

The Mediation of Aggressive Behavior: Arousal Level Versus Anger and Cognitive Labeling

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The principal goal of the present research was to contrast the arousal-level and cognitive-labeling (anger) interpretations of aggressive behavior. In a 2×5 factorial between-subjects design, subjects were first either insulted or treated neutrally by a confederate. Four fifths of the subjects then received on each of 50 trials a 10-sec tone sequence while deciding whether or not to give an "electric shock" to the confederate. The stimulation was either simple (4.00 bits/tone) or complex (9.17 bits/tone) and was presented at either a comfortable (73-db.) or an aversively loud (97-db.) level. A group was assigned to each of the four stimulation treatments. The remaining subjects received no stimulation. In terms of the total number of shocks administered by subjects in different groups, the cognitive-labeling hypothesis was strongly supported. Both complexity and loudness had an effect, but only on insulted subjects. Other implications of the results were discussed.

Recent research indicates that under certain conditions the level of physiological arousal and the amount of aggressive behavior are closely related. When subjects are insulted and rudely treated by an experimental confederate, their sympathetic arousal level is substantially increased in comparison to the pretreatment level and appropriate controls (e.g., Gambaro & Rabin, 1969; Hokanson & Shetler, 1961; Kahn, 1966). Subjects thus treated also tend to display a significantly greater amount of aggressive behavior in comparison to the neutrally treated subjects (e.g., Doob & Wood, 1972; Konečni, 1975; Konečni & Doob, 1972). Further results obtained by Konečni (1975) indicate that variables expected to decrease the level of arousal (such as the distraction of insulted subjects and the delay of measurement of aggression) decrease the amount of aggression also and show that these effects are additive. It is difficult to explain the effects of these variables on aggression without

invoking the mediating function of the level of arousal. With regard to the mentioned experimental situations, then, the level of arousal appears to be a parsimonious explanation of the amount of aggression observed.

By exploring the generality of the arousal-aggression relationship in some detail, the present research simultaneously makes possible an examination of the adequacy of the arousal-level position. Specifically, the treatment-induced fluctuation of the level of arousal may be a necessary, but not a sufficient, condition governing changes in the amount of aggressive behavior. After all, in the experiments cited, a confederate's insulting remarks caused an increase in subjects' arousal level; the source of the arousal-level increase was thus social in nature and unambiguous. Under these circumstances, one would have expected the subjects to label themselves angry (cf. Schachter & Singer, 1962), and this was, in fact, the case (Konečni, 1975). Therefore, the knowledge of whether or not the aroused people have adopted the cognitive label of anger may be indispensable for the prediction of the amount of aggression emitted by them. The latter may be governed by the degree of anger, which, in turn, presumably depends on the extent of the physiological justification for the emotion (i.e., the feedback from the level

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of arousal). This interpretation (Konečni, 1975) is similar in part to that offered by Zillmann (1971). In contrast, the source of the arousal-level increase (and any resultant cognitive label) is an issue of secondary importance for the "pure" arousal-level position.

An interaction favoring the cognitive-labeling interpretation was obtained by Zillmann, Katcher, and Milavsky (1972). In this experiment, subjects received either a small or a large number of electric shocks from a confederate and then engaged in either strenuous or less strenuous physical exercise prior to the dependent measure of aggression. For the low-instigation subjects, there was no effect of the physical exercise factor. Since strenuous exercise was highly arousing, the arousal-level interpretation cannot handle this outcome. However, shocks delivered to the confederate responsible for the instigation by the high-instigation/strenuous-exercise subjects were more intense than those in the high-instigation cell involving less strenuous exercise. From the cognitive-labeling position, the arousal-level increase due to strenuous exercise led to more aggression by extending the physiological basis for the label of anger previously adopted by the highly instigated subjects.

In a 2×5 factorial between-subjects design of the present experiment, subjects were first treated either insultingly or neutrally by a confederate. All subjects then had an opportunity to give shocks to the confederate on each of a number of trials. Four fifths of the subjects listened to a 10-sec tone sequence on each trial while making the decision whether or not to shock the confederate, whereas the remaining fifth received no stimulation. The tones for the four different groups were either simple or complex (in information-theory terms and subjectively) and were played at either a comfortable or a high loudness level (73 vs. 97 db., respectively). The design can also be regarded as a $2 \times 2 \times 2$ factorial with two additional control groups.

The insult manipulation served as a social source of the arousal-level increase, and it was expected that subjects exposed to it would label themselves angry (Konečni,

1975). Both loud noise and complex stimuli have previously been found to raise the level of arousal (e.g., Berlyne, Craw, Salapatek, & Lewis, 1963; Berlyne & Lewis, 1963; Bryson & Driver, 1969), but the effects of these variables on human aggressive behavior have not been investigated.¹ In addition to being arousing, a tone sequence at close to 100 db. is also aversive (Konečni & Sargent-Pollock, Note 1). However, the present subjects knew that the arousal-level increase was due to aversive stimulation from a nonsocial source, that is, that the stimulation was a "part of the experiment," rather than the confederate being responsible for it. For this reason, the subjects were presumably far less likely to label the arousal-level increase due to stimulation as anger. Finally, prior work with the complex stimuli presently used has shown that these stimuli are not aversive and that they tend not to lead the subjects to assign the anger label to the resultant arousal-level increase (Crozier, 1973; Konečni, Crozier, & Doob, in press; Konečni & Sargent-Pollock, Note 1). In this sense, exposure to complex (vs. simple) tones can be thought of as conceptually equivalent to the strenuous (vs. less strenuous) exercise manipulation used by Zillmann et al. (1972).

In summary, the present design permitted a comparison of individual and joint effects on aggression of three arousal-raising treatments. One of these treatments (insult vs. no insult) presumably differed from others in that it led to subject differentiation in terms of the adoption of the label of anger. The remaining two treatments could reasonably be expected to differ in terms of aversiveness. The arousal-level hypothesis predicted main effects of all arousal-raising treatments and no second-order interactions. In particular, the pattern of results for the loud-soft and complex-simple stimulation factors was not expected to differ at insult versus no insult. In contrast, the cognitive-labeling hypothesis predicted that subjects exposed to loud (vs.

¹ Geen and O'Neal (1969) found that subjects exposed to relatively soft (60-db.) white noise gave more shocks to a confederate than those not exposed to noise. In the present experiment, tones were used rather than noise, and the loudness levels were considerably different.

soft) tones and to complex (vs. simple) tones would give more shocks to the confederate *only if* they had previously been insulted by him. Both hypotheses predicted that subjects in the insult-loud-complex cell would give more shocks than those in any other cell.

It should be noted that the present experiment incorporated a very stringent test of the cognitive-labeling hypothesis. The notion, based on the research with infrahumans (e.g., Ulrich, 1966), that exposure to aversive events "automatically" leads to aggression predicts that subjects presented with tones at 97 db. would give more shocks than those listening to 73-db. tones irrespective of whether or not the subjects had been insulted.

METHOD

Tone Sequences

The method of construction of the tone sequences used in the present experiment has been described by Crozier (1973) and Konečni et al. (in press). Two types of continuous "melodies" differing in complexity or "uncertainty" (Garner, 1962) were generated by means of a PDP-8/S computer. This was achieved by varying the number of pitches, durations, and loudnesses of tones from which the two types of melodies were constructed. The method of construction involved sampling with replacement, with an average of two tones presented per second. The quantification in information-theory terms consisted of taking the logarithm (base 2) of the total number of possible tones used in the construction of a given type of melody. For the "simple" melody, there was a total of 16 possible tones, that is, 16 possible pitch-duration-loudness combinations, or a complexity/uncertainty level of 4.00 bits/tone; 576 tones were possible for the "complex" melody, or 9.17 bits/tone.

Continuous sequences of the two types of melodies were recorded on separate tracks of a magnetic tape. Either a simple or a complex melody (depending on the experimental condition) was binaurally presented to subjects through the headphones in 10-sec segments (each subject heard 50 such segments). As a result of the method of construction, the different 10-sec segments of a given type of melody were quite similar, but not identical. However, both quantitatively and subjectively, any 10-sec segment of the simple melody was far simpler (involving less uncertainty) than any 10-sec segment of the complex melody. Loosely speaking, while the former were reminiscent of nursery tunes, the latter resembled avant-garde music.

Loudness

All fifty 10-sec segments of one or the other type of melody were presented to subjects at

either the "soft" (comfortable) or the "loud" level, depending on the experimental condition. For subjects in the simple-melody condition, assigned to the soft presentation level, the median sound level was 73 db., with a range of 68-75 db. The range of loudness levels within a melody was due to the fact that loudness had been a variable in the melody construction. For subjects in the simple-loud condition, the median sound level was 97 db. (the range being 92-100 db.). Similarly, subjects in the complex-soft and complex-loud conditions were exposed to median sound levels of 73 (60-78) and 97 db. (86-103), respectively.

Subjects

The subjects were 66 female and 64 male freshmen from the University of California, San Diego. These people were experimentally naive, had not taken any psychology courses, and received remuneration for their participation. The data could not be collected for 4 females and 3 males, since they refused to administer what they thought were electric shocks. Two females and 1 male indicated in the postexperimental interview that they had been suspicious about the confederate's role; their data were not included in the analyses. This left 60 females and 60 males, with 6 subjects of each sex randomly assigned to each cell of the 2 × 5 design.

The confederates (a female and a male undergraduate) had been carefully trained, but were not acquainted with the experimental hypotheses.

Procedure

After both a subject and a confederate of same sex had arrived at the laboratory, they were escorted to an experimental room and given identical lists of 7 difficult anagrams on which to work independently for 7 minutes. The instructions, given verbally by the experimenter, and identical to those in the Konečni-Doob (1972) study, emphasized the problem-solving aspect of the anagram task.

Insult-no insult. About 2.5 minutes after the experimenter's departure, the confederate began to insult the subject, if the latter had been randomly assigned to this condition. The confederate was, however, blind to the next condition to which the subject would be assigned. Having "solved" all of the anagrams, the confederate called the subject slow and repeatedly expressed doubts as to his (her) intellectual ability. This was done for all subjects in a standardized manner. The confederate also engaged in a prescribed sequence of staring, humming, and foot tapping. The manipulation culminated in the confederate's snatching the subject's sheet "to see just how poorly" the subject had done, thus preventing the latter from working on the anagrams for a while. The majority of the insult subjects failed to solve any of the anagrams.

If a subject had been assigned to the no-insult condition, the confederate quietly worked on the anagrams without disturbing the subject in any

way. These subjects solved 3-4 anagrams, on the average.

Stimulation conditions and dependent measure. After 7 minutes, the experimenter returned and collected the anagram sheets without looking at them. If the subject attempted to make a comment, the experimenter interrupted by saying that all questions would be answered at the end of the experiment. The experimenter thus remained blind as to whether or not the subject had been insulted.

The experimenter then introduced the "creativity task," with instructions and the task similar to those described in detail by Konečni and Doob (1972). The subject was "randomly" chosen to be the "experimenter," while the confederate became the "subject." The true subject was given a list of 50 words entitled "Creativity Test" and was told to read them one by one to the confederate. The latter would have about 3 sec during which to produce a "creative, one-word, response." The true subject's task was to evaluate these responses using his (her) own criteria, as "no objective definition of creativity was available." If the subject thought that a particular response was creative, he (she) was to press a button labeled "Good," which would allegedly flash a green light for the confederate. If the subject considered a response to be inadequate, a button labeled "Shock" was to be pressed one or more times, depending on how uncreative that particular response was. A "relatively painful electric shock" would allegedly be delivered to the confederate's palm each time the button was pressed, ostensibly so that the effects of reward and punishment on creativity could be studied. At the mention of shock, the confederate expressed some surprise, and was appropriately reassured by the experimenter about his (her) safety.²

If a subject had been assigned to the no-stimulation condition, the confederate was at this point taken to an adjoining room. The subject overheard the experimenter's remarks, which she presumably made while attaching the electrodes to the confederate, and the dependent-measure period began immediately. If a subject had been assigned to one of the four stimulation conditions, the experimenter explained that she was also interested in the effects of musiclike tone sequences on both creativity and creativity evaluation. The two participants were told that they would *both* repeatedly hear some

tones through their respective headphones and that the main characteristics of these tones would remain the same irrespective of the quality of responses (given by the confederate) and evaluations (made by the subject). After further explaining the details of the procedure, the dependent measure period began.

A "trial" consisted of the following components: The subject read a word from the list into a microphone, and the confederate provided a standard response after 3 sec. As soon as the subject heard the confederate's response over a speaker, a 10-sec tone sequence began, which he (she) heard through the headphones. During these 10 sec, the subject pressed either the "Good" or the "Shock" button. When the 10-sec segment came to an end, the subject read the next word. There were 50 such trials. A particular subject received on all trials only one of the four possible stimulation treatments.

The total number of "shocks" administered by a subject to the confederate for the latter's 50 responses was the main dependent measure in the experiment. Obviously, the confederate did not actually receive either shocks or stimulation. The "Good" and "Shock" buttons were connected to an event recorder located in an adjoining room.

After the creativity task, as a check on the insult manipulation, all subjects first rated their own state during the anagram task on a 100-mm angry-not angry scale. They then rated the confederate with whom they had interacted on six scales. A thorough debriefing procedure, usually lasting about 20 minutes, brought the 50-minute experiment to a close.

RESULTS

The checks on the insult manipulation should first be examined. The data from these scales were submitted to a $2 \times 2 \times 5$ (Sex of Subject \times Insult \times Stimulation) analysis of variance. On all of the scales, there was an overwhelming main effect of insult versus no insult, whereas the effects of sex, stimulation, and all of the interactions were negligible. The insult-no insult means for the different scales are presented in Table 1. Subjects who had been insulted considered themselves significantly more angry during the anagram task than those who had been treated neutrally, $F(1, 100) = 13.72$, $p < .01$. In addition, in comparison with the neutrally treated subjects, the insulted people rated the confederate as far less likable ($F = 17.39$), less pleasant ($F = 48.43$), less warm ($F = 60.21$), more aggressive and domineering ($F_s = 123.30$ and 86.12 , respectively), and doubted that they could be on friendly terms with him (her) ($F = 34.21$). Thus, the insult

² The use of the reward-punishment or learning-task context for a measure of aggression has often been criticized on the grounds that subjects give shocks because they want to help the confederate do better. This criticism is clearly inappropriate for experiments that employ adequate dependent-measure tasks and appropriate control groups. Given the predicted difference between insulted and non-insulted subjects in the present experiment, one would have to extend the above criticism by making the implausible claim that insulted subjects are more intent than noninsulted ones on helping the confederate to be creative.

TABLE 1
MEAN RATINGS OF SELF AND THE CONFEDERATE BY INSULTED AND NOT INSULTED SUBJECTS

Confederate's behavior	Rating dimension						
	Self-rating	Rating of confederate					
	Not angry-angry	Likable-not likable	Pleasant-unpleasant	Warm-cold	Not aggressive-aggressive	Not domineering-domineering	Would like as friend-would not like as friend
Insult	35.7	49.7	55.5	56.5	69.2	63.8	49.8
No insult	24.3	31.3	26.7	32.2	28.2	31.0	29.3

Note. $n = 12$ per cell. Numbers represent mean distance in millimeters, on 100-mm bipolar scales, from the scale end named first (e.g., "not angry," "likable," etc.).

manipulation was apparently very successful. These results fully replicate those obtained in the earlier studies (e.g., Konečni, 1975). Note that these verbal measures were explicitly concerned with subjects' experiences during the anagram task. They must be distinguished from the hypothesized changes in the degree of anger, and the corresponding changes in self-report, which were presumably due to the subsequent manipulations. It was, of course, impossible to obtain self-ratings concurrently with the creativity task without causing serious "contamination" problems.

With regard to the main dependent measure, a similar $2 \times 2 \times 5$ analysis was applied to the total number of shocks administered by subjects in different conditions. All three main effects were highly significant. Men gave considerably more shocks than women did, $F(1, 100) = 7.93$, $p < .01$.³ The insulted subjects "hurt" the confederate more than the neutrally treated ones did, $F(1, 100) = 59.55$, $p < .01$, thus replicating the results of Konečni and Doob (1972) and Konečni (1975). Finally, various stimulation conditions significantly differentiated the subjects in terms of aggressive behavior, $F(4, 100) = 7.73$, $p < .01$.

More interesting was the significant Insult \times Stimulation interaction, $F(4, 100) = 3.96$, $p < .01$. All other two- and three-way interactions were negligible. The means for the

basic 2×5 design, with the sex factor summed over, are presented in Table 2. The interaction was clearly due to the fact that exposure to various types of stimulation produced differential effects on aggression only when subjects had been insulted. Among these subjects, exposure to the simple-loud, complex-soft, and complex-loud stimulation conditions resulted in by far the greatest amount of aggression, as indicated in Table 2. The insulted subjects exposed to no stimulation administered considerably more shocks than the equally insulted subjects exposed to simple stimulation at a comfortable (soft) loudness level, but did not differ significantly from the neutrally treated complex-loud subjects.

Among the insulted subjects, exposure to complex (vs. simple) and loud (vs. soft) stimulation clearly had a marked aggression-enhancing effect. The contrast of insult-simple-soft and insult-simple-loud versus insult-complex-soft and insult-complex-loud was highly significant, $F(1, 100) = 15.87$, $p < .01$, and so was the contrast of insult-simple-soft and insult-complex-soft versus insult-simple-loud and insult-complex-loud, $F(1, 100) = 20.68$, $p < .01$.

DISCUSSION

The present research provided rather strong support for the anger (cognitive labeling) hypothesis. An apparently essential condition for the aggression-enhancing effect of complex and loud stimuli, known to raise the level of arousal, was that subjects first be insulted, that is, label themselves angry. The arousal-level increments due to sources not conducive to the anger label had very little

³ This is, of course, a well-established finding in the aggression literature. However, it is interesting to note that while women differed from men behaviorally, the sexes did not differ from each other in terms of the subjective ratings of anger or the verbally expressed dislike of the confederate.

direct effect on aggression. When anger had already been instated, however, such arousal-level changes augmented the amount of aggression, presumably by intensifying the emotion. The present results are in agreement with those obtained by Zillmann et al. (1972). In a more general sense, they further corroborate the Schachter-Singer (1962) two-factor model of emotion and the theoretical formulations of Zillmann (1971) and Konečni (1975).

The cognitive-labeling hypothesis withstood an important test: Even the repeated exposure to aversive auditory stimulation did not enhance aggressive behavior, unless the subjects had a good reason for considering themselves angry. The assumption, favored by various theorists, that insult and frustration affect aggression merely because of their aversiveness may be erroneous. In addition, the present finding has implications for applied issues involving the effects of aversive stimulation on human social behavior.

Prior research (Konečni et al., in press) on the effects of insult and subjects' expression of aggression on their preference for simple versus complex stimulation, had suggested that the degree of anger, rather than the level of arousal, may be responsible for the relationship. The present experiment examined the converse relationship (i.e., the effect of simple vs. complex stimulation on aggression) and has led to a similar conclusion. Two, albeit related, lines of evidence thus suggest that cognitive processes should be taken into account in discussions of human motivation. In this sense, the present results may be particularly relevant for the motivational systems that make explicit use of both the level of arousal and "collative" stimulus

variables, such as complexity (Berlyne, 1967).

Only one aspect of the results was somewhat inconsistent with the foregoing analysis. While the mean for the insult-no-stimulation cell was greater than that for the no-insult-complex-loud cell, the difference was not significant. It is, of course, possible to speculate that a persistent repetition of combinations of arousing events may lead to a level of aggression close to that produced by a past and nonrecurring angering event. However, the overall pattern of results, in addition to the fact that the no-insult-complex-loud cell did not differ from other groups of noninsulted subjects, clearly did *not* support the notion that aggression may be enhanced by stimulation not conducive to the label of anger.

With regard to the effects of complexity and loudness on insulted subjects, it is convenient to consider the insult-no-stimulation cell as providing a point of reference: At the immediate, empirical level, in terms of the amount of aggression and, at the conceptual level, in terms of the level of arousal and the degree of anger. An interesting, and somewhat unexpected, finding was that exposure of insulted subjects to simple-soft stimulation resulted in a very small amount of aggression, equivalent to that displayed by various groups of noninsulted subjects. These people gave significantly fewer shocks than did the insulted subjects exposed to no stimulation. This fact seems to suggest that simple-soft stimulation may have *actively reduced* the level of arousal (and the degree of anger), beyond the gradual recovery pattern of the arousal system due to homeostatic processes (presumably evident in the insult-no-stimu-

TABLE 2
MEAN NUMBER OF SHOCKS BY EXPERIMENTAL CONDITION

Confederate's behavior	Stimulation				None
	Simple-soft: 4.00 bits/tonne at 73 db.	Simple-loud: 4.00 bits/tonne at 97 db.	Complex-soft: 9.17 bits/tonne at 73 db.	Complex-loud: 9.17 bits/tonne at 97 db.	
Insult	11.58 _o	20.33 _a	19.58 _a	22.92 _a	15.58 _b
No insult	10.75 _o	11.33 _o	11.42 _o	13.08 _{bo}	11.00 _o

Note. $n = 12$ per cell. Cells having common subscripts are not significantly different at the .05 level by the Duncan multiple-range test.

lation group). One is tempted to say that simple-soft stimulation was actually soothing (cf. Konečni & Sargent-Pollock, Note 2). This finding is inconsistent with the view that various levels of psychophysical and collative variables, such as loudness and complexity, have a unidirectional effect on the level of arousal.

On the other hand, either loud or complex stimuli were sufficient to lead insulted subjects to display a considerable amount of aggression, presumably by raising the level of arousal above that of the insult-no stimulation group. The evidence for additivity of the effects of complex and loud stimuli is equivocal, however, since the contrast of Insult-Simple-Loud + Insult-Complex-Soft versus $2 \times$ Insult-Complex-Loud was only marginally significant, $F(1, 100) = 3.31$, $p \approx .07$). It is possible that the nature of the creativity task imposed a constraint on the range of the dependent variable, producing a "ceiling" effect in the insult-complex-loud cell.

In conclusion, the present research obtained new evidence in support of the view that aggressive behavior of the type examined here is best understood in terms of the complex interplay of arousal-related and cognitive factors.

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