EFFECTS OF COGNITIONS OF AROUSAL AND ACTUAL AROUSAL IN LOW-EMOTIONAL AND HIGH-EMOTIONAL SITUATIONS

by

EDWARD C. OLIVER

B. A., University of California at Los Angeles, 1973

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Psychology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1975

Approved by:

William Griffitt
Major Professor

CONTENTS

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to William Griffitt for his support and helpfulness throughout this research.

Sincere thanks are also due to Theresa Hayden and Leon Rappoport for serving on the supervisory committee.

INTRODUCTION

In the past dozen years there has been a substantial body of research investigating relationships between physiological reactions, cognitions of such reactions, and emotions or attitudes. Although concern with the relation of physiological and emotional responses is by no means new among psychologists, the particular line of work most immediately relevant to this study can be traced most recently to work by Schachter and his colleagues (Schachter & Wheeler, 1962; Schachter & Singer, 1962; Singer, 1963; Schachter, 1964).

Schachter and Singer (1962) began with three basic propositions: 1. "Given a state of physiological arousal for which an individual has no immediate explanation, he will "label" this state and describe his feelings in terms of the cognitions available to him" (p. 381); 2. "Given a state of physiological arousal for which an individual has a completely appropriate explanation . . . no evaluative needs will arise and the individual is unlikely to label his feelings in terms of the alternative cognitions available" (p. 382) 3. "Given the same cognitive circumstances, the individual will react emotionally or describe his feelings as emotions only to the extent that he experiences a state of physiological arousal" (p.382). To manipulate the factors indicated in the above propositions, Schachter and Singer gave subjects an injection of epinephrine or placebo (disguised as a vitamin, Suproxin). Subjects recieving the epinephrine were either informed, misinformed, or left ignorant as to the physiological effects the injection would cause. After the injection and this explanation manipulation, subjects were placed in conditions designed to provide differing emotional cues--either euphoria or anger. Behavioral and self-report measures were taken to assess the subjects' emotions after these manipulations Although I will not detail here all the comparisons and specific results, the initial propositions were generally supported. Those subjects who were informed of the effects of the shot reported less emotionality than did the remaining subjects.

Schachter and Wheeler (1962) used three groups of subjects given either epinephrine, placebo, or chlorpromazine (a tranquilizer). Subjects in this experiment were exposed to a humorous movie clip and again both self-report and behavioral measures were taken of the emotional variable--amusement. Differences between these groups were as expected, with the epinephrine group showing more amusement then the placebo group which showed more amusement than the chlorpromazine group.

Stuart Valins took this cognitive-physiological model of emotion one step further. He made the point that once it is granted that internal events can function as stimuli, they can be considered a source of cognitive information (Valins, 1966). He proposed that physiological arousal does not function in any special manner but that the cognition of such arousal is but one of the cognitions utilized by the individual to arrive at the conclusion that he is experiencing an emotional feeling. This differs from an explanation involving the intrinsic effects of physiological arousal and stresses the informational value of the arousal. Valins further proposed that this information should then be subject to the same cognitive processes as other information (e.g., denial, distortion, misperception). A given reaction may not even be perceived or a nonexistant reaction may be assumed to have occurred. Valins tested this idea by providing false information to subjects about their internal reactions. If it is the cognitive aspects of arousal that mediate its relation to emotional feelings, then a false cognition of arousal should lead to a more emotional reaction than a cognition of no arousal.

Valins used college males as subjects and showed them slides of <u>Playboy</u>

nudes in order to provide the appropriate cues for an emotional reaction such as liking or attraction. Two groups of subjects were led to believe that while they were watching the slides, they were hearing amplified versions of their heartbeats, which changed markedly in rate to half the slides. Two other control groups heard identical sounds but were not led to associate them with their heartbeats (extraneous sound conditions). One of the heartrate groups and one of the control groups heard increases in the frequency of the sounds, timed so that they occurred with the presentation of half the slides, while for the rest of the slides there was no change in the sounds' frequency. The remaining groups were exposed to decreases in the sounds' frequency in the same places sequentially that the increases occurred for the first two groups. Slides accompanied by a change in the sound were called "reinforced" and slides for which the sound remained constant were "nonreinforced". Subjects then rated each slide on a 100-point scale ranging from "not at all" to "extremely" as to "How attractive or appealing each girl is to you.".

The results of Valins' experiment confirmed his hypotheses. When the feedback was presented as heartbeats, differential feedback affected the ratings Heartrate decrease subjects rated the reinforced slides an average of 6.69 points higher than the nonreinforced slides and the heartrate increase subjects rated reinforced slides 18.31 points higher than the others. Subjects were also allowed to choose 5 of the photographs from which the slides were made to keep as payment for being in the experiment Twenty-nine of the forty subjects in the heartbeat conditions chose three or more of the reinforced pictures and only six of the extraneous sound condition subjects chose this many of the reinforced pictures. The difference in the ratings of the reinforced and nonreinforced slides for subjects thinking they were receiving physiological information has since been called the "Valins effect" and will be referred to as such throughout the rest of this study.

The self-perception interpretation of all the above results is straightforward and clear. Daryl Bem (1967) first proposed this theory as an alternative explanation of cognitive dissonance phenomena, but its application to these data is certainly as well founded as the original application. Self-perception theory as a whole will not be reviewed here as there are a number of excellent expositions available elsewhere (Bem, 1967, 1970, 1972; Nisbett & Valins, 1971). Briefly, Bem's proposition is that people often emit behaviors quite unselfconsciously and then may ask themselves in essence, "Why did I do that?" Bem proposes that the answer to this question is reached in much the same way an outside observer would reach it. We often survey our behavior toward an object and then infer our attitudes toward the object so they are consistent with the behavior. Bem's theory is very much a cognitive, information-processing theory, and its relevance to Valins' experiment is especially evident. Bem stressed his theory's non-motivational or non-drive basis in contrast to the motivational nature of cognitive dissonance theory. Valins also stressed the informational effect of physiological factors in emotion as opposed to an intrinsic, motivational effect. Schachter and Singer's (1962) formulation was more motivational in nature with its "evaluative needs", but the self-perception interpretation of their results is straightforward. According to self-perception theory the subjects in Schachter and Singer's study were aware of their autonomic behavior (some physiological arousal), aware of the emotional aspects (euphoria or anger cues) of the situation, and hence inferred that they were emotional. Valins' subjects were "aware" of their (alleged) autonomic reactions and the external, emotion-inducing situation and they inferred that their greater reactions to reinforced slides must be indicative of greater emotional feelings. In self-perception terms, these subjects were behving as outside observers would in attributing their behavior (increased heartrate or arousal) to a cause (emotional feelings).

The Valins effect has been replicated a number of times (Barefoot & Straub, 1971; Goldstein, Fink, & Mettee, 1972, Stern, Botto, & Herrick, 1972; Oliver & Karr, Note 1; Oliver, Note 2). Its generality has been extended by demonstrating its occurrence with different types of feedback (auditory beating sounds, verbal information, visual meter readings, and a continuous tone varying in pitch) and different stimuli ("positive" Playboy nudes, "negative" auto accidents and injury pictures, and mixed sets of attractive and unattractive faces). However some of these same studies have posed some problems and suggested possible alternate interpretations of the Valins effect. It is one of these problems with which this study is concerned.

In the earliest investigations of this phenomon, the necessity of assessing physiological reactions that may be occurring during the stimulus presentation was noted. Valins asked subjects to rate their awareness of palpitations or actual feelings of their heart beating on a 4-point scale and the heartrate group reported feeling fewer palpitations than the control group. This comparison was replicated in a further investigation which also included GSR and heartrate measures (unpublished data reported in Valins, 1966). Subjects exposed to the heartrate increase and extraneous sound increase manipulations reacted the same physiologically.

Stern et al (1972) replicated Valins' experiment and added a third condition where subjects were told that the sound they would hear was extraneous but they should pay close attention to it. These investigators proposed that Valins' original groups may have differed in the attention they paid to the sound during the slides and that this may be the cause of the difference in ratings. Goldstein et al also took measures of GSR and heartrate during the slide presentation to look more closely for any differences in actual physiological responses. They found that in the feedback and in the extraneous-sound-attention groups there was a Valins effect in the ratings, and that, furthermore, both of these conditions involved a similar physiological response pattern different from the pattern for the extraneous-sound-ignore condition. They concluded that the Valins effect may not be due to cognitions of arousal but rather to an attention factor. In a replication of Stern et al's experiment this writer (Note 2) found no differences in physiological responses among the three groups, no relation of phyiological responses to the ratings, and a Valins effect only in the feedback group. The behavioral results were as expected given the hypotheses of the study, but the physiological results simply added fuel to the fire about the relation of physiological responses to behavioral responses (subjects' ratings).

Goldstein et al (1972) also indicated that real physiological reactions may play a part in determining perceived emotional responses under certain conditions. These authors were interested in the roles of cognitions of arousal and actual arousal in determining emotions and posed the question concerning the possible occurrence of real physiological responses as a result of false feedback (a "mimic" effect). If such a mimic effect were occurring, then subjects exhibiting the Valins effect might be responding to these actual changes rather than the non-veridical cues of the feedback. The two possibilities they outlined are diagrammed below:

A. $PA_C \longrightarrow E$

cognition of arousal (false heartrate) → emotion (subject's ratings)

B. $PA_c \longrightarrow PA_a \longrightarrow E$

cognition of arousal	actual arousal	emotion
(false heartrate)	(actual heartrate)	(subject's ratings)

These authors attempted a replication of the Valins effect and included measures of heartrate changes. In their first experiment, they found a Valins effect and a weak mimic effect, but no significant correlation between the physiological reactions and the ratings. In a second experiment, their male subjects were shown eight more slides of nudes. Half the subjects saw four female nudes followed by four male nudes (offensive condition). The remaining subjects saw eight female nudes (inoffensive condition). Cross-cutting these conditions, half the subjects heard increases in their heart-rate for the last four nudes, and half heard their heartrate remain constant for all the slides. Control groups in these experiments simply heard no feedback. After viewing the slides subjects answered a questionnaire about the experiment. The crucial question was one concerning how offensive they found the experiment with ratings made on a 21-point scale where 1 meant "not at all", 21 meant "very much", and 11 meant "neutral". Goldstein et al found that the feedback had no effect on the offensiveness ratings, and that there was a significant relation between the offensiveness ratings and real heartrate changes (which were not related to feedback). Those subjects who had experienced a change in heartrate were more offended than those whose heartrate had remained constant. The authors concluded that this difference in the effect of the feedback from the first to the second experiment was due to the fact that for these subjects, viewing Playboy nudes was a relatively unemotional experience, while viewing male nudes was a more emotionally provocative experience for subjects in the second experiment. Their conclusion was that in "potent emotional situations" it was real arousal, and not simply the cognition of arousal, that is crucial in mediating emotionality. At present then, we have two studies indicating no differences in physiological responses between feedback and control subjects, and no relationship between physiological responses and ratings. Two other studies apparently do show a relationship between real arousal and rating differences. This situation certainly doesn't allow one to reach a very definitive conclusion about the roles of actual arousal and cognitions of arousal. Goldstein et al concluded that in strong emotional situations it is actual arousal itself that determines emotionality, and they imply strongly that this effect is intrinsic in nature; that cognitive cues are not utilized in the self-perception fashion in these situations. Let me briefly summarize what I feel are a few problems in accepting this conclusion as more than tentative.

In one way the Goldstein et as results do not disagree with a self-perception anlaysis, although the authors imply that it does. In his 1967 paper, Bem states "The major implication of these findings is that, to the extent that internal stimuli are not controlling, an individual's attitude statements may be viewed as inferences from observations of his own overt behavior and its accompanying stimulus variables." (p. 186). Later (Bem, 1972) he states "Thus, to the extent that internal cues are weak, ambiguous, or uninterpretable, the individual is functionally in the same position as an outside observer." (p. 2). What Goldstein et al's "potent emotional situations" may represent are cases where internal stimuli are not weak, ambiguous, or uninterpretable. This does not remove them from the realm of self-perception theory, however, for the above statements are of only one of two fundamental propositions of Bem's theory (albeit perhaps the one most often remembered for its linking of self-attributional and other-attributional processes). The "other half" of Bem's theory is that " individuals come to 'know' their own attitudes, emotions, and other internal states partially by inferring them from observations of their own overt behavior and/or the circumstances in which the behavior occurs." (Bem, 1972.p. 2). This proposition concerns the process by which we learn what our feelings mean, beginning in early childhood. Bem's proposal is that these meanings are not innate in any sense, but must be taught to us by the community. To teach a person the "meaning" of his internal states, the community has to rely on external cues (behavior and/or circumstances) to infer what the person's internal states are. Then the appropriate labels or meanings for the states may be taught and if these states are present later the individual can infer from their presence the nature of his emotional feelings. When these states or internal feelings are not present in a later situation, one must rely on the same type of observations that were used in teaching the labels originally--observations of his behavior and/or circumstances. In either case (presence or absence of internal feelings) the process is assumed to be cognitive and observational. We can see then that real physiological changes are not denied a relation to emotion in self-perception theory. The relation is simply defined as a cognitive one, not an intrinsically causal one. Real changes in physiological states will indeed be related to emotion in so far as one has been taught that such changes signify emotion. A self-perception interpretation of the Valins effect does not suggest that false physiological information is more powerful than actual physiological effects, but suggests that this inferential, cognitive process mediates the relationship of actual physiological changes to emotion. In other words, if the relation of arousal to emotion is a cognitive, information-processing relation, then false knowledge of arousal should work in certain ways to produce judgements of emotion. The value of Valins' (1966) experiment, and those of others which have replicated his results is, as with most research on induced subject errors, to point out the possible mechanisms operating under normal circumstances.

Goldstein et al apparently concluded that because there was a relation between physiological arousal and emotion, it must be causal and direct, that self-perception is not operating in these potent emotional situations. As outlined above, if all of self-perception's foundations are considered, this conclusion is not necessarily supported by Goldstein et al's data. They do not show that it was not the cognitions of real arousal which mediated the subjects' emotions as false cognitions do. In the authors own 3-stage diagram of false cognition to real arousal to emotions, there is logically no reason not to assume a cognition between the real arousal and the emotion, and perhaps such a cognition is even necessary for the emotion to result. Goldstein et al do not report an attempt to look for the presence or absence of such cognitions of actual arousal. Because almost all the offensive condition subjects whose heartrates changed reported being offended, it was concluded that the change itself caused the emotion. A few subjects whose heartrates changed did not report being offended, however, and a few whose heartrates remained the same did report being offended. Perhaps these subjects simply had non-veridical cognitions of their arousal while the other subjects had veridical cognitions.

A somewhat related problem exists in interpreting Goldstein et al's (1972) results vis-a-vis the other work in this paradigm. These investigators used a very different manipulation and measurement. Previous research has used within-subject designs in providing differential feedback and in assessing differential emotional reactions (subjects' ratings). Differential levels of indicated arousal have resulted in differential judgements. The false arousal indicated has been similar to what subjects might naturally expect in the situation, and thus, did not directly conflict with the subjects' expectations. In the Goldstein et at al between-subjects design, however, each subject received either "all" or "none" feedback. That is, the feedback indicated that they were aroused by all of the male nudes or by none of them. This feedback then was subject to being in very direct conflict with possible real arousal and/or cognitions of real arousal. The feedback didn't indicate differing degrees of arousal for different slides, information which could be easily added to a subject's cognitions of his overall arousal. Instead it simply indicated no arousal to any of the slides, or arousal to all of the slides, information potentially more conflicting with a subject's own feelings of arousal. In such a situation it is intuitively logical that subjects would pay more attention to any real feelings they may have than this feedback which indicated otherwise. If subjects were aroused and "knew" it from other internal sources, feedback which indicated that they weren't aroused at all would likely be discounted, and vice versa. The between-subjects measure did not allow for differential ratings of offensiveness either and is subject to similar criticism. It too was all-or-none as subjects were classified as either offended or not offended depending on whether they scored 11 or above or under 11 on the offensiveness question (note too, that this classifies subjects who actually marked "neutral" as offended). If the feedback had indicated, for each subject, arousal to some male nudes and no arousal to others, and if the ratings had then been of the individual offensiveness of each slide, the entire design would have been much more comparable to the rest of the research on this question. This writer feels, however, that if such a design had been used, a Valins effect would very likely have been found. The hypotheses of the present study relevant to the above problems will be introduced after review of further work that influenced their complete formulation.

Howard Leventhal and some of his colleagues have been conducting research on expressive and evaluative responses with various stimuli. In a recent study (Cupchick & Leventhal, 1974) it was proposed that for males there was generally an independence between expressive behavior and evaluative responses while for females there was generally an interdependence of the two. In the humor-inducing situation of their experiment mirth was the expressive behavior (laughing, smiling, etc.). The level of mirth was proposed to be related to rated funniness of cartoons presented to females, while the level of mirth would not influence funniness ratings for males. Subject mirth level was independently manipulated by the presence or absence of canned laughter (previously found to facilitate mirth reactions). The test of these investigators' assumptions was carried out by breaking the assumed link between expressive behavior and the emotion ratings. This should affect females' ratings but not males', as for them the link had not existed to begin with. The disruptor was simply self-observation and reporting of their mirth reactions by the subjects themselves. This had previously been found to isolate the behaviors observed and remove them from the experience of feelings. If this behavior had previously been used by females in their evaluations, such isolation should change their evaluations and it did. For males there was no change in the ratings indicating there had been no original links. Relevant to this study, however, there was a significant Expressiveness x Canned Laughter x Self-observation interaction for males. Generally low-expressive males apparently used their mirth reactions as a guide to their evaluations when directed to self-observe, while generally high-expressive males liked the cartoons less when self-observing and resembled females in the same condition. This suggests that while males may be generally more "objective" and less feeling-oriented than females, low-reactive males are particularly so. For these males the isolation of the expressive reaction makes it a more "objective" discrete event. Directing subjects' attention to the reaction resulted in the reaction being used more, in an informational manner, to rate the cartoons. It is as if these males, particularly lacking in internal cues, were especially open to external ones in forming their judgements of the cartoons.

There may be an interesting parallel between these results and those of Goldstein et al. Leventhal's low-expressive (unemotional?) male subjects and those in Goldstein et al's inoffensive condition both used cognitive information about their reactions in forming judgements (although for one group it was real information about overt behavior and for the other group it was false information about arousal, the mechanism may be similar). Neither Leventhal's high-expressive (emotional?) subjects nor Goldstein et al's offensive condition subjects appeared to use the cognitve information used by the above groups (though they may have used other information in a similar way). This interaction of arousal, sex, and feedback utilization, provides the basis for the hypotheses of this study.

First, given within-subject differential feedback about arousal, the Valins effect will be found for both low emotional and highly emotional stimuli. This should result in a main effect for reinforcement showing that the slides accompanied by a change in the feedback are rated as more unpleasant than the others in all conditions.

Second, males in the low-emotion condition for whom internal cues are particularly weak, will exhibit a greater Valins effect than males in the high-emotion condition. The Valins effect will not differ as a function of the emotional level in females resulting in a Sex x Emotional Condition x Feedback interaction.

Third, if the contribution of real arousal to emotional evaluations is cognitively mediated, increased awareness of one's arousal should attenuate the Valins effect by reducing the relative weight of information in the false feedback.

METHOD

Subjects: Subjects were recruited from introductory psychology courses at Kansas State University. Twenty-eight male and twenty-eight female subjects were used. Fourteen of each sex were randomly assigned to a high-emotion condition and fourteen to a low-emotion condition.

Apparatus: Eight color slides of accident victims were used in each of the emotion conditions. These slides constituted the emotion manipulation. All slides were from a larger set of similar slides obtained from a local insurance company. The slides are pictures of victims of accidents that have occurred on farms and are used by the company in a safety training program. A set of 30 of the slides judged by the experimenter to cover a wide range of emotional impact were shown to 30 subjects other than those identified above. Unpleasantness ratings of the slides from these subjects were used to select those slides eliciting the least and the greatest emotional reactions (eight low and eight high). A concealed cassette tape recorder was used to provide the feedback to subjects in the actual experiament. The feedback was a continuous tone varying from 1950 to 2800 cycles. It was represented as coming from a polygraph and was audible throughout the slide presentation. Actual heartrate was recorded throughout the presentation on a Beckman dynograph using a Beckman model 9857B cardiotachometer and surface electrodes. Electrode placement was on the left and right inner forearms with a ground on the back of one hand.

Procedure: Subjects were brought into the testing room, seated in a comfortable chair, and given the following information and instructions.

> We are studying physiological reactions to unpleasant stimuli. What we would like to do is record your heartrate while showing you some slides of accidents. These slides are in color and were collected by an insurance company to use in a safety course. The slides are of hands and feet or limbs that have been injured in accidents on farms. If you feel that you do not want to watch slides like these, you may leave now with no penalty whatsoever. You will still receive your credit for participating, or, if you stay but feel unable to continue at any time during the experiment, just yell and we'll stop. I will be here monitoring the polygraph, and can stop the experiment at any time you wish.
>
> During the slide presentation, I will be recording your heartrate on the polygraph. I will put these three self-adhesive electrodes on the inside of your wrists and the back of one hand. It will be helpful if you can remain fairly relaxed during the time I am recording your heartrate. The electrodes cannot tell the difference between electrical signals from different sources and if you move your arms or hands during the recording they will pick up a muscle signal and the heartrate recording will be interrupted. Before we begin, you should get in as comfortable a position as possible so that you can remain fairly still during the slides.
>
> After I begin recording I will wait for three minutes before showing you the first slide. It may seem like a long wait at the time, but it will allow me to establish a baseline for your heartrate at rest. Then I will begin showing you the slides which will each be on the screen for 20 seconds with 20 second intervals between slides. The interval will allow time for your heartrate to recover from the effects of any slide before the next one is shown. There are eight slides altogether and I will go through

them twice in the same sequence. This allows me to get a more stable indication of your reactions by having two records for each slide. After the final slide I will wait for another two minutes before turning off the polygraph in order to see at what point your heartrate will stabilize at rest again.

You will probably hear a high-frequency sound coming from the polygraph during the recording that may sound alarming if I didn't tell you it was coming. It is simply a sound made by the component in the polygraph that receives the signal from the electrodes and transforms it to a form that can drive the recording pen. Newer components bypass this and are quiet, but since this is what we already had here and it works fine, we are using it. If you hear the pitch change, that is all right, it does that with changes in your heartrate. It will increase when your heartrate speeds up and will fall again as soon as your heartrate does. Now if you have no questions, I'll attach the electrodes and we'll begin.

The experimenter then turned out the light and presented the slides as indicated. After the second presentation, the light was turned on, a rating scale was explained to the subject, and while viewing the slides once more he rated the unpleasantness of each. Then subjects answered a short questionnaire, were fully debriefed, sworn to secrecy, and dismissed.

<u>Slide and Sound Manipulations</u>: The eight slides were shown to subjects in different, randomly determined orders with the restriction that each slide appeared in reinforced and nonreinforced positions equally often within each condition. The tape played with the concealed recorder produced increases in frequency for half the slides and "constant" frequency for the others. Two tapes were actually used with exactly complementary schedules of increase and constancy, and they were each used for alternate subjects within conditions. The increases occurred either for slides in positions 1, 3, 4, and 7 or for all the others. The increases were also repeated for the same slides in the second sequence of the presentation. During the resting periods and during nonreinforced slides, the tone varied between 1950 and 2000 cycles. Increases progressed from 2000 cycles to 2533 at 10 seconds after onset, to 2800 at 18 seconds, remained there four seconds, then decreased to 2400 at 30 seconds and reached 2000 again by 38 seconds after the slide onset.

<u>Measurement</u>: Subjects rated each slide for unpleasantness on a 101-point scale during the third presentation (5 seconds per slide with no intervals). The ratings were made by writing down a number from 0 to 100 for each slide where 0 means "not at all unpleasant" and 100 means "extremely unpleasant". Following this, each subject answered three written questions. The first question concerned the subject's awareness of his physiological reactions disregarding the information from the polygraph. Subjects responded to this question by circling a number on a seven-point scale anchored at 1 ("no awareness at all") and 7 ("very great awareness"). The second question asked the subject if he felt the high-frequency sound had any meaning other than what he was told, and the final question asked if he felt the experiment might concern anything other than what he was told. If either of the last two answers was yes, the subject was asked to briefly write what he thought, and if that wasn't clear the experimenter questioned the subject directly to make certain of what he thought (See Appendix A).

For the physiological measures, a continuous recording of heartrate was made during the entire slide presentation and the rest periods immediately preceding and following the slides, as indicated above. The onset of each slide was marked on the chart during the recording. The cardiotachometer output is a continuously varying DC potential directly proportional to the instantaneous rate derived from the interval between every two consecutive beats. This allows a direct reading of the rate of each heartbeat. For the 20 second interval that each slide was presented, the rate at each heartbeat was recorded and the standard deviation of these rates for each slide was computed and used as the dependent measure of arousal. This measure of variability in the heartrate was used because some investigators have indicated that heartrate variation may be a better measure of arousal than heartrate per se. In arousing situations, it has been shown that sometimes heartrate will increase and other times it will decrease (Lacey, Kagan, Lacey & Moss, 1963). Even subjects injected with epinephrine to produce arousal show, at times, a greater increase in variability than in level of heartrate (Goodman & Gilman, 1970). Although there is a general speed-up of the heartrate, the variability also introduced may actually lead to some recorded decreases in rate, depending on the measurement interval. Berkhout, Walter, & Adey (1969) have shown that in response to verbal stimuli such as personal questions about sexual and ethical topics, heartrate changes characterized by high variability would be a better index of arousal than the actual heartrate itself.

RESULTS

Behavioral data. The first analysis was the investigation of the basic Valins effect, as concerned in the first two hypotheses above. The primary hypothesis was that a Valins effect should be present in all conditions of the experiment. That is, subjects in all conditions should rate the reinforced slides (accompanied by an increase in the false heartrate feedback) as more unpleasant than the nonreinforced slides (no change in the feedback). The second hypothesis was that for males the Valins effect should be greater in the low-emotion conditions while for females there should be no difference in the Valins effect between conditions.

A mean rating of the four reinforced slides. a mean for the non-reinforced slides, and a difference score (reinforced minus nonreinforced) were calculated for each subject. The mean rating scores were entered into a mixed design 2 x 2 x 2 analysis of variance (Sex x Slides x Feedback). The only significant effects were those for Feedback (F (/52) = 82.58, $p<.001$) and Slides (F (1/52 = 12.72, $p<.001$). The Feedback effect indicated that the reinforced slides were rated as more unpleasant than the nonreinforced slides in all conditions (See Table I), supporting the first hypothesis. The Slides effect was built in by the preselection of the stimuli and simply indicates that the experimental conditions do differ. The second hypothesis requires a significant 3-way interaction, to be supported, and this interaction was not found.

The third hypothesis concerned the effect of a subject's awareness of his actual physiological reactions on the Valins effect caused by the false feedback. The Valins effect may be seen as a demonstration of the probable manner in which real arousal affects emotion, i.e. through the cognitions of that arousal. This interpretation of the Valins effect is the basis for the third hypothesis here, that increased awareness of real physiological arousal should attenuate the Valins effect. As subjects become more aware of their actual reactions (higher awareness scores) the relative weight of the information provided by the false feedback will decrease, resulting in a weaker Valins effect. Using the difference scores obtained above (reinforced rating minus nonreinforced rating) as an indicant of the Valins effect per subject, there should be a negative correlation between these scores and the awareness scores.

Before calculating this correlation, the scores from the awareness measure were first entered into a Sex x Slides ANOVA to ascertain any effects of experimental conditions. Since there were no significant effects, the Sex variable was collapsed for the correlation. (The high and low-emotion condition subjects were considered separately, however, as these subjects had been treated differently.) The correlation between awareness and rating difference scores for subjects viewing the low-emotion slides was -.01 (ns) and the correlation for subjects viewing the high-emotion slides was -.31 ($p<.05$). Following McNemar (1962, p. 140) the r to z transformation was used to calculate an overall correlation which was -.16 (ns). (This procedure involves converting each r to a z, averaging the z's (each weighted by its sampling variance), and testing the significance of the z_{av}.) Although these correlations are in the predicted direction, only the one for subjects in the high-emotion condition is significantly so. These data only offer weak, though suggestive, support for the hypothesis.

Physiological data. Although no specific hypotheses were offered with regard to the physiological results, there are some particular questions of interest. The first question concerned the effect of the false feedback on actual arousal, i.e. the "mimic" effect proposed by Goldstein et al (1972)

Table I

Mean Unpleasantness Ratings

Slide Condition	Feedback: Reinforced	Feedback: Nonreinforced	Difference Reinforced minus Nonreinforced
Males			
Low Emotion	43.25	34.25	9.00*
High Emotion	71.32	54.18	17.14**
Females			
Low Emotion	61.41	43.04	18.37**
High Emotion	73.88	59.95	13.93*

* $p<.005$
**$p<.0005$

and for which they found limited support. The physiological measure of arousal used in all the following analyses is one of heartrate variability (HRV) as described above. Briefly, again, the output of the cardiotachometer indicates the rate of each heartbeat, calculated by the time elapsed since the preceding beat. For the 20-second interval following each slide's onset, the rate at each beat was recorded and a standard deviation of these rates was calculated as the variability measure. Thus, for each subject there were eight raw measures of HRV corresponding to the eight slides. To examine this first question about a mimic effect, a mean HRV for the reinforced slides and a mean for the nonreinforced slides was calculated for each subject. These means were entered into the same 2 x 2 x 2 ANOVA as the rating means (Sex x Slides x Feedback). There were no significant effects in this analysis, demonstrating that there was no mimic effect occurring here. Such a mimic effect would have resulted in a Feedback effect and the $\underline{F}$ for Feedback was in fact less than 1.

The second question of interest in the physiological data was the obvious one concerning the relationship of the physiological reactions and the emotional reactions (unpleasantness ratings). Goldstein et al concluded that in potent emotional conditions there would be no Valins effect and that real physiological reactions would mediate the emotional reactions. We have seen that there was a Valins effect in all conditions here, already, but it is still possible that the actual physiological reactions might be independently related to the ratings in one or the other of the emotional conditions. (The fact that there was no difference in the physiological measures between conditions here does not preclude the following analysis as Goldstein et al found no significant differences in physiological arousal either. What they did find, apparently, was a difference in the <u>role</u> of arousal from one situation to another, and that is what is examined next.) For each subject, two new unpleasantness ratings were obtained. These were the mean rating of the four slides with the greatest HRV and the mean rating of the remaining four. These new rating means were entered into a 2 x 2 x 2 ANOVA (Sex x Slides x HRV). Two effects, if significant, could have indicated a role of physiological arousal in determining the unpleasantness ratings. The most obvious would be a main effect indicating that increased HRV led to higher ratings. This did not occur ($\underline{F}<1$). More specifically relevant to Goldstein et al's conclusion, would have been a Slides x HRV interaction indicating that HRV affected the ratings in the high-emotion condition but not in the low-emotion condition. This interaction did not occur ($\underline{F}<1$). The only significant effect in this analysis was that for Slides (this "effect" will always be present as it does not change from one analysis to another, using the same subjects).

It seemed reasonable that in regard to the possible relationship investigated above, there may be a difference for subjects whose overall level of physiological response was different. That is, there might be a relation of slide-specific HRV and slide ratings for those subjects whose heartrate variability is generally high and not for those whose heartrate variability is generally low, or vice versa. Accordingly, each subject's HRV scores were summed to give a measure of total variability over all eight slides. These total HRV scores were used to divide the subjects into two new groups. Those above the median were considered high overall HRV and those below the median were considered low overall HRV. The Sex and Slides variables were collapsed as this new dividion was not even across the original conditions. The mean unpleasantness ratings of the high-HRV and low-HRV slides for each subject (as used in the preceding analysis) were now entered into a 2 x 2 ANOVA (2 levels of overall HRV x 2 levels of within-subject slide-specific HRV).

There were no significant effects in this analysis, indicating that for subjects in this study there were no direct relationships between HRV reactions to slides and ratings of those slides.

DISCUSSION

The ANOVA on the ratings of the slides clearly showed there was a reinforcement effect (a Valins effect) in both the high and low-emotion conditions of the experiment. However, inspection of the cell means, shown in Table I, reveals a couple of intriquing anomalies. For the females, reinforcement raised the ratings of the low-emotion slides to the same level (even about a point higher) as the high-emotion slides that were not reinforced. In fact, the difference in ratings caused by reinforcement is slightly greater than that caused by the different slide conditions! (Mean rating difference due to slides = 14.69; difference due to reinforcement - 16.15.) In the means for males it can be seen that the smallest Valins effect of the experiment occurs in the low-emotion condition. Although these differences were not great enough to have caused a Sex effect or any interactions with Sex in the original design, it was possible that separate analysis of each sex might yield something more.

For each sex the Feedback effect was still significant, but for females the $\underline{F}$ for Slides fell just short of significance at the .05 level (low-emotion condition, 52.22, high-emotion condition, 66.91; $\underline{F}$ (1/26) = 4.032). This appears to be the result of the strong Valins effect. A comparison of the nonreinforced means across emotional conditions (which is the most similar situation to the pretest) reveals a significant difference ($\underline{t}$ (26) = 2.26, $p<.025$). Reinforcement raised the means in the low-emotion condition enough, however, (note this condition shows the greatest Valins effect) to override the picture difference, as a test of the reinforced means is nonsignificant ($\underline{t}$ (26) = 1.55, $.05<p<.1$). Why reinforcement should actually override the picture difference in this way for females only is not at present clear. Some light may be shed, though, by the Cupchik and Leventhal finding that females generally appear to be more feeling-oriented than males, who are more objective. If then, the feedback is interpreted by subjects as representing feelings, it would be expected that females utilize it more in judging the slides than would males.

The analysis of the ratings made by males showed that the Feedback, Slides, and Feedback x Slides interaction were all significant. The $\underline{F}$ values respectively (all df are 1/26) were 46.64, $p<.001$; 8.97, $p<.01$; 4.52, $p<.05$. Reinforcement increased the unpleasantness ratings of the slides, the slide conditions were effectively different for these subjects, and there was a greater Feedback effect for males in the high-emotion condition than for the others. As shown in Table I, the Feedback effect is significant in every condition, so the interaction here is not due to the absence of a Valins effect anywhere, but simply to a stronger effect for one group than for the other. This brings us to an interesting point, i.e. the direction of the interaction. The second hypothesis of the study was that the Valins effect would differ in strength between emotional conditions for male subjects. The prediction was, however, that the low-emotion group would exhibit a stronger Valins effect, just the opposite of what actually occurred.

Although there is no clear and definite explanation for this interaction, two points might be made. The first relates to one of the present objections to the Goldstein et al methodology, i.e. the degree of discrepancy between a subject's actual subjective feelings of his physiological reactions and the reactions indicated by the feedback. The point was made above that in the case where false feedback is in the position of potentially high conflict with information subjectively available to subjects, it is only logical that the feedback may be less accepted. Possibly, males in this study's low-emotion condition were so unemotional in fact, that the quite marked reaction indicated by the feedback was simply believed less strongly by them than by other subjects. The indication of a strong reaction to the slides may have been so at odds with what these particular males were actually feeling, that they simply relied less upon the feedback in making their judgements.

The second possibility concerns the foundation for the original hypothesis. It was based on Cupchik and Leventhal's (1974) finding that in the self-observing condition of their experiment males who were low-expressive utilized their mirth reactions more in judging cartoons than did males who were high-expressive. The reverse was true in the non-self-observing condition where mirth reactions and funniness ratings were more closely related for high-expressive than for low-expressive males. The direction of the present interaction seems to be an indication that self-perception and Cupchik and Leventhal's self-observation are not necessarily the same. The pattern of the data here is similar to the pattern of data from Cupchik and Leventhal's non-self-observing males. Feedback about reactions does not seem to have had the same effect as did self-observation. Self observation in Cupchik and Leventhal's study isolated the mirth reactions from the experience of feeling, thereby enabling the low-expressive males to utilize their reactions, now "objective" information about the slides. In the present study, however, feedback was apparently interpreted as "feeling", and thus utilized least by the more "objective" males. This pattern of results appears quite similar to the way in which male subjects utilized actual mirth reactions in the Cupchik and Leventhal study. Obviously, comparisons across studies as widely divergent in method and purpose as are Cupchik and Leventhal's and the present one, will be tenuous. However, since the results from the males here do resemble the results from males in Cupchik and Leventhal's more "normal" non-self-observing condition, it may be a further demonstration that false feedback is utilized similarly to real reactions.

The analysis of the awareness scores yielded limited support, at best, for the third hypothesis investigated. The correlation of awareness and difference scores even for the high-emotion subjects, though significant, was small. Examination of the awareness scores showed that not only were the means in the experimental conditions all very close to 4, but that indeed 15 subjects, over a fourth of the total, had a score of 4, the scale median. It seemed possible if these subjects were deleted and those remaining considered in two groups whose average awareness was high or low, that awareness and the Valins effect may be related differently from one group to the other. (There were 19 subjects in the generally low awareness group (mean score 2.63) and 22 in the high awareness group (mean score 5.27) formed by this procedure.) Dividing each of these groups in turn into those having seen the low slides and those having seen the high slides, four correlations between the awareness scores and rating difference scores were calculated. Again following McNemar's advice for averaging correlations, these r's were transformed to z's and the weighted z's averaged to find the correlations for high and low-emotion subjects across awareness, and for high and low awareness subjects across slide conditions. The correlation between awareness and the difference scores did not change from that above for the low-emotion condition (-.01), but for the high-emotion condition it was increased to -.75 ($p<.005$). The correlation for the high awareness group, across both slide conditions was also significant (r (22) = -.57, $p<.005$), while that for the low awareness group was not (r (19) = -.05). Although conclusions drawn after such internal juggling should be highly guarded, this may indicate that a certain minimum level of awareness of one's internal reactions is necessary before such feelings will be strongly relied upon, at least in the face of the very clear and obvious feedback that was presented here. It is certainly logical that a vague feeling about one's internal reactions may be more easily swayed than a stronger one.

Regarding the physiological data, one can draw a number of conclusions. First of all, there was no mimic effect revealed here. This would have required a Feedback effect on the measure of physiological arousal and this did not occur. It is extremely unlikely, judging by these data, that feedback-caused actual physiological arousal is mediating the Valins effect as Goldstein et al propose. Such a mimic effect certainly is not necessary for the Valins effect to occur.

It also is apparent in these data that there is no direct relation of the physiological measure used and the slide ratings. Goldstein et al concluded that in high-emotion situations actual physiological arousal would be more closely related to emotional reactions than would cognitions of arousal. The present data do not offer any further support to that conclusion and do indicate, rather, the importance of subjects' cognitions about their arousal in determining their emotional feelings across conditions. Here, as in Goldstein et al, the high-emotion condition was based on the stimuli used, not on a physiological reaction. There was a possibility that such a division of subjects based on their actual physiological reactions may affect the occurrence of the Valins effect. Remember, the subjects had already been classified as high or low in overall HRV for a preceding analysis. This grouping was used again now. The original rating means of reinforced and non-reinforced slides were entered into a 2 x 2 ANOVA (overall HRV x Feedback). Based on the Goldstein et al conclusion, one might expect an interaction of these factors so that more emotional subjects (now defined by their own reactior regardless of the experimental condition) might exhibit a smaller (or no) Valins effect than less emotional subjects. However, the only significant effect in this analysis was that for Feedback. The Valins effect seems to hold up across emotional conditions whether these are defined by the experimental conditions or by the subjects' own reactions.

In summary, the Valins effect was quite clearly shown in both the high and low-emotion conditions in support of the first hypothesis. This finding offers additional support for the Bemian self-perception interpretation of the Valins effect. A self-perception explanation is further supported by the failure to find a mimic effect in the physiological data. Although such an effect may occur at times, it clearly is disconfirmed as a necessity for the Valins effect. Further, at this level of emotional feeling, which is admittedly not as extreme as can be encountered, the data presented here strongly indicate the subjects' cognitions about their arousal are quite important in evaluating their own emotion. The actual physiological response, however, was not useful in predicting the subjects' feelings about the slides in any analysis performed. Thus, these subjects appeared to judge their own emotions in much the same way an outside observer might, attributing their physiological responses to emotional feelings.

The second hypothesis was not supported and some possible reasons for the results found were put forth. Further investigation of this interaction in the ratings from the males might shed more light on one of the reasons (or, of course, come up with another altogether). In regard to the first possibility noted above, scaling the feedback so the reactions indicated to reinforced slides are weaker for subjects in the low-emotion condition, might increase the Valins effect for males in that condition. In regard to the second possible reason for the present results, perhaps "self-observation" (of responses on the polygraph) might reverse the present pattern of Valins effects across conditions. That is, if subjects were directed, as in Cupchik and Leventhal's study, to observe and record their heartrate responses on the polygraph, the Valins effect might become stronger for males in the low-emotion condition and weaker for everyone else. This would parallel the effects of self-observation on the relationship between mirth and rated funniness in Cupchik and Leventhal's study.

Finally, the hypothesis concerning awareness of one's physiological responses was only weakly supported. It could, of course, simply be wrong, but the evidence is suggestive that it is correct. As noted indirectly above (by the number of subjects scoring at the scale median) this measure may not have been sensitive enough. If, for example, subjects indicated their awareness on a 0-100 scale as they did their feelings about the slides, one might obtain a finer discrimination. This point seems particularly salient in view of the fact that in this study the difference scores representing the Valins effect had a range of over 56 points compared to the 7-point awareness scale. Another point to consider is the probable difficulty subjects may have in recalling their awareness of physiological reactions disregarding the feedback, after the feedback has occurred. The biasing effect of the feedback, here, would be to increase estimates of awareness with increased attention to feedback. Given that greater attention to the feedback would cause a greater Valins effect, there would be a positive correlation between awareness and the Valins effect. Therefore, the above finding of negative correlations between awareness and the Valins effect becomes still more encouraging.

Reference Notes

1. Oliver, Edward, & Karr, Donna. Attribution of self's emotions: The effects of false physiological information. Unpublished manuscript, UCLA, 1973. (Available from Edward Oliver, Department of Psychology, Kansas State University, Manhattan, Kansas 66506.

2. Oliver, Edward. Attention and causal attributions to false heartrate feedback. Manuscript submitted for publication, 1975.

References

Barefoot, J. C., & Straub, R. D. Opportunity for information search and the effect of false heartrate feedback. Journal of Personality and Social Psychology, 1971, 17:2, 154-157.

Bem, D. J. Self-perception: An alternative interpretation of cognitive dissonance phenomena. Psychological Review, 1967, 74:3, 183-200.

Bem, D. J. Beliefs, attitudes, and human affairs. Monterey Calif.: Brooks/ Cole, 1970.

Bem, D.J. Self-perception theory, in L. Berkowitz (Ed.) Advances in experimental social psychology, Vol. 6. New York: Academic Press, 1972.

Berkhout, J., Walter, D. O., & Adey, W. R. Computers in behavioral science: Automatic computation of evoked heart rate and pulse volume responses to verbal stimuli. Behavioral Science, 1969, 14, 393-403.

Cupchick, G. C., & Leventhal, H. Consistency between expressive behavior and the evaluation of humorous stimuli: The role of sex and self-observation. Journal of Personality and Social Psychology, 1974, 30:3, 429-442.

Goldstein, D., Fink, D., & Mettee, D. Cognition of arousal and actual arousal as determinants of emotion. Journal of Personality and Social Psychology, 1972, 21:1, 41-51.

Goodman, L., & Gilman, A. The pharmacological basis of therapeutics (4th ed.). New York: MacMillan, 1970.

Lacey, J. L., Kagan, J., Lacey, B. C., & Moss, H. A. The visceral level: Situational determinants and behavioral correlates of autonomic response patterns, in P. H. Knapp (Ed.), Expressions of the emotions in man. New York: International Universities Press, 1963.

McNemar, Q. Psychological Statistics. New York: John Wiley & Sons, 1962.

Nisbett, R. E., & Valins, S. Percieving the causes of one's own behavior. New York: General Learning Press, 1971.

Schachter, S. The interaction of cognitive and physiological determinants of emotional state, in L. Berkowitz (Ed.), Advances in experimental social psychology, Vol. 1. New York: Academic Press, 1964.

Schachter, S., & Singer, J. E. Cognitive, social, and physiological determinant of emotional state. Psychological Review, 1962, 69, 379-399.

Schachter S., & Wheeler, L. Epinephrine, chlorpromazine, and amusement. Journal of Abnormal and Social Psychology, 1962, 65:2. 121-128.

Singer, J. E. Sympathetic activation, drugs, and fright. Journal of Comparative and Physiological Psychology, 1963, 56, 612-615.

Stern, R. M., Botto, R. W., & Herrick, C. D. Behavioral and physiological effects of false heartrate feedback: A replication and extension. Psychophysiology, 1972, 9:1, 21-29.

Valins, S. Cognitive effects of false heart-rate feedback. Journal of Personality and Social Psychology, 1966, 4:4, 400-408.

APPENDIX A

Dependent Measures

I will now show you the slides one more time for 5 seconds apiece. During this rating presentation, I would like you to assign each slide, as it is presented, a numerical rating according to the following scale. Ratings are from 0 to 100. A "0" rating means "not at all unpleasant" and a "100" rating means "extremely unpleasant". You may assign your ratings to use as much or as little, or any portion, of the 0 to 100 scale as you feel is appropriate. Please use the following lines, one per slide.

1.________	5.________
2.________	6.________
3 ________	7.________
4.________	8.________

1. It is very seldom that we have a polygraph available to monitor and inform us of our internal physiological reactions. Normally we must rely solely on our own perceptions or feelings for awareness of "what is going on" internally. The question which follows is designed to measure your own awareness of your physiological reactions during the slide presentation. We would like you (for the moment) to <u>disregard the information provided by the polygraph sounds</u>. Please indicate on the following scale the extent to which you were <u>personally and subjectively aware</u> of your own internal physiological reactions during the slide presentation. Circle a number on the following scale indicating the extent of your personal awareness of your internal states <u>disregarding</u> the polygraph sounds. The number "1" corresponds to "no awareness at all" and the number "7" corresponds to "very great awareness". The numbers between should be used to indicate intermediate degrees of awareness of your internal reactions.

<u>Circle One</u>

1 No awareness at all of my internal reactions

2

3

4

5

6

7 Very great awareness of my internal reactions

2. During the slides, did you think the high-frequency sound had any meaning other than what I told you? YES_____ NO_____

3. Do you have any other feelings or ideas that this experiment concerns more than I have told you? YES_____ NO_____

EFFECTS OF COGNITIONS OF AROUSAL AND ACTUAL AROUSAL
IN LOW-EMOTIONAL AND HIGH-EMOTIONAL SITUATIONS

by

EDWARD CURTIS OLIVER

B.A., University of California at Los Angeles

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Psychology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1975

Recent investigations (Valins, 1966, and others) utilizing false feedback about physiological reactions and some measurement of subjects' emotional feelings have established what has been called the Valins effect, i.e. when subjects believe they have reacted physiologically to stimuli, they will report greater emotional reactions to those stimuli than when they believe they have not reacted physiologically. Bem (1970, 1972) and others have noted the applicability of self-perception theory in interpreting this effect.

Some recent investigators have questioned the self-perception explanation of the Valins effect. Goldstein, Fink & Mettee (1972) posed the hypothesis that subjects' cognitions of physiological arousal, from the false feedback, may result in actual physiological reactions (a "mimic" effect) which lead to the reported emotional feelings. Goldstein et al report finding a weak mimic effect in one situation, but heartrate changes alone were not predictive of a subject's slide ratings, while the feedback (indicated arousal or no arousal) was predictive, i.e. a Valins effect. In what Goldstein et al characterized as a more "potent" emotional situation there was no Valins or mimic effects and actual heartrate changes appeared to be the cause of differing emotional feelings. They concluded that in potent emotional situations actual physiological arousal and not cognitions of arousal caused emotional feelings.

The present experimenter feels that due to methodological flaws in the Goldstein et al study (detailed in the body of this report) their conclusions may be misleading. Very briefly, the Valins effect is essentially a within-subject phenomenon, but the measure used by Goldstein et al in the second part of their study was a between-subjects measure. On this basis, the authors concluded that cognitions of arousal were not utilized in the self-perception manner and actual physiological arousal directly caused emotions. The present study utilized both low and high-emotional conditions and a within-subject measure of the Valins effect. It was predicted that by using this standard Valins paradigm a Valins effect would be found in both emotional conditions.

It was also predicted that for male subjects the Valins effect would be greater in the low-emotion condition, while for female subjects there would be no difference in the Valins effect across emotional conditions (based on research reviewed later). The final prediction, consistent with the information-processing/self-perception interpretation of the Valins effect, was that the greater a subject's subjective awareness of his real physiological reactions, the weaker would be the Valins effect due to false feedback. Actual heartrate was measured in order to assess a possible mimic effect and/or direct physiological-emotional links.

The data strongly supported the first hypothesis in that a Valins effect was clearly present in all conditions. The second hypothesis was not supported and possible explanations for the results obtained and suggestions for further research on this question were offered. The third hypothesis, concerning awareness of real reactions and the strength of the Valins effect, was only weakly supported and it was suggested that a refinement of the awareness measurement might yield clearer results. The physiological data revealed no mimic effect and no direct links of phyiological reactions and emotional feelings in any condition. On the basis of these data, it was concluded that the Bemian self-perception theory remains the most fruitful explanation of the Valins effect.