Self-focusing effects of heartbeat feedback

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Self-Focusing Effects of Heartbeat Feedback

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Two studies tested the hypothesis that auditory heartbeat feedback leads to an increase in self-directed attention. In Experiment 1, subjects exposed to a sound representing their heartbeat made greater self-attributions for hypothetical outcomes than did subjects exposed to the same sound identified as an extraneous noise. Furthermore, subjects in the heartbeat condition showed a pattern of color-naming latencies (on a color-word test) that was consistent with the hypothesis that self-related information was being activated in memory. In contrast, no such pattern was observed among subjects in the noise condition. In Experiment 2, comparisons with appropriate control groups indicated that neither an extraneous noise nor the attachment of a heartbeat-recording device influenced self-attribution, but that the presence of either a constant or an accelerating heartbeat increased self-attribution. The latter two conditions did not differ from each other. Discussion centers on the findings' methodological and theoretical implications.

Many psychologists over the years have been interested in the concept of self (e.g., Gergen, 1971; Wylie, 1968) and especially in the self's reflexivity, that is, its capacity to take itself as the object of attention (e.g., Mead, 1934). This long-standing interest has been echoed in a recent theory of self-awareness (Duval & Wicklund, 1972). Research stemming from that theory has demonstrated two major consequences of self-directed attention. First, when a standard for appropriate behavior is salient, self-awareness results in increased conformity to this standard (e.g., Carver, 1974, 1975; Scheier, Fenigstein, & Buss, 1974). Second, in the absence of any clear standard, heightened self-attention leads to an increased awareness of salient self-elements. For example, the experience of transient affective states has been found to be subjectively intensified as a function of self-focus (Scheier & Carver, 1977). As a result, highly self-attentive persons are more responsive to such affective states than are less self-attentive persons (Scheier, 1976). Another illustration of this “salience of self” principle is provided by research showing that increased self-awareness leads to increased self-attribution of causality for hypothetical events (Buss & Scheier, 1976; Duval & Wicklund, 1973).

Manipulations of Self-Attention

Duval and Wicklund (1972) originally argued that self-awareness is increased by any stimulus that directs attention toward the self and reminds the person of his or her status as an object (e.g., a mirror or a camera). Evidence for the validity of some specific experimental manipulations of self-focus has been gathered in several recent studies. Carver and Scheier (1978, Experiment 1) have shown that subjects in the presence of a mirror make more sentence completions that are focused on the self than do subjects with no mirror. In other research, subjects exposed to a TV camera identified more ambiguous foreign language pronouns as being first person pronouns than did subjects with no camera (Davis & Brock, 1975). Finally, Geller and

1 The terms self-awareness, self-attention, and self-focus are used interchangeably throughout this article.
Shaver (1976) found that the presence of a mirror and a camera (together) led to effects on a color-word test (discussed in more detail below) that were consistent with the assumption of increased activation of self-related thoughts. All of these studies provide support for the assumption that stimuli such as cameras and mirrors increase awareness of the self.

The self-focusing stimuli used in laboratory research have invariably made subjects more aware of external aspects of themselves, for example, their faces or their voices. Common experience suggests, however, that the state of self-attention does not depend solely on being made aware of one's external self. The throb of a nagging pain or the pounding heart and flushed face that are characteristic of a strong emotion would seem to be examples of internal stimuli that draw the attention of the person who is experiencing them. Moreover, it may be argued that such internal stimuli do more than attract attention to themselves as specific stimulus entities. That is, in previous research when a mirror reflected only the subject's face or hands, it seemed to produce a state of self-awareness that was more general than simply an awareness of the person's face or hands. Similarly, it seems reasonable to propose that hearing one's heartbeat, for example, would lead to an overall awareness of oneself, rather than simply an awareness of one's heartbeat.

The present research was undertaken to test the notion that feedback of one's own autonomic activity acts as a self-awareness-inducing stimulus. Other researchers (e.g., Misovich & Charis, 1974; Valins, 1966) have shown that experimental subjects, when provided with an appropriate cover story, accept bogus autonomic feedback as veridical representations of their bodily states. In line with such demonstrations, in the present studies we provided some subjects with false heartbeat feedback. We hypothesized that such a stimulus, having been identified to the subjects as their own heartbeat, would increase their level of self-attention.

**Measurement of Self-Attention**

The measurement of subjects' self-attention in the studies reported below was indirect. In brief, in assessing self-focus we attempted to capitalize on previous demonstrations of the effects of self-focus, by showing that the same effects were produced by the present manipulation. Self-awareness was measured in two ways, corresponding to two previously demonstrated consequences of the self-aware state.

First, as was indicated above, self-attention often leads to increased awareness of salient aspects of the self. One highly reliable illustration of this "salience of self" phenomenon is an increased tendency to attribute causality to the self (Buss & Scheier, 1976; Duval & Wicklund, 1973; Fenigstein, in press). Thus, one measure of self-focus in the present research was the degree to which subjects made self-attributions for hypothetical outcomes.

A second approach to assessing self-focus in the present research used a procedure developed by Geller and Shaver (1976), based on the Stroop (1938) color-word test. It has been shown that the latency for naming the ink color in which a target word is printed is increased when semantically related information has recently been activated in memory (Warren, 1972, 1974). Geller and Shaver (1976) argued that if self-awareness leads to activation of self-related information in memory, a state of self-awareness should result in increased color-naming latencies for evaluative, self-relevant words, as compared to non-evaluative, non-self-relevant words. Their findings supported that reasoning. Thus, differential color-naming latencies were used as a second measure of self-attention in the present context.

In Experiment 1 it was predicted that an auditory stimulus labeled as the subject's heartbeat would lead to more self-attention, as reflected both by causal attributions and by color-naming latencies, than would the same auditory stimulus labeled as a self-irrelevant noise.

**Experiment 1**

**Method**

**Subjects**

Subjects were 20 female undergraduates at Kenyon College, who volunteered to participate as a result of door-to-door and telephone solicitation. These
subjects, tested individually, were randomly assigned to one of the two experimental conditions described below.

**Experimental Manipulation**

**Heartbeat condition.** Each subject in the heartbeat condition was told that the study concerned the effects of cognitive activity on physiological processes, specifically heart rate. The subject was going to be asked to engage in a series of cognitive tasks while her heartbeat was being monitored by the experimenter. Recording of the subject's heartbeat was supposedly done by means of a finger plethysmograph, a device that assesses changes in blood volume (corresponding to heart pulses) by means of a photocell. This device was strapped onto the subject's finger. The subject was told that another piece of apparatus converted the photocell output into a clicking sound, each click representing a heartbeat. These clicks ostensibly were to be recorded for later analysis. The experimenter explained that because of the nature of this procedure, the subject would be hearing sounds that corresponded to her own heartbeat during the session. In reality, the sounds were prerecorded clicks that corresponded to the resting heartbeat of a pilot subject whose heart rate averaged 65 beats per minute.

**Noise condition.** Subjects in the noise condition were told that the study concerned the effects of noise on cognitive activity. The experimenter explained that during the session the subject would be listening to clicking sounds that were meant to provide a controlled simulation of repetitious real-world sounds, such as those produced by office machinery.

**Procedures**

After this explanation of the purpose of the study, the experimenter called in a second experimenter, who completed the remaining procedures. These procedures (described below) were identical for all subjects. The second experimenter had no knowledge of which experimental condition the subject was in. The arrangement of the experimental room prevented the second experimenter and the subject from viewing each other.

During the remainder of the session, the subject engaged in two tasks. The first involved making attributions of causality of hypothetical outcomes; the second was a modified version of the Stroop color-word test. During this period, the experimental apparatus continuously emitted the clicking sounds that previously had been identified to the subject either as corresponding to her heartbeat or as being an extraneous noise.

**Attribution task.** The first task required subjects to imagine themselves in a series of hypothetical situations, which were read aloud by the experimenter (this procedure duplicated that of Duval & Wicklund, 1973). Each situation was phrased in the second person, each involved another individual, and of the eight events described, four had favorable outcomes and four had unfavorable outcomes for the subject. Following the presentation of each situation, the subject was asked to estimate (as a percentage value) the degree to which she was personally responsible for the hypothetical outcome. The experimenter recorded the estimate and then began describing the next situation. When attributions had been recorded for all eight outcomes, the experimenter turned to the second task.

**Color-naming task.** The second task required subjects to view a series of printed words presented via a tachistoscope and name the color in which the word was printed. The test words (drawn from a longer list compiled by Geller & Shaver, 1976) were printed in one of five colors (red, blue, violet, orange, or green) on a white background. Twenty evaluative and self-relevant words and 20 nonevaluative words (matched for length, number of syllables, and frequency of usage) were presented in random order. Each word was presented for 2 sec; each interstimulus interval was 5 sec. Latency of response was measured by a stopwatch that was activated by the onset of the tachistoscope and deactivated by a voice-operated relay attached to a microphone in front of the subject. The experimenter recorded the response latency and reset the stopwatch after each trial.

After the color-naming task had been completed, the purpose of the study was explained to the subject, who was then dismissed.

**Results**

**Self-Attribution**

The dependent measure of the first experimental task was the percentage of causal responsibility attributed to the self. Preliminary analysis revealed that there were no systematic differences on this measure attributable to type of outcome (i.e., positive or negative). This result was quite consistent with Duval and Wicklund's previous finding (1973, Experiment II). The data were therefore combined across all eight situations to yield an average self-attribution percentage for each subject. A comparison between groups indicated that subjects in the heartbeat condition made greater self-attributions ($M = 63.5\%$) than did those in the noise condition ($M = 54.0\%$), $t(18) = 2.32, p < .05$.

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2 The hypothetical situations used in this research were taken from those used by Duval and Wicklund (1973). All items used by those authors are printed in full in their report. The specific items used in the present research are available from the first author.

3 Available on request from the first author.


Table 1
Mean Color-Naming Latencies (in sec) Among Subjects in Heartbeat and Noise Conditions, Experiment 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Self-relevant words</th>
<th>Non-self-relevant words</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heartbeat</td>
<td>1.68</td>
<td>1.50</td>
<td>.18</td>
</tr>
<tr>
<td>Noise</td>
<td>1.27</td>
<td>1.28</td>
<td>-.01</td>
</tr>
</tbody>
</table>

Note. n = 10 per group.

Color-Naming Latencies

As was proposed in the introduction, if hearing one's heartbeat increases self-awareness, self-relevant aspects of memory should thereby be activated. Under those conditions, there should be increased interference with, and longer latencies for, naming the colors of self-relevant words, as compared to non-self-relevant words. In contrast, hearing a self-irrelevant noise should not activate self-related memory. Thus, there should be little or no difference in color-naming latencies for the two types of words among subjects hearing the extraneous noise. Accordingly, the second dependent measure of the study was the difference between subjects' latencies for naming the colors of self-relevant words and their latencies for naming the colors of non-self-relevant words.

The difference in color-naming latencies (see Table 1) was significantly greater among subjects in the heartbeat condition than among those in the noise condition, \( t(18) = 4.64, p < .001 \). Additional comparisons indicated that the groups did not differ in their latencies for naming the colors of non-self-relevant words \( (p > .2) \) but differed only on the naming of self-relevant words, \( t(18) = 2.45, p < .03 \).4

Discussion

As predicted, subjects exposed to a sound that was identified as their heartbeat made greater self-attributions of causal responsibility than did subjects exposed to the same sound identified as a self-irrelevant noise. Similarly, subjects in the heartbeat condition took longer to name the colors of self-related than non-self-related words, whereas a comparable difference did not occur among subjects in the noise condition. Both of these findings support the contention that exposure to feedback of one's bodily activity leads to greater self-focus than does exposure to an irrelevant sound.

However, Experiment 1 left several questions unanswered. First, as the study did not include control subjects who heard no sound at all, it was not possible to be sure whether the heartbeat sound heightened self-focus or the extraneous noise diminished self-focus, or both. Second, there was more than one difference between the heartbeat and noise conditions of Experiment 1. In addition to being given differing explanations for the auditory stimulus, subjects in the heartbeat condition were wired with a recording device, whereas those in the noise condition were not. Thus, it could not be clear whether it was the identification of the sound as the subject's heartbeat or the presence of the recording device that had been responsible for the differences between groups. In an attempt to provide additional information on these points, a second study was conducted. Experiment 2 used only the self-attribution measure as an index of self-awareness but included appropriate control groups to consider the following possibilities.

The possibility that an extraneous noise diminishes self-awareness was addressed in Experiment 2 by including two groups of subjects (noise and a no-noise control), none of whom were wired for autonomic recording. The only difference between these groups was the presence or absence of the self-irrelevant auditory stimulus.

4It will be noted that the difference between groups in latencies for naming non-self-relevant words was in the same direction as was the more reliable difference for self-relevant words. Although nonsignificant, this difference raises the possibility that subjects in the heartbeat condition had tended to experience activation of many areas of memory, rather than only self-related memory. Although this possibility is a real one, it would not account for the fact that the difference was maximal for self-relevant words, nor could it account for the attribution findings.
The possibility that simply being wired for autonomic recording heightens self-awareness was addressed by comparing the responses of the no-noise control group described above with responses made by a wired control group. These were subjects to whom recording devices were attached and for whom the study was described as an investigation of the bodily responses associated with thinking.

The possibility that the presence of an auditory stimulus identified as the subject's heartbeat heightens self-focus was addressed by comparing the responses of the wired control group with the responses of subjects who were treated in a similar manner but who actually heard a constant heartbeat sound.

Finally, in Experiment 2 we explored one additional issue that was not addressed in Experiment 1. Most prior research employing bogus physiological feedback has compared the effect of feedback indicating quiescence with the effect of feedback indicative of arousal (e.g., Carver & Blaney, 1977a, 1977b; Mischel & Charis, 1974; Valins, 1966). It has been suggested (Carver & Blaney, 1977b) that one way to interpret the differential effects of such feedback is to assume that an accelerating heartbeat produces more self-focus than does a constant heartbeat. This possibility was tested in the present Experiment 2 by providing some subjects with an unvarying heartbeat sound (as in Experiment 1) and presenting others with an accelerating heartbeat sound.°

Experiment 2

Method

Subjects

Subjects were 51 female and 28 male undergraduates from the University of Miami subject pool. Responses from three other subjects were deleted prior to data analysis. During postexperimental questioning, one of these subjects reported the belief that the heartbeat feedback (described below) was not veridical; one failed to follow the experimenter's directions; and one gave evidence of being under the influence of drugs during the session. Subjects, tested individually, were randomly assigned to one of the five treatment conditions described below. Gender distributions in these groups were roughly equivalent, ranging from 67% to 61% females.

Procedures

Two experimenters participated in each session. The first experimenter greeted the subject, explained the procedures and ostensible purpose of the study, and read the hypothetical situations to the subject. The second experimenter's role was to operate the experimental apparatus, which was described to some subjects as a heartbeat recorder and to other subjects as an environmental noise generator. Although neither experimenter was blind to the subject's experimental treatment group, the experimenters were kept ignorant of the specific hypotheses being tested throughout the running of the study.

Heartbeat and wired control conditions. Subjects in three conditions were told that the experiment was a study of the physiological concomitants of thought processes. The subject would be asked to imagine himself or herself in a series of hypothetical situations. While the subject was doing that, the second experimenter ostensibly was going to monitor and record the subject's heartbeat.

There were some slight procedural differences between Experiment 1 and Experiment 2. In Experiment 2, the subject was told that the heartbeat-recording apparatus picked up the heartbeat sound auditorily. For this reason, the subject was instructed to find a point where his or her heartbeat could be heard clearly (using a stethoscope provided for this purpose). A microphone was placed at that point on the subject's chest and secured with an elastic strap. The first experimenter then moved the subject to a chair facing the wall, and asked him or her to relax, ostensibly so that the second experimenter could record the subject's base rate for a brief period. In the constant and accelerating conditions, the first experimenter then interjected the following, as if it were an afterthought:

Oh, by the way, I ought to warn you, the only thing wrong with this setup is that the recording apparatus was originally intended for another purpose. It records all right, but it has an external speaker built into it that would be a pain in the neck to disconnect. So during the session you'll be hearing the sound of your heartbeat. I hope that it won't hurt your concentration any, but I thought I'd better let you know about it.

In the wired control condition this statement was omitted.

5 In some prior research, accelerating versus constant feedback has been treated as a within-subjects variable (e.g., Valins, 1966); in other studies it has been treated as a between-subjects variable (Carver & Blaney, 1977a, 1977b). The latter research shows quite plainly that the impact of feedback on behavior does not depend on the use of a within-subjects design. The possibility exists that the two types of paradigms differ in the way that feedback exerts its impact on subjects. But a full consideration of that possibility is well beyond the scope of this article.
The first experimenter then stood behind the subject and said,

In a few moments I'll read you a description of a hypothetical situation. When I do, put yourself into that situation. Really try to get into it. When I've finished describing the situation, I'll ask you a question. Don't answer right away. Just think about it, and continue to think about it. Remember, it's the thought processes that we're studying, so don't make a decision immediately. To make things simple, after you have had sufficient thought time, I'll ask the question a second time. At that point express your estimate to me verbally.

The actual reason for this delay was to allow time for a heartbeat acceleration to occur for those subjects in the accelerating condition.

The first experimenter then instructed the second experimenter to turn on the heartbeat recorder. For subjects in the constant and accelerating conditions, the second experimenter turned on the experimental apparatus, which was actually a heartbeat-sound generator (set at 60 beats per minute). In contrast to the clicking sounds used in Experiment 1, the apparatus used in Experiment 2 closely mimicked the sound of an actual heartbeat. For subjects in the wired control condition, the second experimenter flipped a switch that did nothing.

After a 30-sec pause, the first experimenter said, “All right, let's begin,” and read the first of eight hypothetical situations (as in Experiment 1, four had positive outcomes and four had negative outcomes). After asking the subject to what degree he or she was responsible for the hypothetical outcome, the experimenter paused for 8 sec. The experimenter then asked, “What percentage of the responsibility would you estimate to be yours?”, recorded the subject's response, then began the next hypothetical situation. This sequence was repeated until attributions for all eight outcomes had been obtained.

In the constant heartbeat condition, the heartbeat sound stayed constant throughout this questioning procedure. In the accelerating condition, the second experimenter caused the heartbeat frequency to increase gradually from 60 beats per minute to 85 beats per minute between repetitions of the attribution question. The acceleration began approximately 2 sec after the first experimenter paused and consumed approximately 4 sec, leaving a period of about 2 sec of feedback at 85 beats per minute. The heartbeat was returned to 60 beats per minute when the subject responded with his or her attribution. In the wired control condition, of course, no sound was heard throughout this session.

Noise and no-noise control conditions. For subjects in the remaining two conditions, the experiment was described as a study of the effects of environmental variables on thought processes. Subjects ostensibly were being exposed to varying amounts and types of noise stimulation while they thought about hypothetical situations. Subjects in the noise condition were told that they were going to be exposed to a continuous rhythmic, low-pitched sound, which was supposedly a controlled simulation of other sounds to which people were subjected in the outside world (e.g., construction-work noises, trains going over crossings). Subjects in this condition were instructed to think of this sound as being just another environmental noise. For subjects in the no-noise control condition, this description of the noise was omitted, and the noise itself did not occur.

The remaining procedures duplicated those employed in the constant heartbeat and the wired control conditions, respectively. That is, subjects in the noise condition heard the same auditory feedback as did subjects in the constant heartbeat condition; subjects in the no-noise control condition heard no auditory feedback; and all further instructions concerning the hypothetical situations were precisely the same as those used in the other conditions, including the timing of subjects' responses.

After all eight hypothetical situations had been completed, the second experimenter probed the subject for suspicions, checked to ensure that the subject had noticed the acceleration (if applicable), and explained (in very general terms) the reasons for conducting the study.

Results

As in Experiment 1, the dependent measure was subjects' mean percentage of self-attribution (see Table 2). No gender effects were anticipated, and none occurred, either separately or in an interaction. This result was consistent with previous findings (Duval & Wicklund, 1973, Experiment 1). Nor were there any systematic differences as a function of type of outcome (consistent with the findings of the present Experiment 1). Thus, the results as reported here are combined across gender.

A single-classification analysis of variance revealed an overall difference between groups in the degree of self-attribution made by subjects, $F(4, 74) = 2.97, p < .03$. The findings of greatest interest, however, were based on individual group contrasts. As discussed above, the no-noise control group was included to assess separately the effect of a self-irrelevant sound. A comparison between the noise and the no-noise control means showed that the self-irrelevant noise had no impact on self-attributions ($t < 1$). Similarly, a comparison between the no-noise control and the

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11 All comparisons were two-tailed and were based on the error term from the analysis of variance.
wired control groups indicated that the mere presence of a heartbeat recording device did not lead to increased self-attribution \((t < 1)\).

However, comparisons between the wired control group and the two heartbeat feedback groups indicated that, as predicted, the presence of either constant or accelerating heartbeat feedback led to increases in self-attribution, \(t(74) = 2.91, p < .01\), and \(t(74) = 1.97, p < .06\), respectively. The two feedback groups did not differ from each other in their degree of self-attribution, however \((t < 1)\). Finally, as in Experiment 1, the presence of a constantly repetitive auditory stimulus led to greater self-attribution when labeled as the subject’s heartbeat than when labeled as a self-irrelevant environmental noise, \(t(74) = 2.39, p < .03\). The difference between the environmental noise mean and the accelerating heartbeat mean did not attain significance, however \((t < 1.50)\).

**Discussion**

The results of Experiment 2 indicated that compared to a wired control group given no heartbeat feedback, subjects hearing an auditory stimulus identified as their own heartbeat experienced heightened self-focus, as reflected by increased self-attributions. Identifying the same stimulus as an environmental noise apparently does not decrease self-attention, compared to a no-noise control. Nor does simply attaching a recording device increase self-attention. Thus Experiment 2 replicated and clarified the attribution effects found in Experiment 1.

In addition, no difference was found between the self-attributions made by subjects whose "heartbeats" stayed constant and those for whom an acceleration occurred. Thus, it is tentatively concluded that it is the self-relevant nature of the heartbeat feedback that causes heightened self-attention in this situation, rather than the presence or absence of arousal information contained in the feedback. It is, of course, possible that there is a psychological ceiling on the degree to which a given subject will attribute responsibility to himself or herself for a hypothetical outcome. If subjects in the constant heartbeat condition were at that ceiling, any increase in self-focus caused by the heartbeat acceleration would have had no impact on subjects’ attributions. At this point, however, we have no basis for believing that this was the case.

The failure of the recording devices to increase self-focus by themselves also deserves some comment. It can be argued that the attachment of this equipment to the subject's body should have increased his or her awareness of internal events, thus leading to increased self-attention. However, it seems likely that in the present research the equipment simply was not salient to the subject. The role of salience of a manipulation of self-awareness has been demonstrated in previous research (Scheier et al., 1974), in which it was shown that the presence of an audience heightened self-focus only when the audience was made salient through frequent eye contact with the subject. In the present study, subjects could easily have avoided attending to the heartbeat recording apparatus, and the complexity of the experimental task may also have reduced awareness of the equipment by causing attention to be absorbed elsewhere. The continuing sound of the subject's heartbeat, on the other hand, would have been far more difficult to miss, by virtue of its greater salience.

This absence of a difference between constant and accelerating conditions was consistent with data from a pilot study using clicks rather than a heartbeat sound. The overall effect of that study was not significant, but the pattern of means for constant, accelerating, and control groups closely approximated the results of Experiment 2.
General Discussion

A number of researchers (e.g., Carver & Blaney, 1977a, 1977b; Goldstein, Fink, & Mettee, 1972; Misovich & Charis, 1974; Valins, 1966) have used bogus feedback techniques to present information to subjects indicative of autonomic arousal or quiescence, in order to influence their perceptions of their emotional states. Yet, as several authors have pointed out (e.g., Detweiler & Zanna, 1976), the exact manner in which bogus feedback affects behavior has not been ascertained. It has been widely assumed (e.g., Valins, 1966, 1974) that what is important about the feedback is the information it contains regarding the subject’s level of autonomic activity, which thereby is made accessible to the subject for possible use in inferring an emotional state. The present findings indicate, however, that such feedback has at least one other effect: It increases self-attention. Furthermore, self-attention seems to be increased uniformly by heartbeat feedback, regardless of whether the heartbeat stays constant or accelerates. In light of these findings, some consideration should be given to the possibility that results of previous research employing false feedback may have depended in part on increases in self-attention.

Valins (1966)

The first study to employ bogus feedback for the purpose of varying perceptions of arousal was that of Valins (1966). Male college students were given the opportunity to “overhear” their heartbeats while viewing slides of nude females. The heartbeat in that study was preprogrammed so that it appeared to change in response to some slides and to be unaffected by others. Subjects subsequently rated as more attractive the nudes that had been associated with heart rate change than those associated with no change.

One possible role of self-attention in this sequence is very simple: Perhaps the inference of emotion, being an internal process, requires self-attention. A more complex possibility follows from Valin’s argument that his subjects were doing more than simply inferring “arousal equals attractiveness.” Valins believed that subjects used the arousal information contained in the feedback as cues to attractiveness but that they then engaged in an active search process to validate those initial inferences. Subsequent data (Barefoot & Straub, 1971; Misovich & Charis, 1974; Valins, 1974) seemed to substantiate that belief. For example, when subjects were not given sufficient opportunity to confirm their inferences by a visual search, the arousal information had no effect on their ratings (Barefoot & Straub, 1971).

It is reasonable to ask what prompted those subjects to engage in an active search for additional information to confirm their inferences. An answer is provided by Schachter’s (1964) assumption (see also Schachter & Singer, 1962) that when people become sympathetically aroused, they have a need to explain that arousal. Put another way, the appropriate response to the perception of bodily change is to seek the cause of the change. As was noted in the beginning of this article, self-directed attention often increases the degree to which the person matches his or her behavior to whatever is salient as a standard of appropriate behavior. Thus, if information search had become salient as a behavioral standard for Valin’s subjects (by virtue of their perceptions of heart rate variations), the heightened self-attention that subjects were experiencing may have facilitated the processes of searching for and encoding information from the slides, by increasing the degree to which such behavior was executed.

8 Opinions vary as to exactly what constitutes a behavioral standard. Duval and Wicklund (1972) tended to discuss standards in terms of “correctness,” leading others to infer connotations of social appropriateness. Carver (in press), on the other hand, has argued for an information-processing mechanism by which a behavioral standard becomes salient. In that analysis, incoming stimuli are processed in order to classify them; classification is based on a previously developed set of recognitory prototypes. A recognitory prototype may also contain response-prototypic information. This information, then, represents a behavioral standard, to which subsequent behavior is matched. According to this analysis, the process of evoking a behavioral standard may seem phenomenologically to be relatively nonconscious in many circumstances, including that discussed above.
A consequence of this reasoning is the following. If it were possible to manipulate self-focus independent of arousal information, subjects given identical arousal information while viewing nudes should exhibit more stimulus-search behavior when self-focus is high than when it is low. This difference in degree of information search should lead to differences in the degree to which the subjects’ inferences about attractiveness would be confirmed and thus to differences in the degree to which the nudes were actually rated as varying in attractiveness.

In this interpretation of the Valins (1966) findings, the informational influence of the heartbeat feedback is easily distinguishable from the self-focused influence of the feedback. Another illustration of the separability of these two functions is provided by the present research. Our situation was quite different from that studied by Valins in that our experimental context did not suggest to subjects the presence of any particular emotion. Thus, the information conveyed to subjects by the pattern of the heartbeats (i.e., constant or accelerating) was rendered relatively meaningless. Subjects were left with only the state of self-attention, which we assessed through self-attribution.

Self-Awareness Theory

Besides their implications for research using false feedback, the present findings also have implications for self-awareness theory. In general, self-awareness research has emphasized the direction of attention to the self through reminders of external aspects of the self. The present findings suggest that salience of an internal self-aspect is an equally powerful antecedent of the self-aware state. An important implication of these findings is that a state of self-focus may be a natural consequence of normally occurring bodily activity and emotional experience and need not depend on laboratory manipulations that divert attention toward the self (although the present studies obviously did rely on such a manipulation). Such findings represent a growing body of evidence (see also Carver & Scheier, 1978) that theoretical analyses of social behavior based on attentional considerations can be generalized meaningfully into the broader realm of ordinary human experience.

References


Carver, C. S., & Blaney, P. H. Perceived arousal, focus of attention, and avoidance behavior. *Journal of Abnormal Psychology*, 1977, 86, 154–162. (b)


Misovich, S., & Charis, P. C. Information need, affect, and cognition of autonomic activity. *Jour-
nal of Experimental Social Psychology, 1974, 10, 274-283.

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