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

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ABSTRACT

This study investigates user perceptions and employment of interface agents for email notification to answer three research questions pertaining to user demographics, typical usage, and perceptions of this technology. A survey instrument was administered to 75 email interface agent users. Current email interface agent users are predominantly male, well-educated and well-off innovative individuals who are occupied in the IS/IT sector, utilize email heavily and reside in an English-speaking country. They use agents to announce incoming messages and calendar reminders. The key factors why they like to use agents are perceived usefulness, enjoyment, ease of use, attractiveness, social image, an agent's reliability and personalization. The major factors why they dislike doing so are perceived intrusiveness of an agent, agent-system interference and incompatibility. Users envision an 'ideal email notification agent' as a highly intelligent application delivering messages in a non-intrusive yet persistent manner. A model of agent acceptance and use is suggested.

Keywords

Interface Agents, Usage, Email Notification, User Perceptions, Survey

INTRODUCTION

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 (Lieberman and Selker, 2003, Serenko and Detlor, 2004, Serenko, 2007a, Serenko, Ruhi and Cocosila, 2007, Detlor, 2004). Interface agents may be included in most software applications, including email systems (Maes, 1994, Serenko, 2006a).

Email has turned into one of the most successful computer applications ever designed (Sproull and Kiesler, 1986, Lucas, 1998). 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 and 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 enhancing an individual's experiences with email applications.

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 and Staelin, 2002) or SwiftFile (Segal and 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 and 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.

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).

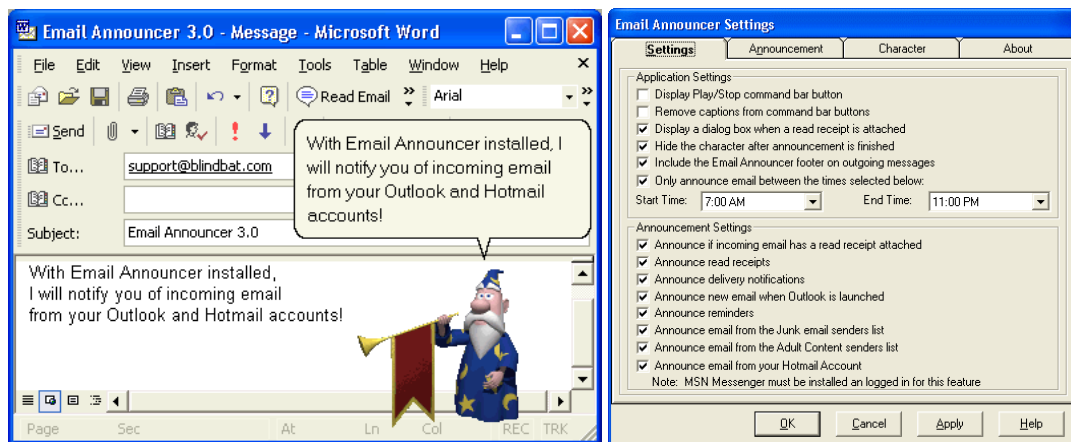


Figure 1: Email Announcer by Blind Bat Software – Agent Interface and Configuration Environment

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 manufacturers 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 and Brentani, 1991). It is crucial to collect information about consumers at each stage of a product's lifecycle (Goldsmith and Hofacker, 1991, Midgley and 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.

The understanding of user attributes and personal characteristics is also important in the field of agent-human interaction (Isbister and 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 and Fishbein, 1980), including the use of computer technologies (Taylor and Todd, 1995) and interface agents (Serenko, 2007b). There are significant differences in perceptions 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.

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).

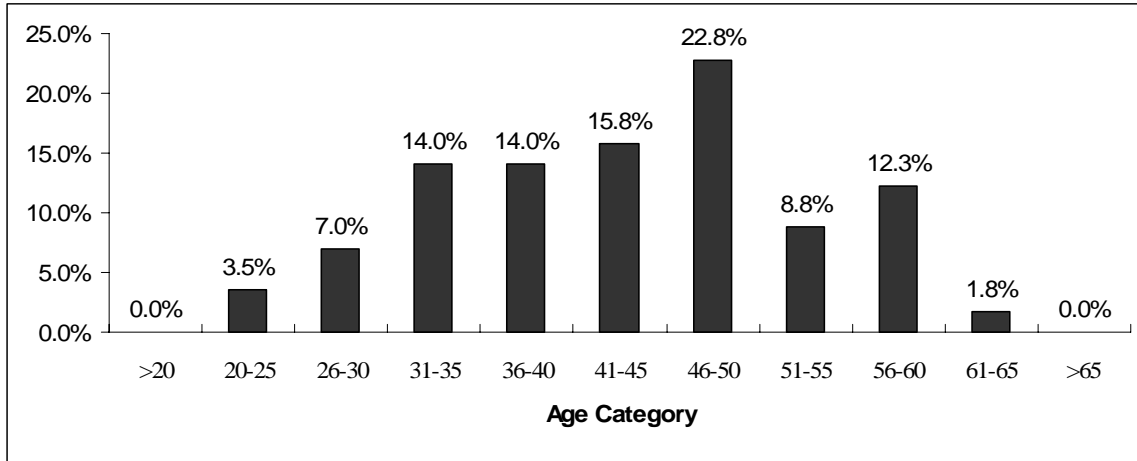


Figure 2: The Age Categories of Email Interface Agent Users

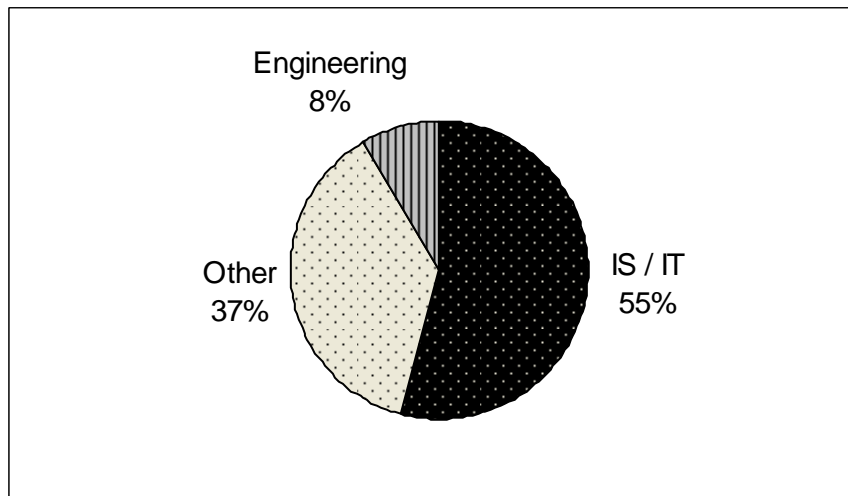


Figure 3: User Occupation

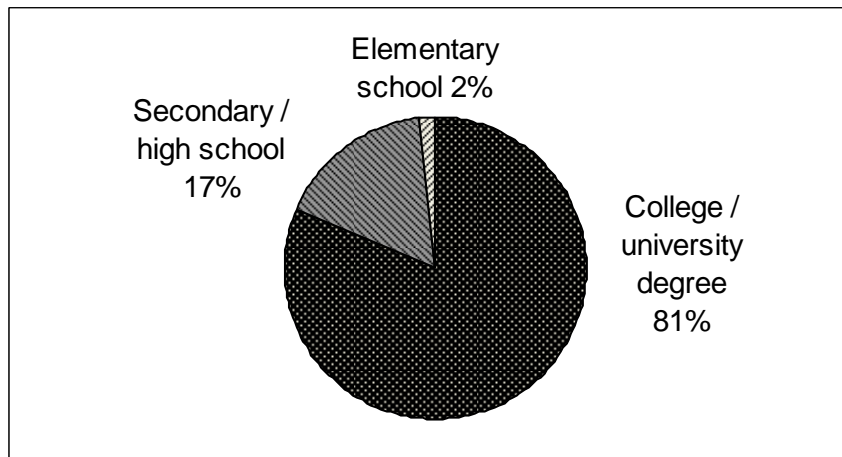


Figure 4: User Education

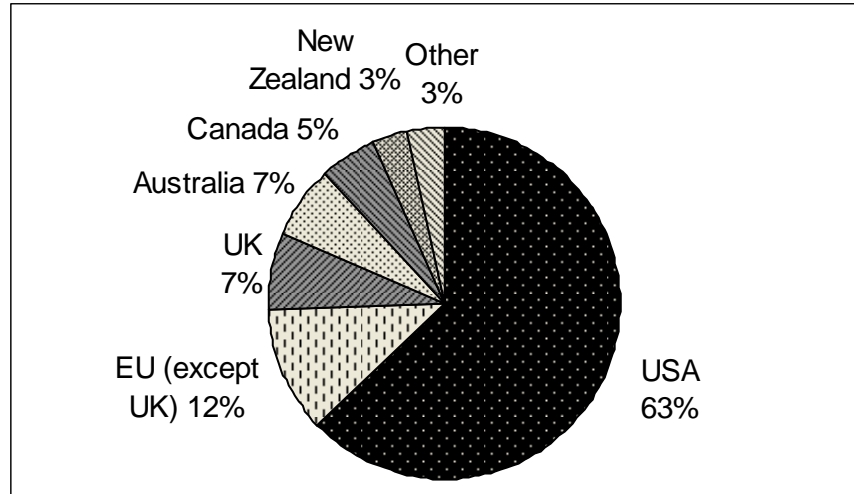


Figure 5: User Country of Residence

Figure 6, 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.

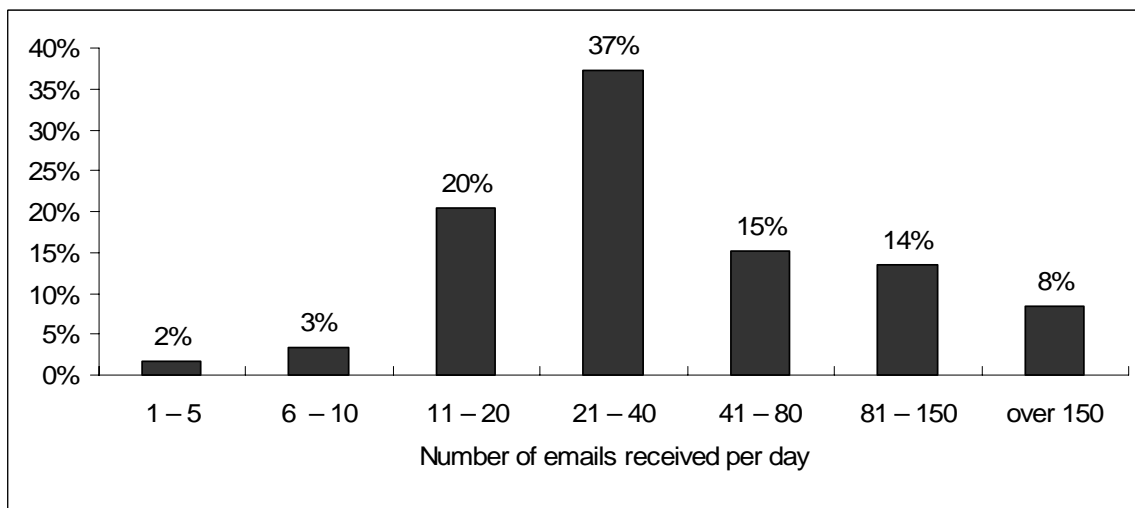


Figure 6: Number of Email Messages Received Daily by Agent Users

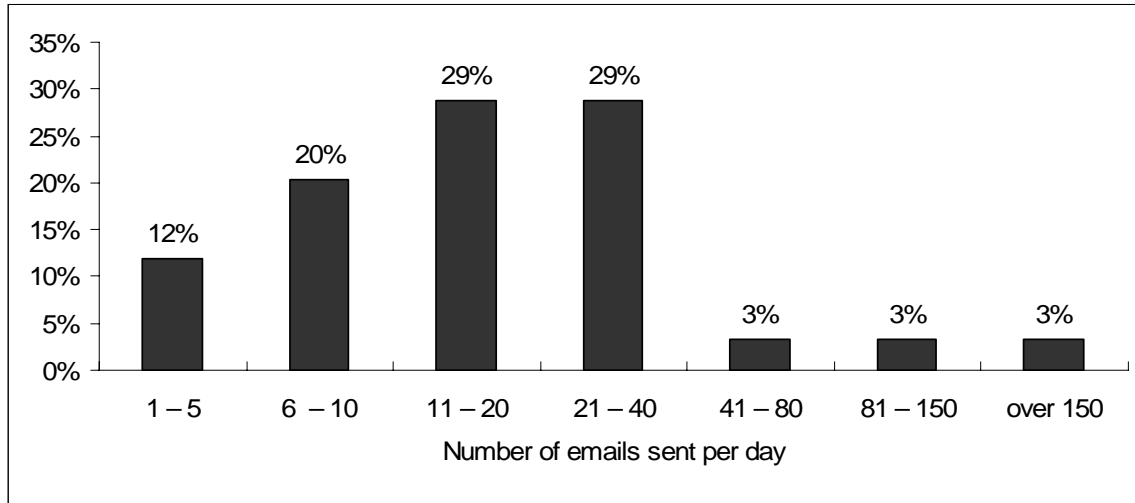


Figure 7: Number of Email Messages Sent Daily by Agent Users

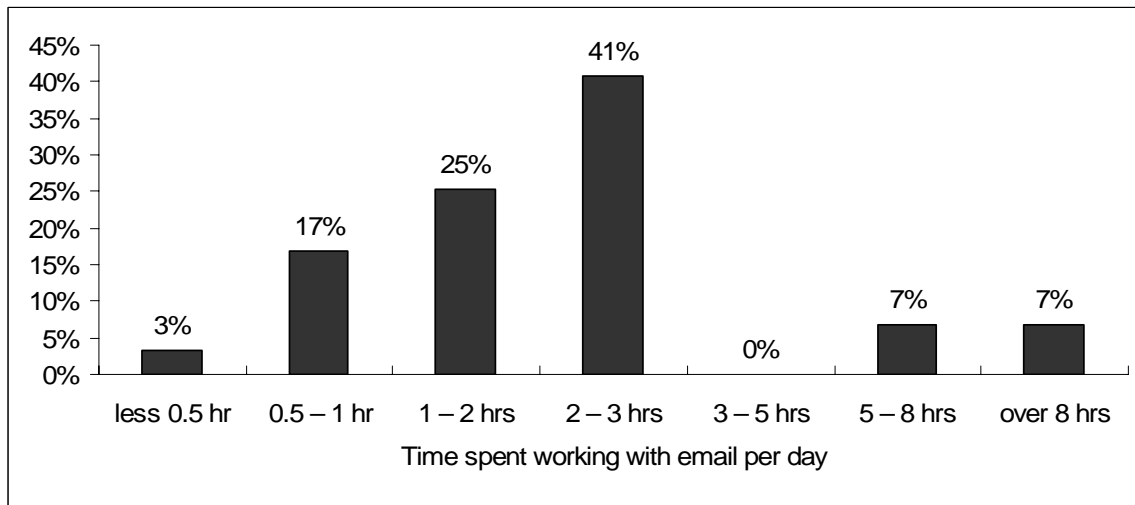


Figure 8: Time Spent with an Email System Daily by Agent Users

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

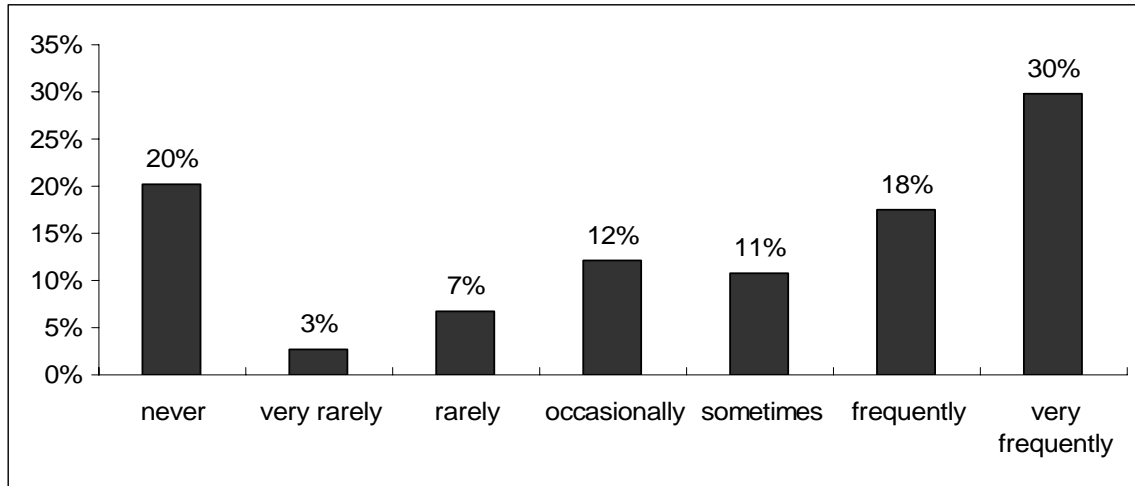


Figure 9: Actual Usage of Email Interface Agents at Work

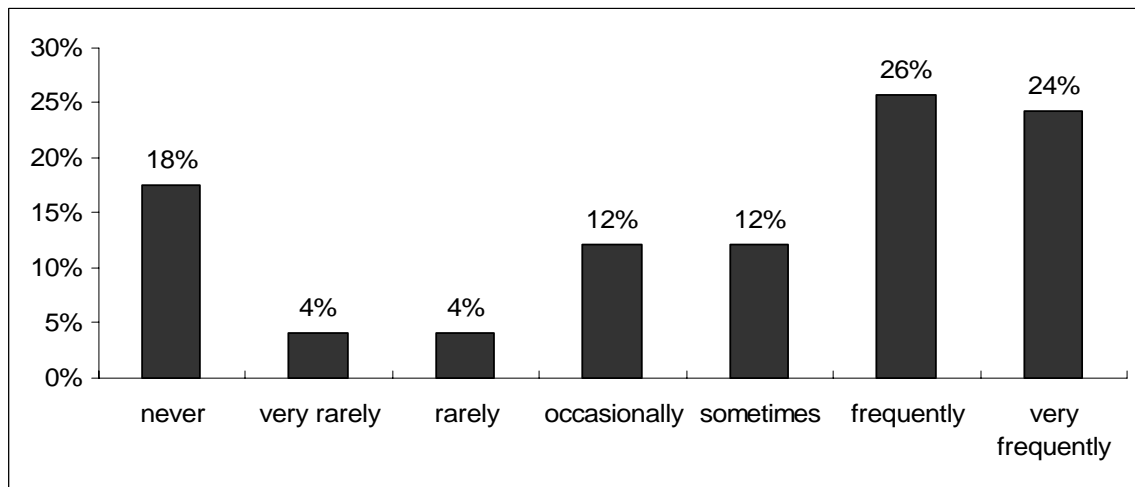


Figure 10: Actual Usage of Email Interface Agents at Home

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.

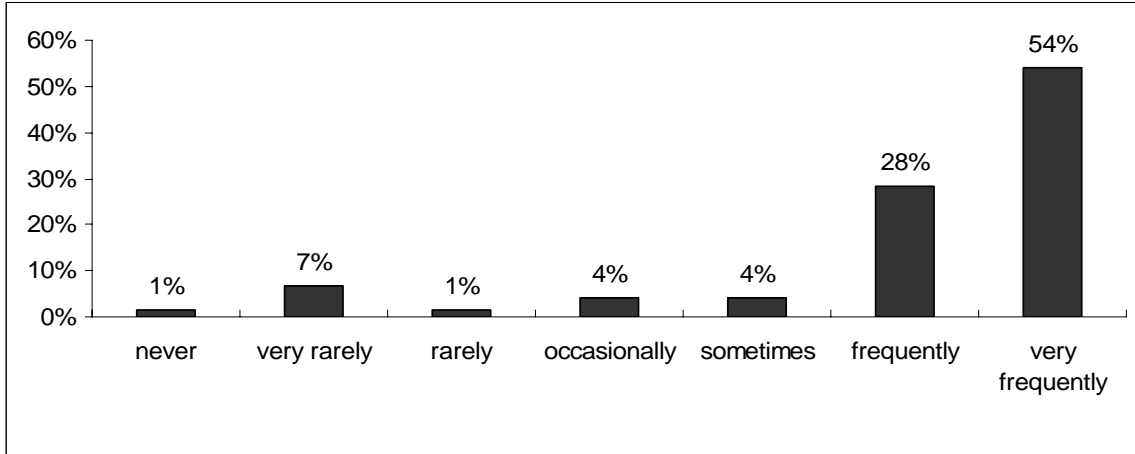


Figure 11: Users who Utilize Agents to Announce Messages in MS Outlook

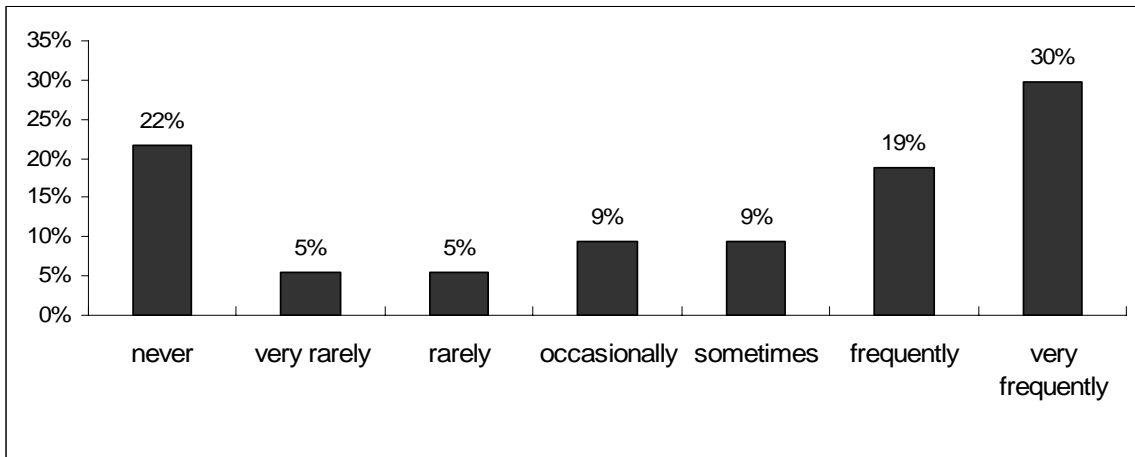


Figure 12: Users who Utilize Agents to Announce Calendar Reminders in MS Outlook

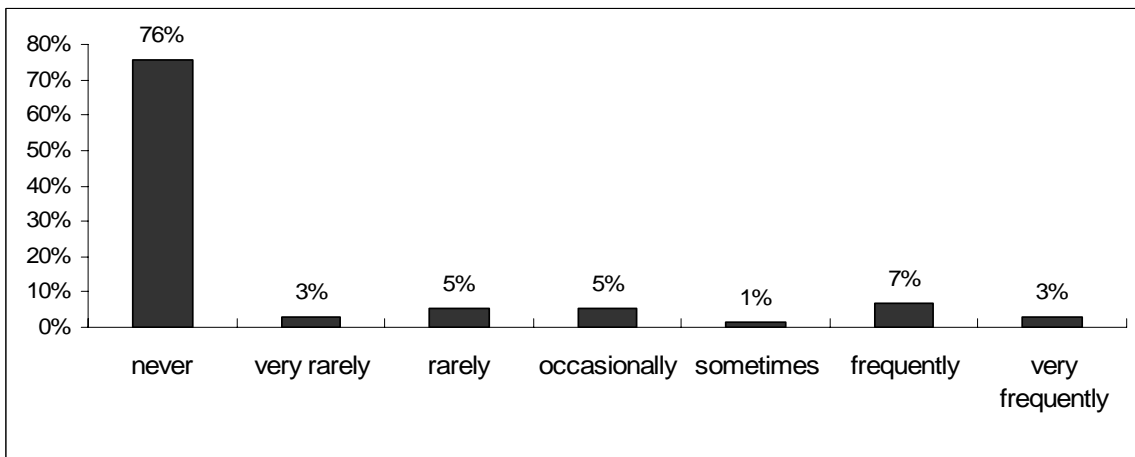


Figure 13: Users who Utilize Agents to Announce Messages in Hotmail

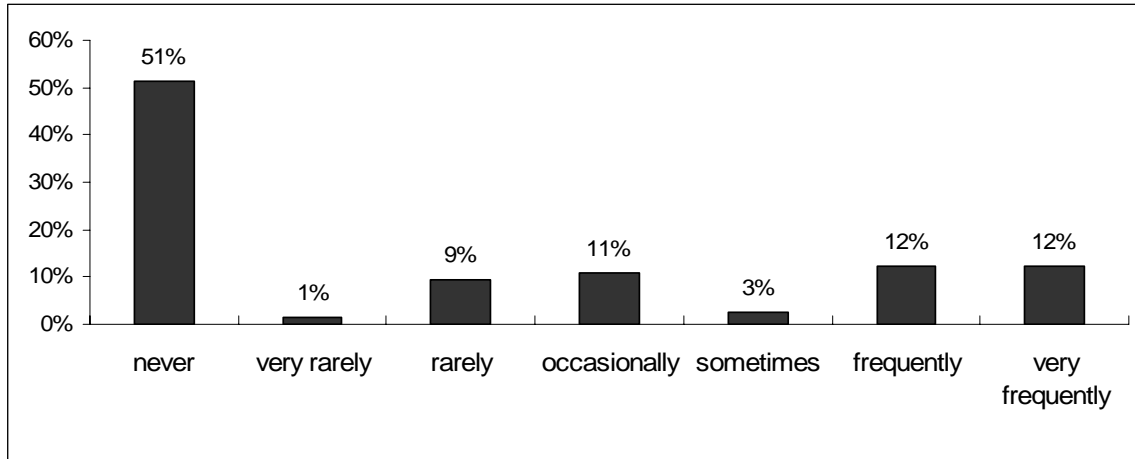


Figure 14: Users who Utilize Agents to Announce Read Receipts in MS Outlook and / or Hotmail

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 delivered by email interface agents. This confirms the earlier observation that message announcement was the most often utilized feature.

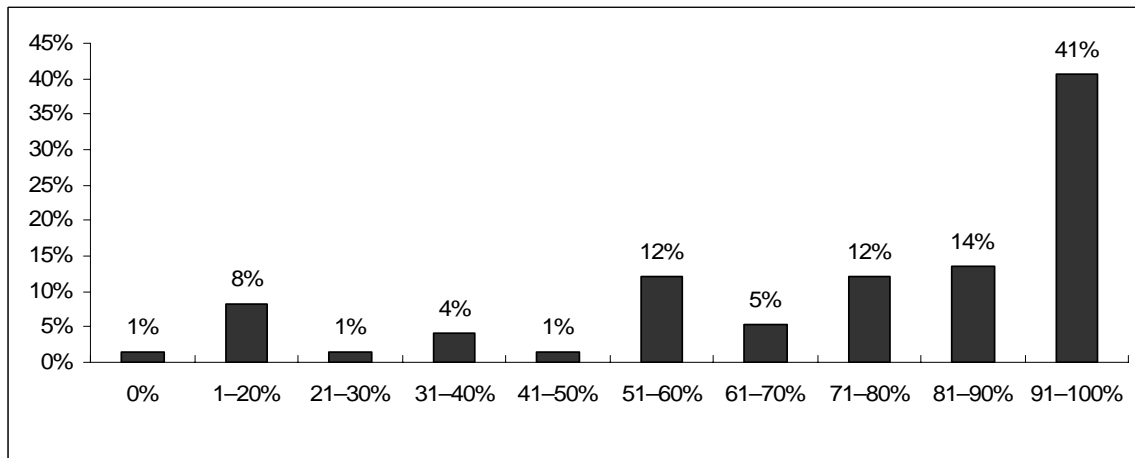


Figure 15: Incoming Email Messages Announced by Interface Agents

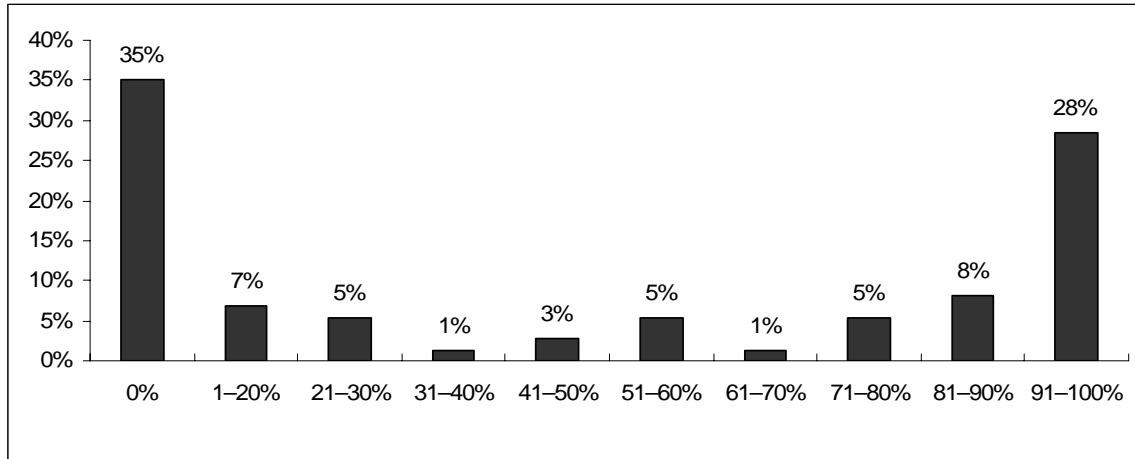


Figure 16: Calendar Reminders Announced by Interface Agents

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.

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

Table 1: Agent Usage Correlation Coefficients (bold: $p < .1$)

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.

Reasons for Agent Usage Termination

The results demonstrated that 35 individuals 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%). **Negative user perceptions** (high degree of perceived intrusiveness or distraction caused by the agent, low degree of perceived 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%). Effects of the **external environment** that influenced a user's adoption decision were the last category (18%). Respondents referred to their company policies that prohibited the employment of unauthorized 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.

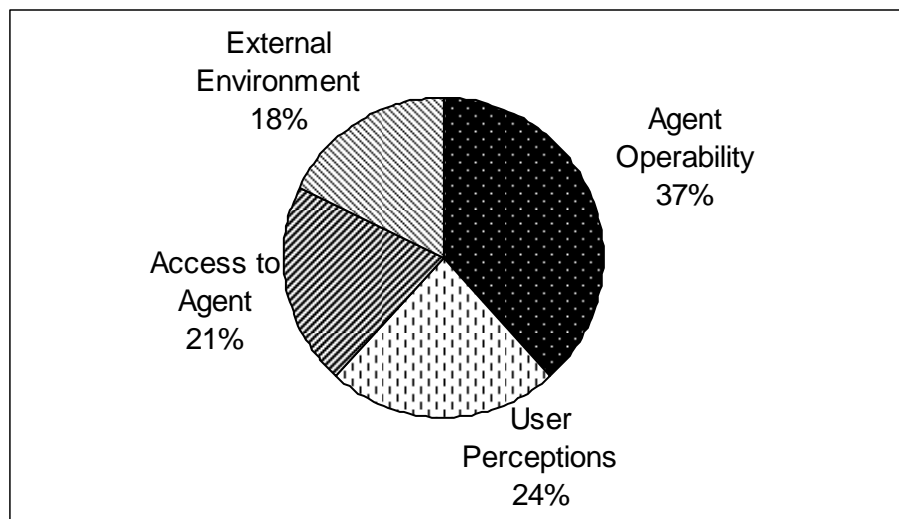


Figure 17: Reasons for Agent Usage Termination

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).

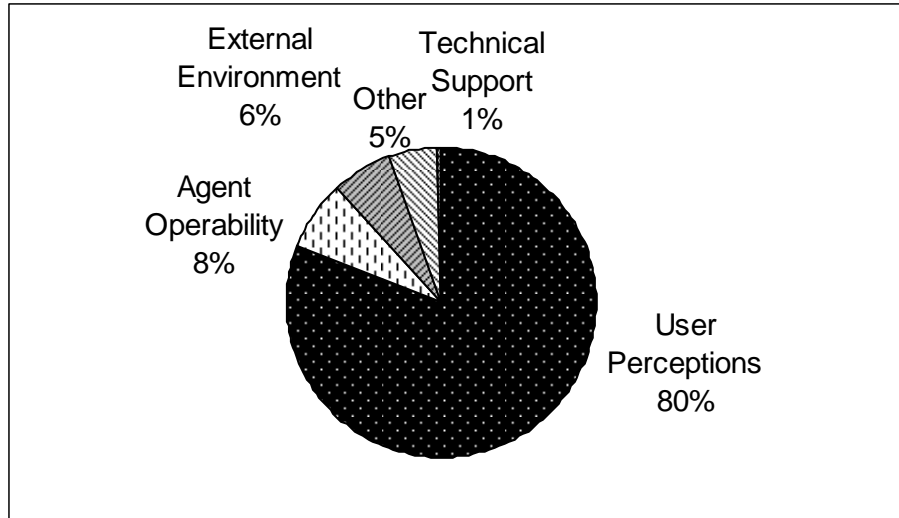


Figure 18: Reasons Why Respondents Like to Utilize Email Agents

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 personalization, compatibility, and reliability of this technology. **External Environment** of an agent user represented 6% 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).

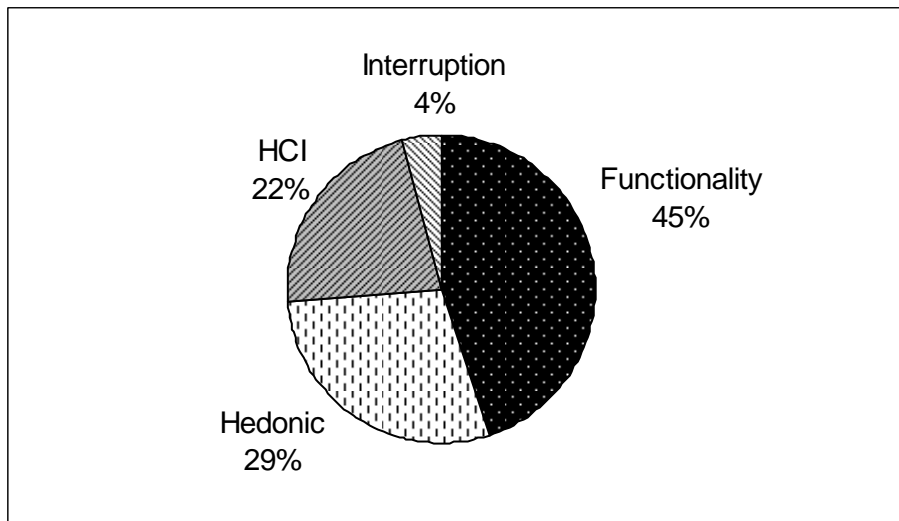


Figure 19: Reasons Why Respondents Like to Utilize Agents (User Perceptions)

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.

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.

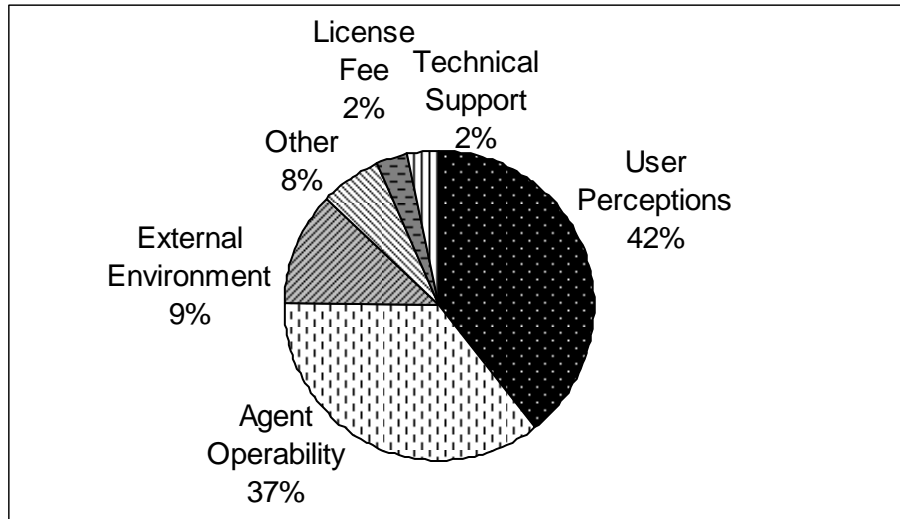


Figure 20: Reasons Why Respondents Do Not Like to Utilize Email Agents

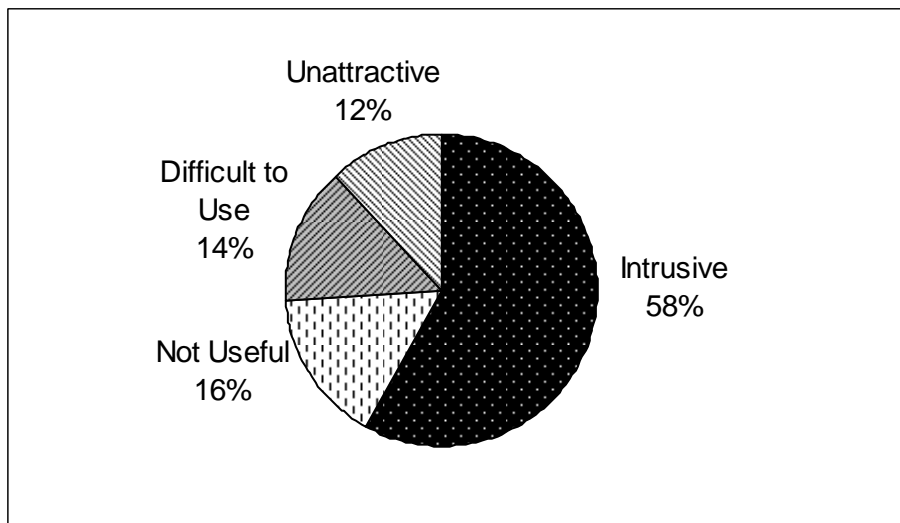


Figure 21: Reasons Why Respondents Do Not Like to Utilize Email Interface Agents (User Perceptions)

Characteristics of an 'Ideal' Email Interface Agent

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

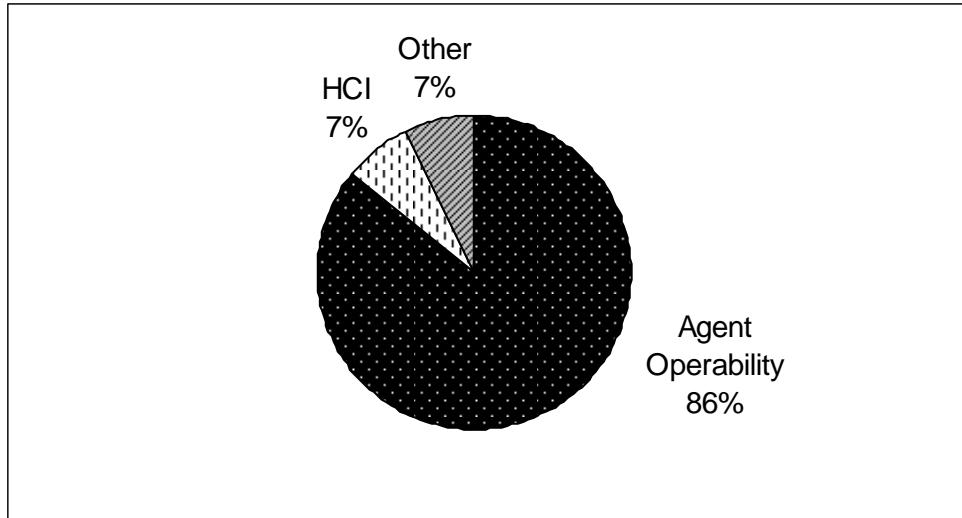


Figure 22: Characteristics of an 'Ideal' Interface Agent

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 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

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. The results 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** constituting 2.5% of the entire interface agent user population.

The goal of the **second research question** is to understand how individuals employ interface agents in their email systems. *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 this technology. *Second*, people employed email agents at work and at home differently. They were expected to utilize desktop email management applications such as Outlook at work. The usage of Web-based email interfaces would be less efficient as the volume of electronic communications increases. At the same time, these users might utilize a different email application 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 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. *Third*, email agent users tended to utilize many agent features simultaneously.

The **third research question** concentrates on understanding user perceptions of various aspects of email notification interface agents. *First*, the overall user perceptions of agents were very positive. Most people terminated the usage for the reason over their control. *Second*, with respect to the reasons why people like to use email agents, the key factors were **perceived usefulness, enjoyment, ease of use, attractiveness, and image**. This is consistent with previous individual-level technology adoption investigations. In addition to these five key categories, the analysis yielded three other important factors that were previously identified in the MIS and HCI literature: **reliability, compatibility, and personalization**. *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 when the agent distracted, annoyed, and irritated individuals by disrupting a conversation or popping 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, 2006b).

Fourth, most users envisioned an 'ideal' email interface agent as being more intelligent, sorting out the incoming information and presenting it in the order of urgency and importance, tracking the completion of suggested activities, and doing so in a very persistent yet non-intrusive manner. Extra intelligence features encompass rule-based logic, machine learning, text analysis, automatic reply, and the real-time adjustments of an agent's behavior. The improvement of personalization, spam filtering, user control, compatibility, and voice recognition is also desirable.

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

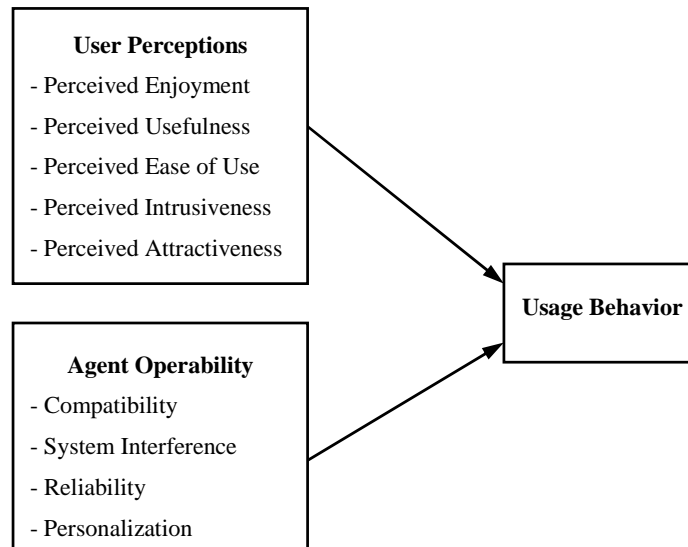


Figure 23: The Model of Factors Influencing Usage Behavior towards Interface Agents for Email Notification

Practical Recommendations

First, developers and marketers should be aware of the user characteristics presented in this investigation. To reach as many of these potential customers as possible, marketers should promote their products through appropriate communications channels, such as websites, newspapers, magazines, and journals that are read by innovative IT professionals. Most users reside in an English-speaking country, but 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.

Second, designers should emphasize the creation of agent-based applications **compatible** with both existing email systems and everyday work applications. The implementation of highly compatible email interface agents is the central, urgent issue for developers. Failure to address this concern will likely result in dramatically low diffusion rates or even in the entire rejection of this technology. *Third*, agent manufacturers need to identify ways of reducing **perceived agent intrusiveness** that is a leading factor why individuals dislike or reject email interface agents.

Fourth, 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. *Fifth*, agent designers should emphasize the existing facets of an **agent's usefulness** and continue incorporating features that users consider important. To improve the extent of an agent's usefulness and add extra features, such as 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.

Conclusions

The field of agent-based computing is relatively new but 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 email 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.

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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