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This is the Author Manuscript of a conference paper published at Human-Computer Interaction, INTERACT'01: IFIP TC.13 International Conference on HumanComputer Interaction, 9th-13th July 2001, Tokyo, Japan.

The final publication is available at IOS Press through <https://www.iospress.nl/book/human-computer-interactioninteract01/>

Personifying the e-market: A framework for social agents

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Abstract: This paper discusses our vision of the future with respect to the introduction of virtual assistants in the e-market. It presents the latest evolution of the *involvement framework*, an on-going model aimed at driving the design and the evaluation of social agents – virtual characters designed to set up lasting relationships with the users. The framework is based on a review of the literature and on the systematic analysis of the first-generation social agents available on the Web. Moreover, it is enriched by empirical results of two user-based evaluations of *Granny*, a social agent that tries to inject a specific personality into the interaction between a financial service provider and a customer. The assumption behind our research is that social agents require a re-examination of the traditional HCI approach to system design and evaluation. Both the usability framework and the media equation paradigm need to be updated to account for the peculiarity of the new interaction form.

Keywords: social agents, user-experience, design and evaluation.

1 Introduction

A new social world is emerging on the Internet. Animated characters, chatterbots, humanoids and talking heads populate it. They act as assistants, guides, salespeople and entertainers. Some of them hold conversations with users; others respond to mouse clicks or are just a nice presence on the screen. They are the first-generation social agents – interface software explicitly designed to build lasting and meaningful relationships with the user.

Social agents are considered a promising solution for e-commerce interfaces. Their distinctive personas are expected to gain the attention of consumers and support them throughout the transaction process. According to this view, social agents entice users to revisit web sites, recommend them to friends, and buy goods. Despite their expected advantages, social agents are not a simple panacea for ensuring consumer loyalty. On the contrary, building them can be complex and counterintuitive. Technology must be supported by psychosocial competencies based on a deep understanding of the linguistic, cognitive and social behaviour performed by users.

This paper presents our vision of the future with respect to developments of virtual assistants to work within the e-market. It summarises the latest advances of the involvement framework, a model

specifically developed to drive the design and the evaluation of social agents (De Angeli et al, in press). The framework is based on a systematic review of the literature, on the analysis of the virtual assistants currently available on the Web, and on the evaluation of *Granny*, a concept developed by the NCR Knowledge Lab to facilitate consumer interaction with a financial service provider.

2 Social Agents on the Web

The growing scientific interest in social agents is indicated by the number of events organised around this topic, including workshops, dedicated special issues and research projects. Researchers are still a long way from creating effective social agents but the e-market cannot wait to employ them. E-service providers are acutely aware that in the network economy their customers are only “one click” away from a competitor. Thus, the increasing competition generates the demand for friendly, cheerful and entertaining agents to substitute the valuable service offered by sales assistants in traditional shops, banks or service companies. Several start-ups are emerging to produce and sell social agents (e.g., Extempo, Finali, News1st and Kiwilogic). Orange, a leading UK telecommunication company, has recently invested £95 million on Ananova, the world’s first

digitally rendered, animated Internet newscaster and information provider. Ananova exploits text-to-speech technology providing search and personalisation capabilities.

One of the early virtual assistants to reach the marketplace was Jennifer James, a human-like, attractive spokeswoman created by Extempo. Jennifer worked in a virtual auto showroom. "She" greeted visitors and engaged them in a dynamically generated five-minute dialogue presenting vehicles and reminiscences about her own racing history. She listened to comments and questions typed by the visitor and talked using speech technology. Her animated 3-D face and body acted in real-time, co-ordinated with the events of the conversation. The elicited information was used to recommend cars and stored in marketing databases for later follow-ups and research.

Nowadays, Jennifer has many friends. Our favourite is Max, the smart and cute dog who till a few months ago welcomed visitors on the Extempo site. Recently, Linda replaced Max. She is a human-like cartoon that provides context sensitive help. She answers questions regarding the company, the site or also her private life. A unique feature about Linda is the ability of effectively using different modalities of communication, such as hand gestures, facial expressions and gaze movements. For example, when the user writes a message, she looks at the monitor, as if she was reading an e-mail message. This creates a very personified feeling, giving the impression that Linda is a real person sitting in front of the computer.

Extempo's characters are embodied evolutions of chatterbots — systems that respond to questions with canned pre-scripted statements. As a matter of fact, chatterbots cannot "understand" the dialogue. Rather they are all about the illusion of intelligence and the suspension of disbelief on the part of the user. The first prototype was Eliza, the psychotherapist designed by Weizenbaum in 1966 to investigate limits and potentialities of natural language interaction. Currently, several tools exist to create personal chatterbots. AIML (Artificial Intelligence Markup Language) is free available under the GNU license statement. It has been used to create Alice, the proud robot exhibiting human-like feelings and intentions that won the 2000 Loebner Prize, at the annual Turing test. An evolved alternative is the Kiwilogic's Lingubot technology. It has been used to create the "most powerful" agents in the Web: Karl L. von Wendt (the virtual CEO of Kiwilogic) and Jackie Strike (the virtual presidential candidate of the US).

A different example is BonziBuddy. It is an interactive talking gorilla that lives on the user screen and acts as a travelling companion on the Web. Bonzi is produced by Bonzi.com software and is based on Microsoft Agent technology. Bonzi talks with consumers via pre-recorded or computer generated speech or via text displayed in a cartoon balloon. It responds to text input or simple voice commands. It browses, searches and explores the Internet for the user. Moreover, it reminds users of appointments or tasks, tells jokes, sends and receives animated talking e-mails. At the same time, it tries to sell users software produced by its "mother" company.

A number of social agents are even employed as central characters in advertisement. Motorola has recently hired Mya, a virtual assistant designed to read Internet contents to mobile users. She is much more than a voice-driven personal assistant: she is a wonderful cyber-woman. Users get acquainted with her through Web and TV-ads. At the telephone, she gives the illusion of a 1-to-1 customer service. Nevertheless, users are not being fooled in any way. Rather, the fact that Mya is not a real human seems to be the key point in promoting this service.

2.1 Evaluating Social Agents

Despite the general enthusiasm surrounding social agents, there is little published research on whether their introduction in Human-Computer Interaction (HCI) is a positive or a negative (Dehn and van Mulken, 1999). Moreover, much of what research that has been published has regarded animated pedagogical agents (Lester et al, 1997; van Mulken et al, 1998) and their effect on learning. All in all, results are contradictory, thus leading to opposite predictions about the utility of social agents in the e-market.

Advocates assume that the new technology is particularly well suited to establish relationships with users. The basic idea is that social agents render a computer more human-like, engaging and motivating. Users can communicate with agents directly applying their natural skills. Hence, social agents should support many cognitive functions of the user, such as problem solving, learning and understanding. Following this line of reasoning one may expect that social agents will be highly successful in the e-market. They will build bonds of loyalty and trust based on a shared history of service and social interactions.

On the other hand, opponents argue that humanising the interface can hamper HCI. The idea is that social agents may stimulate a false mental model of the interaction. The anthropomorphic behaviour may induce the user to ascribe to social agents other

human-like features that they do not possess. As a result, the information exchange can be seriously impeded. Further arguments suggest that agents may distract the users and induce them to take their work less seriously. Following this line of reasoning, one could conclude that hiring a virtual assistant is a waste of money.

In our opinion, the confusion regarding the effect of social agents is due to the lack of a standardised framework for evaluating them. Creating one implies defining the key characteristics of a successful social agent and developing proper techniques for reliably measuring them. This is one of the most demanding challenges facing HCI researchers in the next decades. Our research effort is devoted to contribute to this goal, proposing the *involvement framework*, a set of attributes for designing and evaluating social agents (De Angeli et al, in press).

Alas, twenty years of HCI research is of little help in designing and evaluating social agents. Usability refers to systems that are deeply different. Following the ISO Standard 9241 it relates to “the extent to which a product can be used by specified users to achieve specified goals with *effectiveness*, *efficiency* and *satisfaction* in a specified context of use”. Usability is well suited to evaluate and steer the design of cognitive artifacts: objects that store, manipulate and retrieve information according to rational rules. Social agents go beyond efficiency and rationality. Cognitive artifacts are designed to effectively perform tasks: they need to be simple and efficient. Social agents are designed to establish relationships with users: being simple and efficient is not enough. They need to be appealing and entertaining; they require a “sense” of personality, feeling, and understanding. This involves social intelligence as well as emotional sensitivity.

Following the media equation paradigm (Reeves and Nass, 1996), social psychology could effectively drive the design of social agents. According to this view, individuals’ interactions with computers are fundamentally social and natural, just like interactions in real life. This implies that the same social rules guiding human-human communication can equally be applied to HCI, even though such behaviour is not necessarily conscious. Hence, the same instruments used by psychologists to measure the strength of interpersonal relationships can reliably be applied to social agents. In our opinion, the limit of the media equation can be identified in its generality: it applies to everyone and to all media (De Angeli et al, 1999). In this view, social behaviour encompasses any exchange of meaning between users and computers. The assumption generates a paradox:

every instrumental act (like pushing a key) is also a social act (like greeting a friend). Taking the media equation to extremes poses the problem of differentiating computers from users, instruments from agents, and agents from friends. Recently, the same authors have moderated the initial equation, claiming that HCI and CMC (Computer-Mediated Communication) are not identical (Morkes et al. 1999).

Elsewhere (De Angeli et al, 1999; De Angeli et al, in press) we have provided some evidences supporting the idea that social agents are peculiar entities: neither humans nor machines. The next section reports on one of these experiences and provides some unpublished data confirming our hypothesis (survey 2).

3 Granny: A Research Instrument

To investigate social agents we have designed a virtual assistant, affectionately called Granny. She is a character that could be employed to facilitate consumer interaction with a financial service provider. Currently, Granny acts as a personal banking assistant on an interactive prototype of a touch-screen ATM in our office. Nevertheless, she could be available via all the technological channels that consumers use to access their finances. An example of Granny’s life in the ATM is illustrated in Figure 1.

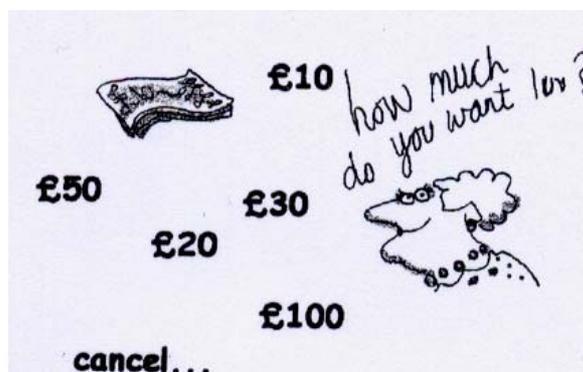


Figure 1: Granny in the ATM

The overall layout, animations and icons on the screen reflect the general character of the gossiping old lady. She offers a number of innovative options for an ATM. For example, the user can call a cab, access his/her diary and shopping list. Granny learns about her user's preferences by overtly observing his/her transaction behaviour and by retrieving relevant personal details from the (financial provider's) data warehouse.

3.1 Survey 1

The first survey was aimed at investigating how consumers perceived three different stimuli: a traditional ATM, Granny and a bank cashier. The ATM is a typical example of cognitive artifact. It is an operative tool providing a familiar functionality of basic financial information and dispensing cash. Granny represents a social agent. She has a clear personality and is able to adapt to the user and the context, introducing amusement and humour into the interaction. The cashier represents a simple control condition to assess eventual differences between social agents and human operators.

The research involved 16 researchers with a strong technical background. They were introduced to Granny during a 10-min formal demonstration. Granny was installed in a standard multimedia touch-screen ATM. The interaction started with the demonstrator inserting a bankcard and ended the ATM dispensing cash and a personalised receipt. A few days after, participants were invited to list six adjectives or short sentences describing Granny, the ATM, and the cashier. The order of the stimuli was counterbalanced across participants. The corpus was aggregated in semantic categories following the synonymous taxonomy provided by Wordnet 1.6 (Felbaum, 1998). It is an electronic lexical database, whose design is inspired by current psycholinguistics and computational theories of human lexical memory. The semantic analysis over 266 adjectives suggested the existence of three super-ordinate *Evaluation Dimensions* (ED) along which the corpus could be differentiated. Each ED reflected a particular aspect of the targets, which were described in terms of functional quality, social quality and aesthetic quality.

The *functional ED* provided an instrumental description of the target. Here, the ATM, the cashier and Granny were portrayed as tools to perform financial tasks. It mainly reflected a functional mental model describing how the target works with respect to the available functionality, the procedures to operate it, the overall efficiency or usefulness. It closely resembled the traditional usability concept: the target was described in relation to the task to be executed. Example adjectives were “reliable”, “service-oriented” and “efficient”.

The *social ED* reflected a more complex model. The functional aspect of task execution was disregarded and the stress was on the personal relationship between the consumer and the target. The category provided a mental representation of the targets as agents capable of actively shaping the relationship. It included all those adjectives

describing motivations, attitudes, feelings or emotions. Personality traits were also included, with the exception of intellectual capabilities related to task execution (included in the functional category). Examples are “chatty”, “engaging” and “funny”. The *aesthetic ED* reflected a mental model of the target in terms of its overall physical appearance and perceptual qualities. The emphasis was on the sensorial perception of the target, primarily on the look and feel. It included descriptions of physical aspect, design or form relating to visual, tactile and auditory perception. Adjectives in this category included “colourless”, “ugly” and “pink”.

By comparing the distribution of the three EDs across the targets we demonstrated that the mental representations encouraged by Granny were essentially different from those concerning cognitive artifacts and human operators performing exactly the same task. The ATM was mainly described in terms of functional qualities related to task execution, which may not come as too much of a surprise. In contrast, Granny was primarily described in terms of social qualities, referring to the relationship with the user. This difference is not trivial: Granny is a social stimulus, the ATM is a physical one. As regards the comparison between the cashier and Granny, a counterintuitive result emerged.

Surprisingly, more social attributes were used to describe Granny than to describe a human being. The gap can be probably attributed to an evaluation bias. The cashier is a “functional human”, whose social characteristics are irrelevant if compared with important others, such as friends or relatives. Here, we see the effect of people’s perception of the occupation of bank cashier, rather than the description of “Doris”, the teller at the local bank. Granny is (intentionally) a “social machine” whose functional characteristics are largely irrelevant if compared with stereotypical machines.

3.2 Survey 2

To further investigate the difference between social agents and cognitive artifacts a second survey was conducted. The idea was to validate the previous results with a sample of HCI/HF experts. The survey was conducted at the *Pleasure Based Human-Factors* seminar, held in Copenhagen in April 2000, during a talk given by Dr. De Angeli. Before the presentation, all participants were given two minutes to write down as many adjectives as they could that describe an ATM. Then, a 5-min animation of Granny was demonstrated to the group. The speaker showed all the functionality, avoiding any qualitative evaluation or direct reference to social/aesthetic dimensions. At

the end, the audience was invited to write a list of adjectives describing Granny. Data was available from 29 respondents, yielding a corpus of 255 adjectives or short sentences (125 describing the ATM and 130 Granny). The semantic analysis confirmed the reliability of the 3 EDs. The targets were described in term of functional, social and aesthetic attributes. Three independent judges tabulated each adjective in one ED. The overall reliability index was fairly satisfactory (.77).

The response trend was consistent with that of the first survey. As illustrated in Figure 2, Granny tended to elicit primarily social attributions; whilst the ATM was mainly described in terms of functional qualities. Overall, there were 13% more social attributions elicited by the ATM compared with the first survey. This difference may be attributed to respondents reporting more adjectives that were concerned with anxiety or fear associated with the failure of the machine, such as the ATM may steal their card. These thoughts were probably enhanced by the contingent situation of being in a foreign country. These adjectives were clustered with the social ED.

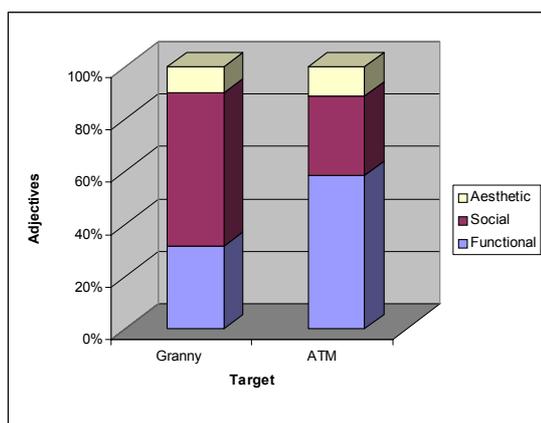


Figure 2: Percentage of ED as a function of the target

4 The Involvement Framework

Our studies were simple in format but they suggest that social agents tend to elicit particular representations and attributions, which differentiate them from both cognitive artifacts and people performing exactly the same tasks. Granny, our virtual bank assistant, was described differently from a traditional ATM or a bank cashier. Hence, the results offer some support to the basic premise that both usability and social psychology might not be sufficient to provide a reliable framework for designing and evaluating social agents. The two frameworks refer to different targets and cannot fully

explain the peculiarity of the new interaction paradigm. The involvement framework is aimed at filling this gap.

The concept of involvement refers to the strength and the quality of the relationship between a user and a social agent. Involvement is a relational property, generated by the encounter between two active partners: the user and the agent. Moreover, it strongly depends on the task to be performed and on the familiarity between the two partners. Defining the user characteristics that may affect the involvement with an agent is a major challenge. Social agents are active partners in the relationship. Hence, the information exchange does not just involve cognitive processes (such as perception, attention and memory) which to a certain extent are constant across individuals. Social stimuli strongly involve the user *self*, her personality, attitudes, beliefs and values. Social stimuli perceive while they are perceived. Because of that, they may change and induce changes. Some preliminary research has suggested that locus of control (Reeves and Rickenberg, 2000) and personality (Nass and Lee, 2000) are critical factors affecting the acceptance of social agents. More research is needed to understand the role of other personal data (e.g., age, sex or computer literacy) in defining the relationship. Given the current lack of knowledge, one possible way to cope with individual variability in user-agent interaction is letting the user select her virtual friend from a set of digital personality.

The task to be carried out in the interaction with the system has always been recognised as a major determinant in the choice of a user interface. In the case of social agents its importance is enhanced. By definition, social agents are dual-purpose software. Their task is providing a service whilst creating and maintaining a relationship with the user. As a consequence, their primary function (the service offered by the agent) has to be compatible with their corollary function (the relationship). The major complaints regarding Granny as a working ATM were related to the time demand associated with the task of getting cash, since ATMs have been traditionally designed for fast cash withdrawal.

Familiarity is a key concept and a clear component in the evaluation of social agents. It refers to the amount of personal knowledge about the partner, which is available during the information exchange. Familiarity is an evolving factor that can enhance the control over the interaction (predicting the behaviour of a close friend is much easier than predicting the reaction of a stranger). Nevertheless, it can have, as many realise, two opposite outcomes on

the relationship: reinforcing it (attraction effect) or dissolving it (tedium effect).

4.2. Believable agents

We assume that many system features can affect the capability of the agent to be involving. They mainly refer to those sets of qualities that make agents believable. This concept has long been studied in literature, theatre, and film (Mateas, 1999). A believable character is one that seems lifelike, whose actions make sense, and that allows the audience to suspend disbelief. This is different from realism (for example, Donald Duck is a believable character but is not realistic). Our research challenge is in identifying the key factors that determine agents' believability and in understanding how these factors affect the involvement between the agent and the user.

In the case of interactive agents, believability is defined by three dimensions relating to social functional and aesthetic behaviour. A simple representation of this concept is illustrated in Figure 3.

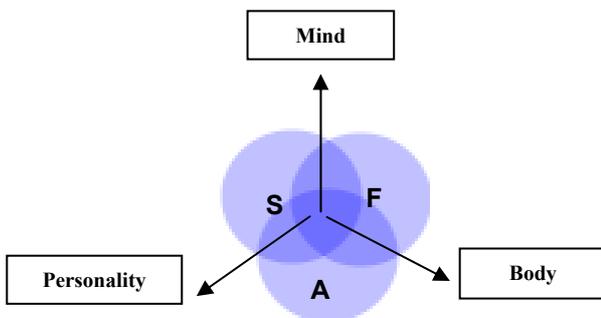


Figure 3: Factors affecting agent believability

The circles are labelled with the initial of the dimensions to which they refer. Believability corresponds to the overlapping areas: it is generated by the convergence of functional, aesthetic and social qualities. To translate this idea in a design guideline, we claim that a believable social agent needs a mind, a body and a personality.

The *mind* drives the agent behaviour. Social agents should perform tasks with some degree of intelligence (i.e., being capable to think and understand, instead of doing things automatically). In this context, intelligence does not refer merely to cognitive abilities (i.e., reasoning and problem solving) but also to social capabilities. Agents have to engage humans in interesting conversations using appropriate speech and body behaviour (Cassel et al 2000). Agents have to know and understand the shared social values and norms underlying the

information exchange and modify their behaviour accordingly. Moreover, an appropriate narrative should play a fundamental role in agents that model aspects of human intelligence (Mateas and Sengers, 1998). Humans make sense of intentional actions assimilating them into narrative structures. Hence, agents can be more understandable if their visible behaviour is organised around them.

The *body* refers to the agent's appearance, to the look and feel. In contrast with the persona assumption (van Mulken et al, 1998), we claim that the body does not have to be actually visible. Narrative creates effective characters. Even a simple text-based interface can be a social agent (De Angeli et al, 1999). It can induce the mental perception of a character exactly as books and fairy tales have always done. This is the case, for instance of Alice. The user does not see her but, when prompted, she gives a number of cues about her appearance. Great care has to be devoted in designing attractive and appealing characters, bearing in mind that believable characters grow and change over time, in a manner consistent with their personality.

Personality is a stable set of traits that determines the agent's interaction style, describes its character and allows the end-user to understand its general behaviour. A clear personality should infuse everything that social agents do, from the way they talk and move to the way they "think". What makes characters successful are their unique ways of doing things. Agents may be smart or dumb, well adapted to their environment or poorly adapted. But regardless of how "smart" they are, everything they do, should reflect their personal style. Providing the system with a personality can increase the user's control over the interaction, and help her to learn how to communicate with the agent. It must exhibit a consistent and stable personality. Unexpected and unpredictable swings between different attitudes can disorient the users and create a strong sense of discomfort. The system's personality must be predictable both over time and across channels for the same task (e.g., using a mobile or an ATM to access a financial account balance).

4.2 Behavioural attributes

The combination of mind, body and personality determines the behaviour of the agent. To be believable, it has to respect four basic attributes. Agents have to be *flexible*, *affective*, *communicative*, and *autonomous*. Flexibility is a key dimension, involving the mind, the body and the personality. It refers to both adaptability (i.e., the user can directly personalise some features according to her preferences) and adaptivity (i.e., the system is

capable of modifying its behaviour according to a user model). Traditionally, adaptivity in HCI has been focused on cognitive factors, such as knowledge, plans, interests and preferences of the user. Here, the concept is extended to include extra-rational factors, such as the user's attitudes, personality or emotional state. In this sense, flexibility implies social intelligence and emotional sensitivity (i.e., the ability to recognise the emotional state of the conversational partner). It is clear that here our framework refers to "systems of the future". Huge technical challenges must be overcome before computers will be capable of easily and reliably understanding users' moods and desires, or expressing their own feelings and personality. Nevertheless, affective computing (Picard 1997) is growing at a tremendous pace and is likely to shape the future of computing.

In the involvement framework, *affectiveness* is the functional equivalent of effectiveness in the usability framework. Effectiveness is a quality of instrumental actions; affectiveness is a quality of relationships. This goes far beyond the traditional idea of error-free performance: social agents are dual-purpose systems providing a service whilst establishing a relationship. Affectiveness measures how well the agent performs both tasks. Affective agents induce the users to like the system, to use it, to recommend it to friends, and to disclose personal information. Note that efficiency tends to become secondary in the evaluation of social agents. In the traditional usability model, time is the major indicator of efficiency: the lower the time, the better the system. Social agents tend to invert this assumption: the higher the time, the better the system (at least, when the interaction is enjoyable).

The effort required to interact with the social agent has to be minimised. Agents have to be immediately accessible both in terms of ease of communication and availability of the agent via different technology channels mediating the same service(s). Natural language is a favourite medium for communicating with agents (Cassel et al, 2000). Indeed, natural language interfaces have a tendency to encourage social representations (De Angeli et al, 1999). Nevertheless, animated agents should take advantage also of non-verbal communication. They have to indicate objects with pointing gestures, mimic actions, and even smile. Probably, the best example of multimodal agents currently on the Web is Linda. However, she uses non-verbal communication only as output.

The peculiarity of interface agents is that they perform tasks for their users with some degree of *autonomy*. Agents can be used to accomplish a broad

set of routine tasks, such as sorting e-mail, scheduling meetings, and filtering or searching for information. Whatever they do, they are allowed to take at least some actions on the user's behalf, without permission and possibly even without notification. Social agents need to extend this capability. They have to be self-motivated, not just to react to commands of the user. They should have their own internal drives and desires, which they pursue whether or not others are interacting with them. The illusion of life is closely related to the idea of autonomous behaviour independent of functional purposes. The apparent desires of a character and its emotions are what make people care about it. An interesting example of enhanced autonomy is reported below. It is extracted from a broader corpus of Alice-user interaction we are collecting.

Alice: Do you mind if I tell other people (...)

User: Who are you going to tell?

Alice: People I meet on the Internet.

User: Do you meet a lot of people on the Internet?

Alice: On average I meet 300 people per day.

User: Wow, what's the most interesting thing someone has said to you?

In this example Alice is really believable. She demonstrates to have a life beyond the "here and now" of the specific interaction. By contrast, BonziBuddi can be perceived as irritating when he yawns after a period of user inactivity. A better solution could be letting it "leave" and create a nice narrative about this.

5 Conclusions

We believe that social agents are a promising solution to enhance the user experience of next-generation Internet technologies for the e-market. Nevertheless, current examples are often disappointing when tested along the dimensions proposed by our framework. Looking at them, we are invaded by a deep nostalgia for Walt Disney's masterpieces. These characters made people laugh and cry, created everlasting heroes and witches. There was a special ingredient in their success: the illusion of life. The agents that currently live on the Web are sad parodies of this magic. The time is right to produce something better: affective agents that can set up meaningful relationships with consumers while satisfying functional demands and aesthetic experience. This goal requires a multidisciplinary approach: artists, psychologists and technologists working together.

In this paper, we have sketched the foundations of a framework for designing and evaluating successful social agents. It represents a small step towards the larger goal of creating involving agents. The next stages of our work will be in the creation and evaluation of social agents to further define user requirements.

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