Available online at www.sciencedirect.com
ScienceDirect
Computers in Human Behavior 23 (2007) 478–495
Computers in Human Behavior
www.elsevier.com/locate/comphumbeh

The development of an instrument to measure the degree of animation predisposition of agent users

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Available online 8 December 2004

Abstract

The study reports on the development and operationalization of a construct that captures an individual's degree of predisposition towards watching animated films. It is believed that this construct may potentially explicate a person's perceptions and usage behavior towards animated agents in Microsoft Office applications. Animation predisposition is defined as an individual specific trait that reflects a person's predisposition towards watching animated films. It is operationalized in form of a four-item Likert type scale, which was found highly reliable and valid. This construct does not correlate with two other individual specific traits: computer playfulness and personal innovativeness in the domain of information technology. As such, it is suggested that animation predisposition is a distinct and independent research construct exhibiting desirable psychometric properties. The analysis demonstrates that the degree of people's animation predisposition is positively associated with their perceptions of enjoyment with an animated agent in MS Office. The computer users who have a higher degree of animation predisposition attempt to explore an agent's personalization settings more frequently than those with a lower degree of animation predisposition. Overall, this study offers a new approach to the investigation of an untapped area aiming to improve the quality of the contemporary research on the usefulness and user acceptance of animated agents.

Keywords: Animated agents; Animation predisposition; Instrument development

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0747-5632/$ - see front matter
doi:10.1016/j.chb.2004.10.042

1. Introduction

Even the most advanced users may experience anxiety, hesitation, and fear when they interact with computers (Seaward, 1998). People constantly have to upgrade their skills, learn new versions of software or totally new products, understand complex interfaces, and change their human–computer interaction (HCI) behavior. In order to address the challenging task of supporting users in their interactions with computer systems, software designers supply their applications with help features. The goal of help systems is to provide users with important, useful, timely, and easy-to-understand information within the very specific context of a user's lack of adeptness or familiarity with a particular task (Randall & Pedersen, 1998). Early help facilities represented paper documentation, books, reference guides, and tutorials. In the 1980s, software products began to have some sort of embedded software-based assistance marketed under the label of 'online help' that referred to the obtaining of help from a machine in electronic form rather than from the Internet (Bergman & Keene-Moore, 1985). Help authors aimed to improve a system's usability, experimented with different ways to present information, and emphasized user-friendliness of help facilities. In the 1990s, action-sensitive, context-aware, artificial intelligence-based, and intelligent coaching help systems emerged (Breuker, 1998). The purpose of those help applications was to predict when a user needs assistance rather than passively waiting for a request. For example, the incorporation of context-sensitive tool tips has shown to be a good way to improve the usability of virtually any interfaces including Webpages. The implementation of clickable icons or 'show me' buttons does not require individuals to switch from one interface to another that reduces their cognitive load, improves productivity, and increases satisfaction with the system (Chalmers, 2003). For the past decade, researchers have begun to experiment with the incorporation of animated, human, or cartoon-like agents in the graphical user interface of help systems.

Since 1992, Microsoft has devoted substantial efforts to design a computer character that would interact with a user in natural language and serve as an intermediary between a person and a software application. Ideally, it was meant to replace the entire conventional help facilities. The driving force behind this research stream was the long-term vision that the direct manipulation interface (Schneiderman, 1983; Shneiderman, 1997) is not a good match for the communication needs of contemporary computer users (Ball et al., 1997). Two major agent implementations were conducted by Microsoft Research: the UTOPIA Project (Microsoft Bob), and the Persona Project (Peedy the Parrot). The UTOPIA Project concentrated on the development and commercialization of an animated personal guide, or agent, which served as a primary application interface. This product was targeted to novice computer users who presumably might benefit from Bob's presence. Bob generated its speech in a text balloon and offered several buttons that a person might utilize in the next operation. In addition, Bot gave real-time tips, shortcuts and suggestions, emphasized important system's features, and pointed out to more efficient ways to complete a current task. Unfortunately, despite the over-optimistic predictions of

Fig. 1. Settings of an animated agent in MS Office.

Microsoft, Bob became a $100 million financial disaster (Dykstra-Erickson, 2000) because most potential users entirely rejected the agent.

Nevertheless, Microsoft continued exploring the possibility of the incorporation of animated agents in help systems. The Persona Project resulted in the introduction of animated Office Assistants that have been included in all Office applications starting with Office 97 (Windows) and Office 98 (Macintosh). In addition, Microsoft delivered the MS Agent technology that facilitates the development of animated agents compatible with many Office products, for example, Word, Excel, and Power Point. Most users come across an agent when they utilize a help menu in one of these applications. Fig. 1 offers a screenshot of an agent in Microsoft Office.

Despite the persistent attempts of Microsoft developers to deliver agents on the software market, the current literature, periodicals and the Internet offer anecdotal examples of the appropriateness of this technology based on user feedback. For example, the Paper Clip (or Clippit [1]) always attracts much critique (BBC, 2000; CNET, 2003). Technologies for the removal of MS Agents from Windows Operating System were developed (Trott, 1998). A few years ago, to address users' complaints, Microsoft attempted to limit the presence of animated characters on the screen of Office XP (Magid, 2001). At the same time, in spite of the negative publicity around this technology, various studies suggest that many users tend to enjoy animated agents. The underlying reason for this disparity is unclear. For example, it is

[1] Clippit is usually referred to as 'the Microsoft Paper Clip'. Since it is a default character, many people associate the MS Agent technology with this agent interface.

unknown why some Microsoft Word users enjoy obtaining help from an animated paper clip whereas others are inclined to use conventional textual help menus.

Help systems are not the only area concerned with the implementation of agent technologies. Recent years have demonstrated a growing interest in agents as aids for providing user assistance and automating complex or routine tasks that have been previously performed by human users (Hayes-Roth, 1995; Jennings, 2001; Jennings & Wooldridge, 1998; Maes, 1994; Maes, Guttman, & Moukas, 1999). As such, agents may be incorporated in virtually any computer applications where they play various roles, for example, Web guides (Keeble & Macredie, 2000; Lieberman, 1995), shopping assistants (McBreen & Jack, 2001), tutors (Johnson, Rickel, & Lester, 2000), or personal secretaries (Maes, 1994; Maes & Kozierok, 1993).

Considering past trends in agent development, there is no doubt that the technological realizations of animated agents will continue to transpire at a fast pace. However, the fact that end-users of agent-based computing will be able to adopt and utilize this promising technology successfully is not clear. An overview of the market of agent-based computing reveals that most agent projects fail to achieve commercial success. At the root of this matter lie two factors. First, agent manufacturers rarely analyze existing agent markets nor look at user requirements. Second, prior agent research lacks end-user adoption analysis that may explain the reasons why individuals accept or reject agent technologies. Practice shows that some users exhibit the willingness to accept agents more than others.

A recent meta-review of interface agent research conducted by Dehn and van Mulken (2000), demonstrates that the findings of prior empirical investigations on the usefulness and user acceptance of animated agents tend to be mixed and inconsistent. A possible explanation is that the contemporary agent scholars do not have research instruments targeted to the investigation of this new technology. There are few, if any, theories, frameworks, or models designed to explore the phenomenon of user adoption of animated agents. This study attempts to bridge that void by proposing and empirically validating a construct that may potentially explicate the reasons why some computer users adopt animated agents whereas others reject them. As such, this investigation introduces the animation predisposition construct and demonstrates that it positively influences people's perceptions of enjoyment with an animated agent as well as individuals' propensity towards exploring, manipulating, and personalizing an agent in MS Office applications.

2. Theoretical background

Most today's software agents, including Microsoft Agents, are implemented in form of computer characters that resemble characters of animated films. Often, those agents exhibit anthropomorphized features. For example, the Agentry.net website presents a list of 415 MS Agents most of which are designed in form of human, animal, or cartoon-like animated characters. This observation suggests that utilizing an animated agent in computer applications, for example, in a MS help menu, is, to some aspect, similar to watching an epigrammatic animated movie where a spectator is permitted to interact with the character. Thus, a person's associations, perceptions, and feelings towards animation in general are transferred to an animated agent that an individual is experiencing during the HCI process. This identifies the need for a new construct that may reflect a person's predisposition towards animation. As such, this factor may serve as an antecedent of an individual's perceptions of the human-animated agent interaction process. For example, it may be hypothesized that if someone is highly predisposed towards watching animated films, he or she finds animated agents in MS Office applications very enjoyable and is inclined towards exploring all features of this technology. In order to explore the rationale of this proposition and to develop a definition of the construct, the rest of this section presents an overview of animation and agent-related literature.

Animation is a type of filmmaking where characters are drawn by animators or artists, or created by computer technologies (i.e., no human actors present on the screen). Over the past two decades, animation has been transformed from its previously marginalized status. First, it attracts not only a young audience, but also adult viewers. This is reflected in the growing importance of animation as a medium that spans across a wider range of movies than those of children films (Pilling, 1997). For example, innovative adult-oriented cartoon series, such as The Simpsons or the recent releases of Shrek increase the popularity of animation among people of different ages. Second, animation producers can now employ new computer technologies that augment and sometimes even substitute previous film-making approaches. The latest trends reveal an attempt to move this technology towards 'cognitive animation' (Miranda, Kögler, Hernandez, & Netto, 2001). According to cognitive animation principles, characters perform action requests while behaving according to their own roles, motivation, strategies, and reasoning. Cognitive animation goes beyond the traditional model of computer-aided animation because a character's cognitive model controls what the character knows, how it acquires knowledge, and how it acts. These autonomous quasi-intelligent characters begin to populate the domain of animation production, game development, multimedia content creation, and virtual reality (Terzopoulos, 1999). Their usage is also predicted to encompass the Internet and electronic commerce (Funge, 2000). The fields of artificial intelligence and intelligent agents play a central role in the design of cognitive characters for animated movies.

When users interact with animated agents in a MS help menu, they notice that designers have drawn heavily not only upon animation principles, but also upon the anthropomorphization of computer interface. *Anthropomorphism* (the word anthropomorphism comes from the Greek words anthropos – 'human being/man' and morphe – 'form/shape/structure') is the ascription of human-like attributes and features to non-human objects. This characteristic of intelligent machines has a long-standing tradition in robot engineering, HCI, artificial intelligence, and interface agents research (Burgoon et al., 2000; De Laere, Lundgren, & Howe, 1998; Duffy, 2003; King & Ohya, 1995, 1996; Nass, Fogg, & Moon, 1996; Nass, Steuer, Henriksen, & Dryer, 1994; Nass, Steuer, Tauber, & Reeder, 1993). Some people tend to anthropomorphize hardware and software, to interact with computer systems as if they were real living beings, and to describe them in terms of human or personal characteristics such as needs, beliefs, desires, and intentions. For example, someone may say that an anthropomorphized machine 'reads', 'writes', 'thinks', 'talks', 'learns', 'feels', 'catches and transmits viruses', etc. Such modeling of computer behavior allows these individuals to understand software systems more easily since it is instinctually natural for people to think of anything that exhibits very complex behavior as a person rather than a thing. If it is applied properly, "anthropomorphism may provide opportunities to enhance human–computer interaction, to improve training and educational activities, and to extend the computer's capabilities through the application of intelligent agents and avatars" (Marakas, Johnson, & Palmer, 2000, pp. 738–739). Anthropomorphism has also entered the field of animation. For example, several recent animated films, such as Chicken Run, Toy Stories, Antz, and Bug's Life, present anthropomorphized worlds where characters and societies are prescribed human-only features.

The notion of anthropomorphism influenced decisions of agent designers working under the Microsoft Persona Project. As such, out of eight animated characters available in MS Office, six exhibit some degree of anthropomorphism. For example, Clippit often tries to express human emotions by blinking its eyes, smiling, and changing appearance. The look and feel of those agents may remind computer users their favorite characters from animated movies. This observation suggests the link between animation and software agents embedded in Microsoft Office applications and identifies the need to address the degree of animation predisposition of agent users.

Animation predisposition is defined as an individual-specific trait which reflects a person's predisposition towards watching animated films. Previous HCI and psychology research has demonstrated two basic approaches to depict a person-specific construct: (1) as a state (or flow), and (2) as a trait. *States* are affective or cognitive episodes that depend on a particular situation and fluctuate over time. States "can be influenced by situational factors and the interaction between the person and the situation" (Webster & Martocchio, 1992, p. 203). Flow is a time-limited experience. People in flow should not be completely aware of their own actions at a particular point in time. Once they look at themselves from outside, flow is interrupted (Csikszentmihalyi, 1975). For example, a software game player may be so deeply involved in the game that he or she finds a self-reinforcing optimal experience and interacts with the computer in a certain way. However, a few minutes later, the game pattern of the same player may completely change.

As opposed to states, *traits* are moderately stable individual behavioral characteristics which are relatively invariant across different situations. For example, a person may possess extraordinary divergent thinking abilities which he or she may constantly apply under various circumstances. This concept of trait stability has been successfully utilized in human resources management research as a proxy for identifying patterns of employees' behavior and formed the foundation for several theories of personality such as The Big Five (Digman, 1990), Allport's theory (Allport, 1924; Allport & Allport, 1921), Eysenck's model (Eysenck, 1990; Eysenck & Eysenck, 1969), and Cattell's (1946) theory. Two key antecedents of a user's perceptions of computer systems: computer playfulness (Webster & Martocchio, 1992) and personal innovativeness in the domain of information technology (Agarwal & Prasad, 1998) are defined as individual-specific traits.

According to the *interactionist approach*, both traits and states influence people's behavioral patterns (Magnusson, 1981; Shibutani, 1961). This view offers a solution to the trait versus state debate by postulating that traits shape individual behavior in the long-term whereas states may delineate short-term behavior with respect to a specific situation. For example, a university student may feel very comfortable using a computer for various activities such as games, Internet browsing, communications, and learning and demonstrate the stable traits of confident computer usage. However, he or she may express a high level of situation-specific anxiety while using a computer under stressful or risky circumstances, for example, during a computerized test.

With respect to animation predisposition, this research analyzes animation predisposition as an individual trait rather than a state. The argument behind this decision lies in the disruptive, intermittent, and sporadic nature of human–animated agent interaction in MS Office applications. Indeed, users interact with an agent for a very short period of time; mostly, when they utilize built-in help functions of the system. This irregular process, which usually lasts no longer than a few seconds, does not allow users to submerge fully into the process and to experience states (or flows). As such, traits of animation predisposition represent a relatively enduring tendency to watch animated movies.

The following section of this paper reports on the operationalization of the animation predisposition construct. The created instrument is subjected to further reliability and validity testing.

3. Instrument development

The instrument for measuring an individual's predisposition towards animated films was designed, tested, and validated within this study. At the first phase of instrument development, the substantial body of animation literature was reviewed. The current streams of animation research cover two distinct areas: animation history and animation technologies (Pilling, 1997). No papers that investigate the reasons why individuals like animated movies or scales for the measurement of the extent to which people are predisposed to watching animation were found. As such, an entirely new instrument should have been created.

At the second stage, the first ten-item draft of the questionnaire was designed. Several new items were developed and other items were adapted or re-worded from the existing HCI and MIS research instruments. In order to achieve a high degree of content validity of the suggested scale, the pool of questions was reviewed by a team of HCI and MIS experts, such as information technology specialists, university professors, and doctoral students. Several rounds of revisions were conducted until a consensus on the appropriateness and applicability of all items was reached. As a result, the instrument was dramatically modified and re-designed in the form of a seven-item Likert-type scale (see Table 1).

Table 1
Animation predisposition scale items

Scale items. 7-item Likert agree/disagree scale	
1	I like watching animated films
2	Given a similar plot and equal entertainment value, I would prefer watching an animated film than a non-animated one[a]
3	I wish I could watch animated films more often than I presently do
4	Watching animated films is an enjoyable part of my leisure activities
5	I have fun watching animated films[b]
6	When I hear about a new animated film, I wish I could watch it soon
7	In general, I find animated films annoying (R) [b]

R, reverse-scaled item.
[a] Item dropped after the first pre-test of the scale.
[b] Items dropped after the second pre-test of the scale.

At the third phase, two pilot studies were done to assess the reliability, validity, and psychometrical properties of the instrument. During the first pre-test, the scale was administered to 36 respondents who comprised randomly chosen students, staff, and faculty members of a Canadian University. In addition to completing the instrument, 18 individuals were briefly interviewed on the subject of face validity of the scale. Six items received very positive assessment and demonstrated high internal consistency. One item (question 2) was excluded for the following reasons. First, many respondents expressed their concerns with this item since many individuals like watching both animated and non-animated movies. Second, this item exhibited lowest internal consistency; after that question was eliminated, the Cronbach's α of the remaining items increased. Third, the loading of that item on the construct was below the recommended threshold of 0.7.

During the second pilot-test, an improved six-item instrument was administered to 126 subjects drawn from the same population. The loadings of two items (5 and 7) were below the selected cut-off value of 0.7. Thus, these items were eliminated. Question 5 pertained to the 'fun' or 'entertainment' aspect of animated films. The low loading of this item reveled that even though some individuals may tend to watch animated films, they may not necessarily have fun with this activity. The reversed-scaled item 7 asked whether respondents find animation annoying. In contrast to prior expectations, it was discovered that many people do not believe that animated movies are annoying although they tend not to watch them. These two questions were dropped, and the instrument was re-evaluated. After that, the scale behaved very consistently (Cronbach's $\alpha = 0.9$, item loadings >0.8).

4. The research hypotheses

The proposed animation predisposition construct was empirically tested. The purpose of this testing was twofold. The first goal was to estimate reliability and validity of this construct. The second objective was to demonstrate its explanatory power as

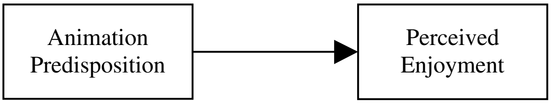

Fig. 2. Association between animation predisposition and perceived enjoyment.

a determinant of user perceptions and usage behavior regarding animated agents in MS Office applications. In order to achieve these goals, a theoretical model was constructed. Fig. 2 presents this model.

This model looks at the relationship between animation predisposition and perceived enjoyment with a MS Office animated agent. *Perceived enjoyment* is "the extent to which the activity of using the computer is perceived to be enjoyable in it's own right, apart from any performance consequences that may be anticipated" (Davis, Bagozzi, & Warshaw, 1992, p. 1113). Perceived enjoyment refers to purely intrinsic motivation. Intrinsic motivation is a voluntarily activity done for no apparent reinforcement other than the process of performing the activity per se (de Charms, 1968). In this case, satisfaction is inherent in the task and the positive experiences associated with the activity itself. This concept originated in the computer game field (Malone, 1982), and it is now often employed in information systems research. Many empirical investigations demonstrate the importance and high explanatory power of the perceived enjoyment construct (Atkinson & Kydd, 1997; Bourdeau, Chebat, & Couturier, 2002; Igbaria, Schiffman, & Wieckowski, 1994). Several studies include perceived enjoyment into the Technology Acceptance Model (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). This shows that people adopt software systems not only because of their usefulness and ease of use, but also because of their entertaining potential (Igbaria, 1996; Venkatesh, 2000).

In addition, the degree of user enjoyment is frequently credited as being one of the major arguments in favor of the employment of software agent technologies. Entertainment features are also incorporated into many agent interfaces, especially ones that are realized in forms of interactive characters. As such, many animated agents try to evoke positive human emotions, for example, smile or laugh (Dehn & van Mulken, 2000; Maes, 1995; Rist, André, & Müller, 1997) that positively influence the entire human-computer interaction process (Koda & Maes, 1996; Lester, Voerman, Towns, & Callaway, 1999; Suzuki, Ishii, & Okada, 1998; Takeuchi & Naito, 1995). Overall, this body of knowledge makes it reasonable to presume that perceived enjoyment may potentially influence usage behavior with respect to any innovative computer technology including animated agents.

With respect to the purpose of this study, it is proposed that individuals who are highly predisposed towards watching animated films will perceive animated agents in MS Office to be more enjoyable on their own right, apart from all anticipated consequences. The following hypothesis is suggested:

H1: Animation predisposition is positively associated with perceived enjoyment with animated agents in MS Office applications.

In addition, the relationship between people's animation predisposition and their manipulation experience with animated agents was investigated. Literature suggests that previous experience influences a person's behavior in a variety of situations, including the usage of software systems (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975; Taylor & Todd, 1995). Knowledge, derived from prior interactions with information technologies, resides in a person's long-term memory. It may be applied when a similar situation arises. Thus, system perceptions and adoption behavior differ between experienced and inexperienced computer users. Recently, Venkatesh, Morris, Davis, and Davis (2003) included IT experience as a key moderating variable in their suggested Unified Theory of Acceptance and Use of Technology (UTAUT) that further demonstrates the importance of addressing user experience in MIS research.

The Microsoft Office Agent technology offers a personalization interface which facilitates the selection of favorite characters or the specification of the nature of assistance. Fig. 3 provides a screenshot of this menu.

By personalizing this menu, individuals may choose when, how, and what category of assistance an agent may provide. For example, someone may ask an agent to offer tips on the usage of shortcuts while working under a new task with MS Word. The exploitation of this information allows users to identify effective patterns of interacting with software applications, remember them, and apply those patterns across a variety of situations. An attempt to personalize the setting of the agent requires that a person like the presence of animated characters on the computer screen. Thus, it can be assumed that people who exhibit a higher degree of animation predisposition may tend to explore the agent personalization settings more often.

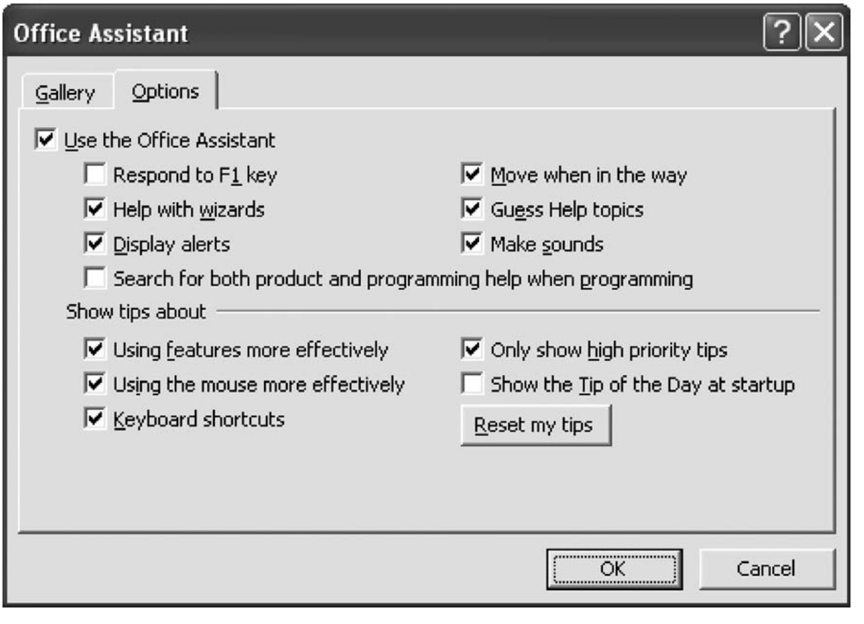

Fig. 3. MS agent personalization menu.

In order to test the explanatory power of the animation predisposition construct, it is suggested that:

H2: Computer users who have a high degree of animation predisposition attempt to explore an agent's personalization settings more frequently than those with a low degree of animation predisposition.

5. Methodology

In order to subject the proposed animation predisposition construct to a comprehensive methodological testing, a survey of 243 users of animated agents in MS Office applications was conducted. To establish construct validity of the measure, it is important to construct a cross-loadings matrix which compares the construct of interest with several other distinct measures. A decision was made to utilize the Computer Playfulness Scale (CPS) (Webster & Martocchio, 1992) and the personal innovativeness in the domain of information technology (PIIT) instrument (Agarwal & Prasad, 1998). Data on CPS and PIIT were collected as part of a larger instrument that measured several other determinants.

5.1. Subjects

Respondents to this survey comprised both undergraduate and postgraduate students of a Canadian university. On the one hand, the use of students in research surveys or experiments corresponds to a convenience sampling method (Kitchenham & Pfleeger, 2002). On the other, with respect to this investigation, it was believed that surveying this sample population allowed collecting reliable, valid, and generalizable data for the following reasons.

First, the students were motivated to accurately complete the survey by either bonus points or randomly drawn gift certificates. Four reverse-scaled items were included to common method bias. Second, the students were knowledgeable enough about the technology under investigation to offer insights on their experiences because over 99% of them indicated they were familiar with animated agents. For the past three years, all school's computer laboratories have had MS Agents installed in Office applications. Lastly, these students were the actual representatives of the general agent user population.

5.2. Measures

The perceived enjoyment scale was adapted from Davis et al. (1992). The original seven-item CPS developed by Webster and Martocchio (1992) and four-item PIIT instrument introduced by Agarwal and Prasad (1998) were applied. The degree of agent manipulation experience was measured by a single question asking individuals whether they have ever tried to select settings of a MS animated agent by experimenting with a personalization form. Two screenshots of the agent's configuration settings were provided. Respondents answered either 'yes' or 'no' to this item.

6. Results

The full study involved 243 individuals who were presumed current users of animated agents in MS help applications. Two participants reported that they were not aware of agents, two questionnaires were returned incomplete, and two others scored negatively on the reverse-scaled items. These questionnaires were excluded from data analysis. Seventy percent of all respondents were 20–25; 23% were 26–30; and 7% were over 30 years old. Fifty-eight and 42% were male and female; 43% tried to experiment with settings of an agent.

The loadings of the total set of all items were estimated by using Partial Least Squares (PLS) (Chin, 1998; Gefen, Straub, & Boudreau, 2000). Table 2 offers the measurement model. The results show that the loadings of three out of seven items of the CPS did not exceed the required threshold of 0.7 and were dropped. At the same time, the Cronbach's α was 0.81 which implies high internal reliability of the instrument. Once these items were removed, the model was re-evaluated. The item-to-total correlations of all indicators were greater than 0.35.

Tables 3–5 offer the matrix of cross-loadings, construct statistics, and the correlations matrix. The analysis of these tables allows concluding upon psychometric properties of the suggested construct.

Table 2
Estimated loadings for the total set of measurement items

Item	Mean	Std. dev	Loading	Error	Item-total correlations
CPS1	4.90	1.22	0.572[a]	0.673	0.444
CPS2	4.78	1.36	0.796	0.366	0.633
CPS3	5.47	1.21	0.621[a]	0.615	0.494
CPS4	5.30	1.28	0.806	0.350	0.649
CPS5	5.34	1.31	0.516[a]	0.128	0.391
CPS6	4.80	1.24	0.809	0.346	0.650
CPS7	4.76	1.37	0.836	0.301	0.684
PIIT1	4.82	1.51	0.876	0.233	0.764
PIIT2	3.86	1.73	0.851	0.277	0.731
PIIT3	5.19	1.45	0.817	0.333	0.683
PIIT4	5.06	1.36	0.885	0.218	0.777
ANM1	5.69	1.41	0.895	0.200	0.758
ANM2	4.66	1.61	0.891	0.206	0.830
ANM3	4.54	1.68	0.892	0.205	0.835
ANM4	4.19	1.61	0.877	0.231	0.790
PE1	3.30	1.79	0.915	0.162	0.761
PE2	3.37	1.61	0.736	0.458	0.517
PE3	3.13	1.64	0.940	0.117	0.828

[a] Dropped items.

Table 3
Matrix of loadings and cross-loadings

	CPS	PIIT	ANM	PE
CPS2	**0.796**	0.315	0.036	−0.071
CPS4	**0.806**	0.450	0.132	0.009
CPS6	**0.809**	0.277	0.117	−0.024
CPS7	**0.836**	0.368	0.099	−0.099
PIIT1	0.333	**0.876**	0.089	−0.189
PIIT2	0.437	**0.851**	0.062	−0.135
PIIT3	0.338	**0.817**	−0.040	−0.311
PIIT4	0.381	**0.885**	0.089	−0.152
ANM1	0.045	0.058	**0.895**	0.120
ANM2	0.102	0.032	**0.891**	0.191
ANM3	0.135	0.072	**0.892**	0.116
ANM4	0.145	0.066	**0.877**	0.122
PE1	−0.034	−0.191	0.181	**0.915**
PE2	−0.062	−0.186	0.062	**0.736**
PE3	−0.071	−0.233	0.138	**0.940**

Table 4
Construct statistics

	CPS	PIIT	ANM	PE
Arithmetic mean (used items)	4.95	4.73	4.77	3.27
Cronbach's α	0.83	0.88	0.92	0.83
Internal consistency[a]	0.886	0.917	0.939	0.900
Convergent validity[b]	0.660	0.727	0.790	0.754

[a] Fornell and Larcker (1981) measure of internal consistency of a construct is greater than 0.7 threshold.

[b] Fornell and Larcker (1981) measure of convergent validity of a construct is greater than 0.5 threshold.

Table 5
Correlation matrix and discriminant validity assessment[a]

	CPS	PIIT	ANM	PE
CPS	**0.812**			
PIIT	0.434	**0.853**		
ANM	0.118	0.060	**0.889**	
PE	−0.058	−0.227	0.162	**0.869**

[a] Fornell and Larcker (1981) measure of discriminant validity which is the square root of the average variance extracted compared to the construct correlations. The values are greater than those in corresponding rows and columns as per Fornell and Larcker.

First, the reliability of the animation predisposition scale was demonstrated because all item loadings exceeded the minimum threshold of 0.7, and Cronbach's α was 0.91 that falls into the acceptable range. Secondly, the construct as well as its indicators demonstrated high convergent and discriminant validity (see Tables 3 and 4). Thirdly, the multi-trait assessment of the scale indicated that the animation predisposition construct does not correlate with two other individual-specific traits: personal innovativeness in the domain of IT and computer playfulness (Table 5). Based on this evidence, it was concluded that animation predisposition is a distinct and independent research construct that exhibits desirable psychometric properties.

In addition to the examination of the properties of the emerged construct, further evidence on the rigor of this research was obtained. First, the correlation between the PIIT and CPS constructs was relatively close to the one obtained by Agarwal and Prasad (1998). Second, all other items utilized in the questionnaire demonstrated high reliability, internal consistency, and convergent and discriminant validity.

Jackknifing was done to derive *t*-statistics. Jackknifing is a resampling procedure for the assessment of the significance of PLS parameter estimates (Chin, 2001). With respect to H1, a strong positive association between the degree of people's animation predisposition and their extent of perceived enjoyment with animated agents in MS Office applications was found ($\beta = 0.162$, $p < 0.01$). Thus, H1 was supported.

Regarding H2, the animation predisposing scores of two populations were compared: those who explored the agent personalization menu in MS Office, and those who did not. A score for each person was obtained by performing factor analysis of responses pertaining to the animation predisposing scale. As such, the individuals who were more predisposed towards watching animated films attempted to explore the agent settings more frequently ($t = 1.655$, $p < 0.1$). This partially supports H2.

7. Discussion and conclusions

Recall the purpose of the study was to introduce a new construct that may potentially explain the reasons why some individuals enjoy utilizing animated agents in MS Office applications whereas other prefer to use conventional computer interfaces. The construct was created based on the convergence of MIS, HCI, and intelligent agent literature, operationalized in form of a four-item Likert-type scale, and successfully subjected to empirical testing. In addition, the explanatory power of this determinant was demonstrated. As such, the study proved that the degree of people's animation predisposition influences their perceptions of enjoyment with animated agents and partially affects their decision whether to explore all features, functions, and settings of this technology.

This investigation has several implications for both theory and practice. With respect to theory, it introduces a new construct that may lay the foundation for the development of other frameworks, models, and instruments targeted to user adoption decisions regarding agent-based computer technologies. It demonstrates a methodological approach to the investigation of a totally new area aiming to improve the quality of contemporary research on the usefulness and user acceptance of software agents. In addition, the study highlights the importance of addressing user-specific traits as a major determinant of the perception of the human–computer interaction process. With regards to practice, this investigation shows that MS Office users associate animated agents with animated movie characters. This implies that agent developers may take advantage of this phenomenon.

The study also shows that the level of perceived enjoyment with agents in MS Office is very low (3.27 out of 7). Less than 50% of MS Office users tried to experiment with an agent's settings. Definitely, MS Agents add little, if any, extra functionality; their enjoyment potential is very limited; they confuse novice users; and distract individuals from obtaining assistance. The mandatory usage of animated agents in the help system is another potential reason that explains this phenomenon. It is recommended that software manufacturers should respect individual differences and preferences of computer users by allowing to opt-out of the use of agents.

With respect to future investigations, several avenues can be explored. For instance, researchers may try to identify other user-specific factors that may contribute in our understanding of the reasons why individuals accept or reject agents in software systems. Other projects may utilize the suggested determinant as an antecedent of other constructs measuring user perceptions of computer applications. The significant body of MIS literature reports that perceived enjoyment with a computer system positively affects an individual's perceptions of usefulness, ease of use, and behavioral intentions towards usage (Davis et al., 1992; de Souza Dias, 1998). That would be interesting to see whether the same principles apply to agent-based computing. For instance, it may be investigated whether the levels of perceptions of animated agents of people who have already explored all functions and features of MS Agents versus those individuals who have not may potentially account for a greater variance in user adoption behavior.

Looking at the past trends of agent development, there is no doubt that agents will continue to transpire in computer applications at a fast pace. Currently, the field of agent-based computing is in an early stage of development. This study is one of the first attempts to explore the phenomenon of agent usage in software applications. It is hoped that by analyzing animated agents from a user's perspective and by utilizing new models, constructs, and instruments that a greater understanding of factors influencing individuals' decisions whether to accept or reject agent technologies can be obtained.

Acknowledgements

The author is grateful to Dr. Nick Bontis and Dr. Brian Detlor who generously offered their help with ideas, suggestions, and data analysis. Special thanks goes to Dr. Gregory J. Fleet and Tracy Jenkin who provided very valuable feedback on the earlier version of this paper at the Administrative Sciences Association of Canada (ASAC) Conference.

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