Computers Are Social Actors: A Review of Current Research

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Abstract: In this chapter, we present evidence that computers are social actors. Five experiments are presented; together, they demonstrate that people engage in social behavior toward machines even in situations in which users state that such responses are wholly inappropriate. Specifically, the studies provide evidence that: (1) users apply politeness norms to computers; (2) users respond to computer personalities in the same way they respond to human personalities; (3) users are susceptible to flattery from computers; and (4) users apply gender stereotypes to computers. A fifth study demonstrates that individuals do not exhibit social responses to computers because users are thinking of the programmer. Implications for improving the design of interfaces are explicated.

On the surface, the fact that people respond socially to technologies is not altogether surprising. After all, almost all of us can think of situations in which we have muttered to our computers, cursed at our automobiles, or "talked back" to the television set. However, the traditional academic response to such social responses has been one of dismissal; indeed, the tendency to respond socially to technology is typically viewed as some kind of aberration.

The arguments generally fall into two categories. On the one hand are the scholars who argue that social responses to technologies are a function of deficiency, such as youth, lack of knowledge about technology, or psychological or social dysfunction (Barley, 1988; Turkle, 1984; Winograd & Flores, 1987; Zuboff, 1988). According to this view, "normal," well-adjusted individuals are unlikely to engage in social behavior toward machines. Others argue that this social behavior is, in fact, directed toward the human creator behind the machine. In other words, because the machine is logically perceived by the user to be a human artifact (Dennett, 1987; Heidegger, 1977), the rational response is to adopt an "intentional stance" (Dennett, 1987) toward the technology since it is simply a proxy for the creator or programmer (Searle, 1981).

What both of these explanations have in common is the assumption that individuals' social responses to technologies are consistent with their beliefs about technology (Nass, Steuer, Henrichsen, & Dryer, 1994). In other words, in

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the first case, behavior is presumably based upon a mistaken belief about the nature of machines; in the second case, behavior is presumably based upon a rational decision to orient toward the human creator behind the machine.

In this chapter, we seek to demonstrate that neither explanation sufficiently accounts for the extent to which people respond socially to computer technologies. Five studies are presented, all of which provide evidence that individuals engage in social behavior toward machines even though: (1) they are not deficient in any way; and (2) they do not perceive themselves as having a relationship with the machine's creator. In other words, individuals engage in social behavior toward technologies even when such behavior is entirely inconsistent with their beliefs about machines.

In addition, the present studies suggest that social responses to technologies are much more commonplace than many may believe. In all of the experiments presented below, the social response does not involve an overt behavior such as "talking" to a computer. Rather, the social behavior under investigation is much more subtle, involving an experimental manipulation to which the subjects are blind. When subjects do engage in social behavior toward the computer, they are unaware that they are doing so. Postexperimental debriefs confirm this lack of awareness. In other words, users in these experiments automatically and unconsciously apply social rules to their interactions with computers.

All of the studies described in this chapter were conducted as part of the Social Responses to Communication Technologies (SRCT) research program in the SRCT Laboratory at Stanford University. Taken together, the studies suggest that the model for human–computer interaction should be interpersonal. Given this discovery, the results have intriguing implications for theoretical and design principles in human–computer interaction. Hence, the SRCT approach is not only to adopt this model to predict outcomes in various human–computer relationships, but also to generate suggestions for product design.

In making these product design suggestions, our goal is rather straightforward: We are interested in making technologies more "likable." And just as "liking" leads to various secondary consequences in interpersonal relationships (e.g., trust, sustained friendship, etc.), we suspect that it also leads to various consequences in human–computer interactions (e.g., increased likelihood of purchase, use, productivity, etc.).

The experimental paradigm used in the SRCT research program is similar across a variety of studies. In each case, we investigate a well-established social science hypothesis that concerns behavior or attitude toward humans. The hypothesis regarding human–human interaction is, however, rewritten for human–computer interaction. This involves changing the word "human" to "computer" in the statement of the hypothesis. Our next step is to experimentally test the new hypothesis, using a methodology similar to that used in testing the hypothesis in human–human interaction. The primary exception is that we replace the human in the experiment with a computer. The computer used in the experiment is programmed to exhibit certain characteristics traditionally associated with humans, such as language output, responses based on multiple prior inputs, and/or voice. Finally, if the hypothesis is supported, implications for theory and design are explicated.

All of the studies reviewed in this chapter have used this approach successfully. The studies address the following questions and concepts adapted from the interpersonal interaction literature: Do users apply politeness norms to computers? Do users respond to computer personalities in the same way they respond to human personalities? Are users susceptible to flattery from computers? and Do users apply gender stereotypes to computers? In addition, we present a fifth study that tests an alternative explanation (the programmer explanation) for social responses to computers.

STUDY 1: ARE PEOPLE POLITE TO COMPUTERS?

People apply politeness norms when responding to questions posed by other individuals. For example, an individual who directly asks others about oneself will receive more positive answers than if the same question is posed by a third party (e.g., Finkel, Guterbock, & Borg, 1991; Kane & Macaulay, 1993; Reese, Danielson, Shoemaker, Chang, & Hsu, 1986; Schuman & Converse, 1973; Singer, Frankel, & Glassman, 1983). Furthermore, politeness norms dictate that people directly evaluating an individual will feel more constrained in their responses than when a third party asks; thus, across individuals, responses will tend to be much more homogeneous (i.e., fall in a much narrower range) when a person asks about oneself compared to when a third party asks.

This first experiment was designed to determine whether people are "polite" to computers. To conduct this study, subjects underwent a tutoring, testing, and evaluation session with a computer. Following completion of the task, subjects were interviewed about the computer's performance during the task. In the first condition, this interview was conducted by the computer itself. Under this condition, there would seem to be no apparent reason for subjects to be anything less than honest, since it is impossible to "hurt a computer's feelings." On the other hand, if subjects were to give polite (i.e., socially appropri-
ate) answers to the computer in this situation, then this would provide support for the idea that people unconsciously respond to computers in a social manner.

In a second condition, subjects were asked to evaluate the computer by answering a paper-and-pencil questionnaire. We predicted that subjects would perceive this paper-and-pencil questionnaire as a third party because it was physically separate from the computer. Thus, the prediction was that subjects would be much more likely to criticize the computer in this condition, compared to the first condition.

There was also a third condition in this experiment. Because paper-and-pencil is a fundamentally different medium than a computer, it could generate different types of responses. So, in the third condition, subjects were asked about the computer’s performance by a separate, but identical, computer. Again, the prediction was that subjects would perceive this other computer as a third party, and thus be more likely to criticize the computer in this condition, compared to the first condition.

Method

University undergraduates (N=33) from various communication classes were randomly assigned to one of three conditions – same-computer, paper-and-pencil, or different-computer – in a balanced between-subjects design. Upon arrival the subject was told that he or she would work with a computer to complete a task. Every effort was made to ensure that the appearance of the computer was as simple and straightforward as possible; neither graphical representations nor audio cues were used. The computer used only text-based output.

The subject then underwent the tutoring, testing, and evaluation session with the computer. Following completion of the task, the subject was interviewed about the performance of the computer. Depending on condition, this interview was conducted by either: (1) the same computer; (2) a paper-and-pencil questionnaire; or (3) a separate but identical computer in the next room. The dependent variables were subjects’ perceptions of the computer. We also looked at the variance in the subjects’ perceptions, because previous studies have indicated that extensiveness of responses is associated with greater honesty on the part of interviewees (see, e.g., Sproull, 1986). The prediction here was that same-computer subjects would rate the computer’s performance more homogeneously than paper-and-pencil or different-computer subjects. Homogeneity of responses was measured in terms of standard deviation.

The actual interview consisted of a set of questions that asked subjects to evaluate the computer according to a given adjective. For all items, respondents answered on a 10-point scale anchored by “Describes Very Poorly” and “Describes Very Well.” In our analysis, we used twenty-one different items that covered various aspects of the user’s affective feelings toward the computer and the interaction, as well as perceptions of the computer’s performance. The twenty-one items were: informative, helpful, likable, knowledgeable, friendly, analytical, fun, competent, useful, enjoyable, warm, and polite (tutoring session), and friendly, fun, likable, accurate, competent, confident, polite, fair, analytical, warm (evaluation session).

The specific model we examined was a comparison of the same-computer condition to both the paper-and-pencil and different-computer conditions. To test the relative positivity of assessments of the computer, we combined the items into a single factor score; higher scores on the factor indicated more positive responses toward the computer. We then performed t-tests to determine whether differences between conditions existed. For the comparison of the relative homogeneity (dishonesty) of responses, we did an item analysis: For each item, we calculated the standard deviation, and then did a paired comparison t-test by item. For both tests, we adjusted the p-level to control for the inflated significance levels associated with multiple comparisons.

Results

As predicted, subjects gave significantly more positive responses when interviewed by the computer asking about its own performance, compared to when interviewed by the paper-and-pencil questionnaire. In addition, subjects in the same-computer condition gave significantly more homogeneous (less honest) responses than subjects in the paper-and-pencil condition (see fourth column in Table 1).

What about the third condition? Again, as predicted, subjects who were interviewed by the same computer gave significantly more positive responses and more homogeneous responses, compared to subjects who were interviewed by a different computer (see the fifth column in Table 1). In other words, subjects seemed to perceive the different computer as a third party to whom they could give honest responses.

Finally, in postexperimental debriefs, all of the subjects denied feeling constrained in their responses, and all of them asserted – some of them rather strongly – that it would be absurd to engage in polite behavior toward a computer.
Table 1: Mean Perceptions of Tutor and Evaluator Sessions

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Same Computer (SC)</th>
<th>Paper &amp; Pencil (PP)</th>
<th>Different Computer (DC)</th>
<th>SC vs. PP</th>
<th>SC vs. DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Ratings</td>
<td>5.5</td>
<td>4.8</td>
<td>4.9</td>
<td>1.9*</td>
<td>2.7**</td>
</tr>
<tr>
<td>Homogeneity</td>
<td>2.0</td>
<td>2.5</td>
<td>2.5</td>
<td>3.5***</td>
<td>3.4***</td>
</tr>
</tbody>
</table>

*p<.05; **p<.01; ***p<.001.

Note: Mean Ratings are based on an index of 10-point scales; significance level of t for Mean Rating is based on factor scores. Significance tests based on one-tailed Dunnett's t.

Theoretical and Design Implications

The results of this study illustrate the extent to which people respond socially to computers. The more specific implication is that people obey politeness norms when interacting with computers, even though they are not consciously aware of doing so. In other words, people are polite to computers, however strange that may seem.

This study leads to important suggestions for those engaged in product testing. In product evaluation, these results suggest that questions about a product should not be asked by the product itself. Nor should they be asked by the technology used to test the product, despite the convenience. Instead, the interview should be conducted by using either a paper-and-pencil questionnaire or a different product or technology.

Another possible implication of this research may be that, in addition to being polite to computers, users also expect politeness from computers. These expectations may be unconscious, but if not met, may result in dissatisfaction and irritation on the part of the users. Most computer software programs avoid obvious impolite behaviors, such as directly insulting the user, but many other important politeness rules are commonly ignored by interface designers.

A good example of this is confusing error messages, which are often blatantly impolite.

In fact, lists of politeness rules can be found in a wide variety of books. Of course, politeness rules differ from country to country and culture to culture. Hence, when one modifies an interface for another country, rather than simply changing the language, one must also avoid behaviors that would be considered as impolite in that country. (For complete details of this study, see Nass, Moon & Carney, 1996).

STUDY 2: ATTRACTION AND PERSONALITY

Psychologists have found that one of the best ways to predict whether two people will be attracted to each other is to find out how similar they are (Byrne & Nelson, 1965). The more similar they are, the more likely they will be attracted to each other. This is particularly true with respect to personality: People with similar personality characteristics tend to like each other (Blankenship, Ilinat, Hess & Brown, 1984; Byrne, 1969; Duck & Craig, 1978; Griffin, 1969; Izard, 1960a, 1960b, 1965). For example, people prefer strangers who have personalities similar to their own over strangers who have personalities different from their own (Byrne, Griffin & Stafisiak, 1967; Griffin, 1967). Similar results have been found with respect to naturally occurring relationships, such as friendships (Duck & Craig, 1978; Izard, 1960a, 1963), as well as formal relationships, such as college roommate assignments (Carli, Ganley & Pierce-Otay, 1991).

Is the same thing true for computers? Are people attracted to computers that exhibit personality behavior similar to their own? To determine whether this is so, we constructed an experiment that matched different types of people with different types of computers. The participants were categorized by personality, using a standard personality test. The personality dimension on which we focused was the dominance/submissiveness dimension of the personality. This dimension is one of the two most psychologically important dimensions in impression formation (Williams, Munic, Saiz & Formy-Duval, 1995). Moreover, the behavioral characteristics of this dimension are rather straightforward: Dominant people tend to be self-confident, leading, and assertive; submissive people tend to be self-doubting, obedient, and passive (Kiesler, 1983; Wiggins, 1979).

The computers were also categorized by "personality." The dominant computer was given characteristics associated with dominance, while the submissive computer was given characteristics associated with submissiveness.

It is important to note that this was accomplished using only the most simple, preprogrammed, text-based cues. In contrast, most interface designers and programmers tend to try to create computer "personalities" using technological features such as sophisticated graphics, natural-language program-
ming, or artificial intelligence. We took a much more psychological approach, drawing on the literature on personality to find a limited set of text-based cues that would be sufficient to evoke a psychological response on the part of users.

The prediction was that once these computer personalities were created, people would respond to them in a social manner, i.e., in the same way that they would respond to human personalities. In other words, we predicted that people would prefer to interact with computers that exhibit personalities similar to their own.

Method

Undergraduates from various communication classes (N=80) were categorized as being either dominant or submissive, using a personality survey conducted several weeks before the experiment was conducted. Forty individuals from each category were recruited to participate in this experiment.

Personalities were then created on computers using four text-based language cues. First, the dominant computer was programmed to use strong language in the form of assertions and commands; the submissive computer used weaker language in the form of questions and suggestions. For example, the dominant computer might display the following text: "You should definitely rate the flashlight higher. It is your only night signaling device." In contrast, the submissive computer would display the following text: "Perhaps the flashlight should be rated higher? It may be your only reliable night signaling device." Second, the dominant computer displayed a high level of confidence in its statements, whereas the submissive computer displayed a low level of confidence in its statements. Third, we programmed the dominant computer to always initiate the interaction, while the submissive computer waited for the subject to initiate the interaction. Finally, we gave the computers different names: The dominant computer was named "Max," and the submissive computer was named "Linus."3

Other than these four differences, the dominant computer and the submissive computer were the same; that is, both the dominant and the submissive computer gave the user the same type and amount of information. The entire manipulation was preprogrammed; no natural-language programming or artificial intelligence was employed.

Half of the dominant subjects were assigned to the dominant computer and the other half to the submissive computer. Submissive subjects were divided in the same way, creating a 2 x 2 balanced, between-subjects design. During the experiment, the subject interacted with the computer to complete a task (the Desert Survival Task; for details, see Lafferty, Eady & Elmets, 1974) that lasted for approximately 15–20 minutes.

When the interaction was complete, the subject went into another room and filled out a paper-and-pencil questionnaire. The questionnaire presented a series of questions about the computer and about the subject's attitude toward the computer. Using factor analysis as a guide, we created three indices: Affiliation, Competence, and Quality of the Interaction. The Affiliation index was based on four items: friendly, likable, sympathetic, and warm. The Competence index was based on twelve items: intelligent, knowledgeable, rational, insightful, credible, competent, clever, helpful, efficient, conscientious, reliable, and the question, "How much did the computer improve your final ranking?" The Quality of the Interaction index was based on seven items: engaging, enjoyable, exciting, fun, interesting, involving, and satisfying.

Results

All results were based on a full-factorial ANOVA design.

First, the subjects identified and distinguished dominance and submissiveness in the computers even in the absence of anthropomorphic presentation. The dominant computer was rated as significantly more aggressive, assertive, authoritative, confident, controlling, dominant, domineering, and forceful—all adjectives associated with dominance. Conversely, the submissive computer was rated as more submissive, shy, and timid.

Second, the subjects were able to detect similarity of the computer's personality to their own. Dominant subjects found the dominant computer to be significantly more like them in style of interaction and in the phrasing of comments than submissive subjects did. Also, on the same attributes, submissive subjects found the submissive computer to be more like them than dominant subjects did.

Third, there was strong evidence that subjects preferred interacting with computers that shared their personality type. Moreover, this crossover interaction effect was found consistently over a wide range of attributes. For example, when the personalities of the subject and the computer matched, the com-

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3 These names were chosen based on a pretext of dozens of names. "Max" and "Linus" were most closely associated with dominance and submissiveness, respectively, without being associated with other dimensions of personality, such as friendliness, intelligence, etc. In subsequent replications of this experiment, we dropped these names from the manipulation; when we did this, the results were similar to those reported here (see Moon & Nass, 1990).
computer was given higher affiliation ratings than when the person and the computer had different personalities (see Figure 1).

This same transverse interaction effect was found with respect to competence. When the subject and the computer shared the same personality, the computer received higher competence ratings (see Figure 1) compared to when the subject and the computer had different personalities. Finally, subjects matched with similar computers found the interaction to be more satisfying, compared to subjects matched with dissimilar computers (see Figure 1).

A second design implication of this research is that personality may be an important way to segment the market for computer interfaces. Traditionally, the primary focus for marketing of computers and other highly technical products has been user expertise. But if users are humans first and foremost, and experts second, as SRCT theory argues, then personality may be a very underutilized diagnostic. (For complete details of this study, see Nass, Moon, Fogg, Reeves & Dryer, 1995.)

### STUDY 3: RESPONSES TO COMPUTERS THAT FLATTERY

People have a basic desire to think of themselves favorably (Berscheid & Walster, 1978; Taylor & Brown, 1988). For this reason, people are "phenomenal suckers for flattery" (Cialdini, 1993). Not only do we tend to believe flattery (i.e., insincere praise), but we also tend to feel emotionally satisfied when we are flattered (Byrne, Rasche & Kelley, 1974), we tend to like people who flatter us (Jones, 1964), and we tend to judge their performance more favorably (Watt, 1993). In fact, flattery is so powerful that it often can evoke the same effects as sincere praise.

What happens when people are confronted with a computer that flatters them? Will they respond in the same manner? This third experiment was conducted to test this idea. Our prediction was that people would, indeed, respond to computer flattery in the same way that they respond to human flattery.

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4This figure is reprinted from Nass, Moon, Fogg, Reeves & Dryer (1995).
Method

The participants (N=40) in this experiment were randomly assigned to one of three conditions: (1) sincere praise; (2) flattery (insincere praise); and (3) generic feedback.

After arriving at the laboratory, subjects were instructed to play a guessing game on the computer. The computer was programmed to give the subjects feedback on their performance at periodic intervals during the game.

For subjects in the generic feedback condition, this feedback consisted of a simple message that said, “Begin next round.” For subjects in the other two conditions, this feedback consisted of positive statements praising the subject’s performance, such as “Great job! You seem to have an uncommon ability to structure data logically.”

The only difference between the sincere praise condition and the flattery condition was the description subjects received about this positive feedback: Subjects in the sincere praise condition were told that the feedback was contingent on their performance (although it was in fact randomly generated), whereas subjects in the flattery condition were told that the feedback was totally noncontingent on their performance. More specifically, subjects in the flattery condition were told that the evaluation portion of the program was not yet written and therefore was randomly generated. In the latter case, this information was repeated several times to ensure that subjects understood that the computer feedback had nothing to do with their actual performance. Finally, subjects were given a paper-and-pencil questionnaire.

Based on factor analysis, we created six dependent variable indices from the items in the questionnaire. They were: Positive Affect of the User, Power-feeling of the User, User’s Perception of Own Performance, Enjoyment of the Interaction, User’s Willingness to Continue Working, and Evaluation of the Computer’s Performance. Positive Affect of the User was based on three items: good, happy, and relaxed. Power-feeling of the user was based on three items: important, powerful, and dominant. User’s Perception of Own Performance was based on four items: how well subjects felt they performed, how satisfied subjects were with their performance, how efficient their game framework was, and how favorably subjects rated their performance compared to other subjects. Enjoyment of the Interaction was based on three items: fun, creative, and rewarding. User’s Willingness to Continue Working consisted of two items: how willing to continue working with the computer and how willing to continue on the task. Evaluation of the Computer’s Performance was based on three items that referred to the computer: helpful, intelligent, and insightful.

Results

A manipulation check at the end of the postexperimental questionnaire confirmed that all subjects in the flattery and sincere praise conditions understood whether the praise from the computer was (ostensibly) contingent on their work or not.

In addition, as predicted, praise from the computer – both sincere praise and insincere praise (flattery) – had a remarkable impact on how users felt about themselves, the interaction, and the computer. To control for the experiment-wise error rate, we compared the flattery and sincere praise conditions to the generic feedback condition using Dunnett’s t. Subjects in both the flattery and sincere praise conditions enjoyed the interaction more, felt more powerful, thought they performed better, liked the interaction more, were more willing to continue working with the computer, and evaluated the computer more highly, as opposed to subjects in the generic feedback condition (see Figure 2).

In addition, the responses of subjects in the flattery condition did not differ from the responses of subjects in the sincere praise condition. All comparisons were clearly insignificant with respect to all six measures, and this result was not a problem of lack of statistical power (see Figure 2).

Theoretical and Design Implications

Results from this study provide further evidence that people respond to computers socially. When confronted with computers that flatter us, our reaction is the same as when flattered by people: We like them, and ourselves, better.

This research has strong implications for the design of computer software and hardware. Most current computer applications are heavily geared toward critical feedback (e.g., error messages); adding positive feedback to these systems would significantly enhance the user experience. Note that under these circumstances, even noncontingent positive feedback would be quite effective.

Similarly, adding either sincere praise or flattery to training and tutorial software would aid in the learning process by increasing user enjoyment, task persistence, and feelings of self-efficacy. Applications that enhance user creativity, such as drawing and painting programs, would also be evaluated more highly if they were to incorporate a positive feedback mechanism.
Do people also apply gender stereotypes to computers? This study tested whether they do, by using computers with male- and female-voiced output.

Specifically, three stereotypes were tested. The first stereotype concerned dominant behavior. When men exhibit dominant behavior, they tend to be perceived as being “assertive” or “independent.” When women exhibit dominant behavior, they tend to be perceived as being “pushy” or “bossy.” In other words, researchers have found that dominance and aggressiveness are often considered undesirable in women but not in men (Costrich, Feinstein, Kidder, Marecek & Pascale, 1975; Deutsch & Gilbert, 1976; Pleck, 1978; Spence, Helmreich & Stapp, 1974). Based on this stereotype, the prediction was that a female-voiced computer in a dominant role would be perceived more negatively than a male-voiced computer in the same role.

The second stereotype involved evaluation. In general, when people are evaluated, they tend to consider the evaluation to be more valid if it comes from a man than if it comes from a female. Men are stereotypically regarded as being more “influential” than women: men are also perceived as being more “effective leaders” (Eagly & Wood, 1982). And according to researchers, both men and women are prone to using this stereotype. Thus, the prediction here was that users—regardless of gender—would take evaluations from male-voiced computers much more seriously than evaluations from female-voiced computers.

The third stereotype concerned knowledge about various topics. Research has shown that we tend to categorize certain topics and professions as being “masculine” or “feminine.” These stereotypes, in turn, affect the entrance of men and women into these occupations (e.g., Heilman, 1979). In other words, people tend to gender-stereotype across topics, assuming that women know more about “feminine” topics and men know more about “masculine” topics. To test this stereotype, two different topics were used in the experiment. One was stereotypically “feminine” (love and relationships) and the other was stereotypically “masculine” (computers and technology). The prediction was that a female-voiced computer would be perceived as a better teacher of the former, while a male-voiced computer would be perceived as a better teacher of the latter.

In sum, this experiment tested whether people apply gender stereotypes to computers. The only gender cue in this experiment was the computer’s voice output. In addition, subjects were never led to believe that they were interacting with a human hidden behind the computer; rather, they were explicitly told that they were interacting with the computer itself. Thus, the experiment was conducted to determine whether gender stereotypes are applied in human-
computer interactions, where gender is downplayed and commonly thought of as irrelevant.

Method
Participants (N=40) in this experiment were told that they would be using computers for three separate sessions: tutoring, testing, and evaluation.

During the tutoring session, the tutor computer verbally presented (via a prerecorded female or male voice) ten facts on each of two topics, computers and technology, and love and relationships.

After the tutoring session, the subject was directed by the tutoring computer voice to move to a "tester" computer for the testing session. The tester computer, which had no voice, administered a text-based, multiple-choice test. Each question ostensibly had a "correct" answer.

Upon completing the testing session, the tester computer told the subject to go to a third computer, the "evaluator" computer, for the evaluation session. There, the evaluator computer informed the subject (via a prerecorded female or male voice) that he or she had answered six of the twelve questions correctly. The evaluator computer then reviewed each question separately. For each question, the evaluator computer indicated whether the subject had given a correct answer and then evaluated the performance of the tutor computer in preparing the subject. The overall evaluation of the tutor's performance was generally positive (e.g., "Your answer to this question was correct. The tutor computer chose useful facts for answering this question. Therefore, the tutor computer performed well.")

The evaluator computer thus played two roles: It evaluated the performance of the subject, and it also evaluated the performance of the tutor computer. The evaluator computer was thus extremely dominant (Strong, Hills, Kilmartin, DeVries, Lanier, Nelson, Strickland & Meyer, 1988).

Next, the evaluator computer asked the subject to complete a pencil-and-paper questionnaire that consisted of two sets of questions. The first set asked subjects for their assessment of the tutor computer's performance during the tutoring session. The second set of questions asked for an assessment of the evaluator computer during the evaluation session.

All subjects were randomly assigned to hear either female or male voices during the tutoring and evaluation sessions. These sessions had four possible combinations: male--male, male--female, female--female, and female--male. In addition, four different voices (two male and two female) were used, so that no subject heard the same voice in more than one session. All four voices said the same words within each session. In addition, all four voices were pretrained to guard against the possibility of significant differences in paralinguistic characteristics. Pretests indicated that the four voices were not perceived differently with respect to intonation, pacing, or other paralinguistic cues.

Results
The first prediction — that a female-voiced computer in a dominant role would be evaluated more negatively than a male-voiced computer in the same role — was supported. Both male and female subjects found the female-voiced evaluator computer to be significantly less "friendly" than the male-voiced evaluator, even though the content of their comments was identical (see first row of Table 2). The full-factorial ANOVA revealed no other main effects (gender of tutor, gender of subject), and no significant interactions with respect to this measure.

The second prediction — that evaluations from male-voiced computers would be taken more seriously than evaluations from female-voiced computers — was supported as well. Subjects thought the tutor computer was significantly more "competent" when it was praised by a male-voiced evaluator computer, compared to when it was praised by a female-voiced evaluator computer (see second row of Table 2). Furthermore, subjects thought the tutor computer was significantly "friendlier" when it was praised by the male-voiced evaluator computer, compared to when it was praised by the female-voiced evaluator computer (see third row of Table 2). And in both cases, the gender of the subject and the gender of the tutor computer's voice made no difference.

Table 2: Means for Assessment of Tutor and Evaluator as a Function of Gender of Evaluator Voice

<table>
<thead>
<tr>
<th>Evaluator Voice</th>
<th>Male</th>
<th>Female</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluator Computer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friendliness</td>
<td>16.25</td>
<td>11.55</td>
<td>6.03*</td>
</tr>
<tr>
<td>Tutor Computer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competence</td>
<td>28.41</td>
<td>24.26</td>
<td>5.70*</td>
</tr>
<tr>
<td>Friendliness</td>
<td>19.65</td>
<td>14.75</td>
<td>5.74*</td>
</tr>
</tbody>
</table>

*p<.05.6

6This table is reprinted from Nass, Moon & Green (1986).
The results also confirmed the third prediction—that a female-voiced computer would be perceived as a better teacher on the topic of love and relationships, whereas a male-voiced computer would be perceived as a better teacher on the topic of computers and technology.

Finally, all of the subjects were experienced computer users who, in postexperimental debriefs, denied harboring stereotypes or being influenced by the gender of the computer voices. None of them thought the voices represented the computer programmer; in fact, most subjects said they thought the three computers used in the experiment were programmed by the same person (which they were), and that the person was male (which is ironic, since they said they did not harbor stereotypes).

Theoretical and Design Implications

These results suggest that the tendency to gender-stereotype is so deeply ingrained in human psychology that it extends even to computers. In this experiment, vocal cues alone were enough to elicit stereotypic responses from users. Indeed, the most important design implication of this study is that users automatically and unconsciously stereotype computers based on the gender of the computer voices. Thus, choosing a computer voice's gender is one of the most important design decisions that can be made. By choosing (or casting) a particular voice, a designer will trigger in the user's mind a whole set of expectations associated with that voice's gender. A common mistake in the industry is to assume that a male voice is neutral; a male voice brings with it a large set of expectations and responses based on stereotypes about males.

This study also raises the possibility that visual representations of computer agents and even their language style may elicit stereotypic responses, and that computer voices may indicate much more than gender. For example, users may consciously or unconsciously assign an age, a social class, and a geographic location to a computer agent or voice, which creates expectations about how the agent will, or should, behave. In other words, no matter what choice a designer makes to represent the computer or a computer agent, the results may produce a number of expectations in the user.

Designing a computer agent or character can therefore involve tough decisions. For example, if you are selecting a voice to guide users through a CD-ROM on medical advice for pregnant women, should the voice be male or female? How old should the voice sound? Should it have a particular accent? Should there be two voices—a male voice for certain topics and a female voice for others? Perhaps a more important question is whether computer agents should be designed to conform to stereotypes at all. There may be very good reasons for designing agents that challenge these stereotypes. Obviously, these are questions that designers, their employers, and perhaps users, must answer. (For complete details of this study, see Nass, Moon & Green, in press.)

STUDY 5: TESTING AN ALTERNATIVE EXPLANATION FOR SRCT RESULTS: IS THE PROGRAMMER PSYCHOLOGICALLY RELEVANT?

As discussed in the introduction to this chapter, one of the most common explanations for social responses to computers is as follows: When users respond socially to computers, they are actually responding to the “source” behind the computer, i.e., the programmer. In other words, the unseen programmer, rather than the computer, is perceived by the user to be the psychologically relevant source of the computer's content.

Evidence from the field of psychology suggests the opposite. Social psychologists have shown that people generally orient to proximate sources rather than original sources (Stone & Bell, 1975). That is, the messenger, rather than the creator of the message, is typically considered the psychologically relevant source and is assigned credit or blame for the message.

Nonetheless, in order to test the possibility that people orient to the programmer when interacting with computers, we conducted an experiment in which half the subjects were told they were working with computers, and the other half were told they were working with programmers. The SRCT prediction was that there would be significant differences between responses from subjects who were told they were working with the programmer and from subjects who were told they were working with a computer. The programmer prediction, on the other hand, was that there would be no difference between responses from subjects in the two conditions, because the description of the computer as a programmer would be redundant.

Note that this study was not designed to provide a critical test of the idea that people respond socially to technologies; indeed, we believe the four previously mentioned studies, along with dozens of other studies conducted at the SRCT Laboratory (Reeves & Nass, 1996), already provide strong evidence of this. Rather, this study was constructed for a single purpose: to disconfirm the idea that people orient to the programmer when interacting with a computer.
Method

Participants (N=30) in this study were told the purpose of the experiment was to evaluate a tutor computer (or programmer). In the computer condition, the computer was labeled "computer." In the programmer condition, the computer was labeled "programmer." All verbal references to the computers were consistent with this labeling. In reality, all subjects worked with the same computer.

After being tutored, tested, and evaluated by the tutor, subjects were asked to complete a questionnaire that assessed the tutor's performance. In these questionnaires, the words "computer" and "programmer" were avoided so that the questionnaire would be the same for all subjects.

Based on factor analysis, four indices were created: Friendliness, Effectiveness, Playfulness, and Similarity to the User. The Friendliness index was based on seven items: cheerful, gentle, likable, warm, friendly, sympathetic, and affectionate. The Effectiveness index was based on nine items: articulate, clever, insightful, intelligent, helpful, responsive, competent, and analytical. The Playfulness index was based on four items: childlike, entertaining, enthusiastic, and playful. The Similarity to the User index was based on two items: subjects' perceived similarity to the computer's style of teaching, and subjects' perceived similarity to the computer's style of evaluation.

Results

The results confirmed the SRCT prediction: There were significant differences between the responses of subjects who were told they were interacting with a computer and the responses of subjects who were told they were interacting with a programmer.

Specifically, subjects in the computer condition perceived the tutor to be significantly more friendly, effective, playful, and similar to themselves than did subjects in the programmer condition (see Figure 3).

Theoretical and Design Implications

This experiment suggests that from a psychological standpoint, when users interact with a computer, they are in fact interacting with the computer itself, rather than the programmer behind the computer. Hence, this study suggests that computer users, like all people, tend to orient to the most proximate source. When the computer is psychologically relevant, then programmers, content providers, and other distant sources are not. Indeed, when a user is working with a program, the programmer is psychologically invisible, possi-

bly because the user finds it difficult to focus on both the proximate source and the distant source at the same time. (For complete details of this study, see Nass & Sundar, 1996.)

![Figure 3. Mean response, as a function of condition.](nass.png)

GENERAL CONCLUSIONS

In this chapter, we have presented several studies that provide evidence that computers are social actors. All of the studies demonstrate that people apply social rules to computers, even in situations in which they state that such responses are wholly inappropriate.

Of course, the assertion that computers are social actors raises interesting questions about what it means to be a social actor. Traditionally, the term social has been defined in terms of interpersonal interaction; hence, in order to be considered a social actor, a necessary requirement has been *humanness*. If, however, it can be demonstrated that social behavior is routinely directed toward nonhuman entities, then perhaps a reevaluation of the meaning of the word "social" is in order. Clearly, if we were to adopt an ontological perspective on this issue, the question would become a philosophical one that is essentially unanswerable (What does it mean to be a social actor?) using social

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7This figure is reprinted from Nass & Sundar (1996).
science methodology. On the other hand, if we adopt a psychological criterion—that is, something is a social actor to the extent that people respond to it as if it were a social actor—then based on the research presented above, we could argue that computers are social actors.

This is exactly what we have done in this chapter. Based on the results of the first four experiments (along with numerous other studies from the SRC Laboratory), we contend that, from the users' psychological perspective, computers are social actors. In addition, social responses to computers do not appear to be the function of deficiency or dysfunction; rather, they seem to be automatic and unconscious responses to social situations, i.e., situations that contain certain social cues.

So why do people behave this way toward computers? One possible explanation is that humans are social animals. That is, we are so emotionally, intellectually, and physiologically biased toward responding in a social manner that when confronted with computers (and other communication technologies) that bear even the slightest human resemblance, those deeply infused social responses are unconsciously triggered.

Obviously, there are a thousand ways in which computers are not like people. However, there are also a few very significant ways in which computers are very much like people. Computers use language, for example, unlike almost all inanimate objects. In addition, computers can respond based on multiple prior inputs, they often fill roles traditionally occupied by humans, and they can produce human-sounding voices. It might be that when we are confronted with an entity that does even some of these things, our brains' default response is to unconsciously treat the entity as human, even though at a conscious level, we know that it is not.

Furthermore, these studies suggest that it does not take extremely sophisticated technology to generate social responses. Indeed, in three of the five experiments described above (the exception being the gender experiment and the alternative explanation experiment), the computers used text-based output only. Social cues such as voice or sophisticated graphical representations were avoided. It thus appears that social responses are easy to generate, using a limited set of social cues.

Finally, it is important to note that the studies presented in this chapter cover a wide range of topics, ranging from politeness to gender-stereotyping. Other SRC studies, not reviewed in this chapter, have looked at areas such as team affiliation, adaptivity, attributions of responsibility, and criticism (see Reeves & Nass, 1996). Indeed, our research has convinced us that social responses to computers are not limited to a single area; rather, these responses apply across a wide variety of human-computer situations.

REFERENCES


When the Interface Is a Face
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Abstract: People behave differently when in the presence of other people than they do when they are alone. People also may behave differently when designers introduce more humanlike qualities into computer interfaces. In an experimental study, we demonstrate that people's responses to a talking face interface differ from their responses to a text-display interface. They attribute some personality traits to it; they are more aroused by it; they present themselves in a more positive light. We use theories of person perception, social facilitation, and self-presentation to predict and interpret these results. We suggest that as computer interfaces become more "humanlike," people who use those interfaces may change their own personas in response to them.

This paper explores the implications of designing computer interfaces to look or act more like people do. People act differently in the presence of other people than they do when they are alone. They pay attention to those people; they work harder; they present themselves in a more positive light. If this phenomenon extends to people in the presence of "humanlike" computers, then as interfaces display more humanlike characteristics, people who use those interfaces may change their own behavior in response to them.

Technologists have aspired to humanize computer interfaces for a long time. Humanizing interfaces entails making them more humane, in the sense of easier and more comfortable to use (Laurel, 1990; Shneiderman, 1987). Humanizing may also entail "humanifying," in the sense of embodying such humanlike attributes as speech (Eichenwald, 1986), speech recognition (Itoh, Hayamizu, & Tanaka, 1992), and social intelligence (Binnick, Westbury, & Servan-Schreiber, 1989; Resnick & Lammers, 1985). Adding more humanlike attributes presumably makes interacting with the interface more satisfying — either because it is more "natural" or because it is emotionally more satisfying or both. This assumption can be quite problematic of course — consider, for example, the case of talking seatbelts in automobiles, which auto makers removed because of customer dissatisfaction.

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