User Perceptions and Employment of Interface Agents for Email Notification:
An Inductive Approach

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ABSTRACT

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Keywords: Email Notification; Interface Agents; Survey; Usage; User Perceptions

INTRODUCTION AND LITERATURE REVIEW

The purpose of this study is to empirically investigate how people utilize and perceive interface agents for electronic mail notification. Interface agents are software entities that are continuous (long-lived), reactive (adapt their actions depending on an external environment), collaborative (collaborate with users, other agents or electronic processes), and autonomous (independent). They act as an intermediary

between a user and a system and communicate directly with the person by offering assistance in computer-related activities (Detlor, 2004; Lieberman & Selker, 2003; Serenko, 2007a; Serenko & Detlor, 2004; Serenko, Ruhi, & Cocosila, 2007). Interface agents may be included in most software applications, including email systems (Maes, 1994; Serenko, 2006).

Email has turned into one of the most successful computer applications ever designed (Lucas, 1998; Sproull & Kiesler, 1986). However, as the volume of communication and the variety of tasks grow, today's email systems fail to provide an adequate level of user support for many routine tasks, especially for message searching and filing. People feel overwhelmed with the volume of textual information received. For example, when a person receives a new message in Outlook, he or she has to interrupt the current task to screen or read the message.

There are ways to improve email systems. One viewpoint is that a conventional text-based direct manipulation interface is a major source of users' dissatisfaction with their email tools (Ducheneaut & Bellotti, 2001) and that interface agents may provide a possible solution to address email challenges. Interface agents may potentially address some shortcomings of the contemporary email systems by meeting actual user needs, offering value-added services, implementing new approaches, automating complex or routine tasks, improving system interfaces, and en-

hancing an individual's experiences with email applications.

There are at least five categories of email related assistance which may be provided by agents (Gruen, Sidner, Boettner, & Rich, 1999):

1. Pre-Processing – an agent processes a message to present it in the most efficient way to the user;
2. Filtering / Prioritizing – an agent filters out incoming mail and ranks it in order of importance;
3. Adding Relevant Information – an agent supplements a message with additional relevant information; for instance, the sender's affiliation;
4. Delegating Complex Tasks – an agent performs a series of complex or repetitive steps in response to a single high-level request by directly manipulating the system; and,
5. Inferencing – an agent makes suggestions and recommendations which are based on a user's profile; for example, points out information a user might consider significant.

In addition to these types of support, agents may help users integrate their email systems into various computer applications, facilitate the use of email with new devices, trace the status of all messaging and work related activities, generate automatic responses, and add interactivity and emotions to convey equivocal information.

In spite of a number of initiatives that aimed to develop interface agents for email, there are very few end-user

applications that are actually available on the software market. Most previous projects focused on the creation of models and prototypes of email interface agents rather than on the development of ready-to-use commercial products. Even though there are several successful applications, for example, CoolAgent (Bergman, Griss, & Staelin, 2002) or SwiftFile (Segal & Kephart, 2000), very few products were made freely or commercially available to all email users. Interface agents for email notification represent one of the earliest applications that have already been commercialized. The goal of these systems is to inform individuals about the current state of their email (Libes, 1997). Recently, developers have started designing add-on interface agents for some email clients.

There are several challenges that all email agents researchers currently face (Dehn & van Mulken, 2000). First, most research initiatives in this area are disparate and independent from one another which often results in the duplication of prior work. Secondly, many projects are purely technology-oriented, emphasize a technological implementation of an agent system over user evaluations, and rarely commercialize the application. Thirdly, preceding research rarely addressed the practical aspects of the usage, development, and promotion of interface agent technologies. Currently, there are few, if any, guidelines or recommendations for manufacturers of this technology. It is these problems that impede the development of this

research area and delay the emergence of really useful email agent systems.

There are at least ten distinct theories that were developed to understand user acceptance and diffusion of electronic mail: 1) diffusion of innovations (Murphy & Tan, 2003; Rogers, 1995); 2) social influence (Fulk, 1993; Fulk, Schmitz, & Steinfield, 1990); 3) social presence (Rice, 1993); 4) critical mass (Markus, 1990); 5) structuration (Orlikowski, 1992; Orlikowski, Yates, Okamura, & Fujimoto, 1995; Yates & Orlikowski, 1992); 6) critical social (Ngwenyama, 1997); 7) media symbolism (Trevino, Daft, & Lengel, 1990); 8) media richness (Daft & Lengel, 1986; Daft, Lengel, & Trevino, 1987); 9) channel expansion (Carlson & Zmud, 1994, 1999); and, 10) uses and gratifications theory (Dimmick, Kline, & Stafford, 2000). None of them, however, may be utilized in the present project. First, these theories concentrate on the electronic communication itself. Second, they view email as a communications medium without taking into consideration technical aspects. Third, they ignore factors that may be associated with systems augmenting email, such as agents. Therefore, other research approaches should be investigated.

In order to fill that void, the purpose of this study is to gain insights on how individuals utilize and perceive interface agents for email notification in their electronic mail environments. This project focuses on notification agents for two reasons. First, little is known about end-user perception and

employment of interface agents in general and, particularly, interface agents for email notification. Second, there are commercially available versions of this technology that makes it possible to poll the actual users instead of conducting a laboratory experiment. On the one hand, laboratory experiments may generate valuable findings that are of interest to both scholars and practitioners. On the other hand, as hypothesized by Dehn and van Mulken (2000), adequate perceptions and behavioral intentions towards interface agents may take some time to establish; therefore, laboratory studies should be combined with user surveys.

Therefore, the study suggests an inductive research approach that polls real-life end users of this technology, via a Web-based questionnaire, on the cognitive and contextual factors surrounding the employment of email interface agents. It is hoped that by analyzing interface agents for email notification from a user perspective, a greater understanding of the factors that influence individual decisions whether to accept or reject agent technologies can be obtained.
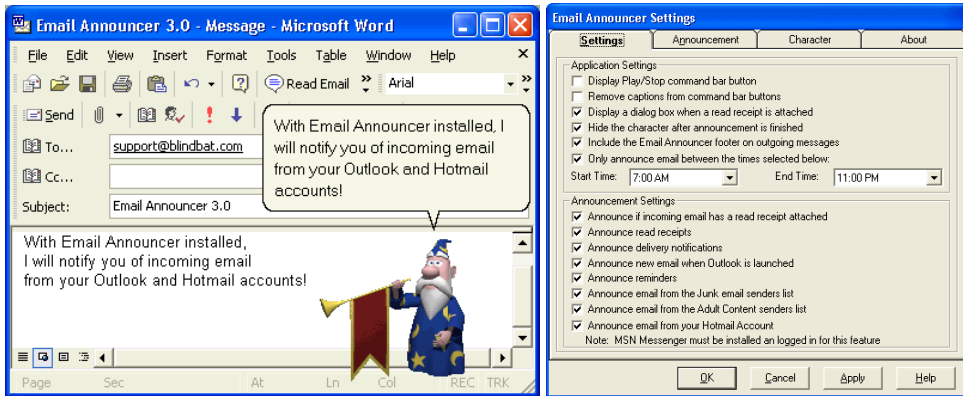
RESEARCH QUESTIONS

An intensive Web-search for such applications was conducted, and several email interface agent-based programs that are commercially available on the market were identified. They employ the Microsoft Agent Technology and are relatively similar in terms of their functionality. Their purpose is to inform users about the state of an email system by announcing incoming messages, calendar reminders, current time, jokes, etc. They may read help files, webpages, or any text. Several offer extensive features such as teaching tutorials on email system usage and sending animated messages. Out of these products, Email Announcer developed by Blind Bat Software was randomly chosen, and agreement with the company to conduct user survey was reached (see Figure 1).

To develop the understanding of user perceptions and employment of this technology and to produce recommendations that may be of interest to manufacturers, three research questions were developed. Innovation research suggests that users often play a leading role in the invention and improvement of new products and services (Biemans, 1991; Lüthje, 2004). Many commercial projects have succeeded because designers and manufactures involved users in the early stages of innovation development. A strong understanding of user needs is a key factor separating new product winners from losers (Cooper & Brentani, 1991). It is crucial to collect information about consumers at each stage of a product's lifecycle (Goldsmith & Hofacker, 1991; Midgley & Dowling, 1978). The goal of most marketing surveys is to form a sound understanding of the various characteristics of product users, such as demographics, habits and inclinations.

Figure 1. Email announcer by blind bat software – agent interface and configuration environment

The understanding of user attributes and personal characteristics is also important in the field of agent-human interaction (Isbister & Nass, 2000). Therefore, the following research question is proposed:

Research Question 1: *What are the characteristics of the user population who adopt interface agents for email notification? For example, age, gender, occupation, email usage experience, and country of residence.*

In addition to user attributes, the actual usage and user perceptions of interface agents are important issues that are of interest to developers. Prior experience has been found to be an important determinant of behavior in various situations (Ajzen & Fishbein, 1980), including the use of computer technologies (Taylor & Todd, 1995) and interface agents (Serenko, 2007b). There are significant differences in per-ceptions of applications, depending on a user's level of hands-on familiarity. For example, expert and heavy users of email interface agents may develop a stronger knowledge, special usage habits, and different perceptions of agents than individuals who use email agents less frequently. Currently, it is unknown why people like or dislike employing email interface agents, and how they envision an 'ideal' agent.

Based on this discussion, it is believed that the knowledge of agent usage patterns and people's perceptions of interface agents will help all parties involved in the process of inventing, development, and marketing email interface agents to deliver the product that will meet customer expectation. The following research questions are suggested:

Research Question 2: *How do people typically utilize interface agents for email notification?*

Research Question 3: *What are people's perceptions of interface agents for email notification?*

METHODOLOGY

This project utilized an inductive approach with the goal to investigate the contextual factors surrounding end-user employment and perceptions of email interface agents.

An inductive approach was chosen because of an exploratory nature of this study. As such, this project presented three general research questions. Based on the answers to these questions, a number of hypotheses may be suggested. An inductive method of inquiry allows new phenomena to emerge from the data, without restrictions imposed by other research techniques (Romeyn, 2004; Stolee, Zaza, Pedlar, & Myers, 1999). The purpose of inductive data analysis is similar to those of other research techniques (Miles & Huberman, 1994). Specifically, this approach is useful if the objective is to summarize open-ended data, establish links among variables, link data to research questions, and develop general models, theories or frameworks that may be further tested through deductive methods.

For **research question 1**, information on user background was solicited. Individuals were asked about their email usage in terms of time spent with their email, average daily number of sent and received email messages, age, gender, occupation, country of residence, and education.

To tackle **research question 2**, users were asked to indicate whether they were employing Email Announcer on the date of the survey. Those who did not use the agent were asked for their usage termination reasons. All were asked to specify how frequently they employed this technology at work, at home, in school, and other places. They also provided the most frequently utilized functions, the extent to which these functions were used, and period of agent usage.

For **research question 3**, open-ended questions asked respondents to list at least three reasons why they like to utilize interface agents in their email application, three reasons why they dislike doing so, and three tasks that they would like an 'ideal email interface agent' to perform.

The online survey included instructions, definitions, and screenshots of an agent-based notification program. A list of respondents was randomly formed from the customer database. Only those who purchased Email Announcer at least three months ago were selected. All selected individuals were sent an initial invitation and three weekly reminders. A monetary incentive of ten US dollars was offered.

RESULTS

User Background

Seventy-five usable responses were obtained at a response rate of over 30%. Eighty and twenty percent of users were male and female (Figure 2). Over 65% were between 31 and 50 years old, and the 46 – 50 age category was the most frequent user group. Two distinct occupational categories emerged: information systems / information technology-related (IS / IT), and engineering (Figure 3). The 'Other' category includes various occupations not related to IS / IT or engineering. 34% of users belonged to middle and senior management, such as a chief executive officer, vice president, department manager, or senior expert. The majority of email interface agent users were well-educated and resided in the USA (Figure 4 and Figure 5).

Figure 6, Figure 7, and Figure 8 outline current email usage: the number of email messages received, the number of email messages sent, and the number of hours spent working with an email application daily. They imply that the individuals who utilized interface agents were very heavy email users.

Based on our interaction with respondents, a solid understanding of users' financial position was formed. It was concluded that the respondents were financially well-off. As such, one-third of the users belonged to middle or senior management, most of them were highly educated that leads to a higher income, and 19% of the subjects kindly declined the compensations of $10.

Actual Usage of Email Interface Agents

Forty people employed the agent on the date of the survey and thirty-five did not. The current users indicated that they used it for 16 months on average, ranging from three to 36 months. The past users utilized it for 8 months on average, also ranging from three to 36 months. Figure 9 and Figure 10 outline the extent of the usage of interface

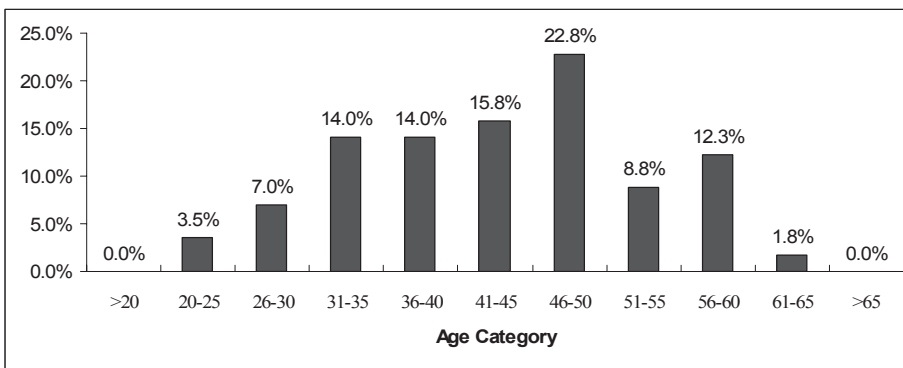*Figure 2. The age categories of email interface agent users*
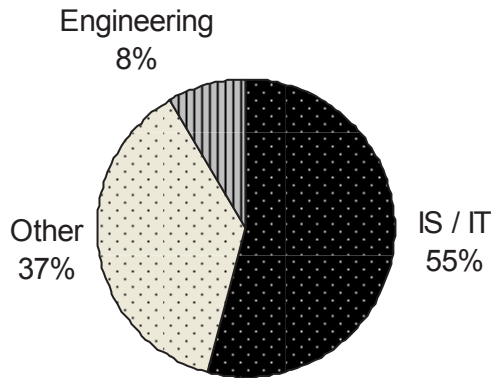
Figure 3. User occupation
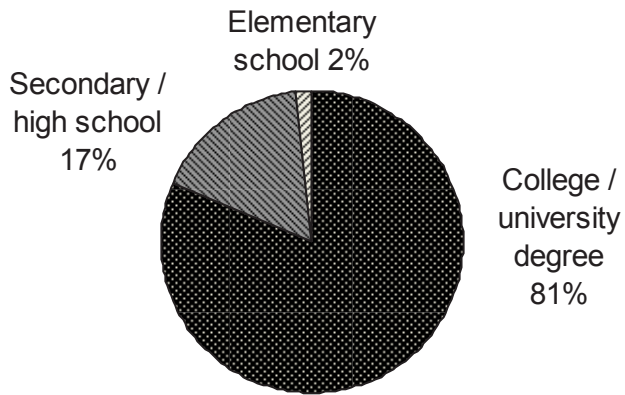

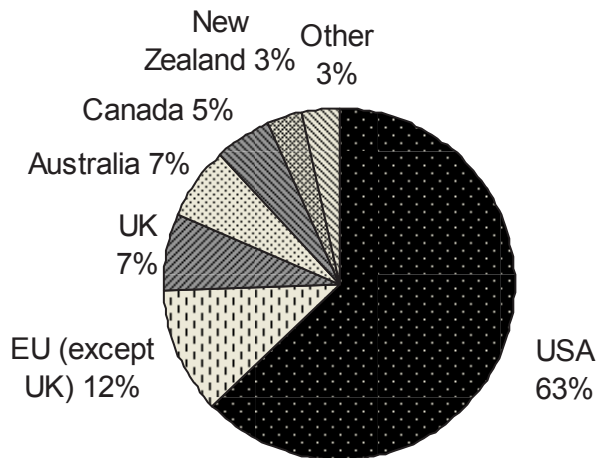*Figure 4. User education*

Figure 5. User country of residence

Figure 6. Number of email messages received daily by agent users

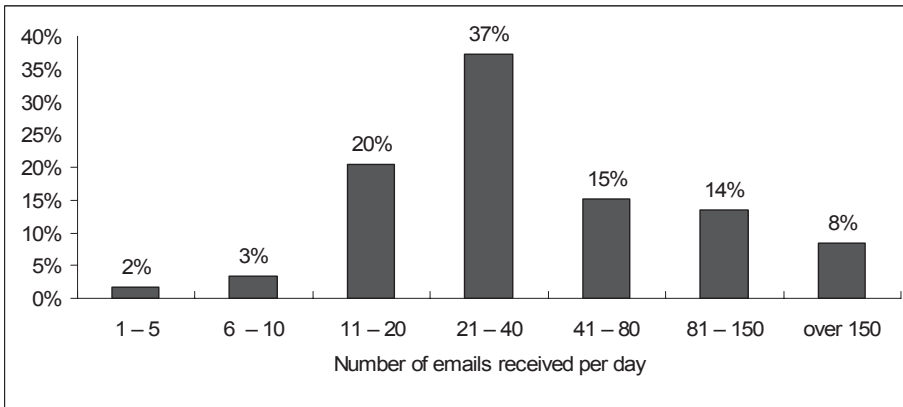Number of emails received per day

Figure 7. Number of email messages sent daily by agent users

Number of emails sent per day
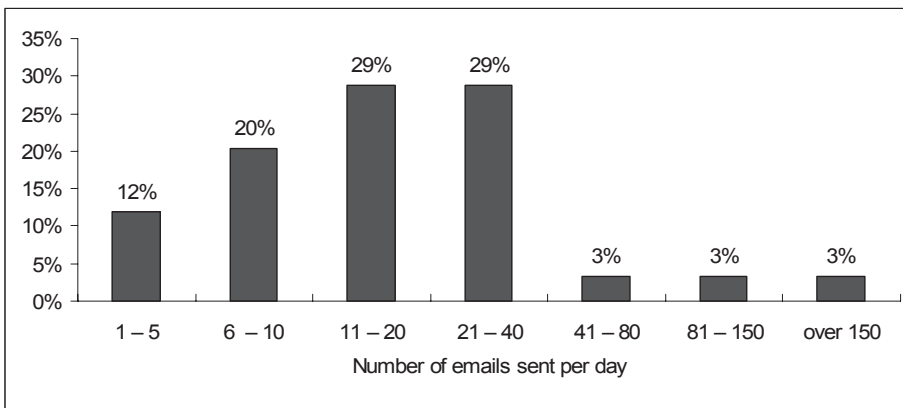
Figure 8. Time spent with an email system daily by agent users

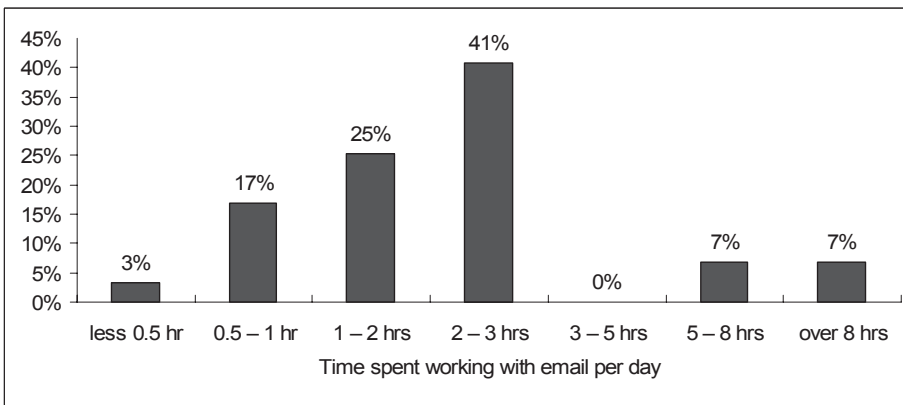Time spent working with email per day

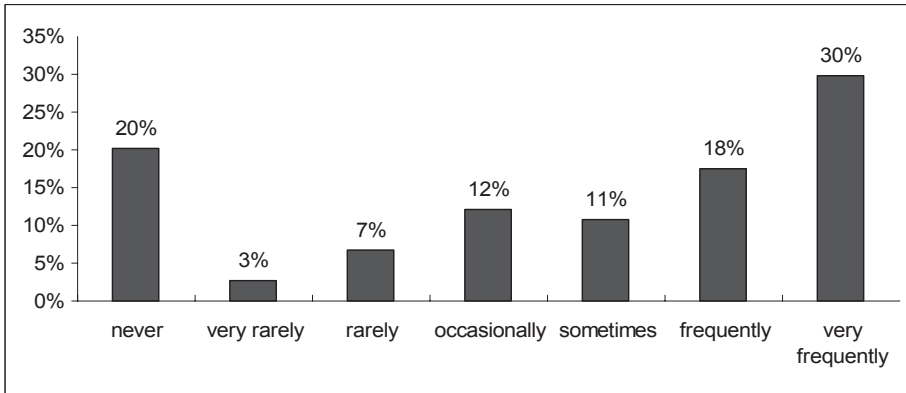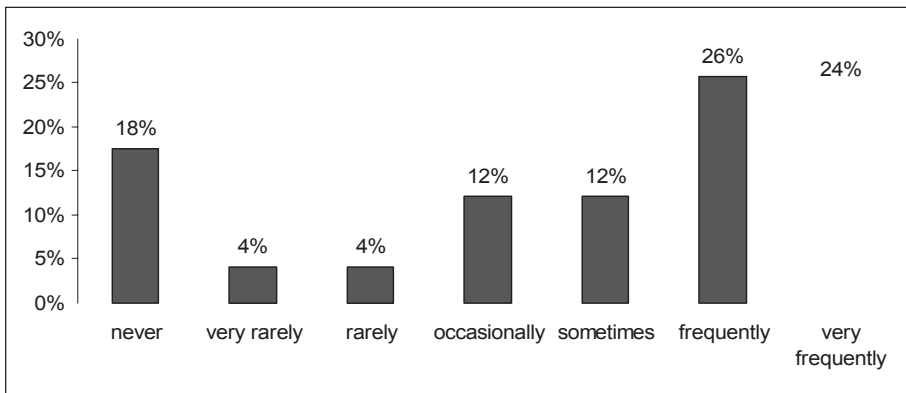*Figure 9. Actual usage of email interface agents at work*

Figure 10. Actual usage of email interface agents at home

agents at work and home. Most respondents were very heavy users of agents; they utilized agents both at work and at home.

Figure 11 and Figure 12 present the percentage of users who employed interface agents to announce messages and calendar reminders in MS Outlook. Figure 13 depicts the percentage of people who utilized interface agents to announce messages in Hotmail, and Figure 14 offers the percentage of individuals who used interface agents to announce read receipts in any email system.

These figures demonstrate that most people used interface agents in MS Outlook. The announcement of incoming messages was the most frequently employed feature followed by the presentation of calendar messages. The announcement of read receipts was utilized less frequently; one-half of all email agent users never used it.

Figure 15 and Figure 16 present the percentage of all incoming messages and calendar announcements that were

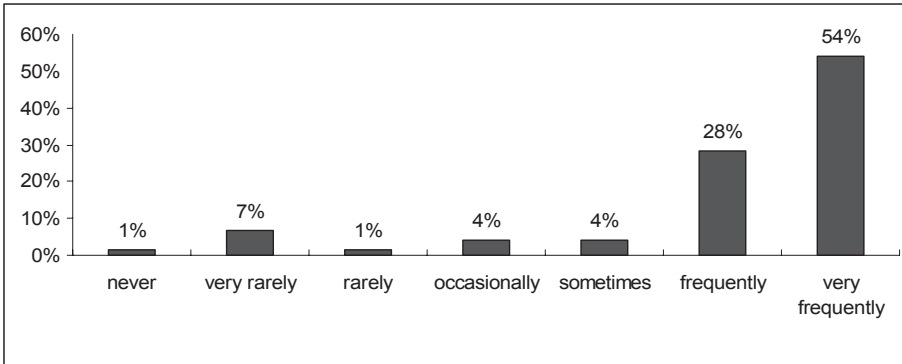*Figure 11. Users who utilize agents to announce messages in MS Outlook*

Figure 12. Users who utilize agents to announce calendar reminders in MS Outlook
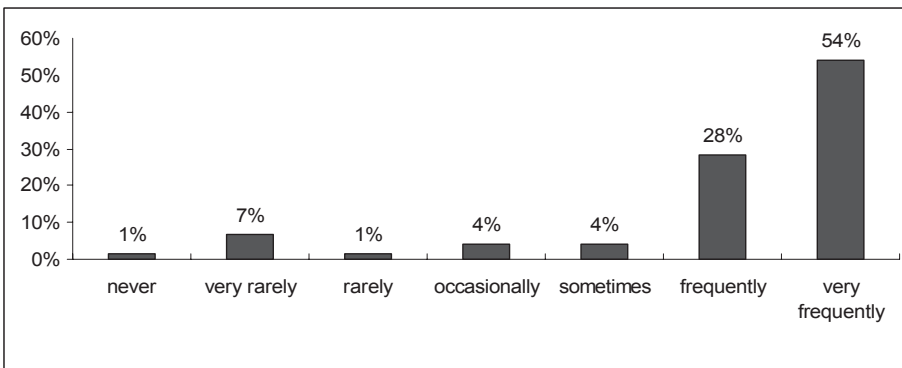
Figure 13. Users who utilize agents to announce messages in Hotmail
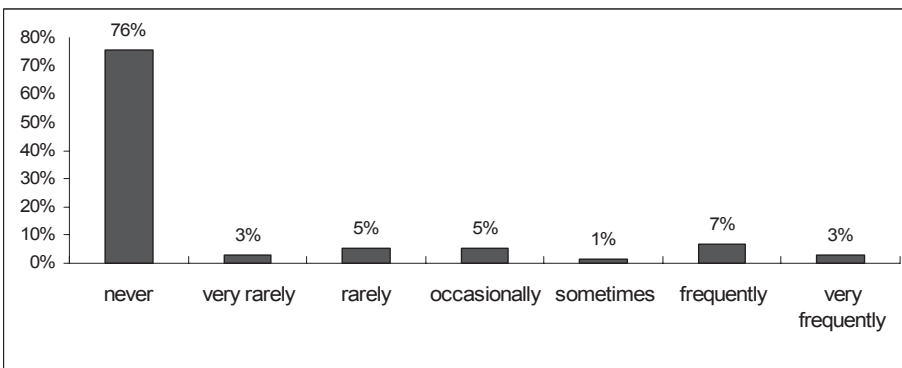
delivered by email interface agents. This confirms the earlier observation that message announcement was the most often utilized feature.

Figure 14. Users who utilize agents to announce read receipts in MS Outlook and/or Hotmail

Figure 15. Incoming email messages announced by interface agents

Figure 16. Calendar reminders announced by interface agents

The usage categories provided by each respondent were converted into scores and a correlations matrix was constructed (see Table 1). For example,

the categories corresponding to Figure 11 were converted as follows: never – 1, very rarely – 2, rarely – 3, occasionally – 4, sometimes – 5, frequently – 6, very frequently – 7.

Perceptions of Email Interface Agents

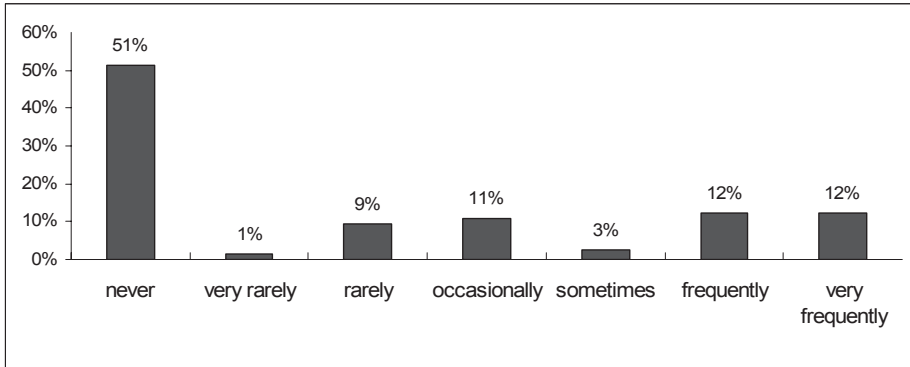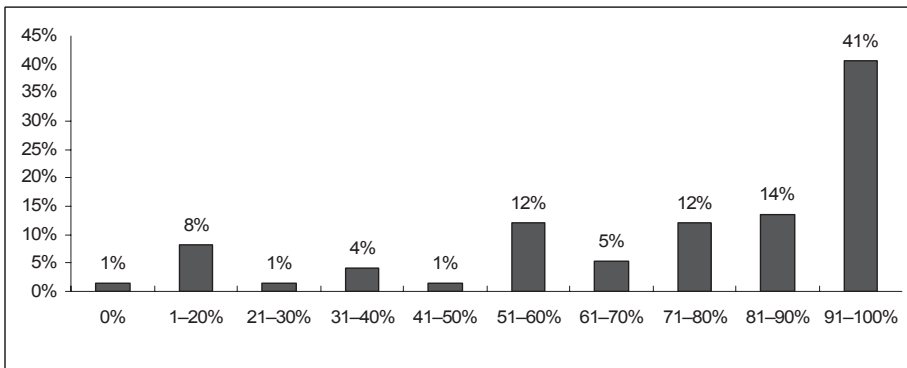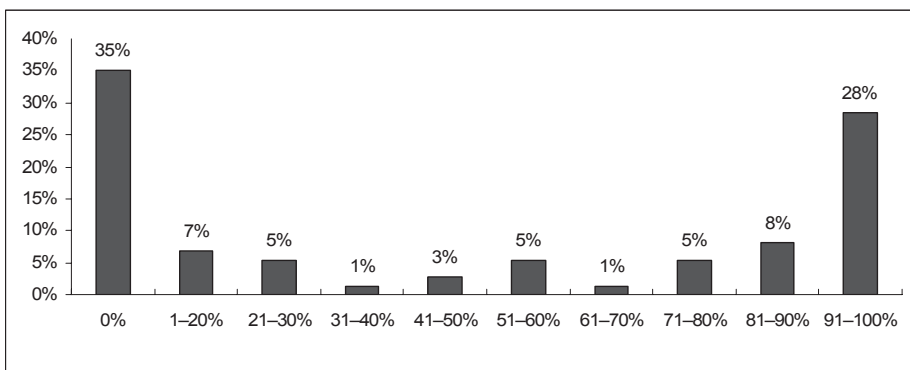The respondents were asked to provide several answers in the form of open-ended questions and classical content analysis was done. Draft *a priori* categories for a preliminary codebook were developed based on human-computer interaction, technology adoption and innovation theories. The researcher conducted successive rounds of coding, developed new codes, modified earlier codes, grouped codes together, discarded repeated codes, and aligned code labels and descriptions with concepts and definitions in the existing literature. The draft version of the codebook was evaluated by an independent expert, and two rounds of revisions were made until agreement on item classification was reached. All items were coded on the lowest level by three independent coders, and only one code was assigned to a particular text unit. A training session was conducted on the use of Email Announcer and the codebook. The Krippendorff's (1980) agreement coefficient ranged from 0.77 to 0.84 that is acceptable (Keaveney, 1995). All discrepancies were discussed, and a final agreement on the classification of all items was reached. When the response was unclear, and the coders failed to agree on which category it belongs to, it was excluded.

Table 1. Agent usage correlation coefficients (bold: p <.1)

Correlation/ Significance	Work Usage	Home Usage	Message Announc. Outlook	Reminder Announc. Outlook	Message Announc. Hotmail	Read Receipt Announce.	% of Messages Announc.
Home Usage	**0.282** **0.015**	1.000					
Message Announc. Outlook	**0.479** **0.000**	**0.290** **0.012**	1.000				
Reminder Announc. Outlook	**0.296** **0.010**	**0.245** **0.035**	**0.439** **0.000**	1.000			
Message Announc. Hotmail	0.029 0.805	**0.243** **0.037**	-0.045 0.703	0.188 0.109	1.000		
Read Receipt Announce.	0.179 0.128	**0.208** **0.075**	**0.276** **0.017**	**0.357** **0.002**	0.165 0.161	1.000	
% of Messages Announc.	**0.327** **0.004**	0.073 0.535	**0.611** **0.000**	**0.284** **0.014**	0.004 0.970	**0.226** **0.053**	1.000
% of Reminder Announc.	0.186 0.114	**0.206** **0.078**	**0.280** **0.016**	**0.658** **0.000**	0.096 0.415	**0.200** **0.088**	**0.422** **0.000**

Reasons for Agent Usage Termination

The results demonstrated that 35 in-dividuals did not use the agent on the date of the survey. Figure 17 shows the results for agent usage termination. An **agent's operability**, which is defined as factors pertaining to the operational characteristics of an agent, was the most frequent reason for which people stopped using the agent (37%). **Nega-tive user perceptions** (high degree of perceived intrusiveness or distraction caused by the agent, low degree of per-ceived agent usefulness, and perceived unattractiveness of the agent interface) were the second most common reason (24%). Lack of **user access**, in a result of computer crash, to an agent was the third most common reason (21%). Ef-fects of the **external environment** that influenced a user's adoption decision were the last category (18%). Respon-dents referred to their company policies that prohibited the employment of un-authorized software, substitute software products, noise constraints, and privacy concerns. Overall, the data showed that most respondents were willing to continue using the system. Only 24% of them discontinued the usage because of their negative perceptions.

Reasons Why Users Like Email Interface Agents

With respect to the factors why people liked to use the email interface agent, 146 reasons were provided (Figure 18).

User perceptions of an agent were the major reason why people liked to utilize agents. They were followed by an **agent's operability**; users liked person-alization, compatibility, and reliability of this technology. **External Environ-ment** of an agent user represented 6%

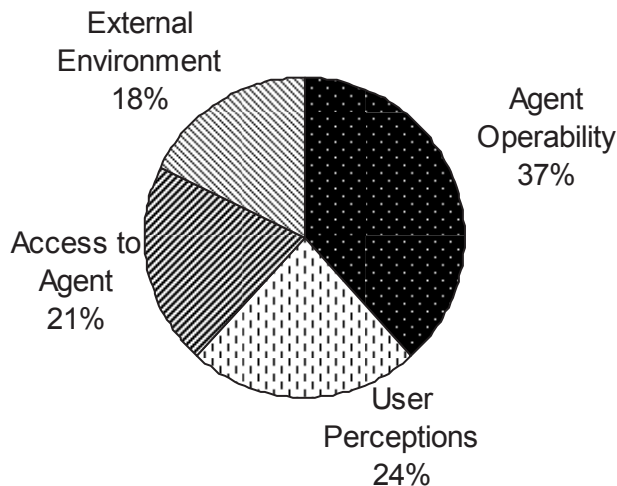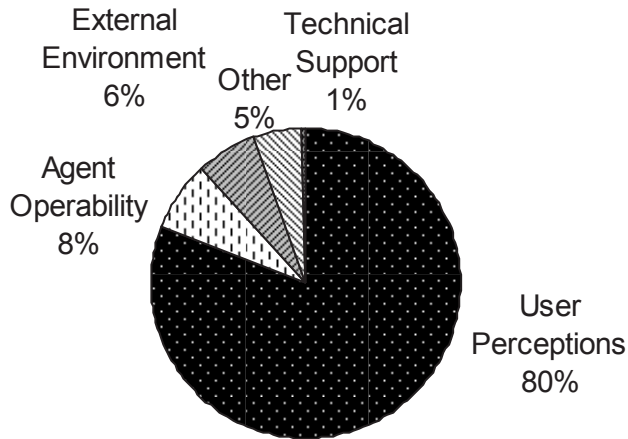*Figure 17. Reasons for agent usage termination*

*Figure 18. Reasons why respondents like to utilize email agents*

of responses. People stated they liked to utilize agents because this improved their image of being a highly innovative individual within their social group. Given that 80% of all responses related to **user perceptions**, a detailed review of this category was done (Figure 19).

The perceptions of an agent's usefulness (i.e., functionality) were a leading factor. Users perceived themselves to become more productive with the usage of their email by engaging in multi-tasking. They did not have to interrupt their current non-email or even non-computer related activities. For example, when a person was working with MS Word, an agent popped up and informed her about a new message. Based on user preferences, the agent might announce a sender, a subject line, or the entire message. The individual did not have to switch from MS Word to an email system to be aware of incoming messages. Moreover, the user might be away from the computer and hear email, calendar, and event announcements that saved time and increased productivity.

Hedonic reasons, which were independent of the outcome of agent usage, constituted 29% of user perceptions. Most people mentioned that agent usage was fun, amusing, and entertaining. It made them laugh and gave them pleasure. **Human-computer interaction** factors comprised 22% of reasons relating to user perceptions of agents. Respondents positively perceived an agent's attractiveness, ease of use, and accessibility. Some referred to **interruptions** initiated by an agent; they liked when an agent interrupted their activities by initiating breaks and providing distractions from routine tasks.

Figure 19. Reasons why respondents like to utilize agents (user perceptions)
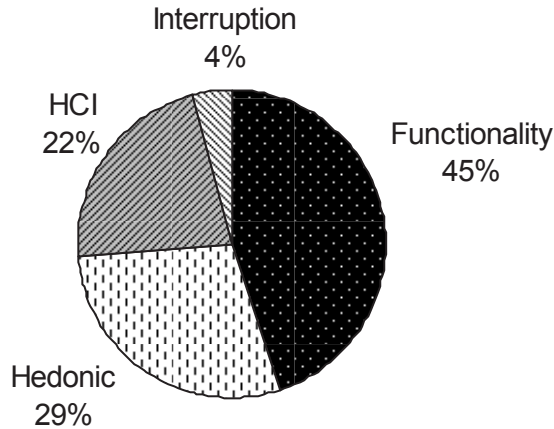
Reasons Why Users Do Not Like Email Interface Agents

The subjects offered 116 reasons why they did not like to use interface agents (Figure 20). Negative user perceptions of an agent (42%) were the key reason. Figure 21 outlines the breakdown of responses pertaining to this category.

Characteristics of an 'Ideal' Email Interface Agent

In terms of characteristics of an 'ideal' email interface, 126 answers were obtained (Figure 22).

Two distinct groups of responses emerged: items relating to an agent's operability (86%) and to human-computer interaction (7%). For an agent's operability, answers pertained to an agent's notification capabilities, which were referred to as the presentation of information, such as incoming messages, reminders, due events, etc., in a timely and persistent manner. At the time of the survey, the email interface agent by Blind Bat (as well as all other agents from other manufacturers) performed basic information notification tasks. Users wished to improve the way the agent performed some activities and to be able to utilize extra features. For instance, it should deliver more urgent notifications first, tell current time, time to take a break or go home, and due dates of critical events, such as an approaching project completion deadline. It should be more persistent, yet non-intrusive, in user notification. After announcing an important, urgent message, an agent should track task completion and remind a user if the activity was incomplete, but it should do it in a non-intrusive manner, and the user should have full control over its actions. Users also wanted agents to possess more intelligent features, including rule-based logic, machine learning capabilities, text analysis features, automatic response

Figure 20. Reasons why respondents do not like to utilize email agents

License Fee 2%
Technical Support 2%
Other 8%
External Environment 9%
User Perceptions 42%
Agent Operability 37%
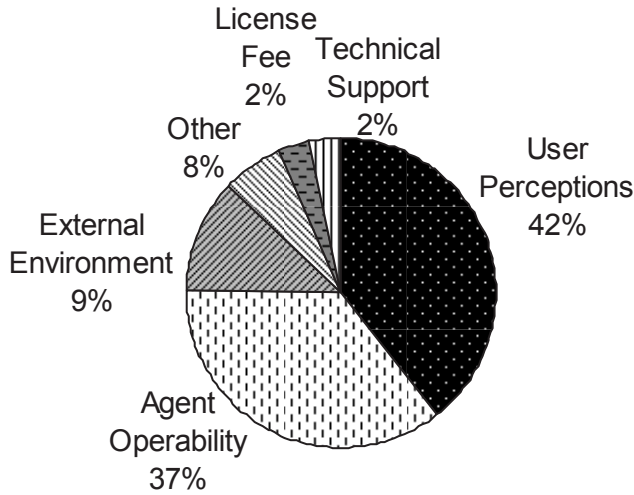
Figure 21. Reasons why respondents do not like to utilize email interface agents (user perceptions)

Unattractive 12%
Difficult to Use 14%
Intrusive 58%
Not Useful 16%
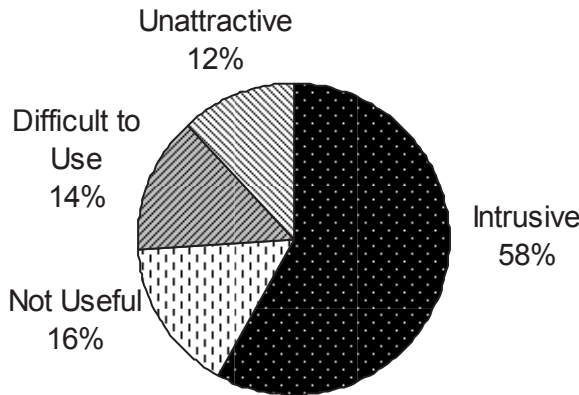
Figure 22. Characteristics of an 'ideal' interface agent

Other 7%
HCI 7%
Agent Operability 86%
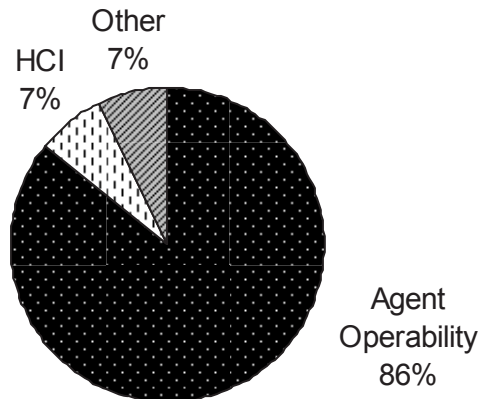
to simple messages, and the dynamic adjustments of an agent's behavior, voice and appearance depending on user requirements and the type of incoming information.

In the human-computer interaction category, users wished their agents to have a lower degree of intrusiveness, better ease of use, and higher enjoyment. Overall, from the user's perspective, an 'ideal' interface agent for email should effectively, efficiently and persistently perform message and event notification tasks, be intelligent, personalizable, and incorporate several other important functions and features.

DISCUSSION, RECOMMENDATIONS AND CONCLUSION

The purpose of this study is to investigate user perceptions and employment of interface agents for email notification. For this, a Web-based survey of the actual users of an interface agent-based system was conducted, and seventy-five responses were obtained. Several interesting findings emerged as discussed below.

Answers to Research Questions

The purpose of the **first research question** is to provide characteristics of the user population based on the demographical data obtained from the survey questions. In order to develop interface

agents that meet the needs of end-users and to market this product to the appropriate category of potential adopters, it is crucial to understand who the users of this technology actually are. The results of the empirical investigation show that the current email interface agent users are innovative individuals who:

- are predominantly male;
- range in age from 31 to 50 years old;
- work in the IS/IT or engineering sector;
- utilize email very heavily;
- reside in English-speaking countries, mostly in the US;
- are well-educated; and,
- are economically well-off.

According to Rogers (1995), contemporary email interface agent users may be classified as **innovators** who constitute 2.5% of the entire interface agent user population. These individuals are virtually obsessed with innovating, and they are always first to try out new ideas and technologies. For them, email is the major communications medium. They are either financially well-off or have control over substantial financial resources. Recall that 34% of the surveyed agent users belonged to middle or senior management, and that 19% of them kindly declined the compensation of $10 US for their participation in the study. Innovators are usually well-educated, have high social standing, and belong to large organizations. Again, 81% of the respondents had a college

or university degree, and all of them were employed. Agent users are ready to cope with a high degree of failure, uncertainty, and risk associated with an innovation that is why they are the first to start using this technology.

Over a half of them is employed in the IS/IT field. According to a classic study by Couger and Zawacki (1980), IS/IT people are fundamentally different from non-IS/IT professionals in terms of their growth and social needs. They argue that IS/IT employees demonstrate higher growth needs; they have a stronger need for personal accomplishment, constant learning, challenge, motivation, and job satisfaction. At the same time, some IS/IT professionals exhibit low proclivity to social interaction with other people. Often, IS/IT people lack important communications skills and teamwork training, whereas they successfully apply different types of reasoning to problem-solving (Armour, 2002). Empirical research shows that the style of creativity of IS/IT workers differs from that of non-IS/IT people; both groups apply creativity but in slightly different ways (Miller, Couger, & Higgins, 1996).

The goal of the **second research question** is to understand how individuals employ interface agents in their email systems. Most innovators who started using an agent made a decision whether to continue utilizing it within several months after they first installed the product. Recall 76% of the respondents who did not utilize email interface agents on the date of the sur-

vey indicated that they abandoned this technology for the reasons they did not control. As such, most people stopped using an agent because of operability problems with an agent, lack of access to an agent, or an external environment that influenced their termination decision. Those, who terminated the usage for negative perceptual reasons, utilized an agent for only five months, whereas the current users used it for almost a year and a half on average. In other words, users form reliable perceptions soon after they acquire an agent. In the case of positive perceptions, people continue using it in the future, and in the case of negative perceptions, individuals immediately uninstall it from their computers.

Based on the correlations table (Table 1), three key observations were made. First, given that almost all individuals utilized agents with MS Outlook, the announcement of incoming messages and calendar reminders in Outlook might potentially serve as a proxy for the degree to which the respondents utilized the technology under investigation in general. Secondly, people utilized email agents at work and at home differently. Given that the respondents to the survey were very heavy email users, they were expected to utilize a desktop email management application such as Outlook at work. The usage of a Web-based email interface would be less efficient as the volume of electronic communications increases. At the same time, the same individuals might utilize a different email applica-

tion at home. In addition, the interface agent was compatible with both Outlook and Hotmail. Therefore, it may be assumed that the respondents utilized Outlook at work and Hotmail at home. The results indicated a strong positive correlation between work agent usage and message and reminder announcement in Outlook, and between home usage and message announcement in Hotmail. At the same time, no correlation between work usage and message announcement in Hotmail was found. Thirdly, email agent users tended to utilize many features of this technology simultaneously.

The **third research question** concentrates on understanding user perceptions of various aspects of interface agents for email notification. With respect to the reasons why individuals like to utilize interface agents in their email applications, four important points are suggested. *First and foremost*, the overall user perceptions of agents were very positive. Most people terminated the usage for the reason they did not control. According to the findings, users provided a slighter higher number of factors why they liked (146) than disliked (116) this technology. If, for example, the number of negative answers dramatically exceeded the number of positive responses, it might be assumed that user perceptions were more negative since they tended to complain about agents to a greater extent.

Second, with respect to the reasons why people like to use email agents, the key factors were **perceived usefulness**, **perceived enjoyment**, **perceived ease of use**, **perceived attractiveness**, and **perceived image**. This is consistent with previous individual-level technology adoption investigations. For example, the Technology Acceptance Model (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) states that users form their behavioral usage intentions based on the degree of perceived usefulness and ease of use. Serenko et al. (2007) tested a model of user adoption of interface agents in MS Office and concluded that perceived usefulness and perceived enjoyment strongly influence user adoption decisions.

Perceived attractiveness relates to user perceptions of an agent's appearance; overall, the respondents indicated that an agent's interface was cool, cute, near, or versatile. This finding emerged in pervious studies; the HCI literature labels this phenomenon as the degree of an agent's likeability (for example, see Dehn & van Mulken, 2000; Koda & Maes, 1996; Sproull, Subramani, Kiesler, Walker, & Waters, 1996).

Perceived image is the degree to which the use of an agent is perceived to enhance one's social image or status in one's social system (Moore & Benbasat, 1991). Venkatesh and Davis (2000) demonstrate that image has a positive effect on perceived usefulness of an information system. This construct may have an explanatory power only when the use of agents is visible to other people, such as co-workers or friends. For example, it may have an impact on user perceptions if people use agents

at work, but it may have no effect if individuals utilize agents at home.

In addition to these five key categories, the analysis yielded three other important factors that were previously identified in the MIS and HCI literature. These are **reliability**, **compatibility**, and **personalization**. Reliability is the dependability of an agent, such as the absence of bugs and crashes. Compatibility is the degree to which an agent works well with other software applications, including email clients. The reliability and compatibility constructs were already applied to other IS systems; they constitute part of a Task-Technology Fit Instrument developed by Goodhue (1998). Personalization is the degree to which an agent's actions, appearance, and voice may be tailored according to a user's requirements.

Third, with regards to the reasons why individuals do not like to utilize email interface agents, the extent of an agent's **perceived intrusiveness** was the top reason. It constituted 25% of all responses. The users stated that the agent distracted, annoyed, and irritated them. This frequently happened when an agent disrupted a conversation or popped up in an inappropriate time. This supports the frequent complaints of interface agent users on a high extent of an agent's perceived intrusiveness (Serenko, 2007a).

A number of users complained about **agent – system interference**. They stated that the agent sometimes interfered with other software applications or slowed down the entire com-puter. Some respondents mentioned the **compatibility** of an agent. Often, an agent was incompatible with other systems, especially with MS Outlook Express. Other reasons why individuals did not like to utilize email interface agents pertained to various, relatively small categories. Subjects mentioned limited usefulness, unreliability, difficulty of use, limited vocabulary, and unattractiveness.

Fourth, with respect to the characteristics of an 'ideal' email interface agent, most users wished to improve the way an agent presented message and event notifications, and the degree of an agent's intelligence. As such, an 'ideal' agent should sort out the incoming information and present it in the order of urgency and importance. It should also provide additional information and due events in a very persistent yet non-intrusive manner and track the completion of suggested activities. Extra intelligence features encompass rule-based logic, machine learning, text analysis, automatic reply, and the real-time adjustments of an agent's behavior. Other less frequent requests referred to the improvement of personalization, spam filtering, user control, compatibility, and voice recognition.

The findings above are summarized in form of a model of agent adoption and use (see Figure 23).

The constructs of this model are based on the most frequently reported categories provided by the respondents in this study. According to the model, there are two general types of factors

Figure 23. The model of factors influencing usage behavior towards interface agents for email notification
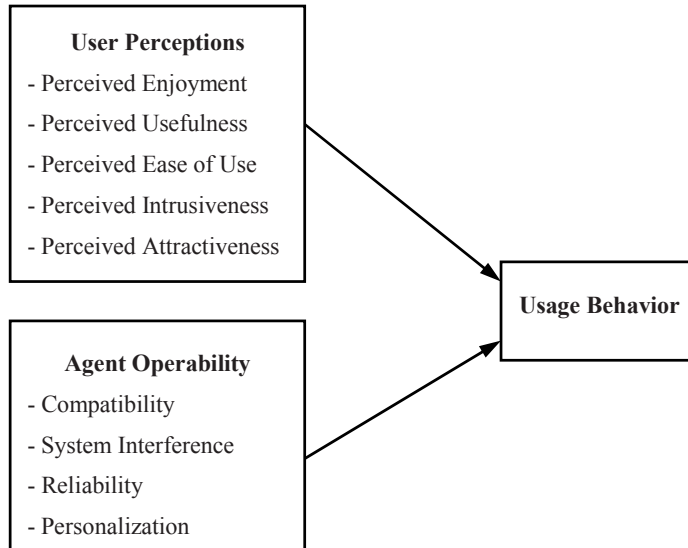
– user perceptions and agent operability. **User perceptions** are either positive or negative mental reflections of several properties of an agent. They include perceived enjoyment, usefulness, ease of use, intrusiveness, and attractiveness of an agent. Perceived enjoyment, usefulness, and ease of use are well-established in the management information systems domain (Davis et al., 1989; Davis, Bagozzi, & Warshaw, 1992). **Perceived intrusiveness** is the degree of negatively interpreted, unwanted interactions that are initiated by an agent. When an agent is perceived to be highly intrusive, users perceive it to distract, bother, annoy or irritate them diverting their attention from current activities. For example, someone may concentrate on a difficult task or talk over the phone when an agent pops up and interrupts this important activity. Since agent intrusiveness is the top reason why individuals dislike using an agent, it is presumed that there is a negative relationship between perceived intrusiveness and usage behavior. **Perceived attractiveness** is the degree to which a user finds an agent's interface and voice appealing. A positive association between perceived attractiveness of an agent and usage behavior is suggested; those individuals, who find an agent more attractive, utilize it to a higher extent.

Agent operability embraces factors pertaining to operational characteristics of an agent. During the analysis of open-ended responses, a set of factors related to agent operability was discovered that are presumed to play an important role in user adoption decisions. It is for

this reason agent operability factors are included in the suggested model.

Agent operability constructs differ from perceptual constructs because they can be measured directly by a researcher rather than by surveying users. They include compatibility, system interference, reliability, and personalization. **Compatibility** is the ability of an agent to work well with other software applications, for example, with various email clients. It is believed that there is a positive relationship between agent compatibility and usage; users should utilize the agent more extensively if it is compatible with a higher number of other computer applications. **System interference** is the hindrance of normal workflow of other applications. It occurs when an agent intrudes into the computer processes related to other systems, for example, MS Outlook or MS Word that slows down these systems and troubles users. Thus, a negative relationship between system interference and agent utilization is hypothesized. **Reliability** is the absence of bugs, crashes or other technical problems that take place during the employment of an agent. It is hypothesized that there is a positive relationship between agent reliability and usage; people should utilize an agent more frequently if it is more reliable. **Personalization** is the degree to which an agent's appearance, voice, and actions may be tailored to the needs of each user individually. It is presumed that there is a positive relationship between personalization and usage; the more personalized features and func-

tion an agent has, the more extensively people should utilize it.

Overall, this model offers some insights on other factors of user adoption of interface agents for email that may be utilized in future investigations.

Practical Recommendations

Based on the answers to these research questions, a number of practical recommendations are presented.

First, the usage of interface agents by IS/IT professionals may be a useful way to boost their creativity and encourage imagination. Prior research shows that creativity and productivity are positively related. When people are most creative, they also become most productive that may positively contribute in the achievement of organizational goals (Miller, 1986, 1998). Therefore, under appropriate conditions, the employment of this technology may serve well the overall organizational goals.

Second, it is suggested that developers and marketers be aware of the user characteristics presented in this investigation. To reach as many of these potential customers as possible, email interface agent marketers should promote their products through appropriate communications channels, such as websites, newspapers, magazines, and journals that are read by innovative IT professionals. In addition, the study's survey showed that most users resided in an English-speaking country. Given that only one-third of all Web users speak English as their

primary language, it is recommended that marketers also target IT personnel in non-English speaking countries. For this, Websites need to be translated, and agent systems should be available in other languages, besides English. Overall, it is suggested that the above strategy may be successfully utilized in the short-term. However, as interface agent technology becomes widespread in the future, other types of individuals may dominate the population of email interface agent users. In this case, it is recommended that marketers reconsider their promotional strategy.

Third, in order to facilitate the usage and adoption of this technology, designers should emphasize the creation of agent-based applications **compatible** with both existing email systems and everyday work applications. Currently, the implementation of highly compatible email interface agents is the central, urgent issue for agent developers. Failure to address this concern will likely result in dramatically low diffusion rates or even in the entire rejection of this technology in the future.

Fourth, agent manufacturers need to identify ways of reducing **perceived agent intrusiveness**. Perceived intrusiveness is a primary factor why individuals disliked email interface agents, and one of the top reasons why they entirely rejected them. Currently, the issue of perceived intrusiveness of information technologies has not been studied by the MIS research community. The extant MIS literature does not provide a clear definition of perceived

intrusiveness, misses measurement instruments, and lacks recommendations on the manipulation of user perceptions of technology intrusiveness. The two first works that report on the issue of perceived intrusiveness of mobile phones were presented by Perry et al. (2001) and Love and Perry (2004). It is recommended that agent developers start investing in research projects that investigate the influence of perceived intrusiveness of interface agents and the methods to manipulate user perceptions. As a short-term solution, more personalization features need to be introduced. For example, advanced options or visual programming environments for message or event processing rules would allow individuals to precisely specify an agent's actions depending on each particular situation. They may instruct the agent to ignore messages that are automatically filed, arrive from certain people, or contain special keywords. However, the employment of such complex features should be optional.

Fifth, developers should eliminate the **interference** of an agent with other software applications and reduce CPU, memory, and system resources that it consumes. An agent's interference was an important factor for usage termination and the second key reason why respondents to the survey disliked using it.

Sixth, interface agent designers need to emphasize the existing facets of an **agent's usefulness** and to continue incorporating features that users consider important. To improve the extent of an

agent's usefulness, additional features and facets should be implemented. These may include, but are not limited to, machine learning capabilities, basic text analysis with automatic message response mechanisms, run-time adjustments of an agent's behavior, appearance and voice, and rule-based logic. To implement these functions, designers should review the literature and research projects in reference disciplines, such as artificial intelligence and human-computer interaction.

Overall, it is believed that by addressing the issues above, practitioners will be able to eliminate a number of critical factors and to increase the rate of user adoption of email interface agents.

CONCLUSION

The field of agent-based computing is relatively new. At the same time, it may boast a comprehensive body of knowledge with the purpose to improve the contemporary agent applications. This work represents an attempt to understand the issue of user perceptions and employment of interface agents for electronic mail notification in order to produce guidelines for technology developers. It was demonstrated that a survey of actual users is a fruitful approach to achieve the purpose of such a study.

This study had several limitations. First, users of only one email interface agent were surveyed. It is possible that users of other agents would offer slightly different insights on the usage of this technology. Second, the findings are limited to interface agents for email only. Currently, there is a variety of interface agents that may be employed with various technologies. It is likely that some of this study's conclusions may not be generalizable. Third, the survey was cross-sectional in nature. A longitudinal study design is desirable to observe changes in user behavior and perceptions over time.

It is recommended that future researchers continue investigating factors that influence user adoption decisions by conducting empirical investigations that involve real-life users. It is also suggested that agent manufacturers recognize the importance of these research projects, provide academics with necessary assistance and support, and incorporate their findings in agent-based applications.

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