Reactions to Computerized Testing in Selection Contexts

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Organizations are increasingly using computerized tests (e.g., multimedia, web-based, computer adaptive testing) in selection systems. A 2 (mode of presentation: paper-and-pencil – computerized) $\times$ 2 (technical level of the job: high technical job–low technical job) $\times$ 2 (selection decision: rejected or selected) between subjects design was used to assess proposed relationships between reactions to tests, their antecedents, and their consequences. While test-takers' post-test perceptions did not significantly differ as a result of mode of administration, computer anxiety and experience with computing were important factors in performing successfully. Significant relationships were found between post-feedback reactions and test-takers' intentions. The discussion highlights implications for implementing computerized selection tools.

Introduction

Leading organizations have recognized the potential for computers to change the way selection systems are implemented (McHenry and Schmitt, 1994). The attractiveness of using multimedia, computer adaptive, and video testing rather than paper-and-pencil tests comes from the increased standardization, cost effectiveness, positive image of the organization, and realistic job preview they are able to provide. With the decreasing costs of personal computers, increased networking capabilities, and new video equipment and software, an increasing number of companies are incorporating computerized testing into their selection systems.

Since the introduction of computers into psychological testing, researchers and practitioners have been concerned with reactions to these tools (e.g., Lucas, Mullins, Luna and McInroy, 1977; Slack and Slack, 1977; Slack and Van Cura, 1968). Despite a great deal of research concerning examinees' reactions to computerized testing, few studies (Arvey, Strickland, Drauden and Martin, 1990; Schmitt, Gilliland, Landis and Devine, 1993; Shotland, Alliger and Sales, 1998) within a selection context exist. Further, while computers are becoming an increasing part of our lives, recent US surveys suggest that there are still significant demographic, educational, and socio-ecomonic differences in access and use of computers at home (http://www.census.gov/population/www/socdemo/computer.html) and at work (http://www.bls.gov/cps/). As it appears that the 'digital divide' is still quite large, selection researchers need to examine how reactions to computerized testing differ from those to traditional selection tests.

Studying reactions to computerized tools within a selection context is important for several reasons. First, a key influence on reactions to tests in hiring contexts is whether the individual is selected or not (Gilliland, 1994; Kluger and Rothstein, 1993; Ployhart and Ryan, 1997), but the influence of selection outcome has not been examined in studies of computerized tests. Second, there are a number of outcome variables of particular importance in selection settings such as fairness (e.g., Gilliland, 1994; Horvath, Ryan and Stierwalt, 2000), recommendation intentions (Ployhart and Ryan, 1997), and organizational attractiveness (Bauer, Maertz, Dolen and Campion, 1998) that have not been examined in studies of computerized testing. That is, although researchers in other settings are interested in reactions to computerized testing in terms of effects on test-takers' performance, selection researchers are also concerned about effects on recruitment outcomes. Third, the large body of research on reactions to selection procedures (e.g., Bauer *et al.*, 1998; Gilliland, 1993) provides a framework that has not yet been applied to the study of reactions to computerized testing. The few researchers that have attempted to develop a framework of reactions to

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computerized testing in selection contexts (Burke, Normand and Raju, 1987; Daum, 1994) looked at only a limited number of individual differences known to affect reactions and only a limited number of outcomes of concern in selection settings. The current study examines the antecedents and outcomes associated with reactions to computerized testing procedures in a selection setting. Fourth, most of the research on reactions to computerized testing has used either cognitive ability tests (e.g., Arvey *et al*., 1990; Burke *et al*., 1987; Daum, 1994; Landis, Davison and Maraist, 1998; Schmidt, Urry and Gugel, 1978) or interviewing (e.g., Lucas *et al*., 1977; Martin and Nagao, 1989; O'Brien and Dugdale, 1978). There is limited research using other types of computerized tests such as multimedia tests (Barbera, Ryan, Burris and Dyer, 1995; Richman-Hirsch, Olson-Buchanan and Drasgow, 2000; Shotland and Alliger, 1999) and video-based tests (Chan and Schmitt, 1997) that go beyond simply transferring a paper-and-pencil test to a computer. In order to address these limitations in the literature, the current study examines a computerized in-basket test, an increasingly common computerized assessment tool.

Finally, a limitation of the computerized testing literature as well as the more general applicant reactions literature is the lack of research on the relationship between testing-related individual differences (i.e., attitudes and experiences) and reactions to tests (Chan, Schmitt, Deshon, Clause and Delbridge, 1997; Chan, Schmitt, Jennings, Clause and Delbridge, 1998). That is, how do the individual's experiences with tests, test anxiety, and other test attitudes of the individual influence his/her perceptions of the selection process? In addition, do constructs such as computer anxiety and computer efficacy provide unique variance in predicting reactions and success in a selection setting beyond that accounted for by general test-taking attitudes and experiences? The current study examines a number of general test-taking attitudes, computer-related attitudes, and reactions to testing measures in order to begin understanding these relationships.

Reactions to Computerized Testing in a Selection Context

In this section, we provide an overview of the antecedents and consequences of reactions to testing examined in this study. Based on a review of the literature, we selected liking, process fairness, outcome fairness, test ease, perceived job-relatedness, and self-assessed performance as perceptions that a) are of interest in selection contexts, b) have been the subject of previous empirical study, and c) may vary based on mode of test administration. The importance of these six perceptions lies in their effect on applicants' intentions towards the organization (job acceptance intentions, recommendations intentions, and purchase intentions). First, there are a number of individual differences that may influence reactions to testing in general and to computerized testing specifically (e.g., computer experience, computer anxiety) that we examined. Second, the mode of test administration (computerized or not) is examined to determine if reactions to computerized tests differ from those to testing in general. Third, we considered how the technological level of the job would likely influence reactions to computerized testing. Finally, the selection process outcome (accept or reject) needs to be considered as a likely major influence on reactions.

Individual Differences

There are several individual differences that we expected to affect reactions to an in-basket test in a selection context, regardless of computerization: experience, self-efficacy, and anxiety. Given the lack of research linking these individual differences to the specific six perceptions noted above as our focus, we did not make hypotheses regarding specific perceptions but considered the individual differences as having directional influences on all perceptions.

Test-taking experience should positively influence test-takers' reactions to a selection test. Kravitz, Stinson and Chavez (1994) found that for many types of selection tests (i.e., interview, cognitive ability test, personality test and work sample test) previous experience was positively related to perceptions of the test (i.e., fairness, relevance, invasion of privacy, and overall appropriateness of the test). Ryan, Greguras and Ployhart (1996) also found that experience with a specific type of physical ability test (PAT) was positively related to the perceived job relevance of the test, fairness perceptions of the test, and general perceptions of the PAT's job relevance and fairness. Truxillo, Bauer and Sanchez (2001) found that a measure of test experience was positively related to people's perceptions of the overall fairness of the test. Finally, Barbera *et al*. (1995) found that test-taking experience was positively related to test-takers' belief in tests (i.e., tests are useful for selecting people for jobs).

> Hypothesis 1: Test-taking experience (with in-basket tests) will be positively related to post-test perceptions.

Test-taking self-efficacy is the belief in one's capability to perform effectively when confronted by a test-taking situation (Bandura, 1997). Test-takers low in test-taking self-efficacy are more likely to have negative emotions and cognitions surrounding the test that negatively influence their post-test perceptions (Gist, Schwoeder and Rosen, 1989). Ryan, Ployhart, Greguras and Schmit (1998) found that test self-efficacy was positively related to motivation and test performance and negatively related to test anxiety. Others (e.g., Bauer *et al*., 1998; Gilliland, 1994) have found that self-efficacy was positively related to fairness perceptions of the selection process.

Hypothesis 2: Test-taking self-efficacy will be positively related to post-test perceptions.

Test-taking anxiety is a situation-specific anxiety trait (Spielberger and Vagg, 1995). Hodapp, Glanzmann and Laux (1995) discuss that test anxious people are likely to 'respond with excessive worry, self-deprecatory thoughts, and intense affect and physiological arousal when exposed to examination situations.' Test-taking anxiety has been found to relate negatively to test performance (e.g., Arvey *et al.*, 1990; Hembree, 1988) and perceptions of the test (Barbera *et al.*, 1995; Schmit and Ryan, 1997). Schmit and Ryan (1997) also found that test-taking anxiety was positively related to withdrawal from a selection process.

Hypothesis 3: Test-taking anxiety will be negatively related to post-test perceptions.

We also examined a parallel set of individual difference variables specific to taking computerized tests. As computers are still not ubiquitous in society, researchers are concerned that previous computer experience may affect people's attitudes towards computers and their applications (e.g., Hill, Smith and Mann, 1987; Igbaria and Chakrabarti, 1990; Pope-Davis and Twing, 1991; Zoltan and Chapanis, 1982). Test-takers with little computer experience may see them as an unfamiliar, unfair, part of the process that they should not have to contend with. Research has found that *computer experience* is related to willingness to use computers (Zolton and Chapanis, 1982), liking of computing (Comber, Colley, Hargreaves and Dorn, 1997), confidence in computing (Loyd and Gressard, 1984; Pope-Davis and Twing 1991; Torkzadeh and Koufteros, 1993), general attitudes towards computers (Igbaria and Chakrabarti, 1990; Popovich, Hyde, Zakrajsek and Blumer, 1987), and task performance (Czaja and Sharit, 1993). Although there is some evidence that experience engenders negativity in users (e.g., Rosen, Sears and Weil, 1993), most research finds that computer experience is positively related to attitudes towards computers and their uses.

Hypothesis 4: Computer experience will be positively related to post-test perceptions of a computerized version of the in-basket.

Computer self-efficacy is a variant of the self-efficacy construct (Bandura, 1997) that is positively related to attitudes, intentions, and behaviors with regard to computers and their applications. Similar to test self-efficacy, applicants low in computer self-efficacy are more likely to have negative emotions and cognitions surrounding a computerized test that affect post-test perceptions. Computer self-efficacy is thought to be an important variable in understanding people's decisions to use computers (Hill *et al.*, 1987), reactions to computers (Compeau and Higgins, 1995; Webster and Martocchio, 1995), and performance when using computers (e.g., Gist, Schwoerer and Rosen, 1989; Karsten and Roth, 1998).

Hypothesis 5: Computer self-efficacy will be positively related to post-test perceptions of a computerized version of the in-basket.

Computer anxiety is an affective response where people are worried about damaging the computer, looking stupid, or losing control over their work (Bloom and Hautaluoma, 1990). Research has shown that computerized tests may bring out fear and anxiety in some people (e.g., Abdelhamid, 2002; Gilroy and Desai, 1986; Hedl, O'Neal and Hansen, 1973; Hill, Smith and Mann, 1987; Igbaria and Chakrabarti, 1990; Rosen, *et al.*, 1993; Torkzadeh and Angulo, 1992). Heinssen, Glass and Knight (1987) found that although a measure of computer anxiety was correlated with trait anxiety, it was not correlated with a test anxiety scale. Shermis and Lombard (1998) also found no relationship between measures of computer and test anxiety. Thus, computer anxiety seems to be capturing unique variance in people's reactions to computers beyond that of test anxiety. Research has found evidence that computer anxiety is negatively related to such variables as attitudes towards computers (e.g., Ellis and Allaire, 1999; Howard, 1986; Igbaria and Chakrabarti, 1990; Popovich *et al.*, 1987), amount of interaction with computers (e.g., Mahar, Henderson and Deane, 1997; Rosen *et al.*, 1993; Todman and Monaghan, 1994), and performance (e.g., Bloom and Hautaluoma, 1990; Brosnan, 1998; Elder, Gardner and Ruth, 1987).

Hypothesis 6: Computer anxiety will be negatively related to post-test perceptions of a computerized version of the in-basket.

When computerized technologies are first introduced to people, it is likely that there will be some resistance to using them. When computers were far less prevalent in society, Zoltan and Chapanis (1982) concluded that negative reactions were most likely due to a lack of exposure to and experience with computers. Faerstein (1986) suggests that resistance to computers may be due to resistance to change and fear of the unknown. Thus, people who are less resistant to new experiences and/or change may be more likely to interact with novel applications of computerized technologies and rate these experiences as more positive than people who are resistant to new experiences and/or change.

Hypothesis 7: Openness to experience will be positively related to post-test perceptions of a computerized version of the in-basket.

Mode of Administration

Research suggests that mode of administration influences examinees' reactions to the assessment (e.g., Chan and

Schmitt, 1997; Daum, 1994; Landis *et al*., 1998; Richman-Hirsch *et al*., 2000). Previous research has shown not only positive overall reactions from test-takers towards computerized testing (Barbera *et al*., 1995; Schmidt *et al*., 1978; Slack and Van Cura, 1968), but also that test-takers prefer computerized versions of tests over paper-and-pencil versions (Arvey *et al*., 1990; Ogilvie, Trusk and Blue, 1999; Richman-Hirsch *et al*., 2000). These findings may be attributed to the novelty of the computerized testing. Ogilvie *et al*. (1999) found that participants perceived computerization as efficient and an improvement over the paper-and-pencil tests. Arvey *et al*. (1990) also found the test-takers found the computerized testing was 'intrinsically more interesting, more challenging, less boring…' than the paper-and-pencil version.

Hypothesis 8a: Participants taking the computerized in-basket will show higher liking than those taking the paper-and-pencil version.

Researchers have found that applicants either rate different administration modes of a test as equally fair (Daum, 1994) or rate the computerized version as more fair (e.g., Schmidt *et al*., 1978; Schmitt *et al*., 1993) than the traditional paper-and-pencil version. This may be due to people's perceptions that computers are more objective, accurate, and less prone to biases than traditional forms of selection testing. As these characteristics are considered determinants of fairness perceptions (e.g., Gilliland, 1993; Leventhal, 1980), we hypothesize more positive fairness perceptions from participants taking the computerized version than from those taking the paper-and-pencil version.

Hypothesis 8b: Participants taking the computerized version will rate the test as fairer than those taking the paper-and-pencil version.

A test's difficulty and an individual's perceptions of their performance on the test are related to their general liking of a test and perceptions of test fairness (Chan *et al*., 1998; Kluger and Rothstein, 1993; Ployhart and Ryan, 1997). However, we did not find strong evidence of more or less positive perceptions of these features for computerized as compared to paper-and-pencil versions of tests; thus, we explored whether mode affected these perceptions.

Technological Level of the Job

Research suggests that participants react differently to selection procedures based on the jobs for which they are used (e.g., Kravitz *et al*., 1994; Martin and Nagao, 1989). Although many more workers are interacting with technology, there are still differences between jobs in the degree of technological involvement they require (e.g., a sales clerk in a grocery store versus a computer engineer). Researchers (McHenry and Schmitt, 1994; Shotland *et al*., 1998; Smither, Reilly, Millsap, Pearlman and Stoffey, 1993) have discussed the importance of the face validity of computerized tests in increasing test-takers' perceptions of test fairness. However, test-takers may not see the relevance of the technology to the type of job for which they are taking the test. It is important to note that not every computerized selection test is designed to be more job-related. In many cases, the use of computerized testing is to increase the testing standardization, lessen the scoring time, and decrease the financial cost of testing. Computerized tests should be seen as more valid assessment tools if they are used for jobs that require a similar interaction with the technology. Thus, we suggest that the technological level of the job will moderate the relation of mode of administration to participants' perceptions of job-relatedness.

Hypothesis 9: The technological level of the job will moderate the relationship between mode of administration and perceived job-relatedness such that greater job relevance will be perceived when mode is consistent with the technology level of the job (i.e., paper-and-pencil test for low technology and computerized for high technology positions).

Decision Outcome

There is strong evidence of the effect of the decision outcome on perceptions (Bauer *et al*., 1998; Gilliland, 1994; Kluger and Rothstein, 1993; Ployhart and Ryan, 1997) in that those who are selected have more positive perceptions than those who were not selected. We expect this to hold true for both paper-and-pencil and computerized tests.

Hypothesis 10: Participants who are selected for the job will have more positive post-feedback perceptions (liking, process fairness, outcome fairness, test ease, perceived job-relatedness) compared to participants who are not selected.

Behavioral Intentions

Research has found that people's reactions to selection procedures are positively related to intentions to accept the job (e.g., Macan, Avedon, Paese and Smith, 1994; Ployhart and Ryan, 1997), intentions to recommend others to the experiment or job (Bauer *et al*., 1998; Gilliland, 1994), and intentions to purchase products from the organization (Macan *et al*., 1994). We find no reason to expect any differences in these relations due to computerization, although some of the main effects hypothesized earlier should lead to more positive intentions for those taking a computerized test.

Hypothesis 11: Post-feedback perceptions of the selection process (liking, process fairness, outcome fairness, test ease, perceived job-relatedness) will be positively related to job acceptance, recommendation, and purchase intentions.

METHODS

Participants

The main study consisted of 212 students from a large Midwestern university. Students were recruited from an introductory psychology class and received class credit for their participation. The average age of the sample was 20 years. The sample was 76% Female, 73% White, 10% African-American, and 9% Asian. Ten participants were dropped from the analyses due to not completing both parts of the study, not following instructions, or not fully participating.

Another sample of 50 students from the same population as the main study participated in the pilot study used to develop the technology level of the job manipulation. The average age and gender composition of the sample was similar to that of the main study (race data was not collected for this sample).

Design

The design was a 2 (mode of presentation: paper-and-pencil – computerized) $\times$ 2(technical level of the job: high technical job – low technical job) $\times$ 2 (selection decision: rejected or selected) between subjects design. Due to the resources needed for the mode of presentation manipulation, a condition was designated before participants volunteered. Each session was randomly assigned to the technical level of the job condition. The selection decision was based on actual performance on the selection test using a cut score determined through pilot testing as well as from norms gathered during the test's original development.

Job Level Manipulation

Fifty pilot study participants were asked to rate 20 jobs (selected from a list of positions for which the test is actually used) as to the perceived level of technology used in the job. Two jobs were selected that represented the high and low end of the scale (i.e., business analyst and customer service representative). We then searched a variety of online job search companies (e.g., hotjobs.com, misconsult.com) for job descriptions of the selected jobs. These descriptions were used to describe the jobs for which participants were taking the test.

Procedure

Participants were told they would be working on an exercise used to select applicants for a business analyst (high technology) or customer service representative (low technology) position. Participants in the high technology condition were told that business analysts assist with design, development, programming, and implementation of various software and hardware applications. Participants in the low technology condition were told that customer service representatives are responsible for processing and answering all customer requests and resolving any issues related to client records. All participants were also told that their test score would help determine whether their skills and abilities match those necessary on the job. Participants were told that cash awards of $15 were available for those participants whose test scores were high enough that they would have been selected for the position described. They were then given a description of the in-basket examination and filled out a questionnaire with demographic questions and the pre-test measures.

Participants then took either the computerized or paper-and-pencil in-basket examination. After completing the test, participants were given the post-test questionnaire and told that their tests would be scored and a selection decision would be made. During the one week period between sessions one and two, participants' in-basket results were scored and participants were classified as being hired or not hired based on those scores.

At the second session one week later, participants were reminded as to the purpose of the study, the type of job for which they were taking the test, the type of test they took, and the basis of the selection decision. Participants were then given their selection decision and a final questionnaire and were debriefed.

Measures

Manipulation Check. In order to check the effect of manipulating the perceived technological level of the job, a six-item scale (e.g., 'The current job requires a lot of technology') was given after test instructions but before participants took the selection test. The measure had an alpha of .86.

Motivation Check. To assess participants' motivation to do well on the test, participants were given 10 items adopted from the Motivation sub-scale from the Test Attitude Survey (Arvey *et al*., 1990). This measure was given after test instructions but before participants took the test. The measure had an alpha of .92.

Pre-Test Measures. Reliabilities for these measures are reported in Table 1. *Test-taking experience* was measured using a four-item scale developed by the researchers which asked about experiences with in-basket tests (e.g., 'I have taken a test similar to this test'). *Test-taking self-efficacy* was measured using five items adopted from Pintrich and DeGroot (1990). *Test-taking anxiety* was measured using Sarason and Ganzer's (1962) Test Anxiety Scale (TAS) which is composed of 16 true-false items. *Computer experience* was measured using 12 items from Potosky and Bobko (1998). As results of a factor analysis with varimax rotation supported two components, two-six item measures of technical (e.g., 'I know how to write computer programs') and basic experience (e.g., 'I know what email is') were created. *Computer self-efficacy* was measured using an eight-item scale based on a measure from Levine and Donitsa-Schmidt (1997). We dropped two items from their 10-item scale because one was geared toward school settings and another because of its low factor loading in the current study. *Computer anxiety* was measured using a ten-item scale from Igbaria and Chakrabarti (1990). In examining the relationships among the pre-test measures, we found a correlation of $-.87$ between computer anxiety and computer efficacy. As a result of this finding, we combined the two measures into the measure of computer anxiety used in the subsequent analyses. *Openness to experience* was measured using 12 items from the Openness to Experience sub-scale of the NEO-PI (Costa and McCrae, 1992).

Post-Test, Pre-Feedback and Post-Test, Post-Feedback Measures. The following set of questions was asked in both post-test, pre-feedback and post-test, post-feedback questionnaires. Reliabilities are reported in Tables 1 and 2. *Process fairness* was measured using four items adopted from Gilliland (1994). *Perceived job relatedness* was measured using 10 items adopted from Smither *et al.* (1993). Smither *et al.* (1993) discuss perceived job relatedness as comprising two factors, face validity and perceived predictive validity. *Test ease* was measured using three items created by the researcher and two items adopted from Arvey *et al.* (1990) to examine how difficult examinees perceived the test to be (e.g., 'I thought this test was easy'). The modified measure was used due to Arvey *et al.*'s low reliability (.56) for their four-item measure. *Liking* was measured using four items developed by the researchers (e.g., 'I liked taking this type of test').

Post-Test, Pre-Feedback Only Measure. The next questions were asked only on the post-test, pre-feedback questionnaire. *Self-assessed performance* was measured using five items from Brutus and Ryan (1996) (see Table 1 for reliability estimate).

Post-Test, Post-Feedback Only Measures. The last set of questions was only asked on the post-test, post-feedback questionnaire. Reliabilities are reported in Table 2. *Outcome fairness* was measured using four items from Gilliland (1994). *Job acceptance intentions* were measured using two items from Ployhart and Ryan (1997) and two items created by the researchers. Selected participants were asked the likelihood that they would take the job offered to them (i.e., 'I will accept the job') and rejected participants were asked the likelihood that they would take the job if it were now offered to them (i.e., 'Even if I was now offered the job, I would not accept it'). *Recommendation intentions* were measured using four items from Gilliland (1994). An example item is 'I would recommend this project to my friends.' *Purchase intentions* were measured using three items developed by the researchers to understand if participants' attitudes towards the organization are affected by their experience in the selection process ('I would not use this organization's products or services').

Priority Management Exercise. The Priority Management Exercise (PME) is an in-basket exercise designed by Aon Consulting to measure competencies in multi-tasking, time management, adaptability, ability to deal with complexity, and prioritizing tasks. The in-basket requires participants to use policy guidelines in order to route the numerous requests in their in-box. These requests vary in how clearly they match the stated policies for handling different types of requests. For each request there are a number of cues necessary to correctly process the message (e.g., time frame, type of message, routing order, type of routing). Participants must also deal with new requests that arrive during the exercise as well as new messages that change the priority of the requests. Performance on the test consists of the number of cues (e.g., time frame, type of message, routing order, type of routing) that participants complete for the requests. Participants are given a 20-minute introduction to the task and then a 10-minute period to review the policies they will be using. Participants then spend 30 minutes completing the PME.

The computerized version of the test and some paper-and-pencil documents used in the development of the computerized test were made available to us. We developed the paper-and-pencil version of the PME to parallel the computerized version. To ensure that test content and instructions were perceived similarly, we conducted a pilot test in which 12 participants were given both versions of the test. After giving both tests, the administrator asked participants to provide feedback on the content, instructions, and various aspects of the tests that they found to be non-equivalent so adjustments could be made to the tests. After each pilot session, we examined participant suggestions and appropriate changes were made to the content, instructions, and presentation of the stimulus materials in order to make the computer and paper-and-pencil versions as equivalent as possible. To provide support of the equivalence of the computer and paper-and-pencil versions of the test, we ran two one-way ANOVAs on the 202 participants in the current study to assess the influence of mode of administration on test scores and the selection outcome. Results provide support of the versions' equivalence as mode of administration did not influence test scores ($F(1,200) = 3.00$, $p = .09$) or selection outcome ($F(1,200) = .00$, $p = .96$).

RESULTS

Manipulation Check

A two-way ANOVA was conducted to test the effect of the technological level of the job and mode of administration manipulations on participants' perceptions of the amount of technology involved in the job. The results indicated that both the job-type manipulation ($F(1,198) = 7.13$, $p < .05$) and mode of administration manipulation ($F(1,198) = 32.30$, $p < .05$) influenced participants' perceptions of the technological level of the job. Participants viewed the high-tech job as involving more technology than the low-tech job (3.44 vs. 3.17, respectively). Participants taking the computerized test viewed the job as involving more technology than participants taking the paper-and-pencil test (3.57 vs. 3.00, respectively). Though the significance of job-type indicates the manipulation was successful, the significance of the mode of administration manipulation was unexpected. The results indicate that telling participants the type of test they will be taking can influence their perceptions of the type of job for which they are taking the test. Regardless of the participants' test condition, they perceived the job as involving at least a moderate amount of technology.

Motivation Check

A two-way ANOVA was conducted to test the effect of the technological level of the job and mode of administration manipulations on participants' motivation to perform well on the selection test. Results indicated that there was no difference in motivation across conditions and that participants were all highly motivated (Mean = 4.17 on 5 point scale) to perform well on the selection test.

Descriptive Statistics

Means, standard deviations, intercorrelations, and reliabilities of the pre-test and post-test measures are in Table 1 and the post-feedback measures are in Table 2. Overall, the perceptions of liking were slightly below the scale midpoint at post-test, pre-feedback and post-feedback (2.73 and 2.91, respectively). This is not unexpected given that participants also perceived the PME on the more difficult end of the scale at both post-test, pre-feedback and post-feedback (2.73 and 2.68, respectively) and test ease and liking were positive and moderately correlated at post-test, pre-feedback and post-feedback (.46 and .42, respectively).

Hypothesis Tests

To control for the number of tests in Hypotheses 1–7, we used a $p < .01$ criterion for significance. The results for the three hypotheses regarding test-taking individual differences are in Table 1. Hypothesis 1, which stated that test-taking experience would be positively related to post-test perceptions, received weak support as only liking was positively related to test-taking experience ($r = .19$). Hypothesis 2 which stated that test-taking efficacy would be positively related to post-test perceptions received partial support as liking ($r = .20$), face validity ($r = .19$), test ease ($r = .20$), and self-assessed performance ($r = .31$) were positively related to test-taking efficacy. Hypothesis 3, which stated that test-taking anxiety would be negatively related to post-test perceptions, received weak support as only self-assessed performance was negatively related to test-taking anxiety ($r = -.29$).

Table 1 also shows the results for the hypotheses relating the computer-related individual differences to post-test perceptions. For these tests, only the participants who took the computer version are included ($n = 107$). Hypothesis 4, which stated that computer experience would be positively related to post-test perceptions, received differential support across the technical and basic sub-scales. While both technical and basic experience were positively related to liking ($r = .41$ and $r = .36$, respectively), test ease ($r = .37$ and $r = .35$, respectively) and self-assessed performance ($r = .42$ and $r = .47$, respectively), basic experience was also related to process fairness ($r = .28$) and face validity ($r = .37$). Hypothesis 6, which stated that computer anxiety would be negatively related to post-test perceptions, received good support as liking ($r = -.45$), process fairness ($r = -.29$), face validity ($r = -.43$), test ease ($r = -.41$), and self-assessed performance ($r = -.55$) were all negatively and significantly related to computer anxiety. (Note that Hypothesis 5 is subsumed under Hypothesis 6 because of the combination of the computer efficacy and anxiety scales.) Hypothesis 7, which stated that openness to experience would be positively related to post-test perceptions, received weak support as only face validity ($r = .29$) was positively related to openness to experience.

Hypotheses 8a and 8b, which predicted differences in post-test reactions by mode of administration, were tested using a MANOVA. Pillai's trace indicated the main effect of mode of administration was non-significant ($F(4, 197) = 1.58$, $\eta^2 = .031$). Table 3 shows the means and standard deviations for the reactions measures by mode of administration. Tukey HSD post-hoc analyses indicated that the only difference between versions was that the computer version was perceived as easier than the paper-and-pencil version (2.85 vs. 2.59, respectively).

Hypothesis 9, which stated that the perceived technological level of the job would moderate the relationship between mode of administration and perceived job-

Table 1. Descriptive Statistics and Intercorrelations of the Pre-Test and Post-Test Measures

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
1. Test-taking experience	2.48	1.00	(.88)												
2. Test-taking efficacy	3.24	.66	.27	(−.91)											
3. Test-taking anxiety	22.39	4.13	−.09	−.19	(.84)										
4. Computer experience – basic	3.91	.56	.27	.57	−.11	(.74)				.28	.37	.04	.35	.36	.47
5. Computer experience – technical	2.63	.81	.15	.40	−.12	.51	(.79)			.14	.21	.03	.37	.41	.42
6. Computer anxiety	.00	.97	−.21	−.59	.22	−.78	−.52	(.94)		−.29	−.43	−.06	−.41	−.45	−.55
7. Openness to experience	3.63	.48	.18	.22	−.09	.33	.12	−.38	(.74)	.08	.29	−.05	.05	.05	.11
8. Process fairness	3.64	.83	.08	.08	−.12	.23	.14	−.22	.13	(.92)	.21	.55	.13	.38	
9. Face validity	3.88	.60	.08	.19	−.10	.28	.12	−.30	.28	.38	(.83)	.22	.07	.26	
10. Perceived predictive validity	3.04	.79	.04	.10	−.09	.13	.10	−.13	.02	.64	.36	(.88)	.04	.31	
11. Test ease	2.73	.81	.15	.20	−.14	.21	.21	−.25	.00	.27	.11	.10	(.84)	.43	
12. Liking	2.96	.86	.19	.20	−.15	.25	.21	−.28	.02	.41	.30	.36	.46	(.91)	
13. Self-assessed performance	2.94	.64	.03	.31	−.29	.33	.29	−.40	.12	.38	.23	.24	.53	.58	(.77)

Note: N = 202. Correlations below the diagonal which are above $\pm.17$ and $\pm.12$ are significant at $p < .01$ and $p < .05$, respectively. Reliabilities are in the parentheses on the diagonal. Scale range for test-taking anxiety is 16 (low) to 32 (high). Computer anxiety is a standardized composite of computer anxiety and computer efficacy. All other scales range from 1–5. Correlations between the computer-related measures and the post-test reactions for participants in the computer condition are above the diagonal (N = 107; correlations $\pm.28$ and $\pm.21$ are significant at $p < .01$ and $p < .05$, respectively). Correlations between the post-test and post-feedback reaction measures are above the diagonal (correlations $\pm.17$ and $\pm.12$ are significant at $p < .01$ and $p < .05$, respectively). The test-retest reliabilities for these measures are: process fairness (.59), face validity (.51), perceived predictive validity (.67), test ease (.66), and liking (.72).

Table 2. Descriptive Statistics and Intercorrelations of the Post-Feedback Measures

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Process fairness	3.64	.83	(.92)								
2. Outcome fairness	3.62	.69	.76	(.80)							
3. Face validity	3.75	.65	.48	.51	(.85)						
4. Perceived predictive validity	2.96	.73	.58	.52	.40	(.84)					
5. Test ease	2.68	.81	.11	.07	.10	.14	(.84)				
6. Liking	2.91	.90	.43	.35	.40	.39	.42	(.92)			
7. Recommendation intentions	3.31	.92	.49	.44	.44	.39	.20	.70	(.97)		
8. Purchase intentions	3.21	.55	.44	.42	.30	.36	.14	.39	.48	(.80)	
9. Acceptance intentions	3.03	1.00	.20	.22	.13	.20	.17	.43	.36	.31	(.87)

Note: N = 200. Correlations above $\pm.17$ and $\pm.12$ are significant at $p < .01$ and $p < .05$, respectively. Reliabilities are in parenthesis on the diagonal. All scales range from 1–5.

Table 3. Post-Test Reaction Measure Means and SDs by Mode of Administration

Measure	*Computer*		*Paper-and-Pencil*		*F-Value*
	Mean	*SD*	*Mean*	*SD*	
Process fairness	3.66	.78	3.61	.89	.13
Liking	2.98	.89	2.94	.83	.08
Test ease	2.85	.87	2.59	.72	5.29*
Self-assessed performance	2.99	.67	2.87	.60	1.80

*$p < .05$
Note: N = 107 and 95 in the computer and paper-and-pencil conditions, respectively.

relatedness (face validity and perceived predictive validity), was tested using moderated regression. Table 4 shows Hypothesis 9 was not supported as the interaction was non-significant for both face validity and perceived predictive validity. Results indicated that mode of administration was significantly related to perceived predictive validity. Participants taking the computer version of the test perceived it as having higher predictive validity than participants taking the paper-and-pencil version.

A MANOVA was conducted to assess the effect of selection outcome on post-feedback reactions as the set of dependent variables (Hypothesis 10). Pillai's trace indicated the main effect of selection decision was significant ($F(6, 195) = 12.52$, $\eta^2 = .278$). Table 5 shows the means and standard deviations for these measures by the selection decision. Tukey HSD post-hoc analyses indicated that liking, process fairness, outcome fairness, ease, face validity, and perceived predictive validity were more positive for selected participants than rejected participants. Thus, Hypothesis 10, which stated that participants who are not selected for the job would have more negative post-feedback perceptions compared to participants who are selected for the job, was supported.

Hypothesis 11, which stated that job acceptance, recommendation intentions, and purchase intentions would be positively related to post-feedback perceptions, was tested using correlational analyses. To control for the number of tests in Hypothesis 11, we used a $p < .01$ criterion for significance. Table 2 shows that 15 of the 18 relationships were significant and that all 18 correlations were in the expected direction. The magnitude of the significant correlations between the post-feedback reactions and intentions were low to moderate in size: recommendation intentions (Mean r = .44, range .20–.70), purchase intentions (Mean r = .34, range .14–.44), and acceptance intentions (Mean r = .23, range .13–.43).

Additional Analyses

Mode of Administration. In addition to the preceding hypotheses, we were interested in the influence of mode of administration on post-feedback reactions and intentions. To assess the relative influence of mode of administration and selection outcome on intentions, we ran three regressions with mode of administration and selection outcome predicting each intention (i.e., recommendation, purchase, and acceptance). Results indicated that selection outcome was significantly related to recommendation ($b = -.30$), purchase ($b = -.28$), and acceptance ($b = -.35$) intentions, but that mode of administration

Table 4. Moderated Regression of Technology Level of the Job and Mode of Administration

Model	*b*	*B*	R^2	*F*	ΔR^2	ΔR^2F
Face validity						
STEP 1			.01	.78		
Technology Level of the Job	−.43	−.36				
Mode of Administration	−.41	−.35				
STEP 2			.02	1.18	.01	1.96
Technology Level of the Job × Mode of Administration	.24	.43				
Perceived predictive validity						
STEP 1			.02	2.23		
Technology Level of the Job	−.44	−.28				
Mode of Administration	−.70*	−.44				
STEP 2			.03	2.15	.01	1.98
Technology Level of the Job × Mode of Administration	.31	.43				

*$p < .05$

Table 5. Post-Feedback Reaction Means and SDs by Selection Outcome

Measure	*Selected*		*Rejected*		*F-Value*
	Mean	*SD*	*Mean*	*SD*	
Process fairness	3.90	.86	3.47	.77	13.32*
Outcome fairness	3.92	.69	3.42	.63	29.29*
Face validity	3.96	.64	3.62	.63	14.40*
Perceived predictive validity	3.24	.64	2.77	.73	21.76*
Liking	3.35	.78	2.62	.85	38.21*
Test ease	2.99	.86	2.46	.69	23.73*

*$p < .05$
Note: N = 83 for the Selected group and N = 119 for the Rejected group.

did not predict significant variance in any of the intention measures. The results for the selection outcome indicate that selected participants had more positive intentions than rejected participants. Thus, it appears that intentions are due more to the selection outcome than the mode of administration.

We also examined the relative influence of mode of administration versus the selection outcome on post-feedback reactions. We ran a series of regression analyses with mode of administration and selection outcome predicting each post-feedback reaction (liking, process fairness, outcome fairness, test ease, face validity, and perceived predictive validity). Results indicated selection outcome was significantly related to liking ($b = -.40$), process fairness ($b = -.25$), outcome fairness ($b = -.35$), test ease ($b = -.31$), face validity ($b = -.25$), and perceived predictive validity ($b = -.31$). The results indicate that selected participants had more positive post-feedback reactions than rejected participants. Results also indicated that mode of administration did not predict significant variance in any of the post-feedback reactions. These results provide further support that the selection outcome largely determines reactions to the selection process.

Influences on Performance. We examined the influence of the individual difference variables on participants' test performance. We regressed the general individual difference variables (test anxiety, test self-efficacy, test experience) onto test performance and selection outcome in STEP 1 and the computer-related variables (computer anxiety, computer experience – basic and technical) in STEP 2 onto both test performance and selection outcome. We also ran separate sets of regressions for those taking the paper-and-pencil version and those taking the computerized version. We expected that the general test measures would significantly predict test performance and the selection outcome for both groups but the computer related variables would only add to the prediction of these dependent measures in the computer condition.

The results indicated that as a set the general test-taking variables did not predict either test performance or the selection outcome for either condition. Results did indicate significant beta weights for test experience ($b = -.22$) in predicting test performance for the paper-and-pencil condition and test efficacy ($b = .20$) in predicting selection outcome for the computer condition. The results for both test experience and efficacy are not consistent with expectations as more experience with an in-basket test was associated with lower test performance and higher efficacy was associated with not being selected.

As expected, the computer-related variables did not add to the prediction of either test performance or selection outcome for the paper-and-pencil condition, but did significantly add to the prediction of both for the computer condition. While the overall ΔR^2 was significant for both test performance and selection outcome ($\Delta R^2 = .10$ and .12, respectively), only one beta was significant in both regressions (i.e., computer experience – technical for test performance). The beta ($b = .31$) indicates that participants possessing more technical components of computer experience perform better than participants with less technical experience.

Determinants of Reactions. We also examined the incremental validity provided by the computer-related measures in predicting post-test reactions for those taking the computerized version of the in-basket. We examined these relationships by partialling out the general test-taking individual difference measures (i.e., test-taking experience, test anxiety, test self-efficacy). For each computer-related measure (computer anxiety, computer experience – basic and technical), we entered the general test-taking measures in STEP 1 and the computer-related measure in STEP 2. Results indicated that after controlling for the general test-taking measures, computer anxiety produced a significant ΔR^2 for process fairness ($\Delta R^2 = .04$, beta $= -.24$), face validity ($\Delta R^2 = .11$, beta $= -.40$), test ease ($\Delta R^2 = .03$, beta $= -.22$), liking ($\Delta R^2 = .09$, beta $= -.36$) and self-assessed performance ($\Delta R^2 = .12$, beta $= -.42$). Results indicated that after controlling for the general test-taking measures, computer experience–basic produced a significant ΔR^2 for process fairness ($\Delta R^2 = .04$, beta $= .23$), face validity ($\Delta R^2 = .06$, beta $= .30$), liking ($\Delta R^2 = .03$, beta $= -.21$, $p = .06$) and self-assessed performance ($\Delta R^2 = .07$, beta $= .32$). Finally, after controlling for the general test-taking measures, computer experience – technical produced a significant ΔR^2 for test ease ($\Delta R^2 = .04$, beta $= .22$), liking ($\Delta R^2 = .08$, beta $= .30$), and self-assessed performance ($\Delta R^2 = .08$, beta $= .30$). Thus, after controlling for the general test-taking measures, the computer-related measures add significantly in predicting post-test reactions.

Discussion

The results of the study suggest that implementing computerized selection tools will likely proceed without major negative effects on people's reactions, but there are factors that practitioners and researchers should consider. We will begin the discussion by first addressing the role that individual differences had in influencing participants' reactions and the outcomes associated with those reactions. Next, we describe the effects of our manipulations of mode, technological level of the job, and selection outcome. We then note limitations of the current study. We conclude the paper by providing future research directions and suggestions for implementing computerized testing in a selection context.

Individual Differences

Results for the individual difference measures suggest a number of important points to consider. First, test-taking efficacy, basic and technical computer experience, and computer anxiety influenced perceptions of the selection process. Second, the computer-related measures provided incremental validity in predicting reactions after accounting for general test-taking measures and test ease. When assessing reactions to computerized testing, researchers should assess computerized testing experience and attitudes. For practitioners, these findings are important as they suggest an additional set of factors that they should consider when implementing a computer versus a paper-and-pencil test. In particular, while many tests involve lengthy tutorials designed to 'equalize' experience before testing, comfort and experience with computing beyond what can be provided in a short training session may affect how successfully one executes the test. Given demographic differences in computer exposure (Ebo, 1998; Robinson, 1998), this may cause adverse impact concerns with computerized tests.

The results also indicated that test-taking experience did not significantly relate to post-test perceptions. Similar to the current study, past studies have examined test-taking experience by using measures of the amount of experience, not the types of experiences that test takers have had (Kravitz *et al.*, 1994; Barbera *et al.*, 1995; Ryan *et al.*, 1996; Truxillo *et al.*, 2001). Conceptually, individuals' test-taking experiences may be both positive and negative. Thus, to the degree that people's test-taking experiences are mixed (i.e., both positive and negative), their amount of experience may not influence their perceptions of the test. A clearer measure of test-taking experience would be one that assesses both amount and valence of exposure to a test type.

Neither performance on the in-basket test nor the selection outcome was predicted by measures such as test anxiety, test efficacy, and test experience that have been shown to affect test performance (Hembree, 1988; Sadri and Robertson, 1993). Most of the research on test taking attitudes has been with cognitive ability tests, which are ones for which test-takers have evaluation histories and thus know their likely performance. The in-basket would not only be less familiar, but individuals may be less able to accurately self-assess performance and/or to generalize performance expectations across in-basket tests.

The computer-related measures significantly predicted both performance and selection outcome after accounting for the general individual difference measures. These results are consistent with the suggestion that differences in experience and anxiety related to computers may handicap the performance of test takers (Karsten and Roth, 1998; Shermis and Lombard, 1998). We need to better understand how these computer-related individual differences develop and how to change them. Tests involving computers may not be intended to measure differences in experience but the test may be unknowingly selecting applicants based on experience. Organizations should be prepared to either provide the type of familiarization needed to eliminate these differences or eliminate these biases from the selection test. Alternatively, a third variable such as cognitive ability may be contributing to performance, computer anxiety, and computing experience and may be the cause of the observed relations.

Mode of Administration

Contrary to previous research, mode of administration did not have an effect on participants' post-test reactions except for perceptions of test ease. Previous studies assessed these relationships using different types of tests: computer adaptive cognitive ability tests (Arvey *et al.*, 1990; Daum, 1994; Landis *et al.*, 1998), situational judgment tests (Chan and Schmitt, 1997), interview (Martin and Nagao, 1989), computerized multiple-choice exams (Ogilvie *et al.*, 1999), and a computerized conflict resolution skills assessment (Richman-Hirsch *et al.*, 2000). Perhaps in-baskets are uncommon enough as selection tools that they are perceived the same regardless of mode of administration. Also, this particular in-basket may be more difficult than the tools examined in other studies. One other explanation is that computerization of tests is no longer a novelty, with many individuals exposed to computerized tests in academic and employment settings.

Technological Level of the Job

Technological level of the job did not moderate the relationship between mode of administration and perceptions of job relatedness. Previous research strongly supports the notion that perceptions of job relatedness should be affected by the match between the selection test and job for which an applicant is applying (Martin and Nagao, 1989; Murphy, Thornton and Prue, 1991; Murphy, Thornton and Reynolds, 1990; Kravitz *et al.*, 1994). The manipulation did lead participants to view the high-tech job as involving more technology than the low-tech job; however, both jobs were rated as having higher than average levels of technology. Participants taking the computerized version viewed the job as involving more technology than participants taking the paper-and-pencil version. Thus, participants attended to differences in the job descriptions that were given in the instructions, but also gathered information about the job from the mode of administration in which the test was to be given. Although this outcome resulted in a less pure manipulation, it does provide a useful insight into how test-takers' perceptions of job relatedness may be formed. To the degree that people have limited information about the requirements of the job to which they are applying, they may look to aspects of the selection system to understand what the job may involve.

Selection Outcome

As expected, the selection decision had a significant impact on most of the post-test reaction variables. This result is consistent with previous research that indicates a 'self-serving bias' (Chan *et al.*, 1998; Horvath *et al.*, 2000; Ployhart and Ryan, 1997). Participants who are selected like to think the test was fair, valid, etc. which helps to maintain their self-image. In order to also maintain their self-image, participants who are not selected reflect negatively on the selection test, which diverts blame for the outcome outside of themselves. Studying perceptions of computerized tests without considering test outcome, as has been typically done, may be very misleading.

Limitations

The current study has some limitations that should be noted. First, a simulated selection setting was used. The lab setting allowed us to address many more questions of interest than practical constraints would allow in the field, provided greater control, and enabled random assignment to mode of administration. Ethically, it would be difficult to argue for giving one set of actual applicants a test administered in a way that we anticipated would affect their performance, and to treat another set of applicants differently, thereby affecting their chances of obtaining a job. We attempted to insure that participants would be highly motivated to perform well on the in-basket test by using an incentive and our motivation check indicates that was successful. Second, the manipulation of the technical level of the job was tainted by a main effect of mode of administration. This may be unavoidable and does shed light on how participants may form perceptions of the job relatedness of a selection system. Third, the sample consisted of college students who indicated a relatively substantial amount of basic computer experience (Mean = 3.9 on a 5 point scale). In addition, the sample was young, female, and White. As age, gender and education have been shown to influence attitudes towards computers (Comber *et al*., 1997; Igbaria and Chakrabarti, 1990; Pope-Davis and Twing, 1991; Torkzadeh and Angulo, 1992), we may find stronger or different effects in a more diverse sample.

Future Directions

In reviewing the literature on reactions to computerized testing, our conclusion is that much of the research may be outdated. For example, Dyck, Gee and Smither (1997) explored the changes in a measure of computer anxiety that was originally developed in the late 1980s. They found that the factor structure changed over time for both younger and older adults and that there were age differences in the factor loadings of items. As changes in technology will likely not slow down, researchers should be prepared to make sure the measures being used accurately capture how people view technology and their interactions with it.

The current study suggests some issues that researchers and practitioners should attend to when implementing new types of selection tools. First, designers need to consider the impact that individual differences may have on applicants' perceptions of the selection test as well as their performance. We need a better understanding of which individual differences can be changed through simple interventions (e.g., self-efficacy). Second, the costs and benefits of the new types of selection tools should be weighed carefully before implementation. Without considering issues such as test-taker perceptions, organizations may design and implement costly selection tools that have unintended effects on who is selected.

Acknowledgements

We would like to thank Amy Mills, Neal Schmitt, and Kevin Ford for their help on various parts of this project.

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