

Self Disclosure on Computer Forms: Meta-Analysis and Implications

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ABSTRACT

Do people disclose more on a computer form than they do in an interview or on a paper form? We report a statistical meta-analysis of the literature from 1969 to 1994. Across 39 studies using 100 measures, computer administration increased self-disclosure. Effect sizes were larger comparing computer administration with face-to-face interviews, when forms solicited sensitive information, and when medical or psychiatric patients were the subjects. Effect sizes were smaller but had not disappeared in recent studies, which we attribute in part to changes in computer interfaces. We discuss research, ethical, policy, and design implications.

Keywords

computer forms, computer interviews, electronic surveys, measurement, disclosure, response bias, electronic communication.

INTRODUCTION

As computer and computer-based telecommunications technologies improve, assessment increasingly is being accomplished using these technologies. Previously existing mental health questionnaires, personality scales, job attitude scales, cognitive selection tests such as the Graduate Record Examination, and training inventories are among the many kinds of forms that have been converted to computerized administration [24]. Computer-administered employment, medical intake, and blood donor forms are being developed to replace face-to-face interviews, and electronic surveys administered from remote sites already are being used to gather personnel, medical, and consumer information, as well as in social science research [20, 29].

The possibility that people would tell an impartial machine personal or embarrassing things about themselves, without

fear of negative evaluation, has been raised since the first uses of computers for communication [27]. One of the first applications of the computer for assessment was the computerized psychiatric interview [32]. Researchers reported that patients not only responded positively to computer interviews but also gave honest answers [13]. Subsequently, medical, marketing, personnel, and social science researchers have explored computer administration as a means for reducing social desirability biases [9] and obtaining more sensitive information from respondents than could be obtained using more traditional formats. A belief that computer administration encourages self-disclosure has led to the development of important applications, such as computer interviews to detect risk conditions and behaviors of blood donors [2, 23].

If existing interviews and forms are converted to computer forms, or if forms are administered by computer and also in other formats, then increased self-disclosure by those using the computer version raises psychometric and ethical questions. Increased self-disclosure might lead to nonequivalence of scores on measures in which respondents are asked to reveal personal or sensitive information. The computerized form might even be measuring a different underlying construct.

Among the reasons offered as to why people disclose when using a computer are that computer interfaces as compared with traditional formats create in respondents an inattention to audience, immersion in the immediate task along with a sense of invulnerability to criticism, an illusion of privacy, the impression that responses "disappear" into the computer, or other misattributions that cause respondents to be careless about their responses. For example, people can be induced to behave as if computers are human, suggesting that human-computer interaction is fundamentally social [25]. If so, perhaps informed consent statements should warn respondents about these misattributions. Perhaps computer forms that simulate a face-to-face interview should include a representation of the interviewer. These speculations are moot if respondents, in fact, do not in fact respond differently to computers than to other formats, as some researchers have concluded [6].

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META-ANALYSIS

Researchers' mixed conclusions about self-disclosure in computer forms led to our examination of the literature using statistical meta-analysis. The main hypothesis we tested was that responses to a computer form, as compared with its face-to-face or paper-and-pencil counterpart, would be more self-disclosing. We did not use the meta-analytic procedure to examine the reasons for this difference. However, we derived plausible predictions based on two arguments: (1) that computer interfaces lack social context cues, which in turn causes reduced evaluation anxiety, feelings of safety or invulnerability, and less concern with looking good, and (2) that people lack experience with computers and therefore are not aware of the risks of self-disclosure of personal information to a computer. We explored these hypotheses indirectly by comparing characteristics across and within studies that should predict self-disclosure if these arguments were valid. For example, with respect to the impact of computer experience, since the general public has become more computer literate in each decade, effect sizes should decline with year of study. Predictors such as the year of publication were assessed in models of effect sizes [15].

Sample

Our sample consisted of 39 published experimental studies of self-disclosure in standardized and unstandardized interviews, questionnaires, tests, and scales that solicited socially undesirable, personally relevant, or sensitive information.¹ We included studies in the social science, computer science, and medical literature. We adopted a broad definition of self-disclosure in forms in order to consider all relevant studies. For example, we not only included studies of questionnaires that solicited highly sensitive information such as a person's criminal record but also studies of forms on which consumers were asked to disclose their complaints. However, for a study to be included it had to investigate a form; we did not include studies of free group discussion by computer [19], studies of computerized skill or cognitive ability or achievement, such as the GRE [24], or any studies in which some kind of self-disclosure was not measured. Our sample does not include several published studies of disclosure that employed no comparison or control group or otherwise seriously violated normal standards of experimental design.

Variables Coded

The following variables were coded from each study: (a) experimental design (between subjects, within subjects); (b) comparison form (face-to-face interview, paper-and-pencil form, test, or questionnaire); (c) sensitivity of information presented to subjects; (d) subject population (student, psychiatric or medical patient, other adult); (e) sex of sample (male, female, both) based on the percentage of males; (f) presence of others (e.g., other subjects) during computer administration (alone, not alone); (g) whether

subjects responded to a standardized form; and (h) publication. Operationalization of these variables was straightforward except in the case of categorizing measures as sensitive. We coded a measure as sensitive if it asked for information not normally discussed among acquaintances or colleagues, such as about one's marital status, mental health, criminal record, use of drugs, and so forth. Two raters discussed disagreements and resolved them. Many of the measures coded as sensitive were psychiatric tests. We assume such measures are more sensitive than measures such as those assessing professional job satisfaction, for instance.

Calculation of Effect Size

The effect size (g) for each study was calculated as the mean of disclosure in the computer-administered condition minus the mean of disclosure in the traditional or comparison condition (face-to-face interview or paper-and-pencil form), divided by the pooled standard deviation. Effect sizes reported are positive when there was more disclosure with the computer form and negative when there was more disclosure with the traditional format. We used Johnson's DSTAT upgrade computer program to calculate the results [17]. The g 's were converted to d 's by multiplying them for sample size bias in small studies. Each study was weighted by the reciprocal of its variance to put equal weight on effect sizes estimated from large samples. We performed two sets of meta-analyses. One analysis was based on effect sizes that were collapsed across related measures so that each study could be represented by a single effect size. We did this because meta-analytic techniques assume independent effect sizes. The second analysis was based on multiple effect sizes when needed to test particular hypotheses. For example, Koson et al. [21] administered two comparison instruments, one, a face-to-face interview and the other, a paper-and-pencil questionnaire. We hypothesized that disclosure in computer instruments compared with face-to-face interviews versus paper-and-pencil forms. In cases like this, a separate effect size was computed for each relevant instrument.

RESULTS

With each study contributing a single effect size (the mean was .33, indicating greater self-disclosure in computer administered tests. The 95% confidence interval for this mean was, $CI = .28$ to $.39$, which is significantly from 0, $Z = 11.76$, $p < .001$. The hypothesis of homogeneity was rejected, $Q(38) = 339.73$, $p < .001$, which indicates that the effect size derived in this analysis does not describe the entire dataset. We performed an outlier analysis to obtain homogeneity of variance. Outliers (15%) were removed such that $Q(32) = 48.06$. The resulting mean effect size was $.21$ ($CI = .17$), $Z = 6.85$ ($p < .001$).

Categorical Models

We tested a series of hypotheses by applying categorical models to the 39 studies plus any within-study effects that were present after the studies were partitioned on the basis of the attribute under investigation. For exam-

¹Due to space limitations, the studies included in the meta-analysis are not referenced in this paper. A full reference list is available from the authors.

of the 39 studies in our dataset used either a face-to-face or paper-and-pencil comparison condition and 6 studies used both. Hence, we computed 45 (33+(6*2)) separate effect sizes in the categorical model comparing face-to-face and paper-and-pencil cases. A summary of the categorical models are presented in Table 1.

Tests of Social Context Cue Hypotheses

Interviews versus Questionnaires

An absence of social context cues can increase perceived privacy, or reduce evaluation anxiety or perceived risk. We hypothesized that studies comparing computer forms with face-to-face interviews (which have many social context cues) will show a larger effect size (increased self-disclosure in the computer condition) than studies comparing computer forms with paper-and-pencil forms. The 15 computer vs. face-to-face cases showed a much stronger effect size ($d = .62$) than the 30 computer vs. paper-and-pencil cases ($d = .20$), $Q_B(1) = 49.4$, $p < .0001$. The mean effect size for each comparison deviated significantly from zero, indicating that self disclosure was higher in the computer condition, albeit less so in comparison to paper-and-pencil questionnaires.²

Sensitive Information

The presence or absence of social context cues will matter more when the information being elicited from respondents is sensitive. Therefore, we hypothesized that studies comparing computer forms with other formats will show a larger effect size (increase in self-disclosure in the computer condition) when the measure elicits sensitive, personal, or otherwise risky information than when the measure elicits more impersonal information. We divided study measures according to whether or not they solicited sensitive information (e.g., mental health measures, measures of illegal activity). As seen in Table 1, the effect size in favor of computer administration when the measure elicited sensitive information was significantly stronger ($d = .35$) than when the measure did not elicit sensitive information ($d = .16$), $Q_B(1) = 14.55$, $p < .001$.

Vulnerable Populations

Prisoners, patients, and others whose lives are heavily influenced by others' decisions may feel particularly vulnerable to the consequences of self-disclosure, and therefore might be more sensitive to differences in administration. We hypothesized that studies in which the subjects were medical or psychiatric patients would show larger effect sizes. The comparisons shown in Table 1 are of 39 cases in which the subjects were students, patients, or other adults. Consistent with the significant between-classes effect, the mean for the patient effect size differed

significantly from the means of both students and other adults, $\chi^2(1)=25.8$ and $\chi^2(1)=42.4$, respectively, $ps < .001$. This result gives additional support to the argument that computer responding increases the sense of privacy, although many alternative explanations can be generated (e.g., patients probably have lower socio-economic status, less knowledge of computers, and more experience with traditional tests).

Gender

Since females are reputed to be more sensitive to social context and tend to be more disclosing [10], we hypothesized that studies comparing computer forms with other formats will show a larger effect size (increased self-disclosure in the computer condition) when the subjects are female. Table 1 shows studies categorized by whether the investigators' sample was all male, all female, or a mixed sample. The effect size for the 3 studies with all-female samples ($d = .47$) was much larger than the effect size for the 9 studies with all-male samples ($d = .22$), though due to the small number of studies with all-female samples, the difference did not reach significance, $\chi^2(2) = 3.3$, $p = .19$. The effect size for mixed sample studies ($d = .40$) was not different from the effect size for all-female sample studies ($\chi^2(2) = 0.3$, $p = .84$), but it was significantly different from the effect size for all-male sample studies ($\chi^2(2) = 5.8$, $p < .05$). We also ran a continuous model using the percentage of males in the sample to predict effect size. Seven cases were removed because the authors did not say what percent of the subjects were male. The effect (in the direction of more disclosure when the sample had fewer males) was not significant ($Z = -1.43$, $p = .15$).

Presence of Others

The presence of other persons when one is completing a form provides social context cues to the nature of the test environment. We hypothesized that studies comparing computer forms with other formats would show a larger effect size (increased self-disclosure in the computer condition) when respondents in the computer condition were alone while they completed the form. Of the 29 studies where information was available, 19 of them (66%) were those in which subjects were alone at the computer when completing the questionnaire. The effect size and confidence intervals show that self disclosure was increased in the studies where subjects were alone ($d = .26$) as compared to when subjects were not alone ($d = .15$), $Q_B(1) = 2.67$, $p = .10$, though the difference is marginal.

Tests of Technological Change Hypotheses

When a technology is first introduced, people might not be aware of its risks. Lack of computer experience and knowledge might lead people to be careless about the information they give to a computer. Also, the technology may have design deficiencies that are corrected later. For example, early computer-administered questionnaires often prevented respondents from editing or undoing their responses as they could with paper questionnaires. This constraint might have led them to accidentally disclose information they would have deleted if this were possible.

²Outlier analyses were performed when cases within categories were not homogeneous. The procedure involves removing outliers until homogeneity is obtained (when $p > .05$ for the Q_W statistic). Due to space limitations, these analyses are not reported but can be obtained from the authors. None of these analyses change the main results of this study.

Table 1. Categorical Effects for Study Characteristics

Class	Between-classes Effect (Q_B)	k^a	Mean-weighted Effect Size (d_{i+})	95% CI		Q_{wi}^b
				Lower	Upper	
Comparison group	49.37, $p < .0001$					
Face-to-Face		15	.62	0.52	0.73	258.41**
Paper and Pencil		30	.20	0.15	0.27	56.50*
Sensitive information	14.55, $p < .001$					
Sensitive		29	.35	0.29	0.41	315.63**
Not Sensitive		20	.16	0.08	0.24	48.04**
Sample	53.22, $p < .0001$					
Patient		13	.66	0.54	0.77	254.12**
Student		19	.29	0.20	0.37	28.82
Other		7	.16	0.07	0.26	12.53
Sex of sample	6.86, $p < .05$					
Male		9	.22	0.10	0.34	7.02
Female		3	.48	0.23	0.72	1.56
Both		20	.40	0.32	0.48	204.62**
Tested alone ^c	2.67, $p = .10$					
Alone		19	.26	0.17	0.36	67.35**
Not Alone		10	.15	0.06	0.24	28.00*
Standardized tests	3.24, $p = .07$					
Yes		28	.39	0.31	0.45	337.82**
No		14	.28	0.20	0.37	18.22
Year published ^d	32.69, $p < .0001$					
1969 - 1982		10	.63	0.48	0.78	62.35**
1983 - 1986		10	.28	0.17	0.38	51.69**
1987 - 1991		10	.44	0.34	0.54	177.37**
1992 - 1994		9	.15	0.05	0.25	15.62

Note. Effect sizes are positive for differences in the computer direction and negative for differences in the compar condition direction. k = number of effect sizes; ES = effect size; CI = confidence interval for the mean weighted effect size = lower limit; U = upper limit.

^a The sample size for each analysis was based on the total number of studies represented by the measure. Of the 39 studies used for these analyses, one study employed more than one design, and 15 studies employed more than one measure. This varies by category.

^b Homogeneity within each class; significance indicates rejection of the hypothesis of homogeneity.

^c For this category, there were 12 missing cases.

^d The 39 studies used for these analyses were grouped arbitrarily into quartiles.

** $p < .01$, * $p < .05$.

Precomputer Standardized Tests

Standardized tests, such as the MMPI, were developed for traditional forms of communication. People are used to seeing them in traditional formats and may not pay them as much respect, or realize their personal consequences, when these instruments are displayed on a computer screen. Therefore, we hypothesized that studies comparing computer administration with other forms of administration might show larger effect sizes (increased self-disclosure in the computer condition) in studies using standardized tests as compared with unstandardized formats (some of which were developed specifically for computer administration). The hypothesis was supported marginally. The effect size for cases where the researcher used standardized tests was somewhat higher ($d = .39$) than the effect size for cases in which the measure was not a standardized test ($d = .28$), $Q_B(1) = 3.24, p = .07$.

Students

Since high school students and undergraduates are likely to be more familiar with computers than today's adults, and more knowledgeable about computers than others, we hypothesized that studies comparing computer forms with other formats would show larger effect sizes (increased self-disclosure in the computer condition) in studies using subjects other than students. There were 19 cases in which the subjects were students, and as we showed in Table 2, the effect size for computer administration in these cases ($d = .29$) was not smaller than the effect size in studies using other adults as subjects ($d = .16$), $c^2(2) = 3.47, p = .18$. So, there is not strong support for this hypothesis.

Years

We hypothesized that effect sizes would decrease over the years, as people became more familiar with computers and what could be done with them. We first ran a continuous model on the year of publication for the 39 studies. The model showed a strong effect for year, in that effect sizes did get smaller over the years ($Z = 2.6, p < .01$.) We next divided the 39 studies into quartiles. Consistent with the continuous model, Table 1 shows that studies published in the most recent years (1992-1994) had a significantly lower effect size than studies published in two of the earlier periods, 1969-1982 ($d = .63, \chi^2(3) = 26.9, p < .001$), and 1987-1991 ($d = .44, \chi^2(3) = 15.5, p < .001$). Also, studies published in the earliest period (1969-1982) had a significantly higher effect size ($d = .63$) as compared to the studies published in the next period (1983-1986; $d = .28$), $\chi^2(3) = 14.1, p < .01$.

The year effect might be an artifact due to a change in investigators use of study characteristics associated with disclosure (such as whether sensitive information was solicited). We evaluated the impact of any study characteristic used differently over time on the effect size within quartile periods. One significant change in the studies over the years was that in earlier years investigators used more measures we had coded as soliciting sensitive

information. However, considering only studies that used sensitive measures, there remained an effect of year ($Q_B(3) = 18.8, p < .01$). Another manner in which studies changed over the years was in the use of patients as subjects, another variable that strongly predicts disclosure in a computer instrument. Within studies using patients as subjects, however, there remained a significant effect of year of study ($Q_B(3) = 101.8, p < .01$). These analyses indicate that the impact of computer administration has declined over the years and that this decline is not explained fully by changes in the use of various study characteristics in evaluation studies. Despite this decline, the effect of computer administration did not disappear.

DISCUSSION

Research Issues

Our meta-analysis gives support to the main hypothesis that computer administration elicits more self-disclosure than traditional forms of administration do. In recent years, the disclosure effect has declined significantly due, perhaps, to increasing public knowledge of computers, increasing public computer literacy, or even people's reduced awe of the computer. (The credibility of the instrument is important because it affects the degree to which respondents believe the questions have a legitimate purpose and are not simply voyeuristic or commercial, or have criminal intent [7].) Our indirect analysis, however (for example, comparing students to other adults), did not support explanations related to public knowledge of computers.

An unresolved research issue is that changes in computer technology have made it possible for a computer instrument to have the "look and feel" of a paper-and-pencil questionnaire, typed form, or printed test. Forms now look more like paper questionnaires, forms, or tests than they did in earlier years, and allow for more stereotypical questionnaire-type responses using radio buttons and fill in blanks (as compared with typed commands). These changes might have increased respondents' sense of the computer interaction as a evaluation or test situation and consequently reduced their disclosure. Unfortunately, we were unable to evaluate this idea in the meta-analysis because few investigators described their computer interfaces in sufficient detail. Possibly researchers did not realize computer interfaces would change so much. In any case, the idea that differences in the interface can affect disclosure has not been investigated yet.

A related issue is the belief by many that answering questions on a computer changes respondents' perceptions of the test environment. For example, working on a computer could create a sense of privacy or anonymity. Some investigators have reported a strong relationship between anonymous and identified computer responding [6, 8]. However, research is needed to examine directly whether perceptual and motivational changes mediate the linkage between the administration of computer forms and responses to those forms.

Ethical Issues

If people have a false illusion of privacy or otherwise let down their guard when they respond to a computer, the world has discovered an easy, cheap way to obtain sensitive information from people. Other methods of eliciting sensitive information, such as the polygraph [4], bogus pipeline [26], or telephone interviews [22] are difficult or expensive. Researchers, therapists, marketers, developers of World Wide Web sites and others will be drawn to use computers to obtain sensitive information, and increasingly they will do this remotely, so their instructions and consent forms (if any) also are completed by computer. Currently, the American Psychological Association Guidelines for Research on Human Participants, as well as most research organizations' codes of research conduct are silent with regard to such topics as how to obtain informed consent electronically (and whether it is legitimate to do so), how much to reveal about remote sites of data collection, and about electronic forms in general.

Stronger admonishments in instructions, policy statements, and informed consent statements might be required for computer forms to obtain the same level of risk as traditional formats. However, simply changing the wording or format of conventional warnings might not be effective. An unpublished study by Kiesler, Sieff, and Geary³ showed that a small picture of the interviewer on the screen did not inhibit disclosure in a computer interview as did a real interviewer's presence. Moreover, that computer scientists disclose even more than others in a computer instrument [18] suggests that responses to known risks and warnings can habituate.

Policy Issues

To our knowledge, the use of computer forms has not proved to be a source of social disagreement in the way computerized monitoring and informal electronic communications like email have [30]. Our review suggests that more cases will arise like that of the six William Morris assistants who were fired when their candid email correspondence about their bosses and how to avoid additional duties was mistakenly sent to an administrator.⁴ Many companies and universities are embedding forms in their World Wide Web pages to take surveys, orders, and collect personal information about potential applicants.

The legal situation is presently unstable. Many organizations consider any information sent through, or held on, company computers to be in the organization's domain. Few people know that they can be held legally accountable for information they type into a computer and send to others, or that they might be disciplined by a company for information that they access on a computer

form. Unlike telephone calls, electronic forms (and f sent by email) can be treated in the courts as document can be used as legal evidence without a court order. I public and private organizations take the position that have a right to randomly monitor communication "their" networks, and to use computers to collect data employees or customers, on the grounds that such acc necessary to properly administer the computer system, implement business goals [1]. To the degree that pe believe or perceive their communications thro computers to be safe, current organizational and policies may be inappropriate.

Design Issues

As the power and speed of computers continues to incr researchers and technologists have responded by imprc the readability and ease of response in computer fc interviews, surveys, and tests. For example, responc can use radio buttons to select choices from a table r than type commands. Advances in computer interfaces have increased the variety, credibility, and salience of s information in forms, for example, through animr characters or icons. Will new computer interface de: induce people to act more like they would using a p questionnaire or in an interview with another person study by Sproull et al. [28] compared the impres management concerns of subjects who answered ques in one of two computer interview conditions. In condition, subjects interacted with a computer "couns embodied in a talking face on the screen; in other condi subjects interacted with the counselor by typing and rea text on the screen. The subjects revealed less to the tal face than to the text and evaluated her less well. This s suggests that social interfaces will reduce self disclosu computer forms, perhaps because they remind the user face-to-face interview.

However, increasing the amount of social information computer display or device does not guarantee that distribution of social information will be like that i ordinary social setting. Weisband, Schneider, and Con [31] have shown that when a narrow set of so information about members' relative group status is sa in electronic communication, this informa overdetermines people's responses to others. Comp interfaces that partially mimic social situations may of distorted version of these situations, and change peo responses unexpectedly.

An important point that emerges from consideration of computer design is evolving is that "computer interview "computer survey" should no longer be treated as a si unidimensional category of administration by e researchers or practitioners. Computer forms multidimensional, increasingly so as interfaces incorp speech and speech recognition [16], auditory and kinest feedback [12], social intelligence [5], emotional resp [11], directed animation [3, 14], talking to people or screen [28] or even virtual reality [33]. To understand design affects disclosure in new computer instruments

³Manuscript available from S. Kiesler, Carnegie Mellon, Pittsburgh, PA, 15213.

⁴Thompson, Anne. (1992). Forget doing lunch—Hollywood's on E-mail. *The New York Times*, September 6. F-23.

will have to investigate which features of computer forms affect people's perceptions and responses. It will be interesting to see how much users disclose when the computer form is delivered by an animated cartoon character.

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