

WHY EXPERIENCE MAY NOT MATTER IN DATA WAREHOUSING: THE ROLE OF EXPERTISE

Richard J. Goeke, Ph.D. Widener University One University Place Chester, PA 19013 rgoeke@mail.widener.edu (610) 499-1141	Robert H. Faley, Ph.D. Kent State University PO Box 5190 Kent, OH 44242 rfaley@kent.edu (330) 672-1154	Kevin E. Dow, Ph.D. Kent State University PO Box 5190 Kent, OH 44242 kdow@kent.edu (330) 672-1109	Alan A. Brandyberry, Ph.D. Kent State University PO Box 5190 Kent, OH 44242 abrandyb@kent.edu (330) 672-1146
-----------------------------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------

ABSTRACT

Research has shown that despite a year or more of experience, end-users still report that a data warehouse can be difficult to use. We measured the effect of experience on ease-of-use, but also considered a related construct - expertise. Experience had no significant effect, but expertise had a significant effect, on ease-of-use. These results show that experience and expertise are not interchangeable constructs, and explain why experience does not always improve ease-of-use.

INTRODUCTION

A data warehouse can help managers gain new insights into operations and customers, which assists decision-making and leads to improved corporate performance [2,21]. But despite the reported success, many end-users find their data warehouses difficult to use, even after a year or more of data warehouse experience [cf. 3,5]. These findings are troubling for both practitioners and researchers. For practitioners, end-user difficulties after a year or more of experience represents a real threat to data warehouse usage; if users perceive the data warehouse is difficult to use, then they may not be using it to its potential. For researchers, ease-of-use perceptions play a prominent role in technology adoption and use, and experience generally has had a positive effect on ease-of-use perceptions [17,18]. End-user difficulty after this much time, then, represents a stark departure from technology acceptance theory.

We argue that experience alone may not positively affect data warehouse ease-of-use perceptions, and therefore need to consider the user's level of expertise. Using a data warehouse can be complex, because of the number and variety of input and output options available. System flexibility is thought to help experienced end-users [7], or more appropriately, help the knowledgeable (expert) user [9]. Therefore, experience may have a limited effect on data warehouse ease-of-use and flexibility perceptions, because expertise matters more.

LITERATURE REVIEW

Data Warehousing Difficulty and Flexibility

Research into end-users and data warehousing has revealed that end-users with a year or more of experience using the data warehouse still consider it difficult to use. Chen et al. [3] found low ease-of-use perceptions among users with a year or more of data warehouse use. Cooper et al. [5] reported that after a year of data warehouse usage, many analysts either left their positions or left the firm, because they could not develop the advanced skills required to use the data warehouse effectively. Payton and Zahay [13] concluded that data warehouse usage suffered because users found it too difficult to use. And Watson et al. [20] found that users couldn't create their own reports as easily as they had expected, even though these users considered their data warehouses "successful".

One possible explanation for end-user difficulty lies in the flexibility inherent in data warehousing. A data warehouse provides users with flexible access to vast amounts of data. Users can analyze data in various dimensions, over different periods of time, roll-up or drill down to different levels of detail, and perform various "what if" analyses using a variety of output formats [8,10]. While flexibility can be beneficial, users need time to learn how to use all the features a data warehouse provides. Flexibility, then, can act as a double-edged sword: it can benefit those with experience who know how to use it, but can overwhelm novices with less experience [6,7].

Experience versus Expertise

Experience and expertise are highly correlated but separate constructs [16]. Experience refers to the length of time on the job, whereas expertise is defined as a deep knowledge of a specific domain [15]. Expertise is commonly measured as a continuum between novices and experts, in which experts have gone through a period of extensive formal and informal learning that results in higher levels of subject-matter proficiency, adaptability and confidence [1]. Conversely, novices have not gone through extensive formal and informal learning, so their knowledge of a domain is limited and incomplete, which makes them more error-prone.

Experience is often used a proxy for expertise in IS research [c.f. 11,16], because individuals with experience are assumed to have deeper job knowledge than those with less experience. And, measuring someone's level of experience is easier than measuring his/her level of expertise. However, research from applied psychology argues that expertise is the higher order construct, comprised of the individual's experience and general mental ability [14]. Moreover, expertise is thought to be more salient when considering performance on relatively complex tasks [12].

Hypotheses

The present research is motivated by the problem of experienced users having ease-of-use problems with their data warehouse; thus our primary interest is the effect of experience on perceived ease-of-use. We suggest that the data warehouse's flexibility may affect ease-of-use perceptions, because flexibility (i.e. providing more options) can introduce complexity. Therefore, our first two hypotheses are:

H1a: Experience will positively affect ease-of-use perceptions in data warehousing.

H1b: Experience will positively affect flexibility perceptions in data warehousing.

Reports of experienced end-users having difficulty in data warehousing leads us to posit that gaining experience with a data warehouse may be less consequential than gaining expertise. And, gaining expertise with the data warehouse's advanced features, including its flexibility, may be even more important. Therefore, our second set of hypotheses is:

H2a: Expertise will positively affect ease-of-use perceptions in data warehousing.

H2b: Expertise will positively affect flexibility perceptions in data warehousing.

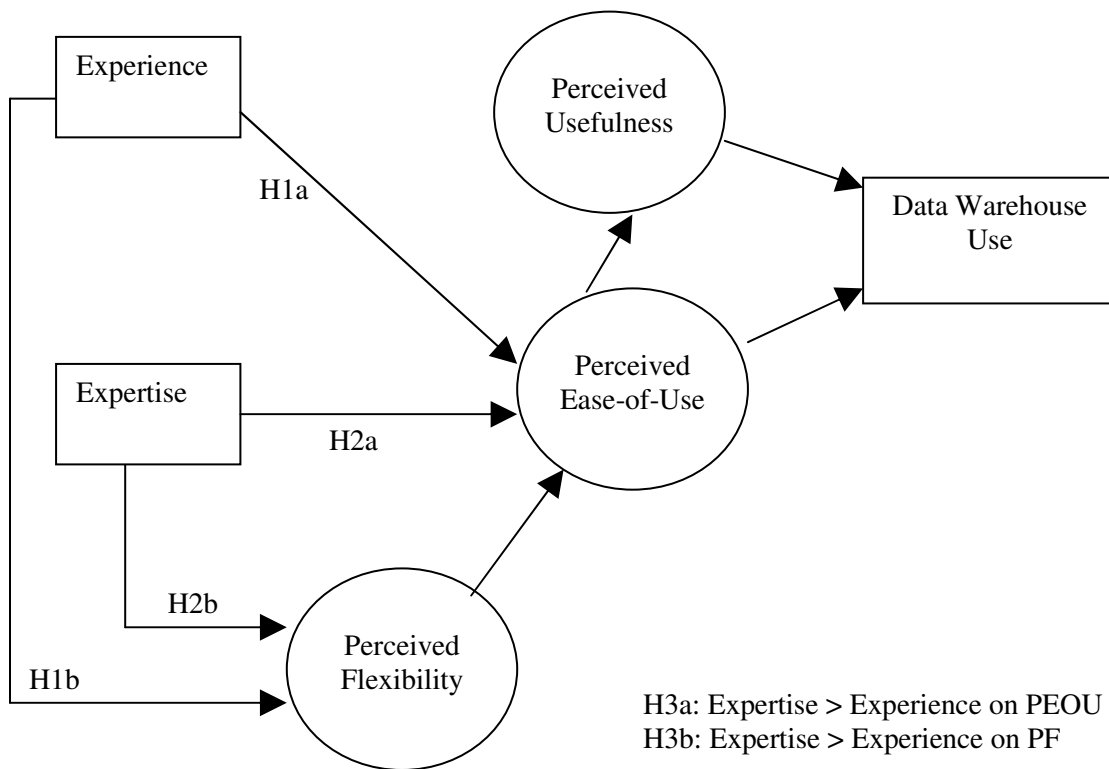
Finally, research from applied psychology argues that expertise contributes more to task performance than experience, especially when the task is complex. Since flexibility is thought to introduce complexity, our third set of hypotheses is:

H3a: Expertise will have a greater effect on ease-of-use perceptions than experience.

H3b: Expertise will have a greater effect on flexibility perceptions than experience.

These hypotheses are shown in Figure 1.

Figure 1: Research Model and Hypotheses



METHODS AND RESULTS

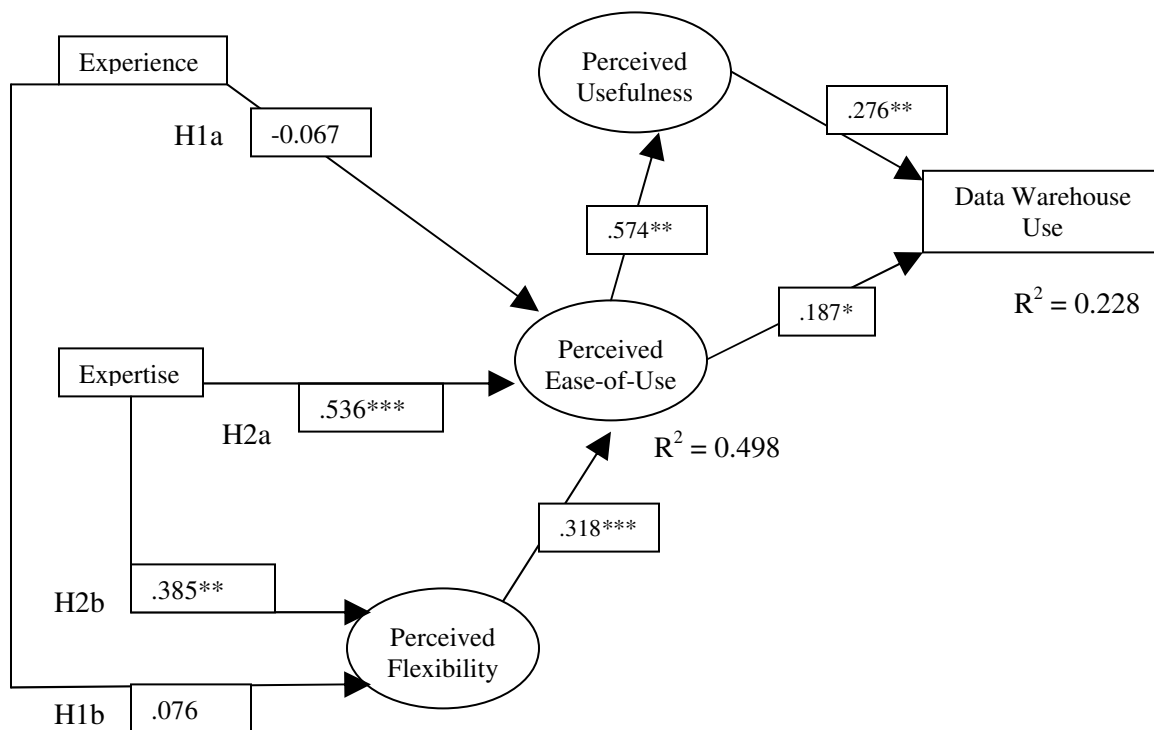
Methods

The survey items for the current research were adapted from Davis [6] for data warehousing. Subject area experts reviewed the items for content and clarity. Data warehouse end-users from forty companies located in the Midwest were asked to complete the modified TAM survey instrument. Thirty-three managers from twenty-nine organizations agreed to participate, and they distributed the survey to fifty-nine additional end-users. In all, ninety-two surveys were returned, of which seven were incomplete, making eighty-five usable surveys. The data were analyzed using the software package PLS-Graph (version 3.00), which has been used extensively in information systems research [cf. 17,18,19].

Results

The test of the measurement model indicated that survey items possessed sufficient internal consistency and convergent and discriminant validity. The structural model's path coefficients and significance levels were calculated using the bootstrap re-sampling method with 100 re-samples. Figure 2 shows the results of these tests.

Figure 2: Results of PLS-Graph Structural Model



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

DISCUSSION

Several key findings emerged from the present research. First, experience did not have a significant effect on ease-of-use perceptions, which is consistent with previous IS research in data warehousing. Experience also had no significant effect on flexibility perceptions, which is in line with findings from applied psychology but contradicts anecdotal evidence from IS. Therefore, H1a and H1b were not supported.

We believe that the reason experience had such a small effect on ease-of-use and flexibility is because the effects of expertise were being simultaneously measured. This is our second important finding: expertise had significant effects on both ease-of-use and flexibility perceptions. Therefore, H2a and H2b were supported. Previous research in applied psychology has demonstrated the importance of expertise on job performance, and IS researchers have found similar results when measuring expertise. Unfortunately, many IS researchers substitute experience for expertise, which leads to our third important result.

Although experience and expertise are significantly correlated ($r=.38$, $p<.001$), they are separate constructs and are not substitutable for each other. This delineation has largely been ignored by the IS community, and these results provide evidence that separating expertise from experience is vital when measuring end-user perceptions. Expertise far exceeds experience as a predictor of ease-of-use (support for H3a) and flexibility perceptions (support for H3b), and represents an important clarification for the divergent results in experience-focused IS research.

References

- [1] Anderson, J.R. *Cognitive skills and their acquisition*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1981.
- [2] Campbell, S., *CDW outpaces expectations for its fourth quarter.*, in *CRN*. 2006. p. 48.
- [3] Chen, L., et al. *Measuring user satisfaction with data warehouses: an exploratory study*. *Information & Management*, 2000, 37(3), 103-110.
- [4] Cohen, J. & Cohen, P. *Applied multiple regression/correlation analysis for the behavioral sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum, 1983.
- [5] Cooper, B.L., et al. *Data warehousing supports strategy at First America corporation*. *MIS Quarterly*, 2000, 24(4), 547-567.
- [6] Davis, F.D. *Perceived usefulness, perceived ease-of-use and user acceptance of information technology*. *MIS Quarterly*, 1989, 13(3), 318-340.
- [7] Goodwin, N.C. *Functionality and usability*. *Communications of the ACM*, 1987, 30(3), 229-233.
- [8] Gorla, N. *Features to consider in a data warehouse system*. *Communications of the ACM*, 2003, 46(11), 111-115.
- [9] Hellerstein, J.M. *Optimization techniques for queries with expensive methods*. *ACM Transactions on Database Systems*, 1998, 23(2), 113-157.
- [10] Inmon, W., Welch, J. & Glassey, K. *Managing the data warehouse*. New York: John Wiley & Sons, 1997.

- [11] Mackay, J.M. & Elam, J.J. *A comparative study of how experts and novices use a decision aid to solve problems in complex knowledge domains*. Information Systems Research, 1992, 3(2), 150-172.
- [12] McDaniel, M.A., Schmidt, F.L. & Hunter, J.E. *Job experience correlates of job performance*. Journal of Applied Psychology, 1988, 73(2), 327-330.
- [13] Payton, F. & Zahay, D. *Understanding why marketing does not use the corporate data warehouse for CRM application*. Journal of Database Marketing, 2003, 10(4), 315-325.
- [14] Schmidt, F.L., Hunter, J.E. & Outerbridge, A.N. *Impact of job experience and ability on job knowledge, work sample performance, and supervisory ratings of performance*. Journal of Applied Psychology, 1986, 71(3), 432-439.
- [15] Shanteau, J. *Competence in experts: The role of task characteristics*. Organizational Behavior and Human Decision Processes, 1992, 53(2), 252-266.
- [16] Thompson, R.L., Higgins, C.A. & Howell, J.M. *Influence of experience on personal computer utilization: testing a conceptual model*. Journal of Management Information Systems, 1994, 11(1), 167-187.
- [17] Venkatesh, V. *Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the Technology Acceptance Model*. Information Systems Research, 2000, 11(4), 342-365.
- [18] Venkatesh, V. & Morris, M.G. *Why don't men ever stop to ask for directions? Gender, social influence and their role in technology acceptance and usage behavior*. MIS Quarterly, 2000, 24(1), 115-139.
- [19] Venkatesh, V., et al. *User acceptance of information technology: Toward a unified view*. MIS Quarterly, 2003, 27(3), 425-478.
- [20] Watson, H.J., et al. *Current practices in data warehousing*. Information Systems Management, 2001, 18(1), 47-55.
- [21] Watson, H.J. & Haley, B.J. *Managerial considerations*. Communications of the ACM, 1998, 41(9), 32-37.