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Ninety-nine Korean workers completed two foreign language proficiency interviews. One was delivered telephonically by a live interviewer and the other was delivered by an embodied agent over the Internet. Examinees preferred the person-to-person interview. Satisfaction with the interviewer and embodied agent predicted reactions to the person-to-person and computer-administered interviews, respectively.

Factors, such as globalization, world politics, and military events have increased the need for foreign language skills in business, governmental, and military organizations. Speaking is often the most commonly required language skill in these organizations. Unfulfilled foreign language skill requirements have led to an escalating demand for hiring language-qualified individuals and a corresponding increase in language training and testing.

Typically, speaking proficiency is assessed via an interviewer-based protocol that requires scheduling a face-to-face or telephonic oral proficiency interview between two individuals. An oral proficiency interview is a semi-structured, 15-30 minute conversation between one or more trained interviewers and an examinee. It is designed to push examinees to the limits of their spoken competence, thereby eliciting a profile of oral proficiency (Halleck, 1995; Malone, 2003). It follows an established protocol and tends to be more like a formal interview than a natural conversation (Johnson, 2001, as cited in Malone, 2003). The interviews are recorded. At least two certified raters, one of whom typically serves as an interviewer during the exam, use scoring guidelines to independently evaluate the examinee's performance.

Increased needs to measure speaking proficiency could create a testing capacity issue because of logistical constraints. As the demand for speaking proficiency testing explodes, scheduling and conducting oral proficiency interviews with human interviewers will need to be supplemented with new methods to meet the future testing requirements of business, government, and military organizations. In anticipation of the need to supplement existing testing capacity created by increased demand, the American

Council on the Teaching of Foreign Languages (ACTFL) developed an Internet-delivered, semi-direct version of its ACTFL OPI® (hereafter referred to as the OPI) assessment of spoken proficiency. The Internet-based assessment of speaking proficiency is called the ACTFL OPIc® (hereafter referred to as the OPIc) with the "c" representing the computerized nature of the assessment. The OPIc was designed to be an internationally used semi-direct test of spoken English proficiency which elicits a sample of speech via computer-delivered prompts. It was created for a variety of purposes: placement into instructional programs, screening or placement for hiring purposes, demonstration of an individual's linguistic progress, and evidence of program effectiveness.

The OPIc uses an Internet-based "embodied agent" to elicit and collect a ratable sample of speech, eliminating the need for a live interviewer and allowing the sample to be scored by certified raters located anywhere in the world. The speech sample is digitally saved and evaluated later by certified OPIc raters. Early studies suggest that ratings assigned to OPIc samples generally correlate with official OPI ratings (Surface, Poncheri, & Bhavsar, 2006).

While initial work shows the OPIc to have acceptable levels of validity and reliability (Surface et al., 2006), users' attitudes about the computerized assessment have not been thoroughly researched. The purpose of the present study is to investigate examinees' affective reactions to the non-interpersonal, computer-administered OPIc described above. These reactions are compared to examinees' assessments of a traditional, person-to-person OPI administered over the telephone. The influences of interviewer and user interface issues on reactions to the OPI and OPIc are also examined.

Examinees' Reactions to Technology-Based Assessments

The transition to a computerized assessment of oral foreign language proficiency is consistent with the broader trend toward a growing reliance on technology in assessment and selection. Various forms of technology are entering the testing scene. Notable examples include computer-based testing procedures, video-based situational judgment tests, and virtual reality (Anderson, 2003). Although new assessment procedures such as these qualify as technological innovations, there has been an unfortunate disconnect between the assessment and innovation literatures, even though "advances in understanding of technical innovation processes in organizations could usefully have been applied to the introduction, adoption, and adoption of new technology in employee ... selection" (Anderson, 2003, p. 122). Notably, there is a danger of adopting a "pro-innovation bias" (King & Anderson, 2002), which entails an untested assumption that new technology solutions are inevitably better than the more traditional methods upon which they are based. At the same time, there is a paucity of research examining whether highly advanced technological forms of assessing individuals work better than traditional modes of delivery (Anderson, 2003). It has been noted that "the research base is struggling to keep pace with the speed with which Internet-based testing is being adopted by organizations internationally (Lievens & Harris, 2003)" (Anderson, 2003, p. 125). The present study helps address these research needs by taking an objective look at examinees' reactions to the OPIc.

Test takers' reactions to assessment procedures are important. As such, this topic has received a great deal of attention in the domain of personnel selection, where research has supported a strong theoretical link between test takers' reactions to selection procedures and justice perceptions. Procedural justice involves the perceived fairness of the methods used to make organizational decisions (Folger & Greenberg, 1985). According to Gilliland's (1993) organizational justice model, several rules comprise procedural justice. Among them are the formal characteristics of a selection system, which include the "chance to perform" via the

assessment methods utilized. As Bauer et al. (2001) point out, applicant reactions research has tended to support Gilliland's justice model, with reactions relating to outcomes such as intentions to pursue employment with an organization, recommending others to apply, and perceived organizational attractiveness. Perceived justice violations may also lead to lawsuits and negative feelings (Goldman, 2001; Seymour, 1988). Clearly, what examinees think of an assessment procedure matters. Technological innovation and its relation to test takers' reactions to assessment procedures is an important area of research which undoubtedly warrants empirical attention (Bauer, Truxillo, Paronto, & Weekley, 2004).

Bauer and colleagues investigated examinees' reactions to technology in their 2004 study comparing test takers' reactions to face-to-face interview screenings, telephone interview screenings, and interactive voice response (IVR) screenings. IVR screenings allow examinees to self-administer an interview (e.g., by pressing "1" for yes and "0" for no) in the absence of a live tester. The authors noted several advantages and disadvantages associated with IVR. Advantages involved convenience (i.e., the interview can occur at any time of day), accuracy (i.e., removing a live interviewer from the loop may decrease interviewer biases), and cost effectiveness (i.e., many examinees can be screened at once). These advantages largely amount to benefits for the organization without taking examinees' attitudes and justice perceptions into account. Among the potential disadvantages noted by Bauer et al. (2004) were the lack of personal interaction and examinees' inability to ask questions and / or request clarification during the IVR screening interview. In the end, these disadvantages appeared to affect test takers' perceptions. The results of Bauer et al.'s (2004) study showed that examinees' reactions to the IVR assessment procedure were relatively negative. The authors concluded that "IVR is a 'non-interpersonal' screening method so it was not surprising that it was rated lower in terms of procedural justice factors" (Bauer et al., 2004, p. 135).

Comparing Reactions to OPI versus OPIc Assessments

Like IVR interviews, OPIc assessments are non-interpersonal. As such, they may be characterized by advantages and disadvantages which are similar to the benefits and drawbacks of IVR interviews. For example, oral proficiency interviews can be administered efficiently, yet examinees might still prefer a live interviewer to an embodied agent. One reason for this involves the fact that human-to-human interviews may provide the chance to request clarification on questions, thereby potentially minimizing confusion during the assessment. The ability to explicitly or even implicitly seek clarification from a live interviewer may allow examinees to feel that they can control and correct their own performance on the fly (Silvester, Anderson, Haddleton, Cunningham-Snell, & Gibb, 2000). Overall, a lack of variety in computerized prompts or the inaccessibility of clarifying statements during a computerized interview could cause examinees to prefer a more adaptable in-person interviewer (Link, Armsby, & Hubal, 2006).

Examinees may also prefer a live interviewer because of the social cues inherent in the human-to-human interview format, which allow the examinee to receive paraverbal performance feedback during the interview. The embodied agent directing an OPIc does not provide paraverbal information to the examinee, thereby removing a potentially desirable component from the interview process.

In sum, there are reasons to believe that a lack of flexibility and paraverbal feedback can be frustrating during an interview. For this reason, the literature suggests that examinees' will react most favorably to OPI assessments that involve a live interviewer. This prediction will be tested.

Hypothesis 1: Examinees will prefer a person-to-person oral proficiency interview over a computer-administered oral proficiency interview.

The Influence of Embodied Agents on User Reactions to the OPIc

Just as an interviewer likely influences examinees' reactions to person-to-person assessments, user interface is a key issue in designing and delivering computer-based exams. The "look and feel" of an exam interface is of interest to test developers because interface problems are likely to dampen reactions to computer-based assessment procedures. To this end, it should be noted that computer users have a tendency to anthropomorphize (i.e., assign human characteristics and traits to) computers. The use of an embodied agent could amplify this tendency and lead people to somehow expect social responses from the computer despite knowing that this expectation is unwarranted (Nass & Moon, 2000). Indeed, social expectations rooted in human-to-human interaction may influence examinees' evaluations of an embodied agent, which cannot possibly meet the standards to which we hold person-to-person conversations (Isbister & Nass, 2000).

Meanwhile, an OPIc embodied agent might unintentionally present an examinee with information in a computer environment that "may take on different social meaning than in everyday life" (Slater, Sadagic, Usoh, & Schroeder, 2000, p. 47). If the examinee perceives cues in the embodied agent that are inconsistent with the cues the examinee is giving to the embodied agent, this can lead to disliking of the embodied agent (Isbister & Nass, 2000). User frustration may also be caused by a lack of relevant affective interpretation and response on the part of the embodied agent.

In short, the human-computer interaction literature suggests reasons why embodied agents often fail to meet examinees' expectations during the administration of a computer-based assessment. From the standpoint of user reactions to assessment procedures, the influences of these unmet expectations are likely to parallel the effects of negative interactions with a live tester encountered during a person-to-person interview. This possibility will be tested.

Hypothesis 2a: Examinees' satisfaction with an interviewer will predict their reactions to a person-to-person oral proficiency interview.

Hypothesis 2b: Examinees' satisfaction with an embodied agent will predict their reactions to a computer-administered oral proficiency interview.

Method

Participants

For the purpose of this study, Language Testing International (LTI) provided a random sample of non-native English speakers who resembled a typical language testing population in terms of key demographics (e.g., gender, age, education, job, etc.). Ninety-nine people were selected from the workforce at a company in Korea to complete OPI and OPIc examinations of English speaking proficiency. This group consisted of 37 men (37.4%), 61 women (61.6%), and 1 person who did not report his or her gender. The participants' ages ranged from 22 to 39 with an average age of 29 (SD = 3.69). The majority of these individuals (82.8%) were university graduates, while 3.0% had graduated from high school without attending college and 14.1% held graduate degrees. In terms of work experience, 64.6% of the participants had worked in their current job for 1-5 years. A total of 36.4% served in a supervisory role in their current job.

Most participants indicated that they had never taken part in a telephonic job interview (82.8%) or taken a test via the telephone (90.9%). Overall, the sample was quite computer savvy, with approximately 7.1% of the participants reporting that they had been using computers for 1-5 years, while 57.6%

had been using computers for 6-10 years and 31.3% had been using computers for 11-20 years. A majority of respondents had experience applying for a job on the Internet (89.9%) and had taken an online course (91.9%). Approximately 64.6% of participants had taken a language course online and 59.6% had taken a test on the Internet.

Almost all participants indicated that they were required to use the Internet as part of their jobs (96.0%) and that they used online messaging (99.0%). A majority of participants (73.7%) reported that they used the Internet for more than five hours at work in a typical day. They used the Internet at home less frequently than at work with 48.5% indicating less than one hour per day of home Internet usage and 37.4% reporting home Internet usage between one and two hours in a typical day.

English training/education and previous experience with English testing were also recorded. Most participants reported that they first began studying English in primary school (39.4%) or middle school (56.6%). There was some variability in terms of the number of English courses that individuals had taken either at school or through private institutes. Most participants (66.7%) indicated taking between one and three courses, although 13.1% had taken between four and six courses and 10.1% reported that they had taken ten or more courses. In terms of experience with English testing, most participants had never taken an oral proficiency interview (96.0%). However, a majority (66.7%) had taken the Test of English as a Foreign Language (TOEFL) or the Test of English for International Communication (TOEIC).

Design and Procedure

Prior to completing their first oral proficiency interview for this study, all participants filled out a pre-assessment survey which included demographic and background questions. Participants then completed both a telephonic OPI and an OPIc. The order of the two oral proficiency assessments was counterbalanced such that participants were randomly assigned to one of two groups: OPIc first, OPI second, (N = 48) or OPI first, OPIc second (N = 51). The second round of testing was scheduled to begin 24-48 hours after the completion of the first round of testing. Approximately 24 hours after the second round of testing, all participants were asked to complete a post-assessment survey measuring reactions to the two test formats.

Measured Variables

Unless otherwise noted, participants were asked to use a 1 (*strongly disagree*) to 5 (*strongly agree*) scale to rate the various questionnaire items included in this study. Affective reactions to the OPIc were assessed via 3 items (alpha = .91). An example item is "I would recommend taking an OPIc to a friend who needs their speaking proficiency assessed."

Affective reactions to the OPI were measured with three parallel items (alpha = .94), which mirrored the OPIc items exactly (e.g., "I would recommend taking an OPI to a friend who needs their speaking proficiency assessed"). Prior to rating these items, examinees were instructed to "read the following items related to taking the OPI (speaking test taken via telephone) and choose the appropriate response."

Participants were also asked to read 7 items "related to taking the OPI (speaking test taken via telephone) as compared to taking the OPIc (speaking test taken on the computer) and choose the appropriate response." Responses to these items were not aggregated but were analyzed at the item level for descriptive purposes. Table 1 lists the first six items, which were accompanied by the 1-5 disagree-agree scale described above. The final item was presented as follows: "In which format (OPI/OPIc) did you feel you were able to demonstrate your best speaking proficiency?" A 3-point scale appeared alongside this item: 1 = OPI; 2 = OPIc; 3 = Both equally.

Satisfaction with the embodied agent was measured via 4 items (alpha = .85). An example item is "I liked the 'look and feel' of

Ava the Avatar." Four different items (alpha = .76) were used to assess satisfaction with the live interviewer (e.g., "The interviewer was friendly and polite.").

Results

The testing order was counterbalanced to ensure practice and fatigue would not be confounded with modality effects. Prior to testing our hypotheses, analyses were conducted to determine whether the order in which examinees took the two tests affected the variables of interest. No significant results were found, confirming that the testing order did not affect affective reactions to the OPIc, affective reactions to the OPI, satisfaction with the embodied agent, and satisfaction with the interviewer.

Hypothesis 1 predicted that examinees would prefer a person-to-person OPI over the OPIc. The results of a paired samples t-test showed that reactions to the OPI (M = 3.73, SD = 0.80) were more favorable than reactions to the OPIc (M = 3.28, SD = 0.81), and this difference was significant, t (62) = 4.20, $p <$ .001). Therefore, hypothesis 1 was supported. Additional information regarding examinees' evaluations of the two test formats is provided via the descriptive, item-level data presented in Table 1. Overall 11-23% of the sample responded in favor of the OPIc when asked to directly compare the two interview formats. Meanwhile, 32-73% of the sample favored the OPI, depending on the nature of the comparison being made. A visual examination of the average ratings shown in Table 1 also suggests that the OPI was evaluated more favorably than the OPIc. When asked "In which format (OPI/OPIc) did you feel you were able to demonstrate your best speaking proficiency?" 69% of the respondents indicated that the OPI provided the best opportunity to perform, 10% reported that the OPIc offered a superior chance to perform, and the remaining 21% felt the two interview formats provided equivalent opportunities to demonstrate one's best speaking proficiency.

Hypothesis 2a stated that examinees' satisfaction with the interviewer would predict their reactions to the OPI. As shown in Table 2, a significant correlation between these two variables supported this prediction. In support of Hypothesis 2b, examinees' satisfaction with the embodied agent significantly predicted their reactions to the OPIc (see Table 2).

Discussion

Today's work world is marked by an increasing need for foreign language skills. Typically, person-to-person oral proficiency interviews are used to assess speaking proficiency. Staffing interviewers and scheduling interviews is a resource-intensive process, prompting a search for more efficient alternatives to the real-time interview. This study investigated how oral proficiency examinees react when humans are removed from the interview loop altogether. In support of the research hypotheses, the results showed that test takers preferred the person-to-person interview to its internet-based alternative. Just as satisfaction with the interviewer predicted reactions to the person-to-person exam, satisfaction with the embodied agent forecasted affective reactions to the computer-administered interview.

Limitations and Future Research

While test takers' attitudes toward assessment techniques have received empirical attention during the past few years, the research literature has been criticized for an over reliance on students as surrogates in studies examining reactions to new selection technologies (Anderson, 2003). The present study took care to select workers typical of the population of interest. Even so, the issue of external validity remains. The degree to which our results generalize to non-Korean examinees is unclear. Future research should seek to replicate these findings cross culturally.

Our first prediction regarding reactions to the two test formats was based on a sound experimental design, which included

counterbalancing. However, the limitations of the correlational methodology used to test our second set of hypotheses should be noted. As with similar correlational research in the published literature, it is impossible to conclusively determine the causal direction of our results. Future research employing an experimental design would be useful, to confirm the effects that satisfaction with an interviewer/embodied agent have on affective reactions to an in-person/computer-administered interview.

As this is an early initiative breaking new ground in a rapidly developing area, there are many other fruitful directions for future research related to this investigation. For example, follow-on work might examine variables (e.g., experience) which lead to more favorable evaluations of computer-administered interviews. Other studies could move beyond reactions and look at issues of adverse impact on examinees tested via person-to-person versus computer-delivered interview formats. Finally, it would also be informative to examine whether the findings in this study generalize beyond language proficiency interviews and apply to employment interviews and other assessments as well.

Conclusion

The potential benefits of computer-administered interviews (e.g., convenience, cost-effectiveness) should not be ignored, especially in light of the escalating demands for hiring language-qualified individuals in today's world of work. Ideally, the results of this research can be used to enhance the quality of Internet-delivered tests. For example, this study suggests that improving the user interface of a computer-delivered interview may prove beneficial from the standpoint of users' reactions to the examination. Follow-on work identifying the reasons why people tend to prefer in-person to computer-administered interviews can further inform advancements in the theory and practice of Internet testing.

References

Anderson, N. (2003) Applicant and recruiter reactions to new technology in selection: A critical review and agenda for future research. *International Journal of Selection and Assessment, 11*, 121–136.

Bauer, T. N., Truxillo, D. M., Paronto, M. E., & Weekley, J. A. (2004). Applicant reactions to different selection technology: Face-to-face, interactive voice response, and computer-assisted telephone screening interviews. *International Journal of Selection and Assessment, 12*, 135-148

Bauer, T. N., Truxillo, D. M., Sanchez, R. J., Craig, J. M., Ferrara, P., and Campion, M. A. (2001) Applicant reactions to selections: Development of the Selection Procedural Justice Scale (SPJS). *Personnel Psychology, 54*, 387-419.

Folger R., & Greenberg J. (1985). Procedural justice: An interpretive analysis of personnel systems. In K. Rowland and G. R. Ferris (Eds.), *Research in personnel and human resources management* (Vol. 3, pp. 141-183). Greenwich, CT: JAI Press.

Gilliland, S. W. (1993) The perceived fairness of selection systems: An organizational justice perspective. *Academy of Management Review, 18*, 694–734.

Goldman, B. M. (2001) Toward an understanding of employment discrimination claiming: An integration of organizational justice and social information processing theories. *Personnel Psychology, 54*, 361–386.

Halleck, G. B. (1995). Assessing oral proficiency: A comparison of holistic and objective measures. *The Modern Language Journal, 79*, 223-234.

Isbister, K., & Nass, C. (2000). Consistency of personality in interactive characters: Verbal cues, non-verbal cues, and user characteristics. *International Journal of Human-Computer Studies, 53*, 251-267.

Johnson, M. (2001). *The art of non-conversation: A reexamination of the validity of the oral proficiency interview*. New Haven, CT: Yale University Press.

King, N., & Anderson, N. (2002). *Managing innovation and change: A critical guide for organizations.* London: Thompson.

Lievens, F., & Harris, M. M. (2003). Research on Internet recruitment and testing: Current status and future directions. In C. L. Cooper and I. T. Robertson (Eds.), *International Review of Industrial and Organizational Psychology.* Chichester: John Wiley & Sons Ltd.

Link, M. W., Armsby, P. P., & Hubal, R. C. (2006). Accessibility and acceptance of responsive virtual human technology as a survey interviewer training tool. *Computers in Human Behavior, 22*, 412-426.

Malone, M. E. (2003). Research on the oral proficiency interview: Analysis, synthesis, and future directions. *Foreign Language Annals, 36*, 491-497.

Nass, C., & Moon, Y. (2000). Machines and mindlessness: Social responses to computers. *Journal of Social Issues, 56*, 81-103.

Seymour, R. T. (1988) Why plaintiffs' counsel challenge tests, and how they can successfully challenge the theory of ''validity generalization.'' *Journal of Vocational Behavior, 33*, 331–364.

Silvester, J., Anderson, N., Haddleton, E., Cunningham-Snell, N., & Gibb, A. (2000). A cross-modal comparison of telephone

and face-to-face selection interviews in graduate recruitment. *International Journal of Selection and Assessment, 8*, 16-21.

Slater, M., Sadagic, A., Usoh, M., & Schroeder, R. (2000). Small-group behavior in a virtual and real environment. *Presence, 9*, 37-51.

Surface, E. A., Poncheri, R. M., & Bhavsar, K. S. (2006, March). *Investigating the reliability and validity of the English ACTFL OPIc® with a sample of Korean employees: The ACTFL OPIc® validation study technical report*. Raleigh, NC: Surface, Ward, & Associates.

Table 1

Examinees' Direct Evaluations of the OPIc Relative to the OPI

Item	% Favorable to OPIc	% Neutral	% Favorable to OPI	*M*	*SD*
I thought it was more difficult to demonstrate my speaking proficiency via the computer (OPIc) than with a live interviewer over the telephone (OPI).	21%	19%	60%	3.44	1.08
I preferred the testing format with a live interviewer than with the Avatar.	11%	16%	73%	3.74	0.94
It was easier to understand questions from a live interviewer than from the Avatar.	19%	34%	47%	3.32	0.95
The OPIc was more user friendly than the OPI.	18%	31%	52%	2.63	0.98
The OPIc provided a better opportunity for me to demonstrate my speaking proficiency.	23%	45%	32%	2.85	0.94
I felt more comfortable recording my answers on the computer than providing answers to a live interviewer.	19%	34%	47%	2.66	0.97

Notes. The original 5-point scale was collapsed into three categories: 1-2 (*Disagree*); 3 (*Neutral*); and 4-5 (*Agree*) for the purpose of computing the percent of examinees who responded in favor of the OPI versus the OPIc for each item. Means and standard deviations reported above are based on the full scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*).

Table 2

Correlations between Affective Reactions and Satisfaction with the Interviewer/Embodied Agent

	1	2	3	4
1. Satisfaction with embodied agent	--			
2. Satisfaction with interviewer	-.02	--		
3. Affective reactions to OPIc	.48**	.18	--	
4. Affective reactions to OPI	.12	.63**	.44**	--

**$p<.01$

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ABOUT SWA CONSULTING INC.

SWA Consulting Inc. (formerly Surface, Ward, and Associates) provides analytics and evidence-based solutions for clients using the principles and methods of industrial/organizational (I/O) psychology. Since 1997, SWA has advised and assisted corporate, non-profit and governmental clients on:

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- Performance measurement and management
- Organizational effectiveness
- Test development and validation
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- Work/job analysis
- Needs assessment
- Selection system design
- Study and analysis related to human capital issues
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- Advanced data analysis

One specific practice area is analytics, research, and consulting on foreign language and culture in work contexts. In this area, SWA has conducted numerous projects, including language assessment validation and psychometric research; evaluations of language training, training tools, and job aids; language and culture focused needs assessments and job analysis; and advanced analysis of language research data.

Based in Raleigh, NC, and led by Drs. Eric A. Surface and Stephen J. Ward, SWA now employs close to twenty I/O professionals at the masters and PhD levels. SWA professionals are committed to providing clients the best data and analysis with which to make solid data-driven decisions. Taking a scientist-practitioner perspective, SWA professionals conduct model-based, evidence-driven research and consulting to provide the best answers and solutions to enhance our clients' mission and business objectives. SWA has competencies in measurement, data collection, analytics, data modeling, systematic reviews, validation, and evaluation.

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