-note texture including grace notes and was played in the second octave above middle C. The second version, designated the "Strong Music," incorporated a minor key, no grace notes, a slow but accelerating tempo, and a double or multinote texture, and was played below middle C.

WEAK-MUSIC SCORE:

STRONG-MUSIC SCORE:

Fig. 5. Themes employed for the Weak and Strong musical soundtracks.

Procedure

The procedure was the same as for the preliminary study with the exceptions as previously described. There were five conditions (Strong-music film, Weak-music film, Strong music, Weak music, and Film) with six student volunteers in each. The 12 items in the rating scale were arranged in three random orders, creating three forms. The three forms of the scale were then presented in random order to subjects in the three film conditions, one form being used to rate one of the three figures.

Results and Discussion

MUSIC

Illustrated in Figure 6a are mean ratings from the Music Only conditions for both music types on each of the Evaluative, Potency and Activity dimensions. The Strong music is markedly differentiated from the Weak music in terms of its high mean Potency ratings. It also is associated with somewhat higher mean ratings for both Evaluative and Activity dimensions.

Figure 6b illustrates mean ratings from the Music-plus-Film conditions for both music types on each of the three dimensions. Again, the greatest differentiation appears on the dimension of Potency, where the Strong music produces a high rating. The Strong music produces a higher rating on

the Activity dimension but also, in contrast to the Music Only conditions, a lower rating on the Evaluative dimension (i.e., closer to good on a good/bad exemplar).

An analysis of variance was performed for music ratings including all four groups who heard the music. The analysis involved two within-groups factors of exemplar and dimension having four and three levels, respectively, and two between-groups factors of type of music (Weak and Strong), and film absence or presence. There was a significant main effect for type of music [$F(1,20) = 8.1; p < .01$] and a significant effect of interaction between scale dimension and type of music [$F(2,40) = 8.8; p < .001$]. There was a significant 3-way interaction of scale dimension, music type, and film absence/presence [$F(2,40) = 3.7; p < .05$]. This is illustrated by the comparison of Figure 4a and 4b on the Evaluative dimension in particular as described above.

OVERALL FILM

The stories produced for the film were consistent with the original Heider and Simmel results.

Mean ratings on the three dimensions for the film overall are shown in Figure 6c. Compared to both Film–Music conditions, the Film Only condition is most pleasing, strong and active; Weak Music produces the lowest ratings. An analysis of variance was performed on the Semantic Differential ratings of the film for Weak and Strong soundtrack conditions. This analysis involved two within-groups factors of exemplar, and scale dimension, and one between-groups factor of film condition, having three levels. A significant main effect was found for scale dimension [$F(2,30) = 10.5; p < .001$] and an interaction was found for dimension and film condition [$F(4,30) = 2.6; p < .05$].

Film versus Music

A comparison of Figure 6b and 6c for the two Music-plus-Film conditions shows the effect of the interaction of scale dimension, medium (film or music), and soundtrack condition. For all dimensions, the direction of the difference in the judgments of the film is always matched by that for the judgments on the music, suggesting the interdependence of judgments of the film and music. Those differences are greater for music judgments. The pattern of relative ratings in the Music-Only conditions, Figure 6a, also matches that for the Music-plus-Film music judgments on the Potency and Activity dimensions. Music may exact a direct influence on these dimensions of the film. In contrast, the differences between the Music Only

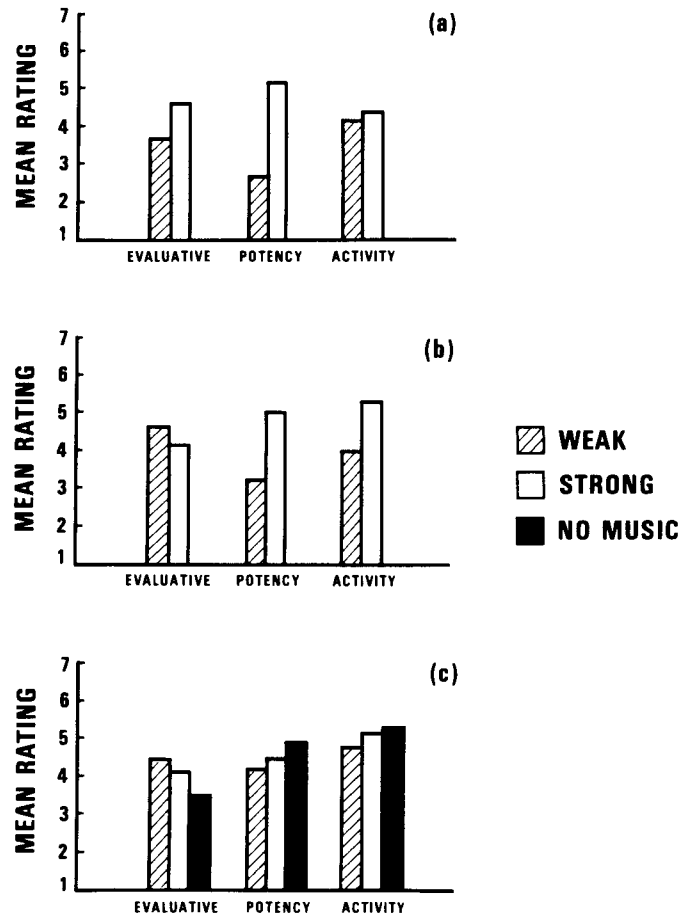


Fig. 6. Mean rating on the Evaluative, Potency, and Activity dimensions for (a) Weak and Strong Music-Only conditions; (b) Weak- and Strong-Music film conditions; and (c) Strong, Weak, and Control conditions of the film.

(Figure 6a), and the Film-plus-Music (Figure 6c) judgments on the Evaluative dimension suggest that the Evaluative rating of a film may be influenced by a musical soundtrack but this may have a component distinct from the independently derived Evaluative rating of the music. The similarity in Evaluative ratings for the film (Figure 6c) and Music-plus-Film (Figure 6b) soundtrack conditions suggests that the judgment may be based on a congruency of the music and the film.

An analysis of variance was carried out to compare the overall film assessments with those of music for Weak and Strong music soundtrack film conditions. There were three within-groups factors of exemplar, scale dimension, and medium (film or music) having four, three, and two levels,

respectively, as well as one between-groups factor of music condition having two levels. The scale dimension by music interaction was significant [$F(2,20) = 6.6; p < .01$] reflecting the lower values for Potency and Activity and higher values for Evaluative under the Weak music. The interaction of scale dimension, medium, and music condition was significant [$F(2,20) = 4.4; p < .05$] reflecting much lower Potency and Activity levels of the Weak music relative to ratings on these dimensions for the film.

FILM ELEMENTS

Consistently, the large triangle was attributed highest Potency, and Activity, and the lowest Evaluative ratings (e.g., most unpleasant), and the circle was attributed the lowest Potency and Activity ratings and the highest Evaluative rating. Figure 7 illustrates the interaction of scale dimension, figure, and soundtrack condition. On the Activity dimension, the rating of the small triangle greatly exceeds that of the circle in the condition with the Strong-music soundtrack as compared to the Weak-music and control conditions. Relative differences between the large triangle and the other two figures increase on the Evaluative dimension under the Strong music. Surprisingly, where the two soundtracks differ most, namely, the Potency dimension, there is the least evidence of effects of the soundtrack. The Potency ratings of the figures hardly change under the two soundtracks; the Potency ratings under the control conditions are however lower than those under the Strong music. An analysis of variance was carried out for the ratings of the figures in the three film conditions, with three within-groups factors of exemplar, scale dimension, and figures, having four, three, and three levels respectively, as well as one between-groups factor of film condition having three levels. Two significant main effects were apparent: that of scale dimension [$F(2,30) = 24.6; p < .001$] and figure [$F(2,30) = 29.5; p < .0001$]. A significant interaction was produced for dimension and figure [$F(4,60) = 11.4; p < .0001$], reflecting the attribution of badness and aggression to the large triangle, and goodness and weakness to the other figures, replicating Heider and Simmel in general. However, of more importance was the three-way significant interaction of scale dimension, figure, and soundtrack condition [$F(8,60) = 2.1; p < .05$] providing evidence of the effect of the music on the judgment of the meaning of the film characters.

In order to test the robustness of the effect of the music on the elevation of the judgment of the small triangle on the dimension of Activity, a follow-up experiment was carried out on the condition in which the film was presented with the accompaniment of the Strong music. Because in the control conditions of the Preliminary Study and the main experiment, the results for the small triangle had been consistently low on the Activity ratings, it was unnecessary to rerun a no soundtrack control condition.

Six subjects were tested in the Strong-music film condition of the main experiment. The mean judgments for the small triangle on the Activity dimension were again considerably higher than in the Control and Weak music conditions in the original experiment. An analysis of variance having two within subjects factors of dimension, and figure, with three levels each, collapsing over exemplar, produced a significant interaction between figure and dimension [$F(4,20) = 4.9; p < .01$].

The result of the change in meaning for the small triangle was therefore replicated. In the absence of the “Strong” music, it was typically judged as moderately Active but with the addition of “Strong” music its Activity rating increased. The response on the Activity dimension had been altered by the music. But in contrast to the preliminary study, the background music was not judged in the Music Only conditions as particularly different on this dimension. The results therefore suggest that the Activity dimension of film is highly vulnerable to musical influences and that the dimensions of greatest difference in musical backgrounds do not necessarily predict the dimension of change in meaning of the film.

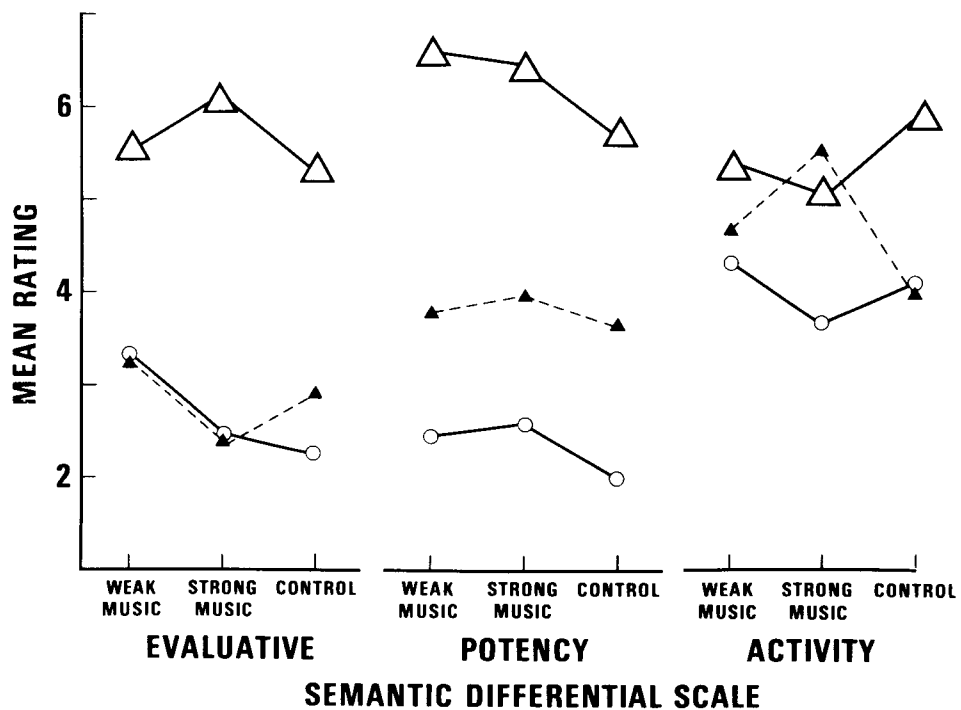


Fig. 7. Mean rating on the Evaluative, Potency, and Activity dimensions for the three film characters as a function of the Weak, Strong, and Control soundtrack conditions.

General Discussion

The main purpose of the study was to explore the influence of musical information on the interpretation of a film. In the preliminary study, the ratings of the small circle and large triangle on the calm–agitation dimension corresponded with the ratings of the musical background on this dimension, whereas judgments of the small triangle varied inversely. This led to the hypothesis that a soundtrack changes the meaning of a film in a rather direct way, that is, a soundtrack with a higher level on one dimension will lead to a high level of this dimension in some aspect of the film. In the main experiment, this hypothesis bore out in judgments of the film overall for the Potency and Activity dimensions and suggests that meaning of the music may become directly associated with the film on the Potency and Activity dimensions. On the Evaluative dimension, however, the soundtrack that received the highest ratings as judged by an independent group led to a lower judgment of the film on this dimension. This inverse relation suggests that the judgments of the film on the Evaluative dimension depend upon a complex interaction of the film and musical material. Such a relation may be affected by the appropriateness of the pairing of the music and the film, a type of cognitive congruency. This process accounts also for the same inverse pattern that appeared in the Evaluative judgment of the soundtrack by those who saw the film. A diagram representing the change of overall meaning of the film is shown in Figure 8a.

As for the judgments of the figures in the main experiment, there were changes on the Activity and Evaluative ratings, although the two musical backgrounds differed most on the dimension of Potency. In a replication of the Strong music condition, there was again a change in the response of the small triangle on the Activity dimension.

It is interesting to note that it is the Activity dimension on which a number of effects of music on judgment of the film occur. Music is a sequential stimulus for which meaning is achieved over time. Studies of the perceived similarity of musical passages reveal the salience of temporal characteristics of music in contrast to other features such as tonality and contour (Monahan & Carterette, 1985). Similarly, Kidd, Boltz, and Jones (1984) revealed in a discrimination study that subjects tended to judge melodies as being alike if their rhythms were identical even when the melodies differed substantially in frequency relations. Film and social action are also sequentially structured and also develop meaning over time. That is, the observer relates events that are not necessarily contingent. Unaccented events may receive little attention. The assignment of accent to events will affect retention, processing, and interpretation.

It is suggested that a temporal congruence between the music and the activity of the small triangle may have drawn attention to or accented the be-

havior of the small triangle, making the information available for processing and memory. In the absence of congruent temporal information, the attention remains directed toward (captured by) the large triangle, and in a subsequent questionnaire, the small triangle is awarded a low Activity value because there has been neither perception nor memory that it had been active.

The temporal component of music may then affect interpretation of a film through congruence with the action or pattern of motion of the film at least at an initial level of analysis. The sensitivity to invariance or redundancy is basic to theories of perception and information processing, for example, Gestalt theory (Goldmeier, 1982), information theory (Garner, 1974), and information pickup (Gibson, 1968, 1979). A good example of this is the work of Spelke (1979) who, in line with the Gibson perspective on perception, showed that young infants attended more to a film that was accompanied by an appropriate soundtrack than a simultaneously presented film for which the accompaniment was inappropriate. She also showed that infants tended to search for pattern of action in the film that

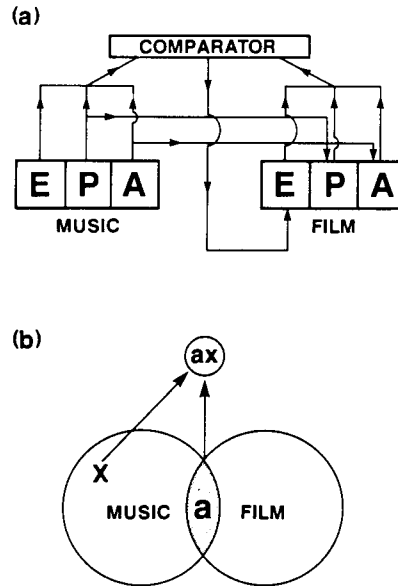


Fig. 8. Congruence-Associationist model. (a) Overall Evaluative (E), Potency (P), and Activity (A) meanings are shown for the music and film. Direct effects of the music are shown for the Potency and Activity levels. Evaluative levels depend upon the overall meaning from the three dimensions of both media. The degree of congruence found in the Comparator establishes the Evaluative meaning of the film and the music. (b) The total meaning of the music and the film are represented by Venn circles. Attention is directed to the overlapping congruent meaning (a) of the music and film. Associations of the music (x) are ascribed to (a). Thus, the music alters meaning of a particular aspect of the film.

corresponded to the tempo of an accompaniment. Adults also were sensitive to congruent relations and often had an illusion that the location of the sound source was in the portion of the film with coordinated activity.

The results of the main experiment indicate that changing the meaning of the film and its components on the Activity dimension does not depend upon changing the overall salience of that dimension in the background music. Changed meaning, however, may depend upon perceived temporal congruence between music and the film. Possibly a congruence between the motion of the music and the small triangle altered attention through grouping by similarity. This notion concurs with the film critic Ernest Lindgren quoted by Emblar (1974) who says “. . . music and film each depend upon the phenomena of movement and are thereby allied esthetically . . . sound movement reinforces visual movement.”

It seems plausible to argue that congruence between internal structure of film and music alters the attentional strategy to and subsequent encoding of information in the film. That is, the pattern of attention to music alone or to film alone is altered under conjoint presentation. Perceptual effects of conjoint stimuli have been demonstrated previously in psychophysical research. For example, thresholds for visual apparent motion have been raised by congruent auditory information (Stall & Donderi, 1983). As already mentioned, Spelke altered the visual preferences of infants by the presentation of an appropriate soundtrack. It follows then, that the perception of features of the film could be altered by a congruent soundtrack. Subsequently, and independently, associations from the music bias, “set” or “prime” the context for interpretation of the film.

Therefore, according to this proposal, effects of musical accompaniment on the interpretation of a character in a film may arise if the music, through congruence, alters the pattern of attention toward the characters in the film and, at the same time, provides connotations. Treisman and Schmidt (1982) describe examples of illusory conjunctions in which stimulus features that co-occur in a single fixation of attention are combined to form an imagined object. Pryor and Ostrom (1981) provide evidence that personality attributes are encoded independently of their owner if the owner is unfamiliar—conditions similar to the unfamiliarity of the film figures in the present study. As illustrated in Figure 8b, if music through structural similarity directs attention to feature “a” of the film and provides information about connotation “x”, then connotation “x” may become associated with feature “a”, in both initial judgment and in memory. Such connotations may influence the hypotheses that the perceiver holds regarding the characteristics of the film figures. Such hypotheses may be confirmed by the subsequent action of the film and the fixing of attributions may result.

This analysis distinguishes the following processes: (a) the generation of the meanings of music, (b) selective attention prompted by congruencies in

the music and film, and (c) the association between the meanings and the attended film items. The suggested effects of structure and meaning of music on interpretation of a film also emphasize for music cognition the significance of formal, affective, and connotative kinds of musical information.²

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