Journal of Gerontology: PSYCHOLOGICAL SCIENCES
1992, Vol. 47, No. 4, P250–P257

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Influence of Direct Computer Experience on Older Adults' Attitudes Toward Computers

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This research examined whether older adults' attitudes toward computers became more positive as a function of computer experience. The sample comprised 101 community-dwelling older adults aged 57 to 87. The intervention involved a 2-week computer training program in which subjects learned to use a desktop publishing software program. A multidimensional computer attitude measure was used to assess differential attitude change and maintenance of change following training. The results indicated that older adults' computer attitudes are modifiable and that direct computer experience is an effective means of change. Attitude change as a function of training was found for the attitude dimensions targeted by the intervention program: computer comfort and efficacy. In addition, maintenance of attitude change was established for at least two weeks following training.

THE pervasiveness of computers in current society raises important questions regarding the willingness and ability of older adults to adapt to this technology. Although several studies have demonstrated that the elderly can acquire a wide range of computer skills including word processing (Czaja, Hammond, Blascovich, & Swede, 1986; Hartley, Hartley, & Johnson, 1984), programming (Yarmon, 1982), and spreadsheet operation (Garfein, Schaie, & Willis, 1988), demographic data indicate that only 1% of those aged 65 and older use a computer (Schwartz, 1988). Given the limited use of computers by elderly adults, it becomes critical to identify factors associated with computer utilization.

The factor that has received the greatest empirical attention is elderly adults' attitudes toward computers. Descriptive studies of older adults' computer and technological attitudes have found that greater experience with computers and related technologies is associated with more positive attitudes (e.g., protechnology attitudes, high computer interest) (Kerschner & Chelsvig Hart, 1984; Krauss & Hoyer, 1984). This is also a consistent finding in research with college, high school, and grade school students (Arndt, Clevenger, & Meiskey, 1985; Chen, 1986; Dambrot, Watkins-Malek, Silling, Marshall, & Garver, 1985; Kerber, 1983; Miura, 1985; Wilder, Mackie, & Cooper, 1985), and adults in the workplace (Arndt, Feltes, & Hanak, 1983; Zoltan & Chapanis, 1982). However, because experience and attitudes were measured concurrently in these studies, it is difficult to determine whether positive attitudes were antecedent to computer utilization or were an outcome of use. Because attitudes are believed to guide behavior (Regan & Fazio, 1977), persons with positive attitudes may be more likely to choose to use computers than those holding very negative attitudes. At the same time, attitude theorists agree that attitudes are acquired and changed through experience (Fishbein & Ajzen, 1975; McGuire, 1985). This experience can be direct (e.g., actual contact with a computer) or indirect (e.g., observations of others using computers, mass media exposure). The information gained about computers through these experiences forms the basis for attitude formation and change. Therefore, attitude change may occur whenever new information about computers is encountered.

The few intervention studies that have assessed attitudes prior to and following computer exposure have yielded mixed results. One study found that direct experience with the computer led to more positive attitudes (Danowski & Sacks, 1980), whereas others reported no attitude change resulting from computer use (Ansley & Erber, 1988; Czaja et al., 1986).

The disparate results in these investigations may be traced to characteristics of the intervention (e.g., amount and type of computer exposure) and to the attitude measure. The three studies varied in the amount of computer exposure provided. The Danowski and Sacks (1980) study, which reported attitude change, involved 3 weeks of computer availability, whereas the other studies provided only 10 minutes (Ansley & Erber, 1988) or one day (Czaja et al., 1986) of computer contact. The more limited computer exposure may not provide enough information about computers to the individual to lead to attitude change; more time may be required for older adults to fully absorb and evaluate the information they have gained in computer training. The studies also varied in the content of training. Attitude change was associated with computer use that was interesting and personally relevant to older adults (i.e., interactive computer messaging and game playing; Danowski & Sacks). Attitude change was not found in the studies that focused on less personal tasks, such as word processing (Czaja et al.) or a computerized vocabulary test or nutrition program (Ansley & Erber).

Factors related to the measurement of computer attitudes, which may be associated with the aforementioned variation in attitude change results, include the psychometric properties of the attitude measures, the type of computer attitudes being tapped, and dimensionality of the measures.

Although attitude measures must have adequate psychometric properties (e.g., reliability) to be sensitive to changes occurring because of intervention, these properties have not been routinely reported in prior research (Ansley & Erber, 1988; Czaja et al., 1986; Danowski & Sacks, 1980), thereby making it difficult to evaluate fully the study results. Regarding the type of attitudes assessed, the research suggests that attitudes more immediately and personally relevant to the individual (e.g., feelings of comfort and efficacy with the computer) may be more amenable to change than attitudes more removed from the individual's experience. For example, Danowski and Sacks report change on attitude items assessing liking for computers, and enhanced self-confidence due to computer use. Ansley and Erber, however, report no change on a measure assessing attitudes toward computer use at a broad, impersonal, societal level (e.g., in the criminal justice system).

This raises the related issue of computer attitude dimensionality. Research focusing on younger age groups indicates that there are multiple dimensions (e.g., interest, comfort, dehumanization) along which an individual's computer attitudes may vary (Richards, Johnson, & Johnson, 1986; Zoltan & Chapanis, 1982). However, given the reliance on unidimensional measurement in research with older adults, our understanding of their computer attitudes at the multidimensional level is lacking, and the extent to which different attitude dimensions are affected by experience with the computer remains unknown.

This study extends prior research on older adults' computer attitudes with the inclusion of a multidimensional attitude measure, the selection of a meaningful and relevant computer training program, and a study design structured to examine change within specific attitude dimensions, as well as maintenance of change following training. More specifically, this research examines three related questions: (1) Will a computer training intervention with certain characteristics (e.g., personally relevant, structured for comfort and success) result in attitude change? (2) Will this intervention lead to differential change across attitude dimensions? (3) Will attitude change as a function of training be maintained beyond the training period?

METHOD

Sample

The sample comprised 101 White older adult volunteers (27 men, 74 women) from rural central Pennsylvania. The mean age of the sample was 75.06 years (SD = 5.93, range = 57–87). The sample was well educated, averaging 13.44 years of schooling (SD = 3.14, range = 6–22). Median annual family income was $13,000. Participants rated their health, hearing, and eyesight on a 7-point scale, ranging from "very poor" to "very good." The modal ratings for all three health and sensory items were "good." Most of the sample were widowed (45%) or married (43%), whereas 11% had never married and 1% were divorced.

Design and Testing Procedures

The study involved a pretest-treatment-posttest, nonequivalent control group design (Campbell & Stanley, 1963), which is presented in Table 1. All subjects were pretested. After the pretest, the training group (n = 60) participated in five 1½-hour computer training sessions over a 2-week period. This was followed by their first posttest (to assess change in attitudes as a function of the intervention). The training group then participated in 2 weeks of unsupervised, self-directed computer usage. Following this 2-week period, a second posttest was administered to assess maintenance of attitude change across the self-use interval. A wait list group (n = 41) was included in the design for two purposes: to provide data for a no-contact control condition and to permit a replication of the training effects. The wait list group received a second pretest when the training group received their first posttest, in order to assess attitude change under a no-contact control condition. Following this second pretest, the design of the wait list condition was the same as the training condition: five computer training sessions followed by posttest 1, and 2 weeks of unsupervised computer usage followed by a second posttest. It was verified that wait list subjects did not use a computer between the two pretests or between the second pretest and the start of training.

The study was conducted at five sites, including three senior citizen centers and two retirement communities. Sites rather than individuals were assigned to training and wait list conditions to ensure that the control group (represented by the wait list group) was not influenced by contact with the computer. Sites were assigned to groups according to type of setting (retirement community or senior center); each group included one retirement community and one or two senior centers.

All testing and computer training took place at the research sites in the communities where subjects resided. Pretesting was conducted in small groups of between 3–13 subjects by a tester; a proctor was present for groups of larger than eight people. Posttesting was conducted individually. Subjects received free computer lessons and access to the computer equipment as compensation for participation.

Measures

A computer attitude measure was completed on all measurement occasions. A background questionnaire and cognitive ability tests were completed at the pretest.

Table 1. Study Design

	Study Phase								
Group	Pretest	Training (2 weeks)	Posttest 1 (TR) Pretest 2 (WL)	Self-Usage (2 weeks)	Posttest 2	Training (2 weeks)	Posttest 1	Self-Usage (2 weeks)	Posttest 2
TR	X	X	X	X	X				
WL	X		X			X	X	X	X

Note: TR, Training group; WL, Wait list group.

The Attitudes Toward Computers Questionnaire (ATCQ). — The ATCQ is a multidimensional measure assessing seven dimensions of attitudes toward computers identified in prior research on students and adults: comfort, efficacy, gender equality, control, dehumanization, interest, and utility (Bear, Richards, & Lancaster, 1987; Dambrot et al., 1985; Elkins, 1985; Krauss & Hoyer, 1984; Nickell & Pinto, 1984; Richards, Johnson, & Johnson, 1986; Zoltan & Chapanis, 1982). The comfort dimension assesses feelings of comfort with the computer and its use. Efficacy taps feelings of competence with the computer. The gender equality dimension assesses the belief that computers are important to both men and women. Control taps the belief that people control computers. The interest dimension assesses the extent to which participants are interested in learning about and using computers. Dehumanization assesses the belief that computers are dehumanizing, and the utility dimension taps the belief that computers are useful. The ATCQ is presented in the Appendix; each dimension is assessed by five or six items. All items are in 5-point Likert scale format, with response options ranging from *strongly disagree* to *strongly agree*.

The 7-factor structure of the measure was developed on a college student sample, and the pattern of salient and nonsalient factor loadings was confirmed on an elderly sample using LISREL VI (Jay, 1989). Fit of the models was determined by examination of the ratio of the chi-square value to the degrees of freedom (df); a chi-square value of between 1 and 3 times the df is considered indicative of an acceptable fit (Carmines & McIver, 1981). The fit of the model with a sample of 420 elderly adults was found to be adequate [χ^2 (535) = 1079.34], as was the fit of the model on the pretest data [χ^2 (535) = 803.42]. Cronbach alpha coefficients for the seven scales in the present sample were comfort (.63), gender equality (.69), control (.54), dehumanization (.82), interest (.64), utility (.67), and efficacy (.78).

For the data analyses, factor scores were calculated for the seven attitude dimensions. The factor scores were standardized to a mean of zero and a standard deviation of one, using the pretest data for the entire sample as the standardization base.

The background questionnaire. — The background questionnaire assessed demographics, physical health status, family status, and prior experience with computers and related technologies.

Cognitive ability. — Three cognitive abilities were assessed: spatial orientation, inductive reasoning, and verbal meaning. The measures of these abilities were taken from Form OA of the SRA Primary Mental Abilities Test (Schaie, 1985).

Computer Training Procedures

The intervention for the study involved providing older adults with direct "hands-on" computer experience. Five 1½-hour training sessions were conducted over a 2-week period. During the first session, participants learned about turning the computer on and off, the central processing unit, floppy disks, software, menus, cursor movement, key location, and printing. The second through fifth sessions focused on the creation and printing of a banner, a sign, letterhead, and a greeting card, respectively.

The training program was specifically designed to influence the computer comfort and efficacy dimensions; it was structured to ensure that participants would feel comfortable with the computer and would experience success in its operation. The lessons were conducted in a familiar, relaxed, and supportive environment. In order to allow a gradual expansion of skills and understanding, each lesson built on those before it, increasing in complexity over time. That is, as the lessons progressed, more menu selections were required, a greater amount of text had to be entered, and the placement of the text and graphics on the screen became more complicated.

Two Apple IIe computers with a graphics printer were used in training. Due to space and scheduling limitations at the training sites, the computer sessions were generally conducted in groups of six, with three people sharing a computer. Participants took turns using the computer during each lesson. In a few instances it was necessary to conduct training in smaller groups or individually because of participants' schedule conflicts or illness. Training sessions for smaller groups were shorter than those for larger groups, because fewer people needed to use the computer. Regardless of the number of people per lesson, each subject had the same amount of "hands-on" computer experience.

The instructor told each participant how to complete each task, keystroke by keystroke, while the others observed. As the lessons progressed, the amount of verbal instruction was gradually reduced to prompting or less, according to the subject's needs. The instructor provided immediate feedback regarding correctness of task performance. To supplement the verbal instructions, subjects received a manual of step-by-step written instructions for each lesson.

The software used in training was a menu-driven desktop publishing program titled *The Print Shop* (1986). This program was selected because it had high interest value for participants, was fairly easy to operate, and provided opportunities to create and print materials that could be kept or shared with others.

During the self-use period, participants recorded on a sign-up sheet each time they used the computer. The majority of the sample (60%) used the computer at least once during this interval (range = 1–17). The remaining 40% of the sample did not use the computer for a variety of reasons, including travel, illness, other time commitments, and disinterest.

Pretest Equivalence

At pretest, the training (n = 60) and wait list (n = 41) groups did not differ significantly in age, sex, education, self-rated health, hearing, or vision; prior use of computers or other technologies; verbal meaning or spatial orientation ability; or on six of the seven attitude dimensions. The two groups did differ in marital status, family income, inductive reasoning ability, and the control attitude dimension. The training group was more likely than the wait list group to be widowed [$\chi^2 (2) = 9.40, p < .01$]. The wait list group had a higher annual family income than the training group [t (89) = 2.64, $p < .01$] and scored higher than the training group on inductive reasoning ability [t (99) = 2.82, $p < .01$], and on the attitude factor assessing the belief that people control computers [t (99) = 2.02, $p < .05$].

Sample Attrition

Attrition occurred at two different points in the study: between the pretest and the first posttest, and between posttests 1 and 2. Eight women, from all five sites, terminated study participation between the pretest and posttest 1. Reasons given for dropping out included poor health of self and others, and travel commitments. These women did not differ significantly ($p > .05$) from other study participants on any demographic characteristics, prior computer experience, or computer attitudes at pretest. Two men and two women, from three research sites, dropped out of the study between posttests 1 and 2. Reasons given for attrition included poor health, disinterest, and dislike of the written and computer testing. These four subjects did not differ significantly ($p > .05$) from those remaining in the study on pretest attitude scores, attitude change scores from pretest to posttest 1, or on any demographic characteristics.

RESULTS

Results are presented with regard to four questions: (1) Were significant changes in attitudes found for the training group when compared with a no-contact control condition? (2) What was the magnitude of change in computer attitudes as a function of training? (3) Was the training effect replicated for the wait list group? (4) Was the attitude change that occurred as a function of training maintained across the 2-week interval following training?

Attitude change. — Change on the seven attitude dimensions was compared for the training group and the no-contact control condition (represented by the wait list group). Change was assessed from pretest to posttest 1 for the training group; change for the wait list group was assessed from their first pretest to their second pretest. A 2 Group × 2 Occasion repeated measures multivariate analysis of covariance (MANCOVA) was conducted on the seven attitude dimensions. Income and inductive reasoning ability were included as covariates to adjust for pretest differences between the wait list and training groups. (Income was significantly associated with the gender equality dimension; reasoning was significantly associated with all but the dehumanization dimension.) Significant occasion [$F(7,76) = 5.27, p < .001$] and Group × Occasion [$F(7,76) = 2.32, p < .05$] effects were found; the group main effect was nonsignificant.

For each of the seven attitude dimensions, follow-up 2 Group × 2 Occasion repeated measures univariate analyses of covariance (ANCOVAs) were conducted. Significant training effects were found for the attitude dimensions of computer comfort and efficacy, as indicated by the significant Group × Occasion interactions. Scores on both of these factors increased from pretest to the second measurement occasion to a significantly greater degree for the training group than for the wait list group. The means, standard deviations, and F-ratios corresponding to the univariate analyses are presented in Table 2.

Significant occasion effects were also found for the attitude dimensions of gender equality, interest, and dehumanization. For both the wait list and training groups, gender equality and computer interest increased, whereas dehumanization decreased. Significant group effects were found for the interest and comfort dimensions, with the training group scoring higher than the wait list group across occasions. No significant effects were found for the utility or control dimensions.

Magnitude of attitude change. — In order to compare the magnitude of change for the different attitude dimensions, effect sizes for the two groups were calculated. Effect sizes express the magnitude of change in standard deviation units. Given that all data were standardized ($M = 0, SD = 1$) using the entire pretest as baseline, the effect sizes reported here are the difference in means across occasions. The effect sizes for those dimensions showing change are reported for the training and wait list groups, respectively: comfort .54, .16; efficacy .47, .08; gender equality .32, .09; interest .18, .13; and dehumanization −.19, −.06. The difference in effect size between the two groups was .38 and .39 standard deviations, for the comfort and efficacy dimensions. The differences in effect sizes for the remaining dimensions were much smaller, ranging from .05 to .23.

Replication of training effects. — This question addresses whether the attitude change associated with the intervention is similar for the wait list and training groups. For the training group, change was assessed from pretest to posttest 1. For the wait list group, change was assessed from their second pretest to posttest 1; thus, any change found for this group would be in addition to that which occurred in the period prior to training and could be attributed to the intervention program. A 2 Group × 2 Occasion repeated measures MANCOVA was conducted on the seven attitude dimensions, using income and inductive reasoning ability as the covariates. The significant occasion main effect [$F(7,76) = 11.12, p < .001$] indicated that attitudes changed following training for both groups. The lack of a significant group main effect or a Group × Occasion interaction effect indicated that the change did not differ between groups.

The univariate analyses conducted separately for each of the seven attitude factors also indicated a replication of effects across groups. The results of these analyses are presented in Table 3. None of the group main effects or Group × Occasion interaction effects was significant, indicating that the intervention effects did not differ between groups. The significant occasion main effects indicated that attitudes changed following training; however, the lack of a no-contact control condition in this analysis precludes interpretation of the occasion main effects as training effects.

Maintenance of attitude change. — The maintenance of attitude change across posttest occasions was examined using regression analyses. Two contrasts, representing two different patterns of attitude change across the three measurement occasions, were calculated for each attitude dimension. The first contrast, titled Maintenance, tested a change in attitudes from pretest to posttest 1, and maintenance (no change) from posttest 1 to posttest 2. The second contrast, titled Instability,

Table 2. Means, Standard Deviations, and F-ratios for Computer Attitude Repeated Measures ANCOVAs: Pretest to Second Measurement Occasion

		Occasion						
		Pretest		Second Occasion[a]		F (1,80 or 82)		
Attitude Dimension	Group	M	SD	M	SD	Group	Occasion	G × O
Comfort	WL	−.07	(.70)	.09	(.70)	9.23**	25.65***	7.54**
	TR	.08	(.64)	.62	(.74)			
	Total	.02	(.67)	.40	(.77)			
Efficacy	WL	.07	(.84)	.15	(.67)	2.35	14.25***	7.46**
	TR	−.02	(.73)	.45	(.76)			
	Total	.02	(.78)	.32	(.73)			
Gender equality	WL	.02	(.68)	.11	(.68)	1.68	8.44**	2.59
	TR	−.01	(.68)	.31	(.71)			
	Total	.00	(.67)	.22	(.70)			
Control	WL	.16	(.63)	.19	(.48)	1.13	2.22	.94
	TR	−.09	(.65)	.07	(.49)			
	Total	.02	(.65)	.12	(.49)			
Dehumanization	WL	.00	(.76)	−.06	(.75)	2.62	4.17*	1.16
	TR	−.10	(.75)	−.29	(.67)			
	Total	−.06	(.75)	−.19	(.71)			
Interest	WL	−.03	(.63)	.10	(.55)	4.53*	5.58*	.16
	TR	.08	(.64)	.26	(.69)			
	Total	.03	(.63)	.19	(.64)			
Utility	WL	−.02	(.70)	.04	(.68)	2.01	1.36	.06
	TR	.08	(.68)	.16	(.53)			
	Total	.04	(.68)	.11	(.60)			

Note: WL, wait list group (n = 36); TR, training group (n = 48). Covariates included income and inductive reasoning ability. The ns were reduced due to subject attrition and missing data on the covariates.

[a]For the training group, the second measurement occasion is posttest 1. For the wait list group, the second measurement occasion is their second pretest.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

tested a change from pretest to posttest 1, followed by a change back to pretest levels at posttest 2. A constant (1) and the grouping variable (wait list, training) were regressed on the two contrast variables for each of the seven attitude dimensions. A significant regression coefficient for the constant indicated that that contrast (maintenance or instability) embodied the pattern of change for that attitude dimension. A significant regression coefficient for the grouping variable indicated that the pattern of change differed for the wait list and training groups. For the training group, the pattern of change was examined from pretest to posttest 1 and posttest 2. For the wait list group, the pattern of change was examined from their second pretest to posttest 1 and posttest 2. The beta coefficients, F-tests, and R-squares for these analyses are presented in Table 4.

The constant was a significant predictor of the maintenance contrast for all seven attitude dimensions, indicating maintenance of attitude change across posttests. The grouping variable was nonsignificant, indicating that the pattern of change across occasions was the same for both groups. Neither the constant nor the grouping variable were significant predictors of the instability contrast for any of the attitude dimensions, indicating that this pattern of change was an inappropriate representation of the data.

Discussion

The purpose of this research was to examine whether older adults' attitudes toward computers would be influenced by direct computer experience, and whether attitude change resulting from computer use would be maintained beyond the training period. A multidimensional computer attitude measure was utilized to assess attitude change. The results of the study demonstrate that older adults' computer attitudes are modifiable and that direct computer experience is an effective means of change. While these findings are consistent with prior research on older adults (Danowski & Sacks, 1980) and students (Mathis, Smith, & Hansen, 1970; Rosenberg, Reznikoff, Stroebel, & Ericson, 1967), they also extend prior work through the identification of differential change across attitude dimensions. Specifically, change was found on the two attitude dimensions targeted by the training program: computer efficacy and comfort.

These results underscore not only the importance of assessing attitudes multidimensionally, but also the importance of the intervention's design in eliciting attitude change. In this study, the computer training was structured such that participants would experience success in operating the computer and would feel comfortable doing so. As such, the information participants acquired through the computer experience was most relevant to the comfort and efficacy attitude dimensions. Similarly, studies seeking to influence other types of attitudes must tailor the intervention accordingly.

Another contribution of this research is its assessment of the maintenance of training effects. Although important for

Table 3. Means, Standard Deviations, and F-ratios for Computer Attitude Repeated Measures ANCOVAs: Pretest to Posttest 1

Attitude Dimension	Group	Occasion				F (1,80 or 82)		
		Pretest[a]		Posttest 1				
		M	SD	M	SD	Group	Occasion	G × O
Comfort	WL	.09	(.70)	.61	(.71)	.47	53.65***	.04
	TR	.08	(.64)	.62	(.74)			
	Total	.08	(.66)	.62	(.72)			
Efficacy	WL	.15	(.67)	.46	(.91)	.02	35.32***	1.34
	TR	−.02	(.73)	.45	(.76)			
	Total	.05	(.71)	.45	(.82)			
Gender equality	WL	.11	(.68)	.29	(.60)	.02	16.18***	1.09
	TR	−.01	(.68)	.31	(.71)			
	Total	.04	(.67)	.30	(.66)			
Control	WL	.19	(.48)	.26	(.50)	2.47	3.97*	.67
	TR	−.09	(.65)	.07	(.49)			
	Total	.03	(.60)	.15	(.50)			
Dehumanization	WL	−.06	(.75)	−.34	(.61)	.35	17.41***	.69
	TR	−.10	(.75)	−.29	(.67)			
	Total	−.08	(.74)	−.31	(.65)			
Interest	WL	.10	(.55)	.35	(.54)	.06	11.90***	.28
	TR	.08	(.64)	.26	(.69)			
	Total	.09	(.60)	.30	(.63)			
Utility	WL	.04	(.68)	.18	(.70)	.46	3.34	.20
	TR	.08	(.68)	.16	(.53)			
	Total	.06	(.68)	.17	(.60)			

Note: WL, wait list group (n = 36); TR, training group (n = 48). Covariates included income and inductive reasoning ability. The ns were reduced due to subject attrition and missing data on the covariates.
[a]Pretest data for the wait list group are from their second pretest.
*$p < .05$; ***$p < .001$.

Table 4. Regression Analyses Testing Pattern of Attitude Change Across Measurement Occasions

Attitude Dimension Predictor	Pattern of Attitude Change					
	Maintenance			Instability		
	b	F	R^2	b	F	R^2
Comfort						
Group	.03	33.82***	.46	.02	.53	.01
Constant	.41***			.04		
Efficacy						
Group	.05	24.71***	.39	.03	.91	.02
Constant	.35***			−.05		
Gender equality						
Group	.04	9.47***	.20	.06	1.24	.03
Constant	.20***			.02		
Control						
Group	.07	3.83*	.09	−.06	.80	.02
Constant	.09*			.02		
Dehumanization						
Group	.04	9.17***	.19	−.02	.41	.01
Constant	−.19***			.03		
Interest						
Group	.01	6.20**	.14	−.01	.09	.00
Constant	.18***			.02		
Utility						
Group	.01	3.26*	.08	−.02	.48	.01
Constant	.11*			−.02		

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

both practical and theoretical reasons, prior studies have failed to examine the maintenance issue. These findings suggest that attitude change resulting from computer use is not transitory, but will be maintained for at least 2 weeks following training.

An unexpected result of this study was the attitude change found for the wait list group prior to their use of the computer. Both groups' interest and gender equality attitudes increased, and dehumanization attitudes decreased from the pretest to the second measurement occasion. One explanation for these results lies in the fact that the wait list group had ample opportunity to think about, talk about, and otherwise anticipate the upcoming computer experience. This heightened awareness of computers likely provided additional information about computers on which the attitude change was based. This hypothesis is consistent with research by Fazio, Lenn, and Effrein (1983/84), which suggests that expectations that one will be questioned about or will use an attitude object, lead to the formation of attitudes toward that object. Expectation of use may similarly lead to attitude change.

Testing may also have sensitized subjects to the study's purpose and resulted in their responding at the second measurement occasion in a manner they believed desirable (i.e., more positive attitudes). However, because the ATCQ was only 1 of 10 measures administered at the pretest, and several weeks transpired between measurement occasions, this does not seem a strong possibility.

This study represents a preliminary effort to examine the effects of computer experience on older adults' computer attitudes. Study limitations that should be addressed in future research involve four areas: the sample, assessment of long-term maintenance, and determination of precisely when and how the attitude change occurred.

First, the study utilized a volunteer sample. Given the substantial time commitment involved and the technological nature of the computer training, it is likely that the sample is representative only of others who would also volunteer for such a program. It is, however, important to note that this sample likely represents a broader spectrum of older adults than earlier studies (Ansley & Erber, 1988; Czaja et al., 1986) because the computer program was offered in the participants' communities and did not require them to travel to a specific research site for lessons. In addition, because of the small sample size for men, it was not possible to examine sex differences in training effects or their maintenance. Because prior research has indicated sex differences in older adults' computer attitudes (Kerschner & Chelsvig Hart, 1984; Krauss & Hoyer, 1984), efforts should be made to recruit sufficient men to permit meaningful comparisons in future studies. Second, this research was unable to examine the long-term maintenance of training effects. Whereas short-term maintenance (i.e., 2 weeks) of change is supported by the data, the question of long-term maintenance (e.g., 6 months, one year) cannot be addressed. Third, it is unclear from the present data when the attitude change occurred (e.g., after lesson 3 or 5). Prior research indicates that a single session or day's contact with the computer does not result in attitude change (Ansley & Erber, 1988; Czaja et al., 1986). However, the precise amount of time required for attitude change to occur is unknown. Finally, whereas this study demonstrates that attitude change can result from computer experience, the process by which the change took place is unclear. The information gained about computers during training is a vital factor, but the actual content of the information and the means by which it is processed and evaluated by the individual are not known.

The results of this study support the plasticity of older adults' attitudes. At the same time, they raise interesting questions regarding the plasticity of older adults' behaviors. For example, how is computer attitude change related to subsequent computer use or broader technology use? Does positive attitude change lead to greater use and negative attitude change to technological avoidance? These questions clearly have important practical implications in our technological society, where the likelihood of older adults' contact with information technology, in work and nonwork settings, is ever increasing.

Acknowledgments

This research was partially supported by the National Institute on Aging grant T32 AG 00048-12 to The Pennsylvania State University.

This article is based on the doctoral research of Gina M. Jay, which was conducted at The Pennsylvania State University.

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Received August 30, 1990
Accepted November 11, 1991

Appendix

Attitudes Toward Computers Questionnaire

Items are presented by attitude dimension. Item numbers reflect the ordering of items in the questionnaire that participants completed. Response options are in 5-point Likert scale format (1 = strongly agree, 2 = agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = disagree strongly). Reversed items are denoted by (R).

Comfort

1. I feel comfortable with computers. (R)
13. Computers make me nervous.
18. I don't feel confident about my ability to use a computer.
31. Computers are confusing.
34. Computers make me feel dumb.

Efficacy

10. I know that if I worked hard to learn about computers, I could do well. (R)
22. Computers are *not* too complicated for me to understand. (R)
24. I think I am the kind of person who would learn to use a computer well. (R)
29. I think I am capable of learning to use a computer. (R)
35. Given a little time and training, I know I could learn to use a computer. (R)

Gender Equality

2. Using computers is more important for men than for women.
4. More women than men have the ability to become computer scientists.
11. Using computers is more enjoyable for men than it is for women.
16. Working with computers is more for women than men.
19. Women can do just as well as men in learning about computers. (R)

Control

3. Computers will never replace the need for working human beings. (R)
23. Our world will never be completely run by computers. (R)
26. People are smarter than computers. (R)
28. People will always be in control of computers. (R)
33. Soon our lives will be controlled by computers.

Dehumanization

6. Computers turn people into just another number. (R)
7. The use of computers is lowering our standard of living. (R)
8. Computers control too much of our world today. (R)
12. Computers are making the jobs done by humans less important. (R)
21. Computers are dehumanizing. (R)
33. Soon our lives will be controlled by computers. (R)

Interest

5. Learning about computers is a worthwhile and necessary subject. (R)
9. Reading or hearing about computers would be (is) boring.
15. I don't care to know more about computers.
17. Computers would be (are) fun to use. (R)
30. Learning about computers is a waste of time.

Utility

14. Life will be (is) harder with computers.
20. Everyone could get along just fine without computers.
25. It is *not* necessary for people to know about computers in today's society.
27. Computers are too fast.
28. People will always be in control of computers. (R)
32. Computers make the work done by people more difficult.