Experiential Profiles:
An Instrument For Assessing The Efficacy Of Surrogates For IS Roles

William D. Burg, (Email: burg@uab.edu), University of Alabama at Birmingham
Tommie W. Singleton, (Email: tsingleton@uab.edu), University of Alabama at Birmingham

ABSTRACT

Given both the need for IS professionals as experimental subjects in behavioral research and their limited availability, IS research would be served by determining a way to assess the efficacy of surrogates for IS professionals so that surrogates could be used where appropriate. Because a single monolithic 'IS professional' does not exist, and comparisons of experiential differences must account for how experience shapes a professional's way of seeing and evaluating the world, the authors identified an instrument for comparing the experiential profile of CIOs to surrogates. The authors validated the instrument using a group shown in the literature to possess a significantly different experiential profile from CIOs.

INTRODUCTION

*T*he efficacy of the use of surrogates for business professionals represents a controversial issue in behavioral research. A number of research studies have questioned the external validity of reported results on the basis that surrogates fail to adequately represent business professionals (Copeland, et al., 1973; Gordon, et al., 1986; Hughes and Gibson, 1991; Robinson, et al., 1991). Specifically, these researchers argue that social differences such as age, wealth, gender, education, and experience, make surrogates an unreliable substitute for business professionals in behavioral research settings where the experimental task is replete with social content (Berkowitz and Donnerstein, 1982; Gordon, et al., 1986).

In light of these results, researchers in management, accounting, and information systems (IS) have sought to control for social differences by empirically testing the adequacy of surrogates for business professionals. By testing surrogates' decision-making skills, these researchers have sought to determine the experimental settings in which surrogates for business professionals perform adequately (Ashton and Kramer, 1980; Gordon, et al., 1986; Hughes and Gibson, 1991; Houghton and Hronsky, 1993; Briggs, et al., 1995). These studies indicate that surrogates perform poorly when asked to make complex decisions in circumstances where they have no real-world experience (e.g., making decisions that affect audit risk) (Houghton and Hronsky, 1993); however, surrogates perform well when asked to evaluate new technologies in which their experience matched or exceeded those of the business professionals (Briggs, et al., 1995).

Based upon these findings and the need for experimental subjects in IS behavioral research settings, IS researchers must either 1) abandon the use of surrogates for IS professionals altogether, or 2) find a way to determine when a specific group would be an adequate surrogate for IS professionals' in behavioral research settings. Because IS professionals are typically very busy, highly-paid individuals who are not readily available as subjects for research studies, adoption of the first alternative would severely limit the ability of IS researchers to conduct behavioral research studies. Instead, IS research would be better served by the adoption of the second alternative which requires determining a way to assess differences in experience between surrogates and IS professionals so that surrogates could still be used where appropriate.

In assessing differences in experience, one might think that experiential differences can be controlled for by simply comparing the number of years of experience of surrogates against the number of years of experience of IS professionals. However, as the literature on the efficacy of surrogates for business professionals has shown, experiential differences can not be accounted for by simply considering years of experience (Ashton and Kramer, 1980; Gordon, et al., 1986; Hughes and Gibson, 1991; Houghton and Hronsky, 1993; Briggs, et al., 1995). Instead, comparisons of experiential differences must account for how experience shapes business professionals' ways of seeing and evaluating the world (e.g. their experiential profile) as compared to surrogates.

Given the complexity of the IS function in large business organizations, one also must realize that a single monolithic 'IS professional' does not exist. Rather, a distinct set of roles, each with its own set of experiences (i.e. CIO, Project Manager, Business Analysis, Programmer, System Administrator, etc.), has evolved to support the IS function. In order to properly compare experiential differences, one must actually compare the experience of surrogates to a specific IS role's experience. As a starting point for developing an experiential profile for each IS role, the authors selected the role of CIO.

METHODOLOGY

As a first step towards identifying an instrument for assessing surrogates' experiential profiles against CIOs' experiential profiles, the authors reviewed the IS literature to determine how CIOs view and evaluate the IS function. In the IS literature, research into the role of the CIO often focuses on the issues faced by the CIO, based upon the premise that understanding the role of the CIO requires understanding the issues with which he or she must deal (Gilbert, et al., 1999). Through a series of five exploratory articles published over the last twenty years beginning in 1982, a set of issues faced by MIS professionals has emerged in the IS literature (Ball and Harris, 1982; Dickson, et al., 1984; Brancheau and Wetherbe, 1987; Neiderman, et al., 1991; Brancheau, et al., 1996).

In 1982, Ball and Harris set questionnaires to members of the Society of Management Information Systems (now known as the Society for Information Management) asking respondents to indicate the importance of eighteen MIS-related issues (Ball and Harris, 1982). Building on the Ball and Harris study, four subsequent studies used the Delphi method to identify and rank the top ten issues faced by MIS professionals. In 1984, Dickson, et al. identified the most important issue as "Improved Strategic Planning" (Dickson, et al., 1984). In 1987, Brancheau and Wetherbe's study identified "Strategic Planning" as the most important issue (Brancheau and Wetherbe, 1987). In 1991, Neiderman et al. identified "Developing an Information Architecture" as the most important issue (Neiderman, et al., 1991). In 1996, "Building a Responsive IT Infrastructure" ranked as the most important issue in a study by Brancheau, Janz, and Wetherbe (Brancheau, et al., 1996).

Using this set of IS issues, Gilbert, et al. developed a set of fifteen enduring IS issues by selecting only those issues from the aforementioned studies that appeared on at least three of the lists developed in each study (Gilbert, et al., 1999). Using these fifteen enduring IS issues, Gilbert, et al. surveyed CIOs asking them to rank these fifteen enduring IS issues in order of importance. The list of fifteen enduring IS issues as ranked in order of importance by 228 CIOs in the Gilbert, et al. study appears in Table 1.

Given the rigor with which these fifteen enduring IS issues have been developed, the authors presume that these fifteen enduring IS issues define the experiential profile of the CIO. Furthermore, the authors posit that the stronger the positive correlation between the ranking of these fifteen enduring IS issues, as ranked by a potential surrogate group and CIOs, the stronger the likelihood that the potential surrogate group represents good surrogates for CIOs and vice versa. To test this assertion, the authors compare the ranking of these fifteen enduring IS issues, as determined by the Gilbert et al. study, with the ranking of a surrogate group that the literature has shown represent poor surrogates for CIOs.

In the literature on the use of surrogates for business professionals, Gordon, et al. reviewed 32 studies which used both student and non-student subjects as surrogates for business professionals. In 22 of these studies (73%), Gordon et al. found students represented poor surrogates due to the existence of significantly different experiential profiles between students and business professionals (Gordon, et al., 1986). Since an undergraduate student

experiential profile is more disparate than is a graduate student profile, compared to CIOs, the authors identified undergraduate students as one of the poorest group of surrogates for CIOs.

Having identified undergraduate students as a group that represents one of the poorest surrogates for CIOs, the authors decided to administer the survey instrument utilized in the Gilbert, et al. study to a group of undergraduate IS students. The survey was administered to undergraduate seniors, in the IS capstone course for IS majors at a regional university, many of whom were in their last semester before graduating. The survey was administered to a total of 64 participants.

Using the survey, students were asked to rate the importance of each of the fifteen enduring IS issues using a seven-point Likert scale that ranged from "Not Important" to "Extremely Important." To convert the Likert scale responses to an overall ranking of the fifteen enduring IS issues, the participants' Likert scale responses were converted to an averaged rating for each enduring IS issue. The ranking was determined by ordering the average rating of the fifteen enduring IS issues from highest to lowest. The overall student rankings for the fifteen enduring IS issues are shown in Table 2.

To determine the strength of the relationship between the two rankings, the authors calculated the correlation between the CIOs' and students' rank orderings of the fifteen enduring IS issues. Given the ordinal nature of the rank data, the correlation between the ranks must be evaluated using a non-parametric statistical technique (Conover 1980, p. 66). Specifically, Spearman's rho (ρ) for measuring rank correlation was selected (Conover 1980, p. 250).

DATA ANALYSIS AND DISCUSSION OF RESULTS

The calculation of ρ for no ties is computed using the following formula where n is the number of items ranked (Conover 1980, p. 252):

$$\rho_n = 1 - (6\,T) / (n^3 - n) \text{ where } T = \Sigma\,[\,\text{Rank}(X_i) - \text{Rank}(Y_i)\,]^2 \text{ for } i = 1 \text{ to } n$$

The value of ρ varies from $+ 1.0000$, which represents perfect positive correlation between the two independent rank samples, and $- 1.0000$, which represents perfect negative correlation between the two independent rank samples. A positive correlation between the two independent rank samples means that there is a tendency for the smaller values of the two independent samples to be paired together. A negative correlation between the two independent rank samples means that there is a tendency for the smaller values from the first independent rank sample to be paired with the larger values of the second independent rank sample and vice versa. A calculated value of 0.0000 for ρ represents no correlation between the two independent rank samples.

Before calculating ρ, the authors plotted the CIOs' and students' ranking on a scatter plot so a visual inspection of the data could be undertaken. Using the students' rankings, a regression line was calculated for the students' ranking. The scatter plot of CIOs' and students' ranking with the regression line for the students' ranking is shown in Figure 1. As can be seen from a visual inspection of Figure 1, the rankings of the students and the ranking of the CIOs appear to be very strongly negatively correlated.

To prove the original assertion that the rankings of the students and the rankings of the CIOs would not be positively correlated, one must show that the rankings are either uncorrelated or are negatively correlated. The authors started by first testing for no correlation between the rankings of the students and the rankings of the CIOs. The formulation of the null and alternative hypotheses for a two-tailed test for rank correlation is as follows:

H_0: The CIOs' rank order and the students' rank order are mutually independent

H_1: Either (a) there is a tendency for larger values of the CIOs' rank order to be paired with the larger values of the students' rank order (i.e. positive correlation), or (b) there is a tendency for smaller values of the CIOs' rank order to be paired with the larger values of the students' rank order, and vice versa (i.e. negative correlation).

Using the formula for ρ, the calculation of ρ is shown below, where the value of T (the sum of the squared differences) is computed in Table 3.

$\rho_n = 1 - (6 T) / (n^3 - n)$ where $T = \Sigma \, [\text{Rank} \, (X_i) - \text{Rank} \, (Y_i)]^2$ for $i = 1$ to n

$\rho_{15} = 1 - (6 \times 914) / (15^3 - 15)$ where $T = 914$ and $n = 15$

$\rho_{15} = 1 - (5484) / (3360)$

$\rho_{15} = 1 - 1.6321$

$\rho_{15} = -0.6321$

Because $\rho_{15} = -0.6321$ is less than $\rho_{15, .02} = -0.6000$, the null hypothesis is rejected and the alternative hypothesis is accepted with 98% confidence. This result indicates that there is in fact a strong correlation between the rank orderings of the CIOs and students and the negative sign on the computed ρ indicates that the correlation is negative. Given the highly significant statistical results indicating a negative correlation, the authors also conducted a one-tailed test for negative rank correlation.

The formulation of the null and alternative hypotheses for a one-tailed test for negative rank correlation is as follows:

H₀: The CIOs' rank order and the students' rank order are mutually independent
H₁: There is a tendency for smaller values of the CIOs' rank order to be paired with
          the larger values of the students' rank order, and vice versa

Because $\rho_{15} = -0.6321$ is less than $\rho_{15, .01} = -0.6000$, the null hypothesis is rejected and the alternative hypothesis accepted with 99% confidence. This indicates that there is in fact a strong negative correlation between the CIOs' and students' rank ordering of the fifteen enduring IS issues. The conclusion that a strong negative correlation exist between the rankings of the students and the rankings of the CIOs supports the authors' original assertion that the two would not be positively correlated.

As predicted in the literature on surrogates, the rank ordering of the students (e.g. a group whose experiential profile differs significantly from CIOs) and the rank ordering of the CIOs was not positively correlated. Even more interesting, however, is the fact that these results highlight an almost perfect disagreement between students' and CIOs' rankings of the fifteen enduring IS issues. A very interesting result for which neither the authors nor the literature on surrogates can provide any insights or explanations and which warrants further investigation.

In terms of the survey instrument, these results indicate that the instrument accurately predicted that undergraduate students would not make good surrogates for CIOs. As a preliminary step in validating the instrument for assessing the efficacy of surrogates for CIOs, these results are encouraging. However, for the instrument to ultimately achieve external validity, the limitations of this single experiment will need to be overcome by validating the instrument across a wide variety of groups and experimental settings.

SUMMARY

The research literature on surrogates indicates that potential surrogate groups make poor surrogates for business professionals in research studies where the experiential profiles of the business professionals and the surrogates vary significantly. In fact, some disciplines shun the use of surrogates for business professionals altogether. However, given the need for IS professionals as experimental subjects in behavioral research settings and the limited availability of IS professionals as behavioral research subjects, IS research would best be served by determining a way to assess the efficacy of surrogates against IS professionals so that surrogates could still be used where appropriate.

Starting with the premise that comparisons of experiential profiles must account for how experience shapes a professional's way of seeing and evaluating the world and the understanding that a single monolithic 'IS professional' does not exist, the authors sought to identify an instrument to compare experiential profiles of a specific IS role to surrogates. In the IS literature, research into the role of the CIO often focuses on the issues faced by the CIO, based upon the argument that understanding the role of the CIO requires understanding the issues with which he or she must deal. Specifically, fifteen enduring IS issues faced by CIOs have been identified in the IS literature.

Using the set of fifteen enduring IS issues, the authors posit that the stronger the positive correlation between the ranking of these fifteen enduring IS issues, as ranked by a potential surrogate group and CIOs, the stronger the likelihood that the potential surrogate group represents an adequate substitute for CIOs. To test this assertion, the authors decided to compare the ranking of these fifteen enduring IS issues as determined by CIOs with the ranking of a surrogate group that the literature had shown to represent a poor surrogate for CIOs. By reviewing the literature on surrogates, the authors identified undergraduate students as one of the poorest groups of surrogates for CIOs.

Using the set of fifteen enduring IS issues, the authors surveyed 64 undergraduate IS students to obtain their ranking of the fifteen enduring IS issues. Comparison of the CIOs rank order and the students rank order of the fifteen enduring IS issues was conducted using Spearman's rho. Analysis of Spearman's rho indicated that not only are the rank order of the set of fifteen enduring IS issues of CIOs and students not positively correlated, but almost perfectly negatively correlated. These results support the conclusion that groups with a significantly different experiential profile than an IS professional make poor surrogates for IS professionals in behavioral research settings. In addition, these results represent a preliminary step in validating an instrument for assessing the efficacy of surrogates for CIOs.

SUGGESTION FOR FUTURE RESEARCH

This research contributes to the IS literature by identifying a means for determining if a specific group is a adequate surrogate for CIOs in behavioral researcher settings. Using this approach, future research studies could test whether other groups (i.e. MBA, Executive MBA, MS, or PhD students as well as non-students) represent effective surrogates for CIOs. Furthermore, studies could be conducted to help understand and predict the nature of the relationship (e.g. negatively correlated, not correlated, or positively correlated) between surrogate groups and specific IS roles.

In addition, other instruments could be identified or developed that would allow IS researches to test whether specific groups make good surrogates for other IS roles (i.e. Project Manager, Business Analysis, Programmer, System Administrator, etc.) in behavioral researcher settings. Lastly, there is an implication for IS education. Should undergraduate senior IS majors be more familiar with the IS issues faced by CIOs? Perhaps there is a need to change or improve IS education to expose IS majors to more of the enduring issues during the IS curricula.

Table 1
Enduring IS Issues Ranked by Cios in Gilbert, Pick, and Ward Study

|	
1	Aligning the Information Systems Organization with the Enterprise
2	Using Information Systems for Competitive Advantage
3	Promoting Effective Use of Data Resources
4	Facilitating and Managing End User Computing
5	Improving Information Systems Strategic Planning
6	Facilitating Organizational Learning and the Use of Information Systems
7	Developing an Information Architecture
8	Increased Understanding of the Role and Contribution of Information Systems
9	Measuring Information Systems Effectiveness and Productivity
10	Improving the Effectiveness of Software Development
11	Planning, Implementing, and Managing Telecommunications
12	Planning and Managing the Application Portfolio
13	Improving Information Security and Control
14	Enabling Electronic Data Interchange and Multi-vendor Integration
15	Specifying, Recruiting, and Developing Information Systems Human Resources

Table 2
Comparison of Rankings Between Gilbert, Pick, and Ward Study and Student Subjects

Enduring IS Issue	Ranking by Gilbert, Pick, and Ward Study	Ranking by Student Subjects
Aligning IS Organization and Enterprise	1	12
Competitive Advantage	2	15
Data Resources	3	10
End User Computing	4	9
Strategic Planning	5	3
Organizational Learning	6	13
Information Architecture	7	8
Role and Contribution of IS	8	11
IS Effectiveness and Productivity	9	14
Software Development	10	6
Telecommunications	11	5
Application Portfolio	12	1
Security and Control	13	4
Multi-vendor Integration	14	2
IS Human Resources	15	7

Table 3
Calculation of T for P

Enduring IS Issue	X_i	Y_i	$X_i - Y_i$	$[X_i - Y_i]^2$
Aligning IS Organization and Enterprise	1	12	-11	121
Competitive Advantage	2	15	-13	169
Data Resources	3	10	-7	49
End User Computing	4	9	-5	25
Strategic Planning	5	3	+2	4
Organizational Learning	6	13	-7	49
Information Architecture	7	8	-1	1
Role and Contribution of IS	8	11	-3	9
IS Effectiveness and Productivity	9	14	-5	25
Software Development	10	6	+4	16
Telecommunications	11	5	+6	36
Application Portfolio	12	1	+11	121
Security and Control	13	4	+9	81
Multi-vendor Integration	14	2	+12	144
IS Human Resources	15	7	+8	64
$T = \Sigma\, [\, Rank(X_i) - Rank(Y_i)\,]^2$				--------
				914
				=====

Figure 1: Scatter Plot of Rankings by Gilbert, Pick, and Ward Versus Student Subjects
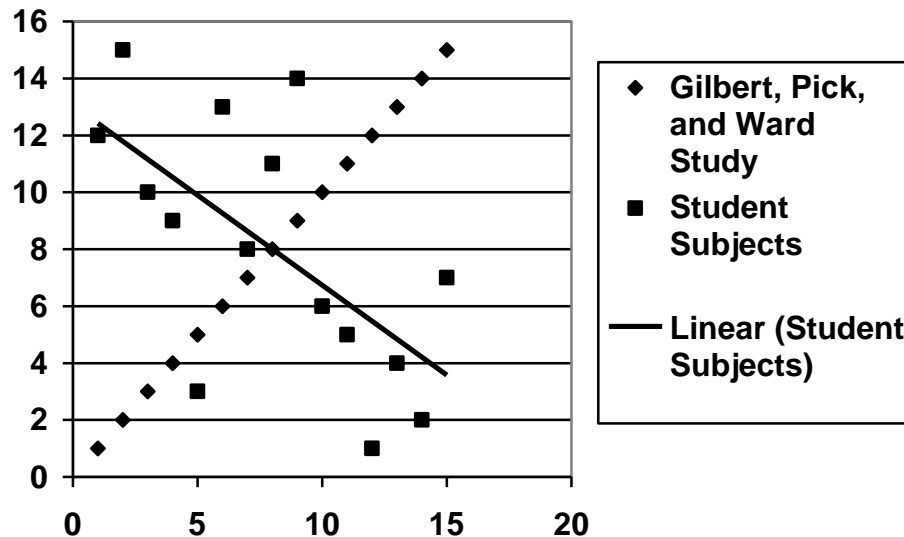
REFERENCES

1.   Ashton, Robert H. & Kramer, Sandra S. Students as Surrogates in Behavioral Accounting Research: Some Evidence, *Journal of Accounting Research*, Vol. 18, Iss. 1, pp. 1-15, Spring 1980.
2.   Ball, Leslie D. & Harris, Richard G. H. SMIS Members: A Membership Analysis, *MIS Quarterly*, Vol. 6, No. 1, pp. 19-38, March 1982.
3.   Berkowitz, Leonard & Donnerstein, Edward. External validity is more than skin deep: Some answers to criticisms of laboratory experiments, *American Psychologist*, Vol. 37, No. 3, pp. 245-257, March 1982.
4.   Brancheau, James C., Janz, Brian D., & Wetherbe, James C. Key Issues in Information Systems Management: 1994-1995 SIM Delphi Results, *MIS Quarterly*, Vol. 20, No. 2, pp. 225-242, June 1996.
5.   Brancheau, James C., & Wetherbe, James C. Key Issues in Information Systems Management, *MIS Quarterly*, Vol. 11, No. 1, pp. 23-5, March 1987.
6.   Briggs, Robert O., Balthazard, Pierre A., & Dennis, Alan R. Graduate Business Students as Surrogates for Executives in The Evaluation of Technology, *Journal of End User Computing*, Vol. 8, No. 4, pp. 11-17, Fall 1996.
7.   Conover, W. J. (1980). *Practical Nonparametrics Statistics,* Second Edition*,* John Wiley & Sons, New York.
8.   Copeland, Ronald M., Francia, Authur J., & Strawser, Robert H. Students as Subjects in Behavioral Business Research, *The Accounting Review*, Vol. 48, No. 2, pp. 365-372, April 1973.
9.   Dickson, Gary W., Leitheiser, Robert L., Wetherbe, James C., & Nechis, Mal. Key Information Systems Issues for the 1980s, *MIS Quarterly*, Vol. 8, No. 3, pp. 135-159, September 1984.
10.   Gilbert, Jr., Arthur H., Pick, Roger A., & Ward, Sidne G. The Role of the CIO: Enduring MIS Issues, *Journal of Computer Information Systems*, Vol. 40, No. 1, pp. 8-16, Fall 1999.
11.   Gordon, Michael E., Slade, L. Allen, & Schmitt, Neal. The 'Science of the Sophomore' Revisited: From Conjecture to Empiricism, *Academy of Management Review*, Vol. 11, Iss. 1, pp. 191-207, January 1986.
12.   Houghton, Keith A., & Hronsky, Jane J. F. The sharing of meaning between accounting students and members of the accounting profession, *Accounting and Finance*, Vol. 33, Iss. 2, pp. 131-147, November 1993.
13.   Hughes, Cary T. & Gibson, Michael L. Students as Surrogates for Managers in a Decision-Making Environment: An Experimental Study, *Journal of Management Information Systems*, Vol. 8, No. 2, pp.153-166, Fall 1991.

14.   Neiderman, Fred A., Brancheau, James C., & Wetherbe, James C. Information Systems Management Issues for the 1990s, *MIS Quarterly*, Vol. 15, No. 4, pp. 474-500, December 1991.
15.   Robinson, Peter B., Huefner, Jonathan C., & Hunt, H. Keith. Entrepreneurial Research on Student Subjects Does Not Generalize to Real World Entrepreneurs, *Journal of Small Business Management*, Vol. 14, Iss. 2, pp. 42-50, April 1991.

NOTES