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Arousal, Positive and Negative Affect, and Preference for Renaissance and 20th-Century Paintings[1]

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Treatments expected to raise the level of arousal and induce different degrees of positive and negative affect were paired on some trials with Renaissance or 20th-century paintings, whereas no paintings were shown on other trials. The design was within-subjects (24 females); the dependent measures were skin conductance (SC) and the preference for paintings. All treatments, including the paintings/no paintings factor, raised SC over the baseline, and the pattern was essentially additive. The perceived failure to attain control over aversive auditory stimulation (resulting in negative affect) raised SC to a higher level than did the unavoidable aversive stimulation (minimal affect) or monetary gains (positive affect). Paintings paired with affect (positive or *negative) were rated as more pleasing than were those paired with no affect. The Renaissance works were preferred to the 20th-century works when negative affect was induced, whereas the opposite was true in the case of positive affect. The collative-motivation model could not account for the fact that pleasingness of paintings was not related to SC by an inverted-U function. The contiguity model could not explain the considerable rated pleasingness of paintings paired with negative affect. In contrast, there was considerable support for a more comprehensive hypothesis ("distraction/soothingness") based on attentional and affective considerations, and the differential cognitive labeling of fluctuations of arousal.*

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The motivational model proposed by Berlyne (1967, 1971) postulates that the hedonic value (e.g., pleasingness) of stimulation is an inverted-U function of the arousal potential of stimulation. The relationship is expected to hold for collative stimulus dimensions, such as complexity and novelty, in terms of which, according to Berlyne (1971), aesthetic materials can be parsimoniously described. Both physiological and behavioral measures have shown that stimuli in the higher ranges of collative dimensions tend to raise the level of arousal more than do stimuli in the lower ranges (e.g., Berlyne, Craw, Salapatek, & Lewis, 1963; Bryson & Driver, 1969; Konečni, 1975b). Since the model assumes that arousal-level increases due to different sources of stimulation are additive, and that a high level of arousal is aversive, one of its important derivatives is that the preference for complex or novel stimuli (including aesthetic materials characterized by such stimuli) should decrease when the level of arousal is relatively high (Berlyne, 1960, 1971).

Two recent studies, concerned with the preference for simple/complex melodies, have provided support for this proposition. However, the results also indicated that the effect of arousing procedures on aesthetic preference is mediated by cognitive factors, and that in some situations, arousal may be irrelevant for preference. Konečni, Crozier, and Doob (1976) found that severely insulted subjects displayed a marked reduction in the proportion of complex-melody choices in comparison with neutrally treated subjects. However, their insult procedure had been shown not only to increase the level of cardiac arousal (e.g., Kahn, 1966), but also to lead—through the cognitive-labeling processes—to a pronounced emotional state, anger (cf. Konečni, 1975a,b; Konečni & Doob, 1972). Thus, negative *affect,* rather than simply the level of arousal, may have been operative in the Konečni, Crozier, and Doob (1976) study. Even though Konečni and Sargent-Pollock (1976) found that preference for complex melodies may also be reduced by an arousing procedure that was less likely to induce affect, the results suggested that the effect of arousal was mediated by changes in the information-processing capacity. In addition, cognitive tasks involving processing effort were very effective in reducing preference for complex melodies, and this was quite independent of the degree of arousal potential of the tasks. In short, the results of these studies pointed to some deficiencies of the collative-motivation model and its predictions. The model largely ignores cognitive factors and has little to say about the effects on behavior (including aesthetic preference) of the arousal-raising treatments that result in qualitatively different emotional states. Moreover, there seem to be situations in which the level of arousal and preference are not related in any systematic way.

The general purpose of the present research was to investigate the relationship between the level of arousal, different degrees of both negative

and positive affect, and aesthetic preference for visual materials (paintings from two different periods). The research also contrasted the predictions of the collative-motivation model with those derived from alternative theoretical positions.

The first question that we sought to answer concerned the combined effect on the level of arousal (measured by skin conductance, SC) of exposure to visual aesthetic materials and to other sources of stimulation expected to induce different degrees of positive and negative affect. On the basis of the work cited earlier, one would predict that exposure to slides of paintings should increase SC in comparison to the base level and to the lack of exposure to such displays; moreover, effects on SC due to various sources of stimulation should be additive. However, it was not certain that the latter prediction would hold, given that paintings might engage the subject's attention and thus reduce the impact of the concurrent stimulation on SC. If so, would it make a difference whether or not the subject believed that the stimulation could be avoided? Would the degree of aversiveness of the stimulation have an effect? Finally, how would the effect of paintings on SC combine with effects of arousal-increasing treatments that could be expected to induce different degrees of positive affect? The literature does not contain clear answers to these questions.

The second issue we addressed was the effect on the rated pleasingness of paintings of the arousal- and affect-relevant treatments with which paintings were paired. According to the collative-motivation model, the hedonic value of a painting (or *any arousal-increasing* display) should decrease when the level of arousal had already been raised to a relatively high point by other treatments. Thus, ratings of paintings paired with treatments that substantially increase SC—*regardless* of whether they result in positive or negative affect—should be less favorable than ratings of paintings paired with treatments of lower arousal potential. Of course, any attempt to test this prediction is confronted with the problem that the model postulates hedonic value to be an inverted-U function of arousal potential without specifying for which stimuli and at which level of arousal the function should peak. We dealt with this issue by exposing each subject to six treatments (in a 3 X 2 factorial arrangement) that could be expected to increase arousal by substantially different amounts; paintings (and the absence of paintings) were paired with each of these six treatments. Thus, we attempted to tap a broad range of the arousal-potential dimension and expected to obtain a unimodal inverted-U function if the model is correct, or detect deviations from unimodality (such as more than one peak) if the model is incorrect.

In the case of aversive stimulation, various classical-conditioning (contiguity) theories of affect and preference would make predictions similar to those of the collative model: Paintings paired with aversive stimulation

should be rated less favorably than those paired with less aversive stimulation. However, paintings paired with stimuli likely to produce positive affect should be found more pleasing than those paired with aversive stimulation, quite independently of the arousal-level considerations; in addition, the favorableness of ratings should be in direct proportion to the degree of positive affect. This position, unlike the collative model, takes into account the type and degree of affect, rather than the level of arousal alone.

Another potentially useful source of predictions—based on attentional, affective, and cognitive-labeling considerations—may provisionally be termed the distraction/soothingness hypothesis (cf. Konečni, 1975b; Konečni & Sargent-Pollock, 1976). It has already been suggested that paintings, like other complex visual displays, may distract subjects and thus reduce the impact of the concurrent stimulation. In addition, paintings and other aesthetic materials, unlike nonaesthetic displays, may have a "soothing" property. Some support for this idea has recently been obtained with musical stimuli (Konečni, 1975b); the results also indicated that the soothing property of such stimuli had an effect only in conditions in which subjects experienced distinct *negative affect.* In the present experiment, the distraction/soothingness hypothesis would make the counterintuitive prediction that paintings paired with stimulation that is arousing, aversive, *and* induces negative affect should receive quite favorable ratings. In contrast, the hypothesized distracting/soothing properties of paintings may be less relevant or appreciated in conditions that are arousing and aversive, but do *not* induce negative affect; in this case, paintings should receive less favorable ratings.[3] Finally, the distracting/soothing properties should be quite irrelevant for the ratings of paintings paired with treatments that induce *positive* affect; subjects would presumably have no reason to appreciate either property of the paintings while experiencing such affect.

The third issue we addressed concerned the possibility of differential effects of treatments on ratings of the Renaissance and 20th-century paintings. Predictions were based on the soothingness hypothesis discussed above. Paintings from the two periods had been selected so as to be approximately equal in terms of SC, pleasingness, and several other dimensions chosen on the basis of the recent psychoaesthetic literature (e.g., Berlyne, 1971, 1974). Nevertheless, it seemed possible that subjects' positive/negative affective states could differentially influence their ratings of paintings from the two periods. In comparison to the 20th-century

[3]It seems both legitimate and desirable to distinguish between (1) treatments that are aversive —in the sense that subjects would rather avoid them—but that do not result in distinct, reportable, negative affect, and (2) treatments that in addition to being aversive, induce a negative affective state or experience, presumably through the operation of cognitive-labeling processes (Konečni, 1975a,b).

works, the Renaissance paintings' greater predictability, order, and structure could be expected to be soothing. This property may be irrelevant to subjects not exposed to any treatments (as in the pilot study on the basis of which the paintings were selected), but potentially quite important to subjects who judge paintings while experiencing negative affect. Therefore, it was predicted that the Renaissance paintings paired with aversive stimulation resulting in negative affect would be rated as more pleasing than the 20th-century paintings paired with identical stimulation. Analogously with predictions based on the distraction/soothingness hypothesis concerning the ratings of paintings in general (regardless of period), it was predicted that the rated pleasingness of the Renaissance and 20th-century works would *not* be differentially influenced by treatments that did not induce negative affect and those that induced positive affect.

METHOD

Subjects

Subjects were 24 female undergraduates from the University of California, San Diego. Each subject spent about 90 min in the laboratory on each of three days and received $12 as remuneration.

Overview of Experimental Design and Rationale

The design was a 6 X 3 X 2 X 2 factorial. The first factor was a between-subjects *order* factor (see below); the remaining three factors were within-subjects. The second factor was *type of stimulation* with three levels: (1) "avoidable" auditory stimulation, where subjects were led to believe that they could learn to avoid the stimulation, but actually had no control over the periodic exposure to it; (2) unavoidable auditory stimulation, where subjects were exposed to as much stimulation as in the "avoidable" condition, but knew they could not avoid it; and (3) positive excitation, where subjects believed they could win money by appropriate actions; they indeed periodically won money, but according to a fixed schedule; the number of "wins," and the ratio of wins/no wins, were identical to the number of exposures to auditory stimulation, and the ratio of exposures/no exposures, respectively, in the "avoidable" and unavoidable auditory stimulation conditions. Each of the 24 subjects was exposed to all three levels of the type of stimulation factor, *one* level per day. Four subjects were randomly assigned to each of the six possible orders in which the three levels could be manipulated over three days.

The third factor, *intensity of stimulation,* had two levels, high and low. In the "avoidable" and unavoidable auditory-stimulation treatments, the high level involved 350 Hz squarewave stimulation at 95 dB-A, whereas the low level involved the same type of stimulation, but at 55 dB-A. In the positive excitation treatment, the high level meant 10¢ wins for the subject, whereas the low meant 1¢ wins. The two levels of the intensity of stimulation factor were manipulated on each of three days for all subjects, as were the two levels of the fourth factor, *slides of paintings presented/no slides presented.*

An example may clarify the experimental design. Each of four subjects assigned to Order 3 was exposed to unavoidable auditory stimulation on Day 1, to "avoidable" stimulation on Day 2, and to positive excitation on Day 3. On each day, the session was divided into four parts during which the four possible treatment combinations of the intensity of stimulation and slides/no slides factors were manipulated.

Treatments comprising the type of stimulation factor were considerable modifications of procedures originally used by Brady, Porter, Conrad, and Mason (1958) and Edwards and Treadwell (1967). On the basis of the latter study, it was expected that (1) all three types of stimulation would increase SC over base level, and to a different degree; (2) the "avoidable"-stimulation treatment would induce pronounced negative affect (anger); (3) the unavoidable-stimulation treatment would result in minimal affect; and (4) winning money would result in positive affect. In the "avoidable" condition, negative affect would presumably be due to subjects' continuing failure to learn the "contingency" and systematically control (avoid) aversive auditory stimulation. In contrast, it was expected that the unavoidable treatment would induce far less, if any, negative affect, since subjects were told that it was impossible to control (avoid) the stimulation.

The six treatments formed by fully crossing the type and intensity of stimulation factors were expected to increase SC to considerably different points. Since slides of paintings were paired with each of the six treatments, a relatively comprehensive analysis of the SC-preference relationship could be carried out.

Experimental Materials and Apparatus

Auditory Stimulation. The stimulation—350-Hz squarewave—was generated by a Bryston Manufacturing oscillator 403-B, recorded on magnetic tape, and delivered through high-fidelity earphones. Each 10-sec segment of the tape contained about 8.5 sec of stimulation and 1.5 sec of silence. The stimulation was presented in bursts lasting approximately 1.0, 1.5, 2.5, or 4.5 sec, in a pseudorandom order. The spread of the high–low

levels (95, 55 dB-A) has been shown by prior research (Konečni & Sargent-Pollock, 1976) to provide a satisfactory differentiation in terms of SC and blood pressure. The same research also demonstrated that the 350-Hz squarewave stimulation is far more aversive than white noise.

Paintings. The size of the projected image of paintings was 46 X 66 cm, 152 cm directly in front of the seated subject. These paintings had been selected in a pilot study in the following manner: Under similar viewing conditions, a separate sample of 12 female subjects provided SC and ratings data for 60 Renaissance and 60 20th-century paintings. Each slide was projected for 20 sec. Ten sec after a slide came on, a light flashed indicating that the subject should begin to rate the painting, for which 10 sec was available. Each painting was rated on three 100-mm scales (controlling for order and right–left bias) anchored as follows: pleasing–not pleasing, interesting–not interesting, would like–would not like to own a reproduction. For each slide, SC was calculated as the ratio of the value at 8.5 sec after the appearance of a slide and the baseline for a group of 60 slides.

Six sets of ten slides each were formed for use in the main experiment on the basis of the pilot data. Each set consisted of five Renaissance and five 20th-century paintings arranged in an alternating sequence.[4] The selection criteria were quite detailed: (1) In terms of the SC ratio, slide/baseline, there was to be no difference between the means for all 12 subsets of five Renaissance/20th-century works. This meant that the subsets of Renaissance and 20th-century works within each of six sets would be homogeneous, and that the six sets of ten paintings would also be homogeneous. This goal was fully accomplished: The grand mean of the SC ratio across all 12 subjects, and across the 12 subsets of five paintings each, was 1.20; *SD* for the 12 subset means, across 12 subjects and five paintings each, was .01. (2) In terms of the ratings of pleasingness, there would be no difference between the means for all 12 subsets of five Renaissance/20th-century works. An additional criterion was that the subset means be as close as possible to the scale midpoint (5.00 cm; the higher the score, the more pleasing a painting). These goals were adequately accomplished: the grand mean for the Renaissance works was 5.10, and *SD* for the six subset means, over subjects and paintings, was .32; the 20th-century mean and *SD*, identically obtained, were 4.93 and .12, respectively.[5]

[4]The 30 Renaissance works were by a total of 12 painters, including Botticelli, Leonardo, Michelangelo, Raffaello, and Tiziano. The 30 20th-century works were by a total of 15 painters, including Braque, Chagall, Kandinsky, Klée, Miro, and Picasso.

[5]The 12 subsets of paintings were matched just as successfully in terms of the interestingness and "owning" scores. In fact, subjects in the main experiment rated paintings on all three scales. However, since no significant results were obtained for either the interestingness or owning scale, these scales are not mentioned in the remainder of the paper.

Six Conductance. The basic equipment consisted of Ag–AgCl electrodes filled with the Redux electrolytic gel (by Hewlett-Packard), a Fels Dermohmeter (subject current of 70 μA, automatic range set), and a Grass polygraph. The measurement method was monopolar. Electrodes were attached to the subject's right leg. One was placed on the back of the calf at fullest point where epidermis (approximately 1 mm in diameter) had been buffed off. The other electrode was placed in the hollow on the inside of the foot between the ankle bone and the Achilles tendon.

Procedure

On each of three days, each subject had 80 trials divided into four groups of 20 trials each. The four treatment combinations involving the intensity of stimulation and slides factors (high stimulation–slides, high stimulation–no slides, low stimulation–slides, low stimulation–no slides) were manipulated during these four groups of 20 trials, one treatment combination per group of 20 trials. The order of the four treatments was randomly and independently determined for each subject, independently for each of the three days.

The beginning of each trial in a group of 20 was signaled by a green light. A trial lasted for 30 sec; there was no intertrial interval. At some point during the first (stimulation-free) 20 sec of a trial, the subject pressed a button. On the "avoidable"-stimulation day, the subject was told that pressing the button "at the right moment" would avoid the auditory stimulation that might otherwise occur "a little later" on that trial.[6] On the unavoidable-stimulation day, it was explained that the button had to be pressed, but that this would in no way affect the occurrence of the stimulation, which might or might not be delivered on a particular trial. Finally, on the positive-excitation day, the subject believed that pressing the button at the right moment would result in a monetary win on that trial. In fact, according to a schedule, in both the "avoidable" and unavoidable conditions, the subject received 8.5 sec of auditory stimulation (95 dB in the high-stimulation treatment, 55 dB in the low) during a 10-sec interval *at the end* of 13 trials in each group of 20. On seven trials in each group of 20, there was no auditory stimulation. In the positive-excitation condition, the subject saw a blue light for 10 sec at the end of 13 trials in each group of 20, whereas there was no light for the remaining seven trials. The presence of the blue light indicated that the subject had won money on that trial (10¢ or 1¢, depending on the treatment in a particular group of 20 trials—of which the subject had been informed beforehand). The order of the 13 trials in a group of 20 on which the subject received auditory stimulation or won

[6]Subjects were told that the experiment did not involve reaction time and that their chances would not be improved by pressing the button as soon as the beginning of a trial was signaled.

money was randomized across subjects, days, and the 12 groups of 20 trials to which each subject was exposed according to a complex schedule that need not be elaborated here.

A 30-sec trial thus consisted of a 20-sec interval in which nothing happened, except that the subject had to press the button in all conditions, and a final 10-sec interval, during which the subject either received auditory stimulation (or the blue light was on), or did not receive it (the light was not on). In a group of 20 trials, the subject thus received either 110.50 sec of auditory stimulation (8.5 X 13; at 95 or 55 dB-A), or saw the blue light for that length of time (for a total gain of either $1.30 or $0.13).

As was explained before, six sets of ten paintings each were used in the experiment. All subjects saw all six sets once, two sets per day. Of the four groups of 20 trials that subjects had on each day, two groups (involving high and low stimulation, respectively) were paired with paintings, one set of ten paintings per group of 20 trials. During the remaining two groups of trials on each day (also involving high and low stimulation, respectively), no paintings were shown. Slides within each set of ten were presented in a fixed order, with five Renaissance and five 20th-century paintings arranged in an alternating sequence in each set. However, the six sets were randomly assigned, independently for each subject, to the six treatment combinations involving the type and intensity of stimulation factors.

Each of the 10 slides in a set assigned to a group of 20 trials came on simultaneously with the light indicating the beginning of a trial, and was shown for 1 min, that is, for the duration of 2 trials.[7] For example, the first painting in a set of ten was shown during trials 1 and 2; the eighth painting was shown during trials 15 and 16. Subjects were asked to look at the paintings very carefully; they did this concurrently with other events characterizing trials (i.e., pressing a button during the first 20 sec, being or not being exposed to 8.5 sec of auditory stimulation during the 10-sec interval at the end of a trial, etc.).

Dependent Measures

A continuous SC record was obtained for the 3-min rest period that preceded each group of 20 trials, as well as for the entire duration of a

[7]A slide was presented for 1 min (2 trials), rather than 30 sec (1 trial), because this increased the probability that a painting would actually be paired with treatments manipulated in a group of 20 trials (e.g., 8.5 sec of auditory stimulation at 95 dB, which the subject "failed" to avoid; this event, of course, occurred on only 13 of 20 trials in a group). Note that this procedure did not in any way confound the effects of treatments on SC or invalidate the definition of a trial. Whereas the 30-sec trials were units through which the type and intensity of stimulation treatments were administered, the main unit of *analysis* was the *cumulative* effect on SC of a treatment combination (including slides/no slides) over a 10-min period (20 trials). Still finer analyses could also be carried out by comparing "treatment" trials paired with paintings to "no-event" trials paired with paintings, etc.

group of trials (10 min). Measurements obtained during the preceding rest period served as the baseline for each group of trials. At the end of a group of trials, electrodes were disconnected, and the subject rested for 1 min. If the preceding trials had been paired with slides, these ten slides were *again shown* for 10 sec each. During this viewing, the subject rated each painting's pleasingness on a scale described earlier (see footnote 5). If the preceding group of trials had not been paired with slides, the subject worked on a brief questionnaire (a "filler" task controlling for activity between groups of trials). After rating the slides (or answering the questions), the subject had a brief rest before the electrodes were again attached, followed by 3 min of rest and a new group of 20 trials.

RESULTS

Skin Conductance

Preliminary analyses indicated that there was no effect of trials within groups of 20. In addition, in the "avoidable" and unavoidable conditions, trials (within groups) in which subjects received auditory stimulation differed negligibly from those in which there was no stimulation; the same was true for the win/no win trials in the positive-excitation conditions. Thus, the anticipation of an event (positive or negative) apparently affected arousal just as much as did the event itself; Zillmann, Katcher, and Milavsky (1972) obtained similar results with electric shocks.

Given the outcome of the preliminary analyses, the main analysis was based on only 12 scores for each of the 24 subjects. A score was the ratio of the mean log SC during a group of 20 trials (based on 20 measurement points) over the mean log SC during the 3-min rest period preceding that group of trials (based on 6 measurement points). Thus, each of the 24 subjects had a score (treatment/baseline) for each of the 12 groups of 20 trials (4 per day), that is, for each cell of the basic 3 X 2 X 2 design (type of stimulation X intensity of stimulation X slides/no slides). These data were submitted to a 6 X 3 X 2 X 2 analysis of variance (also taking into account the between-subjects order factor).

The main effects of all three within-subjects factors were statistically significant, as was the interaction between the type and intensity of stimulation factors. Order effects and other interactions did not approach statistical significance.

The main effect of the type of stimulation factor [F (2,36) = 5.53, $p < .01$] showed that subjects were far more aroused when they "failed" to

Table I. Type of Stimulation × Intensity of Stimulation Interaction (Skin Conductance Data)[a]

Intensity of stimulation	Type of stimulation: "Avoidable" auditory stimulation	Unavoidable auditory stimulation	Positive excitation	$\bar{X}$
High (95 dB or 10¢)	1.351 (95 dB)	1.224 (95 dB)	1.163 (10¢)	1.246
Low (55 dB or 1¢)	1.167 (55 dB)	1.107 (55 dB)	1.123 (1¢)	1.132
$\bar{X}$	1.259	1.165	1.143	

[a]Cell entries are based on $n = 24$ (summed over the order and slides/no slides factors) and represent mean ratios (treatment/baseline) of log skin conductance.

learn to avoid the auditory stimulation than when they believed that the stimulation was unavoidable, or when they were winning money (see the column means in Table I). The latter two conditions did not differ significantly. These results are fully in agreement with those of Edwards and Treadwell (1967), despite the considerable differences in the details of experimental procedures. All three treatments comprising the type of stimulation factor led to a considerable increase in SC in comparison to the appropriate baselines; this was also true of other variables employed in the experiment.

The main effect of the intensity of stimulation factor [F (1,18) = 8.39, $p < .01$] indicated that subjects' SC was increased relatively more during groups of trials in which the intensity of stimulation was high, such as the 95-dB auditory stimulation or 10¢ wins, than during trials in which the intensity of stimulation was low (55-dB auditory stimulation, 1¢ wins; see the row means in Table I). Finally, subjects were more aroused when watching slides of paintings than during groups of trials not paired with any visual material [F (1,18) = 4.09, $p = .057$; $\bar{X} = 1.224$ for groups of trials paired with paintings, and $\bar{X} = 1.154$ for those not paired with paintings].

The only other significant effect was the interaction between the type and intensity of stimulation factors [F (2,36) = 3.41, $p < .05$; the six means involved are shown in Table I]. This interaction is of modest substantive interest, and may be best summarized by the statement that the differential effect of the two levels of the intensity of stimulation factor was greater in conditions in which auditory stimulation ("avoidable" and unavoidable), rather than money (positive excitation), was involved.

Pleasingness of Paintings

In each group of 20 trials that involved paintings, subjects saw five Renaissance and five 20th-century works. During the second viewing, which occurred immediately after a group of trials, subjects rated the pleasingness of paintings (see footnote 5). The mean of ratings given by a subject to the five Renaissance paintings associated with a group of trials was computed; the same procedure was used in the case of the 20th-century works. Thus, all 24 subjects had a score in each cell of the 6 X 3 X 2 X 2 design (order X type of stimulation X intensity of stimulation X Renaissance/20th-century paintings).

There was a main effect of type of stimulation [F (2,36) = 5.44, $p < .01$], due to the fact that paintings in general (Renaissance + 20th-century) were rated more pleasing when paired with the "avoidable" auditory stimulation and positive excitation (which did not differ from each other) than when they were associated with the unavoidable auditory stimulation (see the column means in Table II). Also, when subjects were frequently exposed to the 95-dB auditory stimulation ("avoidable" or unavoidable), or repeatedly won 10¢, they found paintings in general more pleasing than when they were exposed to the 55-dB auditory stimulation, or won 1¢ on the "win" trials [main effect of intensity of stimulation, F (1,18) = 4.56, $p < .05$; $\bar{X} = 5.27$ for the high level of this variable, $\bar{X} = 4.87$ for the low level]. In addition, the Renaissance paintings were found somewhat more pleasing than were the 20th-century works [F (1,18) = 3.74, $p < .07$; see the row means in Table II].

Finally, there was a significant interaction between the type of stimulation and the Renaissance/20th-century factors [F (2,36) = 6.07, $p < .01$; see Table II]. In the "avoidable"-stimulation condition, subjects preferred

Table II. Type of Stimulation X Type of Painting (Renaissance/20th-Century) Interaction (Pleasingness Data)[a]

	Type of stimulation			
Type of painting	"Avoidable" auditory stimulation	Unavoidable auditory stimulation	Positive excitation	$\bar{X}$
Renaissance	5.81	4.74	5.06	5.20
20th-century	4.77	4.71	5.35	4.94
$\bar{X}$	5.29	4.73	5.21	

[a] Cell entries are based on $n = 24$ (summed over the order and intensity of stimulation factors). The higher the score, the more pleasing the paintings.

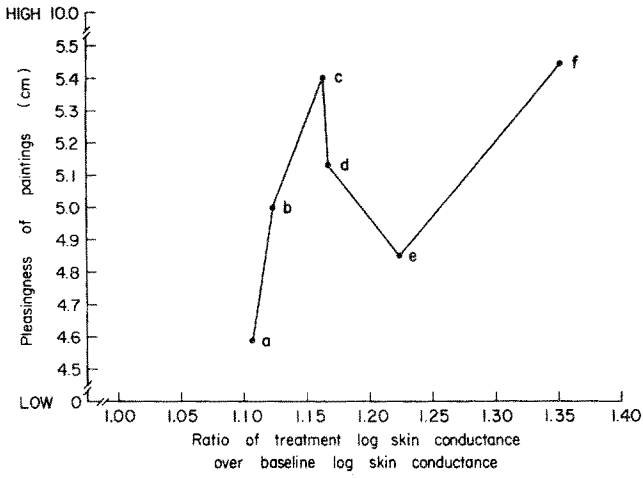

Fig. 1. Pleasingness of paintings as a function of skin conductance (ratio of treatment log SC over baseline log SC). The points in the figure represent the following conditions: (a) Unavoidable stimulation at 55 dB; (b) positive excitation, 1¢; (c) positive excitation, 10¢; (d) "avoidable" stimulation at 55 dB; (e) unavoidable stimulation at 95 dB; (f) "avoidable" stimulation at 95 dB. Each point in the figure is based on the SC and pleasingness scores of the same 24 subjects.

the Renaissance over the 20th-century paintings; in contrast, no differences were found in the pleasingness of works from the two periods in the unavoidable-stimulation condition, and a reversal occurred in the positive-excitation treatment. Thus, that subjects found paintings paired with the "avoidable"-stimulation condition so pleasing was mostly due to their favorable ratings of the Renaissance works. Positive excitation, like the "avoidable"-stimulation condition, led subjects to rate paintings as more pleasing than did the unavoidable-stimulation treatment; however, in comparison to the "avoidable"-stimulation treatment, the difference in pleasingness between the Renaissance and 20th-century works induced by positive excitation was smaller and in the opposite direction (see Table II).

Relationship Between SC and Pleasingness

The six treatment combinations involving the type and intensity of stimulation factors differentially increased SC (Table I). It was of interest to examine the relationship between the SC levels and the rated pleasingness of paintings (Renaissance and 20th-century combined) associated with these treatments. In Figure 1, the mean pleasingness of paintings paired with each

of the six treatments is plotted as a function of the mean SC level (treatment/baseline) induced by the treatments.

Perhaps the most important aspect of the data presented in Figure 1 is that the pleasingness ("hedonic value") of paintings was not the unimodal inverted-U function of SC predicted by the collative-motivation model (the function has two peaks).[8] It appears that SC levels are relatively inadequate predictors of the pleasingness of stimuli with which they are associated. As will be seen, the data can be better explained in terms of a theoretical position that is not concerned solely with the effect of treatments on SC, but takes into account other consequences of the treatments (such as the type and degree of positive and negative affect they induce).

DISCUSSION

Combined Effects of Treatments on SC

In accord with prior research (Berlyne et al., 1963; Bryson & Driver, 1969; Konečni, 1975b), exposure to paintings increased subjects' SC in comparison with both their resting state and conditions in which no paintings were presented. Perhaps more important, the effect of the slides/no slides variable on SC did not interact with other arousal-increasing treatments. Thus, there was no support for the hypothesis that conditions in which subjects were distracted by paintings would reduce the impact of the concurrent stimulation on SC. Even in the case of the highly arousing 95-dB "avoidable"-stimulation treatment, exposure to paintings further increased SC. It also did not matter whether paintings were paired with auditory stimulation or with monetary gains: The positive and negative affective states did not differentially influence SC as a function of the presence/absence of paintings. In short, the effects of various treatments on SC were generally additive. The interaction presented in Table I does not refute this statement; it simply indicates that the differential effect on SC of the 10¢ vs. 1¢ treatment was not so great as the differential effect of the 95-dB vs. 55-dB auditory-stimulation treatments.

A Comparison of Theoretical Models

The collative-motivation model cannot account either for the pleasingness data or for the relationship between pleasingness and SC. First, the

[8]Such a conclusion may be criticized on the grounds that means are plotted against means in Figure 1. However, the inspection of individual subjects' curves revealed an inverted-U function in only two cases. Functions for the majority of subjects were bimodal and similar to that presented in Figure 1.

"avoidable"-stimulation condition increased subjects' SC far more than did the unavoidable stimulation treatment; nevertheless, paintings paired with the former treatment were rated considerably more pleasing than were those paired with the latter treatment (Tables I and II). Second, paintings associated with the "avoidable" auditory stimulation and with positive excitation were found about equally pleasing, even though the former treatment increased SC far more than the latter (Tables I and II). Third, the pattern of the pleasingness data for the intensity of stimulation main effect directly contradicts the collative model. Since subjects were far more aroused by the various high-stimulation conditions than by the low-stimulation treatments (Table I), and since the presence of paintings further increased SC, paintings should have been found more pleasing in the low-stimulation conditions; yet, the very opposite was the case. These failures of the collative model are captured in part by the data presented in Figure 1. The pleasingness of paintings was not an inverted-U function of arousal level. Not only were there two peaks in the function, but the paintings found most pleasing were those associated with the "avoidable" auditory stimulation at 95 dB, that is, the treatment that led to the *greatest* relative increase in SC. These results, together with some prior findings (Konečni et al., 1976; Konečni & Sargent-Pollock, 1976), suggest that the collative-motivation model may be inadequate in that it ignores the cognitive factors involved in the interpretation of changes in arousal level (Konečni, 1975a; Schachter, 1964), and thus ignores affect as a predictor of preference.

The contiguity model accurately predicted that paintings associated with positive excitation would be preferred to those associated with the relatively aversive unavoidable auditory stimulation (Table II). However, this model cannot account for the finding that paintings paired with the presumably even more aversive "avoidable"-stimulation treatment (resulting in negative affect) were found as pleasing as those paired with positive excitation. In addition, the contiguity model implies an interaction between the type and intensity of stimulation factors, such that paintings paired with 10¢ wins would be found more pleasing than those paired with 1¢ wins, whereas the opposite would occur in the 95-dB vs. 55-dB comparisons. This interaction was not obtained: Paintings paired with the high-intensity stimulation were generally found more pleasing than those paired with the 55-dB or 1¢ treatments.

In contrast to the other two positions, the distraction/soothingness hypothesis fared quite well. First, it can account for the counterintuitive finding that paintings paired with the high-stimulation treatments (95 dB, 10¢) were found more pleasing than those paired with the low-stimulation treatments. Second, the hypothesis correctly predicted that paintings associated with the aversive stimulation resulting in negative affect ("avoidable" stimulation) would be found more pleasing than those paired with the aversive stimulation less likely to produce negative affect (unavoid-

able stimulation). Given Edwards and Treadwell's (1967) conclusion that the "avoidable" auditory stimulation at close to 100 dB is not merely aversive, but results in a pronounced negative affective state—anger—the present findings offered rather striking support for the distraction/soothingness hypothesis. Third, the hypothesis correctly predicted that the Renaissance paintings would receive particularly favorable ratings in the treatment combinations inducing negative affect ("avoidable" stimulation). This prediction had been made on the assumption that the Renaissance paintings' greater predictability and structure would make them more soothing and therefore more pleasing to subjects experiencing negative affect.

Since paintings in general increased the level of arousal irrespective of the treatment combination with which they were paired, it seems likely that the considerable rated pleasingness of paintings paired with negative affect was due to cognitive factors, rather than to fluctuations of arousal (cf. Konečni & Sargent-Pollock, 1976). A factor that may have been operative is the differential cognitive labeling of the arousal-level changes as a function of the source producing the changes (cf. Konečni, 1975a,b; Schachter, 1964). The additional arousal-level increase due to paintings may have been either ignored or positively evaluated by the subjects experiencing negative affect to suit the overall positive (soothing) impact of the slides.

We have already suggested that the distracting/soothing features of the paintings should be irrelevant in the case of positive affect. Presumably, subjects would not particularly appreciate the opportunity, provided by the paintings, to shift their attention away from the source of the affect (winning money) to something soothing. Rather, paintings may have been found pleasing (Table II) simply because they were paired with positive affect. The reasoning outlined above also clarifies the fact that the Renaissance paintings paired with positive affect were found somewhat less pleasing than were the 20th-century works (Table II); the soothing features of the Renaissance works may have been irrelevant or even boring to subjects experiencing positive affect.

Finally, as predicted, paintings were found generally less pleasing in the unavoidable-stimulation condition than in other conditions; in this treatment, there were also no differences between the rated pleasingness of the Renaissance and 20th-century works (Table II). Both these findings are in agreement with the assumption that even though the unavoidable-stimulation treatment was both arousing and aversive, neither positive nor negative *affect* was induced (this is further discussed below; cf. Edwards & Treadwell, 1967; Konečni, 1975b).

In short, whereas the presence (as opposed to the absence) of affect enhanced the pleasingness of paintings (regardless of period), this seems to

have occurred for different reasons in cases where affect was positive, as opposed to negative. In addition, whereas affect (rather than the fluctuation of arousal) seems also to have been responsible for the differentiation of the Renaissance and 20th-century works on the pleasingness dimension, the *type* of affect influenced the direction of the differentiation; ratings were in favor of the Renaissance works when affect was negative, and in favor of the 20th-century works when it was positive.

In general, the distraction/soothingness hypothesis seems to have withstood the empirical test. Various current theoretical positions concerned with aesthetic preference may have limited predictive power because they tend to rely exclusively on the antecedent stimulus conditions and/or global concepts, such as the level of arousal; they often ignore (1) attentional processes, (2) cognitive factors involved in the interpretation of stimuli and the labeling of affect, and (3) the differential implications of various types and intensities of affect. In contrast, the distraction/soothingness hypothesis capitalizes on such factors. While the hypothesis clearly needs further elaboration and lacks the elegance often associated with simplicity, it appears to make precise and counterintuitive predictions. Its multiprocess character and comprehensiveness perhaps more realistically reflect the complexities evident in the domain of aesthetic preference than do models that rely on fewer or simpler concepts (Konečni, in press).

Other Implications

The SC results in the high-stimulation conditions (top row of Table I) were fully in agreement with the cardiovascular findings of Edwards and Treadwell (1967). Moreover, this occurred even though in the condition analogous to the present "avoidable" treatment, Edwards and Treadwell's subjects could actually learn to avoid the stimulation; their subjects' task was difficult enough to produce a 65% error rate over trials, but *veridical* feedback was available. In contrast, our subjects received response-*non*-contingent stimulation on 65% of the trials (13 out of 20 in each group of trials), but *believed* that the stimulation could be avoided. Thus, the perceived failure to control the stimulation, produced either by veridical feedback on a difficult task or by an instructionally induced cognitive set, tends to raise the level of arousal far more than does unavoidable stimulation. The present results also showed that failure to obtain control produces the effect of some magnitude only when the stimulation is quite aversive (that is, 95 dB, as opposed to 55 dB, see Table I; Edwards and Treadwell did not have a low-intensity control).

The results discussed above address some important issues regarding conditions that are necessary for the induction of negative emotional states.

Edwards and Treadwell found that subjects in their avoidable-stimulation condition experienced anger. Although we did not obtain self-reports, since they could contaminate the collection of other data, there are reasons to conclude (on the basis of pilot data, postexperimental interviews, etc.) that our subjects in the "avoidable" condition also experienced anger, and that this was not the case in the unavoidable-stimulation treatment. Thus, anger can apparently be induced by nonsocial means, but high arousal, aversive stimulation, and the failure to attain control all appear to be necessary. Moreover, at least when the distracting/soothing effect of aesthetic stimuli is taken as the criterion, nonsocial anger does not seem to differ from the social version (compare the present results to those of Konečni, 1975b). Our results thus appear relevant for the research on human aggression and emotion, in which the social mode of anger induction has been used almost exclusively.

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