The Journal of Social Psychology, 125(6), 761-769

The Influence of Self-Esteem on Cognitive Responses to Machine-Like Versus Human-Like Computer Feedback

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ABSTRACT. Business school students ($N = 49$) who were preclassified as being either high or low in self-esteem (Texas Social Behavior Inventory) interacted with a computer that delivered either human-like, neutral, or machine-like feedback. In line with a compensatory, self-enhancement perspective (Baumeister, 1982), this experiment found that persons high in self-esteem generated more negative cognitive responses and made fewer errors when faced with human-like rather than machine-like feedback from a computer. Overall, however, persons low in self-esteem did not perform more poorly than did persons high in self-esteem.

THE RECENT AND SUDDEN INVASION of personal computers has accelerated interest in the social psychological effects of interacting with a computer. A rather common recommendation or theme resulting from discussions on the people-computer interaction topic is that computers ought to be more human-like, particularly when they so freely distribute frustrating error messages.

To the extent that the computer is perceived to be more or less human in its observation and evaluation of the computer operator, certain social psychological phenomena associated with the effects of the presence of others on one's behavior (e.g., self-presentation effects) are more likely to be operative for a human-like computer than for a machine-like one (cf.

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Dillon, 1983; Orcutt & Anderson, 1974; Quintanar, Crowel, Pryor, & Adamopoulos, 1982; Rywick, 1975; Scheibe & Erwin, 1979; Stang & O'Connell, 1974). For example, self-presentation theory proposes that behavior in the presence of others reflects attempts to regulate public self-image (Arkin, 1981; Bond, 1982). Consequently, one's level of self-esteem is presumed to be a critical moderator of the effects of the presence of others.

Baumeister (1982) suggested that persons high in self-esteem are more likely in many situations to engage in compensatory self-enhancement when confronted with negative feedback from others (or, in this case, from a human-like computer). Persons with high self-esteem expect to be liked, respected, and admired by others and will often take compensatory action to enhance their image when such expectations are unfulfilled (cf. McFarlin & Blascovich, 1981; Sigall & Gould, 1977). In the context of the present study, we predicted that persons with high self-esteem, particularly those faced with human-like computer error messages, would demonstrate this compensatory strategy by increasing the quality of their performance (i.e., by making fewer errors in the long run) and by generating retaliatory, negative cognitive responses toward the source of the negative feedback, the computer. (For a good review on the theory and validity of cognitive responses, see Petty, Ostrum, & Brock, 1981, and Cacioppo, 1982.)

Apparently, however, compensatory self-enhancement is not a usual response strategy of persons with low self-esteem who are noted to anticipate regularly disappointment and rejection (Baumeister, 1982). Instead, persons having low self-esteem may feel more constrained to make their self-presentations consistent with what others expect (Baumeister). Thus, in the present study, computer operators with low self-esteem were expected to perform at a lower level and to engage in less derogation of the computer than were those with high self-esteem. Again, this predicted difference between persons with high and low self-esteem was expected to be exacerbated by human-like error messages, as opposed to computer-like ones.

Looking at this interaction hypothesis from another direction, we proposed that the compensatory behavior of persons having high self-esteem and the consistency behavior of those having low self-esteem are not likely to be triggered by a computer with impersonal, machine-like features but are likely to be triggered by a computer with personal, human-like features.

Method

Research Design and Participants

Business school undergraduates who volunteered for the study (N = 49, 19 women and 30 men) were preclassified as either high or low self-esteem on the basis of median split of their scores on the Texas Social Behavior Inventory (Helmreich, Stapp, & Erving, 1974). The inventory had been administered about 2 months prior to this experiment. The participants were randomly assigned to three experimental conditions (human-like vs. neutral vs. computer-like error feedback). Thus, the experimental design was a 3 × 2 factorial with type of feedback and self-esteem as the between-subjects factors.

Pretest of Human Versus Computer-Like Error Messages

A set of 27 error messages was pretested by having 32 business school undergraduates rate on semantic differential scales the extent to which each message was *computer-like* or *human-like*. The pretest subjects came from the same pool as the experimental subjects did, but they did not participate in the actual experiment. A total of 21 error messages was retained for use in the experiment (7 computer-like error messages, 7 human-like error messages, and 7 neutral error messages). This experimental set of error messages is presented in Table 1.

Procedure

The research participants were told that the study involved the evaluation of certain courses and professors on their campus and that this evaluation was being done on computer terminals on a test basis. The cover story appeared plausible, and no subjects expressed disbelief in the cover. The participants were tested in small groups of two to five. Each participant was seated in front of a computer terminal and was shown by a female experimenter how to start the computer. From then on, the computer led the participant through the exercise of evaluating courses and professors. The manner in which the computer led the participants through the exercises provided for the manipulation of the human-like versus neutral versus computer-like feedback. The feedback conditions were created by writing three versions of a simple COBOL data entry program for the CDC Cyber 750 NOS. The versions differed only in the feedback on the type of error message (human-like vs. neutral vs. computer-like). The program was written so that each participant encountered at least four error messages. For example, when the computer requested the data and the participant entered it, an error message invariably appeared and indicated that the data should be entered in a different format. That is, if the participant entered "April 30, 1983," the computer displayed an error message and expected the data in the format of "4/30/83," and vice versa. In short, a participant could never enter a date correctly the first time. The error messages continued until the participant entered the information correctly. Altogether, this inevitable error situation occurred four times during the course of the experimental session.

TABLE 1
Feedback Messages

Message	Median
Computer-like messages	
Numerics illegal	2.5
Alphanumerics illegal	1.5
Illegal date: Alphanumerics expected	1.0
Illegal date: Numerics expected	2.5
Alphanumerics only	1.5
Numerics only	2.0
Error limit: Processing continues	1.5
Pack Terminated	2.5
Neutral messages	
Use letters only	5.5
Use numbers only	4.5
Date requires month by name	4.5
Date requires month by number	4.5
Use course name	5.0
Use course number	5.0
Continuing to next questions	5.0
Run Complete	4.5
Human-like messages	
I don't understand these numbers	8.0
I don't understand these letters	7.5
I'd like the month name spelled out	8.0
I'd like the month by number	7.0
Nope, course name, please	6.5
Nope, course number, please	7.0
Moving on	7.0
Thank you & have a good day	6.5

Note. Ratings were done on 9-point scales ranging from computer-like (1) to human-like (9).

Dependent Measures

After finishing the computer exercise (most finished within 10-15 min.), the participants were asked to complete a questionnaire booklet containing the dependent measures. These dependent measures included cognitive responses ("Write down any thoughts, ideas, feelings you have about the computer program you just ran"), ratings of the computer program on 12 nine-point semantic differential scales, and ratings of self-perceptions on 15 nine-point semantic differential scales.

In addition to the measures provided by the questionnaire, a performance measure was computed for each subject. This measure consisted of the number of trials it took for the subject to enter data correctly after responding to a contrived error message.

Results

Cognitive Responses

The participants' cognitive responses were categorized independently by an assistant who acted as the experimenter in the study and by a second individual who was unaware of the experiment and its hypotheses. These two judges classified the cognitive responses as being positive (favorable), negative (unfavorable), or neutral/irrelevant comments about the computer program. This classification scheme is quite common in the cognitive response literature (Petty, Ostrom, & Brock, 1981). Interjudge reliability was .83. Disagreements were resolved through discussion.

Neither the type of error feedback nor the level of self-esteem affected the total amount of cognitive response output (Fs < 2.00). The nature of the cognitive responding, however, was affected by an interaction between these two variables, $F(2, 43) = 3.09, p < .05$. Human-like error feedback significantly increased the generation of negative cognitive responses by persons with high self-esteem but significantly decreased the negative cognitive responding of persons with low self-esteem. The means for this interaction effect are shown in Table 2. No other effects on cognitive responses were significant.

Performance (Errors)

In line with the hypothesis of the experiment, a significant interaction effect, $F(2, 43) = 3.41, p < .042$, indicated that the subjects with high self-esteem committed fewer errors in the human-like feedback condition ($M = 0.56$) and in the neutral condition ($M = 0.75$) than they did in the computer-like error feedback condition ($M = 2.83$). Subjects with low self-esteem were not significantly affected by the nature of the error feedback, although there was a tendency for them to make more errors with the computer-like feedback. The means for this interaction effect are presented in Table 2. There was also a type of feedback main effect, $F(2, 43) = 11.37, p < .001$, but it should be interpreted in terms of the interaction just described.

TABLE 2
Cognitive Response and Performance Means

	Type of feedback		
Computer-like	Human-like	Neutral	Human-like
	Low self-esteem		
Positive	.816	.765	1.009
Negative	1.111^{c}	1.246^{c}	1.034^{bc}
Neutral	.917	.822	.880
Total cognitive responses	1.431	1.383	1.425
Number of errors	1.750^{a}	0.899^{ab}	1.220^{ab}
	High self-esteem		
Positive	.901	.901	.822
Negative	1.052^{c}	1.010^{bc}	1.326^{a}
Neutral	.707	.772	.707
Total cognitive responses	1.246	1.229	1.423
Number of errors	2.833^{c}	0.750^{b}	0.556^{b}

Note. Cognitive response analyses were performed on the square root transformations (Kirk, 1968). The cognitive response means reported here are square root transformations. Analyses of the square root transformations yielded more conservative *F*s than did analyses of untransformed cognitive responses. Internal comparisons of the negative cognitive response means and of performance (error) means were computed with Duncan's multiple-range test (Kirk). Means that have no subscripts in common significantly differ at $p < .05$.

Self-Perceptions and Ratings of the Computer

Type of feedback effects. The analyses of subjects' self-perceptions and of their ratings of the computer program yielded several significant main effects. Subjects rated themselves as being least confused, $F(2, 43) = 3.92, p < .02$, and as being least nervous, $F(2, 43) = 4.90, p < .012$, when they received neutrally toned feedback (for computer-like, neutral, and human-like feedback conditions, respectively, the *confused* means were 3.6, 2.0, and 3.7; the *nervous* means were 3.8, 1.6, and 2.6). Subjects also rated the neutral feedback as being the most helpful, $F(2, 43) = 3.37$, $p < .04$, and the human-like feedback as having the most humor, $F(2, 43) = 8.19$, $p < .001$ (for computer-like, neutral, and human-like feedback conditions, respectively, the *not helpful* means were 4.2, 2.8, and 3.3; the *humorless* means were 5.6, 5.9, and 3.9). Finally, the subjects were able to recall more of the human-like feedback messages ($M = 1.9$) than the computer-like messages ($M = 1.2$), $F(2, 43) = 4.36$, $p < .019$. The mean for recall of the neutral messages was 1.6. This main effect on message recall may simply reflect the effects of greater familiarity with the words and phrases in the human-like feedback conditions.

Self-esteem effects. Subjects having high self-esteem, relative to those having low self-esteem, rated themselves as being less bored (*M*s = 2.74 vs. 4.08), $F(1, 43) = 5.82$, $p < .02$; more attentive ($M = 7.52$ vs. 6.65), $F(1, 43) = 3.01$, $p < .085$; less distracted (*M*s = 2.13 vs. 3.35), $F(1, 43) = 5.32$, $p < .026$; less nervous (*M*s = 1.82 vs. 3.27), $F(1, 43) = 6.18$, $p < .017$; and less challenged (*M*s = 3.52 vs. 4.73), $F(1, 43) = 3.46$, $p < .07$. With respect to ratings of the computer, subjects with high self-esteem, relative to those with low self-esteem, rated the computer as being smarter (*M*s = 5.13 vs. 4.46), $F(1, 43) = 3.46$, $p < .07$; less comfortable (*M*s = 2.22 vs. 2.96); $F(1, 43) = 3.03$, $p < .09$; less boring (*M*s = 2.70 vs. 3.85); $F(1, 43) = 7.50$, $p < .012$; and more polite (*M*s = 5.56 vs. 4.81), $F(1, 43) = 3.96$, $p < .052$.

Discussion

As initially proposed, computer-like error feedback did not stimulate the self-enhancement compensatory processes of subjects having high self-esteem. Instead, feedback of a more human-like nature was necessary to spur these processes. Given such human-like feedback, persons with high self-esteem were more negatively critical yet performed better than when they were exposed to the less personal computer-like feedback. Perhaps the persons with high self-esteem were not as threatened by the negative feedback from the machine-like source. Thus, compensatory processes for their errors were not invoked. When the feedback came from a more human-like source, albeit a machine, the persons with high self-esteem exhibited the defensive compensatory behavior often attributed to them (Baumeister, 1982).

From a consistency theory view, persons having low self-esteem would have been expected to perform more poorly than those having high self-esteem, but no evidence was found for this stereotype. In fact, when given computer-like feedback, the subjects with high self-esteem made significantly more errors than did the subjects with low self-esteem. Under none of the observed conditions did the subjects with high self-esteem significantly outperform the subjects with low self-esteem. Nevertheless, the stereotype is not without some basis, for the general picture one gets from the analyses of the rating scales (ratings of self-perceptions and of the computer) is that the subjects with high self-esteem were more comfortable and less nervous about the computer task than were those with low self-esteem. This finding is consistent with the notion that persons having high self-esteem possess a generalized, chronic self-confidence that can exude and manifest itself across many situations.

The cognitive response and performance results, however, were not only more instructive but also revealed that blind reliance on the rating scale results would have led to an oversimplified analysis of the behavior of persons with high and low self-esteem. Overall, the pattern of the performance data as well as the cognitive response results led us to agree with Sigall and Gould's (1977) contention that consistency theory is inferior to self-enhancement theory in accounting for the behavior of persons having high and low self-esteem.

Finally, the effects discovered in the present study have implications for software psychology and marketing, even in light of the usual caveats concerning the generalizability of the data. Our data suggest that the terms "user oriented" and "user friendly" should not necessarily mean that the software contains human-like feedback messages for the user. If the user performs or responds more favorably to machine-like messages, as did our subjects with low self-esteem, then such should be the orientation of the software. The easy solution would be to use neutral feedback, but the high degree of competition in the computer and software industries demands optimal and not just satisfactory strategies for success. Consequently, extensive knowledge of consumers and their preferences should dictate the nature of the software developed. In short, the assumption that all consumers want or learn faster with software that is user friendly probably is not a realistic premise. Instead, it may depend, in part, on such individual differences as self-esteem.

REFERENCES

Arkin, R. M. (1981). Self-presentation styles. In J. T. Tedeschi (Ed.), *Impression management theory and social psychological research* (pp. 311–334). New York: Academic Press.

Baumeister, R. F. (1982). Self-esteem, self-presentation, and future interaction: A dilemma of reputation. *Journal of Personality, 50,* 29–45.

Bond, C. F., Jr. (1982). Social facilitation: A self-presentation point of view. *Journal of Personality and Social Psychology, 42,* 1042–1050.

Cacioppo, J. T. (1982). Social psychophysiology: A classic perspective and contemporary approach. *Psychophysiology, 19,* 241–251.

Dillon, R. F. (1983). Human factors in user-computer interaction: An introduction. *Behavioral Research Methodology & Instrumentation, 15,* 195–199.

Helmreich, R., Stapp, J., & Ervin, C. (1974). An objective measure of self-esteem or social competence. *JSAS Catalogue of Selected Documents in Psychology*, *4*, 79.

Kirk, R. E. (1968). *Experimental design: Procedures for the behavioral sciences*. Belmont, CA: Wadsworth.

McFarlin, D. B., & Blascovich, J. (1981). Effects of self-esteem and performance feedback on future affective preferences and cognitive expectations. *Journal of Personality and Social Psychology*, *40*, 521-531.

Orcutt, J. D., & Anderson, R. E. (1974). Human-computer relationships: Interactions and attitudes. *Behavioral Research Methodology & Instrumentation*, *6*, 219-222.

Petty R. E., Ostrom, T. M., & Brock, T. C. (1981). *Cognitive responses in persuasion*. Hillsdale, NJ: Erlbaum.

Quintanar, L. R., Crowell, C. R., Pryor, J. B., & Adamopoulos, J. (1982). Human-computer interaction: A preliminary social psychological analysis. *Behavioral Research Methodology & Instrumentation*, *14*, 210-220.

Rywick, T. (1975). Increasing student interest by the use of interactive computer simulations. *Behavioral Research Methodology & Instrumentation*, *7*, 102-104.

Scheibe, K. E., & Erwin, M. (1979). The computer as altar. *Journal of Social Psychology*, *108*, 103-109.

Sigall, H., & Gould, R. (1977). The effects of self-esteem and evaluator demandingness on effort expenditure. *Journal of Personality and Social Psychology*, *35*, 12-20.

Stang, D. J., & O'Connell, E. J. (1974). The computer as experimenter in social psychological research. *Behavioral Research Methodology & Instrumentation*, *6*, 223-231.

Received June 1, 1985