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Resistance to change and the adoption of digital libraries: an integrative model

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Abstract

In this paper we extend earlier work on the role of the personality trait of Resistance to Change (RTC) in the adoption of digital libraries. We present an integrative study, drawing on a number of research streams, including IT adoption, social psychology, and digital library acceptance. Using structural equation modeling, we confirm RTC as a direct antecedent of effort expectancy. In addition, we also find that by affecting computer anxiety and result demonstrability, RTC acts as an indirect antecedent to both effort expectancy and performance expectancy, which in turn determine user intention to adopt digital library technology. Implications for research and practice are discussed.

Keywords: Resistance to change, digital libraries, personality, technology acceptance

Introduction

A user's intention to adopt a new technology such as a digital library is influenced by a variety of beliefs and perceptions (Lee et. al., 2003). Among these factors, performance expectancy (PE, or perceived usefulness in earlier studies) and effort expectancy (EE, or perceived ease of use in earlier studies) of the new technology are widely accepted as the two key antecedents to adoption (Venkatesh et al., 2003).. Recent research in social psychology indicates that, as a personality trait, individuals' resistance to change (RTC) dictates how they respond to events such as the introduction of a new

. technology that brings potential changes to their well-practiced routines (Oreg, 2003; 2006). In a recent study, Nov & Ye (2008) found that users with high RTC tend to expect greater effort to be associated with using a new digital library system. However, perception of the effort involved in using a new system is only one factor that determines the intention to adopt it. In the present study, we develop a substantially extended model that includes the direct and indirect relationships between RTC and both determinants

(PE and EE) of adoption intention. Using a larger dataset, the new model connects RTC to intention to adopt in three ways:

1. Directly: through Effort Expectancy, as was demonstrated in the study by Nov & Ye (2008).

2. Indirectly: through computer anxiety, which is associated with EE.

3. Through the other main antecedent of adoption intention, performance expectancy. In this case we show how result demonstrability, mediates the relationship between RTC and PE.

Overall, the goal of this study is to further explore the influence of RTC – within a nomological network of individual differences, system characteristics, and expectancies – on new users' intention to adopt a digital library. As such, the study contributes to the literature on digital libraries by providing better understanding of the factors underpinning digital library systems' adoption

Background and literature review

Digital libraries have become an increasingly important way in providing library services to users (Borgman et al., 2005; Talja et al., 2007; Vakkari, 2008). To encourage users to accept and continually use digital libraries, library designers and managers need good understanding of the factors that influence users' adoption. Researchers of technology adoption have identified two key user beliefs that influence adoption of IT, which together make up the Technology Acceptance Model (TAM): expectancy of the amount of effort required in using a technology (EE); and expectancy of the performance of the technology (PE) (see Venkatesh et al., 2003). These two beliefs, which represent different aspects of the perceived value of information (Ahituv, 1989), are determined by a variety of factors including user perceptions of system characteristics, computer-related personal traits, and general personalities (e.g. Hong et al., 2002; Venkatesh, 2000). For digital libraries, effort expectancy and performance expectancy are also confirmed as direct antecedents of user adoption intentions (Hong et al., 2002; Kim, 2006).

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Several studies have identified and assessed determinants of these two expectancies in the context of digital libraries. System characteristics such as relevance, screen design, and terminology were found to enhance both expectancies (Hong et al., 2001), and resistance to change as well as computer self-efficacy and computer anxiety were found to be associated with perceived ease of use, a commonly used manifestation of effort expectancy (Nov & Ye, 2008).

In recent years there has been an increasing focus on personality traits in the study of technology adoption (McElroy et al., 2007). One aspect of personality that is highly critical for technology adoption is resistance to change (e.g. Venkatesh et al., 2000). However, until recently, the role of the *personality trait* of resistance to change was not considered in the literature on technology adoption.

Recent research by Oreg (2003; 2006) has identified individuals' dispositional resistance to change as a fundamental personality trait, showing that it is more than just an overt behavior in specific situations. Oreg et al. (2005) developed further the RTC construct and introduced the concept and the measurement scale of *domain-specific resistance to change*. Using the concept of domain-specific RTC, Nov & Ye (2008) showed that RTC is negatively related to user's perceived ease of use of a digital library. Their study, however, was limited in scope, as it covered only the direct relationship between RTC and one of the key antecedents of technology adoption (i.e. EE). In the present study, we build on Nov and Ye's model and extend it substantially. We include in not only the EE construct, but also the other main driver of users' intention to adopt technology – PE. Furthermore, we examine other important constructs such as terminology and result demonstrability, as well as the users' intention to adopt the digital library.

Research model

With a goal to better understand the role of RTC in digital library adoption which was explored by Nov & Ye (2008), we propose an integrative and extended model. Our research model (see Figure 1),

incorporates both direct and indirect effects of RTC on new users' EE and PE of a digital library. Consistent with findings from prior research (e.g., Hong et al., 2002; Nov & Ye, 2008), our research model includes system characteristics and user characteristics. In the remaining of this section on antecedents and outcome variables that were not considered in prior research, and hypotheses tested in previous research are presented briefly.

As was demonstrated by Oreg (2003), people with high RTC would find it difficult to work effectively when there are changes in their work environment. When a new technology is being introduced, the degree of ease associated with the use of the system (i.e. effort expectancy) plays a critical role in determining adoption. For users with high RTC, learning and using a new technology would entail more mental efforts because they have to overcome negative cognitive and emotional responses to the changes brought by the technology. Therefore, users with higher RTC would have higher effort expectancy on a new technology. The negative association between users' RTC and their effort expectancy of a new digital library has been empirically verified by Nov & Ye (2008). Therefore we expect that,

Hypotheses 1: RTC will be negatively related to EE of a digital library.

Computer anxiety is defined as apprehension or fear a user feels when he or she faces the possibility of using computers (Simonson et al., 1987). A commonly used scale for measuring computer anxiety was developed by Compeau and Higgins (1995). Negative emotional responses such as anxiety is one of the key dimensions of resistance to change (e.g. Oreg, 2006), and furthermore, user anxiety has been identified as one of the consequences of changes induced by technology (e.g. Joshi, 1991). Therefore, we expect that users with high RTC will be more likely to be apprehensive or unease at using computer technologies.

Hypotheses 2: RTC will be positively related to computer anxiety.

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In earlier studies, it was shown that while people with higher anxiety associated with computer usage tend to perceive a specific computer system to be difficult to use (Venkatesh, 2000), people with higher confidence in their ability to use a computer technology, i.e., greater computer self-efficacy (Compeau & Higgins, 1995), tend to perceive the opposite (e.g. Agarwal et al., 2000). Therefore:

Hypotheses 3a: Computer anxiety will be negatively related to EE of a digital library.

Hypotheses 3b: Computer self-efficacy will be positively related to EE of a digital library.

Reflecting the study by Hong et al. (2002), we want to confirm in this study that following relations between system characteristics and effort expectancy hold:

Hypotheses 4a: Screen design will be positively related to EE of a digital library.

Hypotheses 4b: Relevance will be positively related to EE of a digital library.

Hypotheses 4c: Terminology clarity will be positively related to EE of a digital library.

Technology adoption and Result Demonstrability

TAM has been developed into more extended models, such as TAM2 (Venkatesh & Davis, 2000). TAM2 incorporates three additional system characteristics: job relevance, output quality, and result demonstrability. Job relevance refers to the fit between the technology and the job goals a user needs to accomplish. While job relevance is relevant for many employees, for digital library users, the outcome of using the system needs to match the users' tasks, and this influence is captured in the relevance factor addressed above. Output quality, which captures users' general evaluation of the outputs from a specific system, is better reflected in the screen design and terminology clarity constructs for digital libraries. Therefore, we focus our attention on result demonstrability, defined as the "tangibility of the results of using the innovation" (Moore & Benbasat,1991, pp 203). Result demonstrability reflects the extent to

which a user believes the results of the technology are discernable (Venkatesh & Davis, 2000), and has been studied widely by researchers of technology adoption (e.g. Ilie at al., 2005; Karahanna et al., 1999; van Slyke et al., 2002). Moreover, it is of particular relevance in the case of digital libraries, since using the resources accessible via a digital library (e.g. academic papers, industry reports) is in many cases done for external and demonstrative purposes: e.g. making a presentation, submitting an academic work, etc. Therefore, a user's decision to use a digital library is affected by the user's perception of his or her ability to achieve demonstrable results by using the system. When a user is resistant to change, he or she may be less likely to perceive an unfamiliar system as helpful in accomplishing tasks. For such a user it would be easier to see the demonstrability, or the "tangibility of the results" (Moore & Benbasat, 1991) of more familiar ways of obtaining documents (e.g. photocopying printed material at the library) than the tangibility of the results of using a tool such as a digital library. Therefore:

Hypothesis 5: RTC will be negatively related to result demonstrability for digital library users.

Result demonstrability refers to the user's perception or judgment of his or her ability to discern the benefits of using a specific technology. To make such judgment, the user is likely to take into consideration not only the characteristics of the technology, but also his or her own ability when it comes to computer technology in general. A user who has a higher self-perception of computer literacy, i.e., higher computer self-efficacy, would be more confident in being able to demonstrate the advantages and disadvantages of using a new technology. Therefore:

Hypothesis 6: Computer self-efficacy will be positively related to result demonstrability for digital library users.

The next step in the path between RTC was established by Venkatesh & Davis (2000) who observed a positive relation between result demonstrability and performance expectancy. We therefore expect that:

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Hypothesis 7: Result demonstrability will be positively related to PE of a digital library.

Effort expectancy, performance expectancy, and intention to use

The interrelations among effort expectancy (EE), performance expectancy (PE) and intention to adopt a technology have been well studied in the literature (Venkatesh et al., 2003). Therefore, consistent with past findings, we also expect that the following relationships will hold: effort expectancy will be positively related to performance expectancy of a digital library; effort expectancy will be positively related to intention to use a digital library; and performance expectancy will be positively related to intention to use a digital library.

The overall model is illustrated in Figure 1.

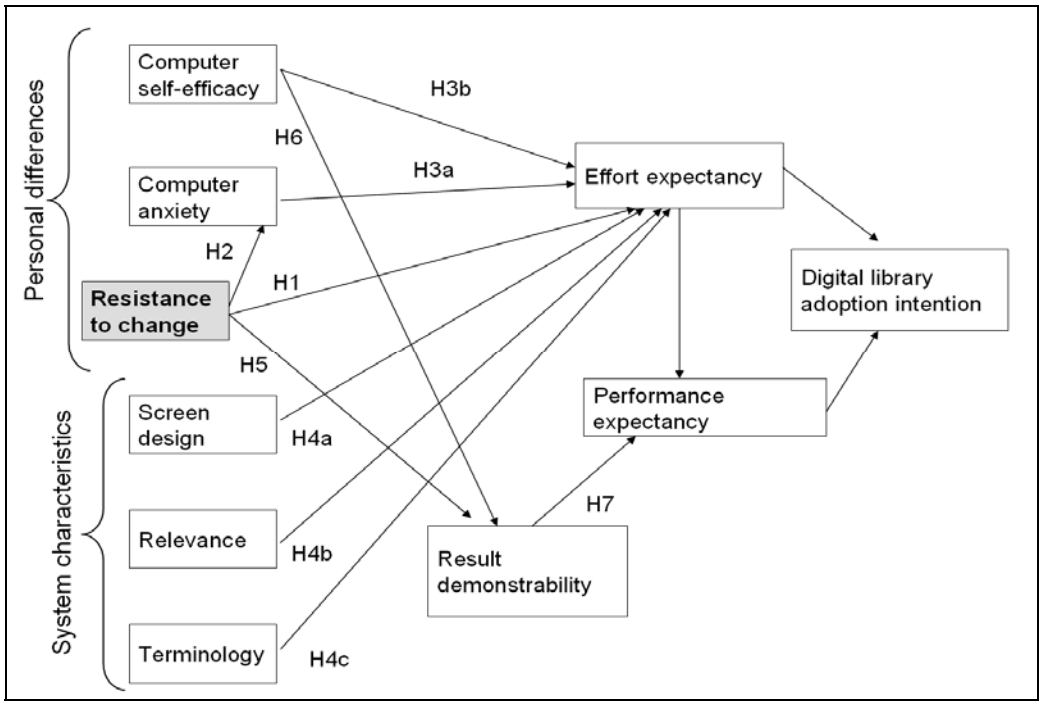

Figure 1. Research Model

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Methodology

The study was carried out in the library of a university in northeastern US. The library provides a Web-based digital library system which enables users to locate books and periodicals, and access to numerous Web-based databases such as EBSCO and ProQuest. As part of their first year curriculum, new students, who are the potential users of the system, take part in a one hour in-class instruction session. Since these potential users are all new students, the instruction provides us an opportunity to examine users' perceptions toward a digital library that is new to them. A survey was administered to 336 students immediately at the end of the library introduction session. 304 students returned the questionnaire. Participation was voluntary and no incentive was provided. After dropping responses from incomplete questionnaires, and those with excessive missing data (for example, more than one missing item in any multi-item measurement), 271 usable responses were obtained, producing a response rate of 81%.

We used Oreg et al.'s (2005) domain-specific RTC scale, adjusted to the context of digital library usage. Effort expectancy, performance expectancy, computer self-efficacy and computer anxiety items were adapted from Venkatesh et al. (2003). Screen design, relevance and terminology items were adapted from Hong et al. (2002), and result demonstrability items were adapted from Moore & Benbasat (1991).

Results

We used Partial Least Squares (PLS), as the structural equation modeling tool (Wasko & Faraj, 2005). The psychometric properties of the instrument were analyzed first. Composite reliability, average variance extracted (AVE), and correlations between the latent variables are presented in Table 1. The composite reliability values of all constructs exceeded the recommended level of 0.70, thus demonstrating good internal consistency. Convergent validity of the measures were assessed by examining the individual

item loadings between an item and its corresponding underlying factor, as well as the average variance extracted (AVE). All item loadings were greater than the suggested minimum level of 0.7, and the AVE for each construct was greater than the suggested minimum of 0.5. These results support the convergent validity of the measures. Discriminant validity was assessed by comparing the square root of the AVE (RAVE) of a particular construct (presented in Table 1, bold figures on the diagonal) and the correlation between that construct and other latent constructs (presented at the off-diagonal positions in the table). We found that the RAVE for every construct is substantially higher than the correlation between that construct and all other constructs, thus signifying good discriminant validity.

Table1. Composite reliabilities, AVE, and correlations among latent constructs

Construct	Composite reliability	AVE	1	2	3	4	5	6	7	8	9	10
1. Effort expectancy	.87	.68	**.82**									
2. Performance expectancy	.88	.65	.34	**.81**								
3. Intention to use system	.96	.90	.37	.58	**.95**							
4. Resistance to change	.82	.54	-.34	-.14	-.16	**.73**						
5. Computer anxiety	.85	.74	-.27	.04	-.14	.22	**.86**					
6. Computer self-efficacy	.81	.58	.19	.30	.24	-.07	.03	**.76**				
7. Relevance	.89	.80	.42	.64	.48	-.12	-.03	.29	**.89**			
8. Terminology	.80	.66	.58	.31	.24	-.25	-.21	.22	.42	**.81**		
9. Screen design	.89	.80	.45	.33	.38	-.03	-.15	.18	. 39	.55	**.89**	
10. Result demonstrability	.76	.52	.45	.41	.46	-.33	-.17	.24	.34	.29	.36	**.72**

We tested the model through the PLS structural model. The significance of structural path estimates was computed using the bootstrapping re-sampling method. Figure 2 shows the results of the PLS analysis.

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All coefficients are reported in the standardized form.

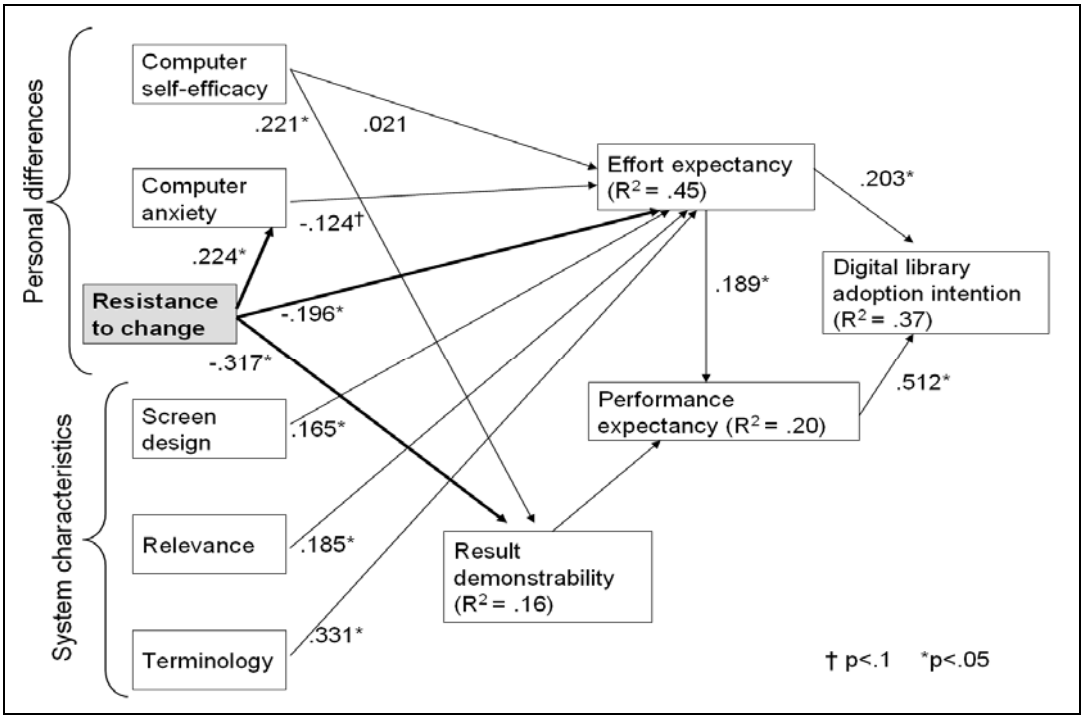

Figure 2. Partial Least Squares Results

The relationship between RTC and computer anxiety, result demonstrability and effort expectancy were all significant in the predicted directions, thus supporting Hypotheses 1, 2, and 5. The coefficients of computer anxiety, screen design, relevance, terminology, and result demonstrability were significant in the predicted directions, supporting Hypotheses 3a, 4, 6, and 7. However, the data did not support Hypothesis 3b concerning the effect of computer self-efficacy on effort expectancy. One possible explanation might be that in this particular context, users make a distinction between their confidence in their ability to use the computer technology (high computer self-efficacy) and the degree of effort they attribute to using the digital library system (effort expectancy). In other words, they may believe that the system is easy to use, but that is not associated with confidence in their ability to use it properly.

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Discussion and conclusions

Addressing the relationship between resistance to change and adoption of digital libraries, the present study extends earlier work (Nov & Ye, 2008) on the role of RTC in the adoption of new technologies. RTC was studied in the social psychology and the innovation literatures (e.g., Cole et al., 2006; Moldovan & Goldenberg, 2004; Oreg et al., 2005), and the findings indicate, domain-specific RTC is both a direct and indirect antecedent of users' EE and PE of digital libraries, Thus the RTC construct improves the explanatory power of a model that includes personal differences and system characteristics used in prior research on digital libraries (e.g. Hong et al., 2002). RTC is found to be a direct antecedent of EE, and also an indirect determinant, via computer anxiety, in itself another antecedent of EE. In addition RTC was found to be a determinant of result demonstrability, an antecedent of PE.

From a methodological perspective, the present research overcomes the reliance on retrospective surveys, one of the common limitations of previous technology adoption studies (Venkatesh et al., 2003). Therefore, the findings represent users' beliefs about the new system's characteristics and the two crucial expectancies at a time that is critical to users' adoption decisions. Furthermore, the respondents were freshmen students, and therefore the actual potential users of the digital library system in a realistic adoption point in time, increasing the generalizability of the study.

Understanding the role of RTC in user adoption can help designers and managers of digital libraries create a better fit between systems' design and their intended users' personal characteristics. For example, to encourage users who are high on RTC to adopt and use a digital library system, new systems should be designed such that they are not perceived to embody a lot of change This can be done by retaining as many characteristics of older systems, computerized or not. Systems' implementation and users' training could be better done if users did not perceive a new system as embodying much change, and therefore, when a new system is introduced, familiar aspects of a new system could be highlighted to mitigate users' resistance. In the same vein, result demonstrability should be enhanced by designers and managers of

digital libraries, by illustrating to users the potential benefits of the system, and how these can be demonstrated. This can be done by using testimonials, by linking resources to course listings, and in any other way that will enable users to demonstrate the benefits of the digital library in the context that is important to them.

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