



## The technology profile inventory: Construction, validation, and application

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### ABSTRACT

The technology profile inventory (TPI) measures attitudes toward computers and the internet. We describe the most recent phase of the construction of the TPI. The studies reported refine and validate the instrument, and we present the final version as an **Appendix A**. Using a new sample of respondents ( $N = 394$ ), we replicated the three major factors found previously (Confidence, Approval, and Interest). The TPI scores were related to patterns of information technology (IT) usage and also to gender. To demonstrate the practical utility of the TPI we report (1) results linking TPI scores to behavior during an internet search task; (2) test–retest results obtained as part of a cognitive training experiment using action video games; and (3) results showing that attitudes to IT may be modified by a particular experience with information technology.

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### 1. Introduction

DeYoung and Spence (2004) proposed the notion of a technology profile that is analogous to a personality profile. Much as a personality profile helps predict how individuals are likely to respond to various situations in everyday life, a technology profile is intended to characterize and predict how individuals are likely to respond to various aspects of information technology (IT). Although similar to the personality profile, the technology profile is more concerned with attitudes that may change with experience, rather than with the fundamental, relatively enduring traits that make up personality. Attitudes to computers affect behavior (Levine & Donitsa-Schmidt, 1998) and, in turn, influence people's use of computers. Thus a reliable measure of individual differences in attitudes to IT can be of value in the field of human–computer interaction (HCI). Knowing an individual's technology profile can help HCI researchers to separate the specific effects of the IT situation from the contribution of individual differences. To take a simple example, a user who is negatively disposed toward IT is likely to respond differently when using a computer, compared to a user who is comfortable with IT. DeYoung and Spence (2004) introduced a preliminary version of the Technology Profile Inventory (TPI); the studies reported here refine and validate the instrument, and a final version of the TPI is presented as an **Appendix A**.

#### 1.1. Existing measures

The first computer attitude scales (e.g. Loyd & Gressard, 1984; Nickell & Pinto, 1986; Popovich, Hyde, Zakrajsek, & Blumer, 1987) were constructed more than two decades ago when personal computers were much less common and the World Wide Web (www) was still several years in the future. Today, computers and the www are so thoroughly integrated into the functioning of society that it is difficult to find educated persons who do not use computers, even if their purpose is only to send and receive email. A comprehensive measure of computer attitudes must reflect these changes; new instruments that are intended to capture responses to a broad spectrum of IT must include items pertaining to internet use. The original computer attitude scales did not do this and are therefore dated.

Over the past three decades, various factors that might affect an individual's attitude to IT have been proposed and discussed by several authors; however, a review by Smith, Caputi, and Rawstorne (2000) concluded that there is little agreement regarding the structure of attitudes toward computers. Although most empirical studies agree that there are no more than three or four dominant factors, these have been given different names by different investigators. Furthermore, many of the less salient factors reported in previous studies have accounted for relatively small proportions of variance and are thus likely to be of interest to niche audiences only. Nonetheless, a few common themes can be identified across studies (DeYoung & Spence, 2004; Levine & Donitsa-Schmidt, 1998; Loyd & Gressard, 1984; Bear, Richards, & Lancaster, 1987; Gardner, Dukes, & Discenza, 1993; Yang & Lester, 2003; Liaw, 2002; Whitley, 1996a); based on a reading of previous work,

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DeYoung and Spence (2004) proposed that the three dominant factors found by most investigators may be characterized as *Confidence* (vs. anxiety), *Approval*, and *Interest confidence* (as opposed to anxiety).

#### 1.1.1. Confidence (as opposed to anxiety)

Research on attitudes to computers has often focused on anxiety. Chua, Chen, and Wong (1999, p. 610) defined computer anxiety as “a fear for computers when using the computer, or when considering the possibility of computer use.” About two decades ago, labels such as “computerphobia” (Jay, 1981) and “computer aversion” (Meier, 1985) were in common use to describe a negative emotional response to computers. This aversion was thought to be the predominant reaction of many people and the focus on anxiety led to several studies that examined the correlates (e.g., gender, learning style), causes (e.g., lack of computer literacy), and effects (e.g., avoidance of computers) of computer anxiety (e.g., Barbeite & Weiss, 2003; Beckers & Schmidt, 2001; Chua et al., 1999; Coffin & MacIntyre, 1999).

Most early instruments included items designed to assess anxiety and related constructs (Loyd & Gressard, 1984; Nickell & Pinto, 1986; Popovich et al., 1987). However, by the mid-nineties, a more nuanced and balanced view was emerging to accommodate the rapidly changing realities of computer use. For example, Whitley (1996a,b) suggested that computer attitudes were driven by three general factors: computer anxiety/confidence, positive beliefs about computers, and negative beliefs about computers.

Computers and the internet have now become so familiar that anxiety is no longer the predominant emotion mentioned when people discuss their feelings regarding IT. There is more to the human response to IT than anxiety, which is merely one trait out of many that might be important in our relationships with computers. Indeed, we are now much more likely to refer to an individual's confidence when working with computers and the internet – the number of truly anxious users of technology has dropped markedly in recent years (Smith & Oosthuizen, 2006). There is a general recognition that the full range and complexity of human personality has become engaged in our interactions with the artificial world of IT and that a number of factors other than confidence/anxiety determine our feelings toward computers and IT.

#### 1.1.2. Approval

Kay (1989, 1993) constructed a *Computer Attitude Measure* (CAM) which proposed that attitudes toward computers are mainly defined by feelings of favorableness or unfavorableness and that these feelings, in turn, are composed of four components – cognitive, affective, behavioral, and perceived control. The cognitive component focuses on belief; the affective component concerns liking; the behavioral component relates to activities in IT; and the fourth component considers “the perceived ease or difficulty of performing a particular behavior” (Kay, 1993, p. 372).

Liaw (2002) developed a survey instrument with two scales intended to measure attitudes toward the computer and the internet. A positive correlation between students' attitudes toward computers and toward the internet was observed. This suggests that attitudes to computers and attitudes to the internet can provide reciprocal concurrent validity. This study also showed that males had more positive perceptions toward computer and web technologies. When students had more years of computer-related experience, they also had more positive perceptions of computer and web technologies. Yang and Lester (2003) observed that both of Liaw's scales had a clear *Confidence* factor (Factor III) and their analysis also suggested that an *Approval* factor was present in both scales (Factor II), although Yang and Lester (2003) did not explicitly name this factor. Significantly, Liaw (2002) concluded that if users do not hold positive attitudes (approval) toward IT, then little else

matters. Bozionelos (2001) expressed a similar sentiment and noted that the more contact people have with computers, the more likely they are to express approval. DeYoung and Spence (2004, p. 61) described *Approval* as “a positive attitude toward the functions and uses of IT”; thus, *Approval* reflects the degree to which people feel positively about IT as a tool to accomplish various ends, such as surfing the internet, sending email, instant messaging, social networking, reconciling accounts, or arranging their photo collections.

#### 1.1.3. Interest

On the basis of their analyses, DeYoung and Spence (2004) proposed a separation of the “liking” or “positive attitude” factor found by others (e.g. Kay, 1989, 1993; Liaw, 2002) into two factors: *Approval* and *Interest*. Our present data also suggest that such a separation makes sense. We distinguish an affective attitude toward IT (*Approval*) from an attitude toward IT that is based on its intrinsic interest (*Interest*). We consider that it is possible to approve of IT and its many uses without necessarily being much interested in the details of how it works. Conversely, there are individuals who find IT interesting but do not have strong likes or dislikes regarding IT.

### 1.2. Need for a simple, comprehensive, and up-to-date measure

Attitudes toward computers and the internet likely have considerable influence on variables like computer use, computer literacy, the efficiency of computer-based learning, and career choices. Individual differences are not likely to be random but rather to be systematic. For example, men may hold different attitudes than women; the young will likely differ from the old; educational level may play a role; ethnicity and religious affiliation may be associated with different attitudes and behaviors; and so forth. If we are to investigate almost any aspect of behavior in the IT environment, it is prudent to assess the attitudes of the individuals studied using an instrument like the TPI. Some examples of individual differences variables that are of interest in HCI include:

#### 1.2.1. Gender

It is important to be able to track changing male-female attitudes (Whitley, 1996a; Yoder and Herrmann, 2005) for several reasons. One of the most important issues is related to the underrepresentation of women in IT. Participation of women in the IT sector is very low worldwide. In industrialized countries only one in four jobs in IT is held by a woman and the situation is worse in the developing world. This is regrettable in both human and economic terms. Many researchers have proposed that individual differences in attitudes are at least partly responsible for low participation rates in IT, with women's attitudes toward IT thought to be less favorable than those of men. Although early education, socialization, and discrimination have frequently been suggested as possible contributory factors, there is a conspicuous lack of accurate and timely baseline data regarding individual differences in attitudes. Such knowledge is critical to guide the design of remedial initiatives. Despite the existence of a considerable literature, our knowledge of women's attitudes to IT is surprisingly meager, with good empirical data and theory lacking. To improve our understanding, we must measure and track the attitudes of women (and men) to IT.

#### 1.2.2. Age

In North America and Europe, the average age of computer users is rising and this demographic change brings with it an increase in impairments and disabilities that affect computer use (Forrester Research, 2004). Aging is also sometimes accompanied by significant changes in personality, independently of changes

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