UNIVERSITY OF Miami

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Department of Psychology
P.O. Box 248185
Coral Gables, FL 33124-2070
Telephone (305) 284-2814
Fax (305) 284-3402

Velocity Toward Goal Attainment in Immediate Experience as a Determinant of Affect

JOHN W. LAWRENCE
Baltimore Regional Burn Center
Johns Hopkins School of Medicine

CHARLES S. CARVER[1]
University of Miami

MICHAEL F. SCHEIER
Carnegie Mellon University

An experiment tested a model in which affect reflects rate of movement (velocity) toward one's behavioral goal. Participants responded to an ambiguous task and received false feedback regarding their performance. The pattern of feedback either remained fairly constant at 50% correct, went from low incidence of correct to 50% correct across trials, or went from high incidence of correct to 50% correct across trials. Self-reported mood change (from before the task to the point at which all groups received 50% correct) took the following pattern: Participants moving from frequent correct to 50% correct (low velocity) changed to less positive mood, whereas those moving from infrequent correct to 50% correct (high velocity) tended to change to more positive mood. Discussion centers on convergence between these findings and those of previous research.

The notion that human behavior is goal directed is commonplace in today's personality–social psychology (e.g., Austin & Vancouver, 1996; Cantor & Kihlstrom, 1987; Carver & Scheier, 1981, 1990a, 1990b, 1998, 1999; Elliott & Dweck, 1988; Emmons, 1986; Gollwitzer & Bargh, 1996; Higgins, 1987, 1997; Klinger, 1975; Markus & Nurius, 1986; Palys & Little, 1983; Pervin, 1983, 1989; Vallacher & Wegner, 1985; Wegner & Bargh, 1998). It is often argued as well that affective experience is bound up with goals. This idea is certainly not new (e.g., Arnold, 1970; Ellsworth & Smith, 1988; Frijda, 1986; Izard, 1977; Kahneman & Tversky, 1984; Lazarus, 1991; Ortony, Clore, & Collins, 1988; Roseman, 1984; Scherer & Ekman, 1984; Simon, 1967). However, interest in the link between affect and goals has re-emerged in recent years (cf. Martin & Tesser, 1996).

What is the relation between affect and goals? We consider one specific possibility here. Carver and Scheier (1990a) proposed a model of affect derived from their view on behavior, which in turn rests partly on the principles of control theory (e.g., MacKay, 1963, 1966; Powers, 1973; Wiener, 1948). In that view, goal-directed behavior reflects the operation of a discrepancy-reducing feedback

[1]Correspondence concerning this article should be addressed to Charles S. Carver, Department of Psychology, University of Miami, Coral Gables, FL 33124-2070. E-mail: CCarver@miami.edu

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loop, as follows: People compare their present behavior to their intentions, goals, or standards. If they see a discrepancy between the perceived and the desired, people alter their behavior to minimize the discrepancy (Carver & Scheier, 1990b, 1998, 1999).

Carver and Scheier (1990a) suggested that the origins of positive and negative affect might lie in a feedback process differing from the one just described. In particular, they hypothesized a process that evaluates how successfully the behavioral loop is reducing the discrepancies on which it is focusing. Put differently, this second loop monitors the rate at which the action loop is moving toward its goal. The input for this second loop would be the sensed rate of discrepancy reduction in the behavioral loop. Its reference value would be some desired rate. If a discrepancy is detected between perceived and desired rates, the person experiences affect. If the perceived rate is too low, affect is negative. If the perceived rate is above the reference point, affect is positive.

Empirically, this model predicts that two people with the same behavioral goal will differ in the affect that they experience as a function of the rate at which they perceive themselves to be moving toward it. A person moving quickly toward the goal should experience more positive affect than a person moving slowly toward that goal. This should be true even if the first person is presently farther away from the goal than is the second. A third person moving even more slowly toward the goal might experience not positive affect or no affect, but negative affect. A person who is actually losing ground—moving farther away from the goal—will feel even more intense negative affect.

Supporting Evidence

Studies bearing on this hypothesis have been conducted by Hsee and Abelson (1991a, 1991b), who arrived at the idea that velocity relates to affect independently of Carver and Scheier. They focused on a specific sort of affect: satisfaction with a desired outcome. In one study, Hsee and Abelson (1991b) had participants read hypothetical descriptions of paired outcome scenarios and indicate which outcome they would find more satisfying. For example, participants chose whether they would be more satisfied if their class standing had risen from the 30th percentile to the 70th percentile over the past 6 weeks, or if it had done so over the past 3 weeks.

Each participant answered seven questions that paired different outcome scenarios. The questions tested the role of final outcome, distance changed, velocity, and direction of change as influences on satisfaction. For our present purposes, the role of velocity is of the greatest interest (e.g., holding the amount of salary change constant and varying the time over which it changes). As Hsee and Abelson (1991b) predicted, participants preferred improving to a high final outcome rather than have a constant high outcome; they preferred a fast

improvement over a slow one; and they preferred a fast small improvement to a slower but greater improvement (this demonstrated the robustness of the time element in predicting satisfaction, compared to the degree of discrepancy reduction at the behavioral level). When the change was negative (e.g., when salaries got worse) participants were more satisfied with a constant low salary than with a salary that started high and fell to that level; they preferred slow falls (downward velocity) to fast falls; and they preferred large slow falls to small fast falls.

That study asked participants to read about possible outcomes and imagine which of a pair they would find more satisfying. A second study (Hsee & Abelson, 1991b, Study 2) was designed to have participants experience an outcome actually change in time by watching hypothetical outcomes that changed in the form of a graph on a computer screen. The computer displayed a bar that moved vertically along a scale portraying changes in outcome (e.g., the price of a stock in which the participant had invested). Unlike the first study, in which outcome scenarios were paired and the participant picked which would be more satisfying, participants had a reference scenario that they were told to assume was a satisfaction level of 5 on a 9-point scale. They were to make ratings of satisfaction in comparison to the reference scenario. In this study, distance changed was held constant, while direction, final outcome, and velocity were varied. The second study replicated the findings of the first study. Most important, there was a very strong velocity effect. Participants preferred a fast rate of change when the outcome was improving and a slow rate of change when the outcome was falling.

The Hsee and Abelson (1991a, 1991b) research is interesting and its findings are valuable. An important limitation of that work, however, is that the outcomes participants experienced were hypothetical. Although participants were asked to imagine themselves experiencing the outcomes, the credibility of the findings depends in part on the assumption that they actually experienced the outcomes as having personal relevance. In part for this reason, we felt that further research was desirable.

In the study reported here, we placed people in a situation with a behavioral goal: performing well at a task that was portrayed as being relevant to a valuable skill. The perceived rate of movement toward that goal across trials was experimentally varied. It was predicted that participants in slower moving groups would experience affect that was negative relative to their previous baseline and that those in faster moving groups would experience affect that was more positive than their baseline.

Method

Overview

The present study used a situation in which feedback of progress toward a desired goal could be plausibly manipulated over an extended period of time. The session was disguised as a study of social intuition, in which participants made a lengthy series of judgments about ambiguous stimuli. Each block of 10 judgments was followed by performance feedback for that block. Mood was assessed before the task began, and again at the end of the sixth block, which participants believed was partway through the session, but actually ended the session.

The phenomenon under study here is subject to an important constraint, which stems from the relations among starting value, ending value, number of trial blocks, and velocity. Specifically, these variables are not fully independent. If one varies velocity, one cannot hold constant all three others. One of them must also vary. In the study reported here, we chose to keep constant the number of trial blocks and the ending value. We varied velocity by varying the starting value.

Participants received one of five patterns of performance feedback, converging such that scores on Block 6 were identical for all participants at 50% correct. Participants in a neutral condition had 50% on the first and last block, and 50% on average across all blocks (thus a zero slope overall). Others started with low scores and gradually moved upward to 50% (thus an upward slope; faster progress despite a worse starting point). Other participants started with high scores and fell to 50% (thus a downward slope; slower progress despite an advantageous starting point). We expected the upward-slope (higher velocity) groups to shift toward more positive affect, the downward-slope (lower velocity) groups to shift toward more negative affect, and the level-slope group (intermediate velocity) to have little or no change in affect. Finally, we expected the affect changes to be more pronounced in groups with more extreme slopes than in groups with less extreme slopes.

Participants and Procedure

Eighty-seven University of Miami undergraduates (56 women, 31 men) participated in the study as part of a course requirement. Each participant completed an individual session and was randomly assigned to one of five experimental treatments. Four additional persons completed the procedures but were omitted prior to data analysis because their responses indicated suspicion about the true nature of the experiment (the decision to omit them was made blind to their responses to the task).

The experimenter greeted the participant, escorted him or her to the laboratory, obtained informed consent, and proceeded to describe the study's ostensible purpose. The session was portrayed as part of a broader project on social perception. This part of the project was said to concern how people assimilate information from words, even words they do not know. When words evolved in human speech (according to the cover story), their sounds conveyed intrinsic meaning. Although different languages use different sounds to mean the same thing, people ostensibly can hear a word in a foreign language and often have at least a

slight intuitive sense of what the word means. This intuitive process was said to be the focus of this research project.

The experimental task was to be administered by a Macintosh computer. The program that presented the task would begin by giving instructions about the task. Afterward, the program would present a list of words from foreign languages that are unfamiliar to most people in the United States. For each word, the participant would be asked if it conveys the same meaning as a given English word. The participant was to answer *Yes* or *No* by pressing the appropriate key (Y or N).

The experimenter continued by saying that evidence exists that a number of factors can influence a person's ability to pick up these subtle semantic cues. For example, slight shifts in a person's mood can influence sensitivity, as can the frequency with which the person interacts with others in the course of a day (because of differences in the use of language centers in the brain). In order to control for these factors in analyzing the data (ostensibly), the participant would be asked several questions pertaining to some of these factors at various times during the experiment.

The experimenter gave instructions on how to interact with the computer, and then left the room. The program started by restating the basic elements of the cover story, amplifying on the fact that the intuitive process appears to happen largely outside of consciousness (with people usually being unable to identify very clearly when it is happening) and also on the social importance of the process (a good "receiver" of subtle linguistic cues is likely to have advantages in many domains, including social sensitivity in relationships and enhanced sensitivity to other people's motives in business transactions).

The words were to be presented one at a time in phonetic spelling. On each trial, the participant would be asked whether the word had the same meaning as a particular English word. The items were presented in blocks of 10. After each block, the participant received feedback indicating how many responses of that block were correct. The orienting information indicated explicitly that since this task is based on deviations from a chance level, people average about 50% correct. Participants were urged to do as well as they could. The orienting information concluded by asking the subjects if they had any knowledge of languages other than English, Spanish, French, German, or Italian; if so, they were not to continue, but rather to notify the experimenter (none did).

Mood ratings. At this point, the instructions repeated that a number of factors are believed to influence sensitivity to linguistic cues, including the frequency with which a person interacts with others and the person's transient mood state. Just as these variables influence the ability to pick up on other social cues, these factors (ostensibly) influence the ability to pick up on subtle linguistic cues. Participants then were asked several questions about these and other factors. The instruction screen also noted that more questions of a similar nature would be asked at other points during the task.

The ratings made by participants at this point included several distractor questions (e.g., "How many siblings do you have?"; "During the course of the day, on average how many people do you talk to?"; "What is your concentration level right now?"), plus the item of interest (a mood rating). In each case, the rating was made by clicking a point on the scale using the mouse. On the item of interest, participants indicated their current mood on an 11-point scale ranging from 11 (*very positive mood*) through 6 (*average*) to 1 (*very negative mood*).

It should be noted that the theory on which the present study was based deals with the creation of affect, and that mood is usually viewed as being a step away from affect. Mood represents a residual affective quality that is less explicitly linked to any particular event. We were concerned, however, that to ask participants directly about feelings arising from their task experiences would be reactive with respect to the study's cover story. Therefore, we decided to assess ambient affect as "mood," rather than as affective reactions to the task.

After making the ratings, the participant began the experimental task. At the end of each block of items, feedback on that block was given in terms of percentage correct on that block. After six blocks, participants again made concentration and affect ratings. The program then instructed the participant to summon the experimenter. The experimenter and participant returned to the cubicle where the participant completed a brief questionnaire, one item of which asked how important he or she felt it was to have good social perception skills. They responded on a scale ranging from 1 (*not at all important*) to 9 (*very important*). An open-ended item, asking what participants were thinking about during the task, began to introduce the process of debriefing and probing for suspicion, which then was carried out more extensively through verbal questioning by the experimenter.

Behavioral goal and velocity manipulation. The meaning of *distance* and *velocity* as applied to this task are difficult to keep clear. For this reason, we give this issue explicit attention here. The behavioral goal of the task was to perform well—to make many correct responses overall. Participants received performance scores (in terms of number of correct choices) after each block. The distance moved toward the goal by the time of the second assessment thus would be reflected in the accumulation of "correct" responses ostensibly made during Block 1 through Block 6.

Our predictions, however, were based on velocity. Thus, we established the feedback patterns of experimental conditions so that they would vary in velocity. Velocity was operationalized in terms of slopes of the success curves over trial blocks (Figure 1). Two groups experienced outcomes with positive slopes across trial blocks, starting with low scores (10% and 30%, respectively) and performing gradually better across blocks (ending at 50%). These were high and medium-high velocity conditions. Subjects in a zero-slope condition received a 50% score on the first and last block, and 50% on average across all blocks. This

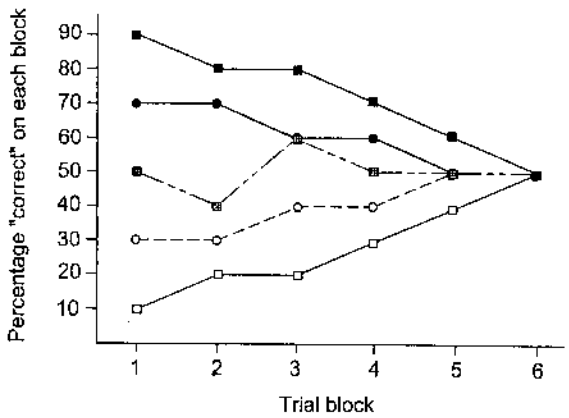

Figure 1. Pattern of feedback across trial blocks given to subjects in each of five experimental conditions. Some participants began with good performances and gradually fell to average; others began with poor performances and gradually improved to average; and a control condition consistently performed at an average rate.

condition was intermediate in velocity, compared to the other conditions. The final two groups had negative slopes, starting well (90% and 70%, respectively) and gradually worsening across blocks (also ending at 50%). These were the low and medium-low velocity conditions.

As was implied in the Overview, this pattern of outcomes controls for two things. First, it controls for the number of blocks completed by the second assessment. This removes the possibility that a difference on the dependent measure would be a function of the amount of task exposure. The outcome on the final block was also controlled. That is, the five slopes converged such that scores on Block 6 were identical for all participants (50% correct). This meant that a difference on the dependent measure could not be attributed to differences in scores on that final block (i.e., a recency effect).

Given these two controls, it is impossible to control the starting point for the five conditions. Thus, the groups had to start with different levels of success in Block 1. This difference in starting point has a useful function, however. In particular, it serves to create an inverse relation between velocity and distance traveled toward the behavioral goal by the second assessment. Participants who had high scores on early trial blocks had the lowest velocity (downward slope) between Block 1 and Block 6, but they had also moved the greatest distance toward the behavioral goal by that time (i.e., they had accumulated the largest total number of "correct" responses by that time). Those who scored low on early trial blocks had the highest velocity (upward slope) between the starting block and second measurement, but they had also moved the smallest distance toward the behavioral goal by that time (i.e., they had accumulated the fewest total "correct" responses).

The result of this is that participants in the conditions with upward slopes (whom we predicted to have a positive change in mood) were those farthest from the behavioral goal (i.e., maximizing correct responses) at the end of Block 6. If behavioral discrepancy is what matters, these participants should be in the worst mood. Participants in the conditions with downward slopes (whom we expected to have a negative change in mood) are those with the least distance from the behavioral goal at the end of Block 6. If behavioral discrepancy is what matters, these people should be in the best mood.

The design of this experiment did not incorporate any group for which velocity was negative, that is, where participants were actually losing ground on their behavioral goal. It certainly would be possible to create such a condition—for example, by imposing a penalty for incorrect responses that would be subtracted from correct responses. However, we wished to focus on conditions that incorporated forward movement for all subjects—reducing behavioral discrepancies for everyone, but at different rates.[2]

Results

Initial mood ratings (prior to Block 1) were relatively positive overall (M = 8.07 on a scale ranging from 1 to 11, SD = 1.84). Analysis of these ratings revealed no difference between groups (as no gender effect emerged from preliminary analyses, the data reported here are combined across gender). Nor did groups differ on post-experimental ratings of how important they felt it was to have good social-perception skills. Importance ratings overall averaged 7.23 (SD = 1.34), indicating that participants believed that the skill assessed by the task was important. We infer from this that participants were relatively fully engaged by the task.

The measure of greatest interest was the change in mood that took place from the initial measurement to the measurement after trial Block 6 (Figure 2).

[2]We believe that the most straightforward interpretation of the instructions to participants is that the goal of the task is to make as many correct responses overall as possible (as we intended). It might be argued, however, that for at least some people, the goal adopted was having high scores on later trial blocks—that is, being skilled at the task by the end of the session. If so, upward-slope conditions would represent movement toward that behavioral goal (thus positive velocity), and downward-slope conditions would represent movement away from that behavioral goal (thus negative velocity). All groups would still have identical behavioral discrepancies after Block 6 (i.e., a score of 50% correct). This view would change the experiment from one in which fast velocity was compared to slow velocity (as we interpret it) to one in which positive velocity was compared to negative velocity. However, this perspective would not change our prediction greatly. Upward-slope conditions should still lead to positive-direction affective change, and downward-slope conditions should still lead to negative-direction affective change. Under this view, the negative-direction change should simply be more intense, since there is reverse movement instead of just slow movement.

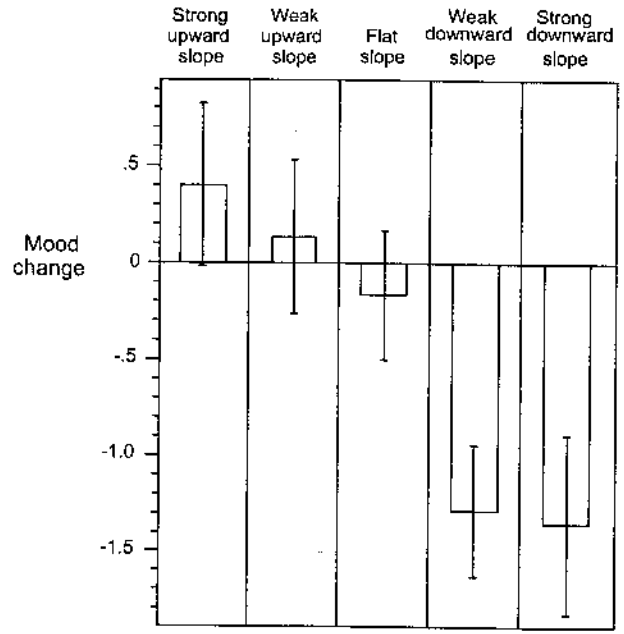

Figure 2. Mood change from pre-task to post-trial-block 6 (standard error is indicated by error bars).

ANOVA on this measure yielded a significant effect for experimental condition, $F(4, 82) = 3.62$, $p = .009$. A contrast analysis (using weightings of 1.0, 0.5, 0.0, -0.5, and -1.0) confirmed that there was a significant linear trend across the five groups, $t(82) = 3.61$, $p = .001$, such that those whose performance feedback displayed an upward slope over blocks tended to have the most positive mood change, and those whose performance feedback displayed a downward slope over trial blocks tended to have the most negative mood change. By Duncan multiple range test for individual group comparisons, the two downward-slope groups had adverse changes in mood that differed from the changes reported by the other three groups, which did not differ significantly from one another.

Discussion

Participants in this study received a series of messages reporting their performances on six blocks of trials on a task. The messages indicated one of five patterns of performance. The patterns varied from a high-velocity performance (progressing toward the behavioral goal with an upward slope) to a low-velocity performance (progressing toward the behavioral goal with a downward slope). Participants who experienced downward slopes across blocks shifted their moods in a negative direction. Participants who experienced upward slopes across blocks tended to shift toward more positive moods. This latter tendency was probably constrained by a ceiling on mood ratings, however, as mood was positive overall among participants at the beginning of the task. Despite this constraint, a contrast analysis confirmed that there was a significant linear trend in affect change among the groups as a function of variation in slope.

These findings are consistent with the conceptual model with which we began (Carver & Scheier, 1990a, 1998). They are also consistent with the results of Hsee and Abelson (1991a, 1991b) in supporting the position that change over time is a more important influence on affect than is distance from a behavioral goal. Our findings extend those of Hsee and Abelson, however, in showing that the effect occurs among people actively engaged in a performance task with direct personal relevance, in addition to occurring among people judging hypothetical situations.[3]

It is worth emphasizing that the findings are not easily interpreted within a framework that takes into account only the degree of behavioral discrepancy from the goal at the point of final mood assessment. That is, participants who reported the most positive mood at the end of the sixth block were those who had accumulated the fewest total correct responses, whereas those reporting the least positive mood at that time were those who had accumulated the most total correct responses. Thus, affect change did not depend on mere cumulative success. Nor did affect change reflect the last piece of information that was received. All participants experienced identical success rates on Block 6, yet the groups differed in the moods they reported.

Limitations

We should be explicit that there are important limitations on what was found here. We are not asserting that this experiment examined all potential contributors to affective experience. For example, Hsee, Salovey, and Abelson (1994) argued that acceleration makes a contribution to satisfaction, with positive acceleration values associated with more satisfaction and negative values associated with less satisfaction. The study reported here was not intended to bear on this issue, nor on several other issues pertaining to potential influences

[3]A reviewer raised the possibility that the findings support a model in which the perceived likelihood of attaining the goal (rather than velocity) produces affect. That is, groups with an upward slope might be more confident of performing well over the full task period than groups with a downward slope. Such an interpretation would be consistent, however, with the model under study. That is, in this model, affect and confidence about outcomes are viewed as parallel readouts of a single processing principle involving velocity (for more detail, see Chapters 8 and 10 of Carver & Scheier, 1998).

on affective experience (see Hsee et al., 1994, for further discussion of such issues).

Further, in this experiment we ignored the considerable divergence among affective qualities that exist in human emotional experience (e.g., Ellsworth & Smith, 1988; Frijda, 1986; Izard, 1977; Ortony et al., 1988; Roseman, 1984). Affect varies in both dramatic and subtle ways, as a function of the variables that surround the situation in which it is occurring (Ortony et al., 1988). This experiment was not intended to explore those variations, but rather to minimize their impact, so that the hypothesis of our focal interest could be examined with minimal intrusion. We do have further thoughts on aspects of the divergence among feeling qualities, however, which are addressed in detail elsewhere (Carver & Scheier, 1998).[4]

Another limitation is that the findings of this study were not as strong as they might have been. Although contrast analysis confirmed the existence of a linear trend across experimental groups, the groups did not differ as distinctly from one another as we had hoped. There are several possible reasons for this. Presumably, people vary in their reference values for both velocity and behavioral performance on tasks such as this; if we had collected information about such individual differences, we might have reduced error and found stronger effects. Indeed, it is possible that the experiences of the six trial blocks caused some readjustment in reference values in the various groups. If we had had an online measure of reference values at various phases of the task, it would have made the analyses even more precise. Another issue here concerns the fact that the theory pertains to the creation of affect, whereas we asked participants to rate their moods. Although the two are certainly related, they are also differentiable. Perhaps the decision to collect these ratings as mood ratings increased measurement error.

Velocity, Gain, and Loss

We close by noting an interesting resemblance between our findings and those of a 1965 study by Aronson and Linder. In that study, a confederate's evaluations of participants were manipulated across trials. Some received consistent positive evaluations, some consistent negative evaluations, and for others evaluations shifted from positive to negative or from negative to positive. Those whose evaluations shifted from negative to positive later reported liking the confederate more than those whose evaluations were consistently positive. (Conceptually, this comparison resembles that between our control group and our upward-slope groups.) An opposite tendency occurred in the other two conditions: Those who experienced a shift from positive to negative evaluation tended (though not significantly) to like the evaluator less than did those whose evaluations were consistently negative. (Conceptually, this comparison resembles that between our control group and our downward-slope groups.)

[4] A specific issue that might occur to readers is how affect might vary as a function of attributions for the cause of the outcome. We have taken the position that the core of affective experience arises with regard to velocity itself, and that perceptions of cause influence more subtle variations among feelings, such as that between pride and gratitude (Carver & Scheier, 1998; see also Carver et al., 2000). This general view resembles statements made by Weiner (1986) and by Smith and Ellsworth (1987).

It is of some interest that the pattern emerged for Aronson and Linder (1965) only when participants were asked to report their feelings about the evaluator; that is, their "gut response." No such effect occurred on participants' ratings of the evaluator's positive and negative personal characteristics. This and other ancillary data appeared to indicate that participants' ratings of the confederate reflected their feelings (their affective responses) rather than cognitive evaluations.

Aronson and Linder (1965) interpreted the finding in terms of shifts in multiple drive states (deriving from the valence of the other person's evaluations), rather than in terms of contrast effects. They did so partly because an additional post hoc group of participants who had a shift from neutral (which does not induce a drive) to positive failed to display enhanced liking. It seems reasonable to ask, however, whether that really settles the matter. Perhaps the failure to find an enhancement of liking in that group simply reflects the fact that the contrast was far less sharp for that group.

The Aronson and Linder (1965) pattern of findings seems readily interpreted in terms of the velocity model from which we proceeded here. Participants who heard consistently positive evaluations were at the desired goal (being well regarded) throughout the experience. Those who heard evaluations that shifted from negative to positive experienced a change. This change implies a higher velocity. The result was positive feeling, which was expressed as liking for the evaluator.

Conclusion

In sum, the findings reported here join with previous evidence (Hsee & Abelson, 1991a, 1991b) in suggesting that the subjective experience of affect reflects a velocity function. Specifically, affect appears to reflect the rate of the person's movement toward (or away from) a salient goal. In this way, affect ties the goal-related aspect of motivation to the dimension of time (see also Carver & Scheier, 1998). Affect is an indicator that the subjective experience of the now derives not solely from the present moment, but partly from relations between the present and a broader temporal span.

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