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DESIGNING COMPANIONS WITH KANSEI

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ABSTRACT

Companions represent a new form of human-computer interaction. They are the next generation of Embodied Conversational Agents (ECA) with a robust dialogue capability. ECAs alter the interaction to a more natural setting: face-to-face communication and because of the anthropomorphic communication this creates, Companions are also expected to be affective interfaces. Empathy is an essential component of the interaction between users and Companions. The vision of Companions is that they are changing interactions between humans and systems into relationships. Companions represent a particular challenge for the design research because of the emergent technologies that they are endowed with and because of the fact that users' response to Companions is unknown. The key elements of these Companions which impact the user experience need to be identified, particularly the global users' perception towards these Companions as interfaces. The methodology of the design process of Companions is inspired by the concept of 'Kansei' and the methods of 'Kansei Engineering', which translate consumer perceptions into design attributes. Analyzing results provide an interesting insight into the societal impact and the new relationships people want to develop with Companions as a new interface involving emergent technology. Firstly, results reveal that users need time to speak about these emergent technologies, secondly, they yearn a relationship with their own Companions which is somewhere between the human relationship and object relationship. The semantic of these artefacts seem to be emerging; as a result users need to make use of metaphors to qualify these Companions. Moreover, people drew a singular approach to how the 'Companion's hierarchy' could work illustrating their expectations of the 'technology promises'.

Keywords: *Kansei Design, Design research, Affective Interfaces, Intelligent Agents.*

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1. INTRODUCTION

An agent is an autonomous entity using the techniques of artificial intelligence: it adapts its behavior to an environment and by remembering its experience, behaves as a subsystem capable of learning. It is able to enhance its belong system by adding, over time, automatic data processing functions, control, storage or information transfer [1]. The Internet and the concept of agents have matured together, therefore the potential of embodied agents (screen based anthropomorphic entities) to enhance interaction with computers have provided very many avenues to explore in the field of Human Computer Interaction (HCI). However, this interest in agents as interfaces remains unclear, opinions and arguments for – more natural interaction that enhancing the engagement with the system- and in opposition to – distraction of people when accomplishing tasks- either have many supporters. Terrific progress in conversational technologies and embodiment techniques of avatars allow us to produce multimodal agents and other forms of intelligent interface technology. Furthermore, the affective process seems to be a major scientific paradigm of this century and the importance that emotions plays in people's everyday life are highlighted. This 'affective revolution' joins the evolution of ECA as interfaces.

In the present study, Companions represent the next generation of embodied conversational agents (ECA) with a robust dialogue capability. ECAs alter the interaction between users and computers to a more natural setting: face-to-face communication. Affect is a central part of the Companions vision. The Companions considered in this paper are personalized conversational interfaces to the Internet that know their 'owners'. They are implemented on indoor and nomadic platforms based on research into multimodal human-computer interfaces, intelligent agents, and human language technology [2]. It is envisaged that Companions will act as managers for a myriad of services offered by the Internet. The vision of Companions is that they are changing interactions between humans and systems into relationships. We think it is possible to design artifacts that will enable people to develop relationships with them. Companions represent a particular challenge for design research because of the emergent technologies that they are endowed with and because of the fact that users' response to Companions is unknown. In this paper we focus on the need to identify the key elements of Companions that impact the user experience and particularly the global users' perception towards Companions as interfaces. Furthermore, we propose a methodology of design process for Companions inspired by the concept of 'Kansei' and the methods of Kansei Engineering (KE), which translate consumer perceptions into design attributes. Our aim is to focus design on the emotional features of the interaction and investigate new tools and process to study this new Human-Companions- Interaction. The aim of this study is to look at the global users' perception towards Companions as interfaces, their impact on the user experience and the features needed for an ECA to be a Companion in the user mental representation. This paper is organized as follows: first we describe the context of the Companion project and the characteristics of Companions. Secondly we present the methodology of Design of Companions based on KE, then our first exploratory work concerning user's perception of the human-companion interaction is presented.

1.1. The Characteristics of Companions

Companions are an evolution of ECAs. As defined by Cassel [3], these new interfaces are not only lifelike, with human or animal embodiment, but also specifically conversational.

They need to use their bodies in a conversation using rules that humans utilize into a face to face conversation. The complex rules, which lead our face-to-face interaction, express several human conditions such as social attitudes, relationship status and affective status. People use these protocols to navigate in a social world. Utility, form, personality, emotion, social aspects and trust are the characteristics of Companions if they are designed for relationships [4]. Personality and trust are key issues if Companions are to gain the confidence of people. Other authors such as Bates or Creed think believability is another important aspect to consider when working with synthetic characters. In particular expressiveness or the expression of emotions and empathy are essential to achieve some degree of believing to improve tasks such as learning or health coach [5,6].

1.2. The Companion Project

Companions Project is a 4 year EU funded Project of Framework Programme 6 , involving a consortium of 16 partners across 8 countries. Its aim is to develop a personalized conversational interface that can act as an alternative access point to resources on the Internet. Companions stay with their owners for long periods of time, developing a relationship and 'knowing' their owners' preferences and wishes. Companions use technologies such as touch screens, sensors or RFID. They glean the most important information about people from conversation with them. This is used to assist carrying out specific Internet tasks [2].

1.3. Methodology within Companions Project

1.3.1. The Kansei Approach

The Kansei concept is deeply rooted in Japanese culture, far off from the Cartesian vision. It is a part of the cognitive process in which the Kansei nourishes the creative side of humans. It is a concept that is difficult to express even with words. Some Japanese currently say this is the case because they need several words in our languages to explain it and because they are unable to find accurate words or phrases in our Western language. When an external stimulus is received by senses, humans perceive it intuitively. To induce a reaction, this information is conceptualized by being compared with past knowledge and experiences. Conceptualization could take various modalities as images or words. Kansei is the ability of reacting and evaluating external features intuitively. It involves the interaction of intuition and intelligent activity. It is a cognitive process where information is concerned with people's knowledge and experience. [7,8].

The concept design phase is decisive for the achievement of products in the industry. The customers' needs have a dual nature: functional and emotional, then product concept design have to deal with both products' physical qualities and products' emotional qualities. 'Total quality product' is defined as a product that satisfies both functional and emotional users' needs, and "total quality elements" the corresponding product attributes. Kansei Engineering (KE) is a methodology for achieving products' emotional quality. KE is successful employed in the industry because it permits to evaluate the "quantitative" relationships between emotions and feelings of users and product elements [9].

To measure the emotional quality of a product, a procedure by KE has been schematized into five phases: exploration of the semantic dimension, exploration of the physical properties dimension, synthesis, analysis, product development strategy. [10]

This KE process seems to be particularly interesting in the field of HCI to examine technology towards user experience and emphasize the importance of the emotional value. Exploration of the semantic dimension when designing Companions could allow us to understand how subjective information is processed. A key aspect of designing for Companions is to introduce affective relations into the interaction between users and companions in order to verify if the affective phenomena could support emergent technologies [10,11]. The emergent technologies, which Companions are endowed with, are not completely mature. They are dependent on the technical capabilities of the devices. Currently there is no device that allows us to display Companion in optimal conditions, using technologies such as visual recognition, touch and gesture, working together.

1.4. Our Methodology

The design process of Companions is presented in Figure 1. In phase 1, experts in two areas were consulted: experts in technologies and interactivity, experts in the application domains for which the companions were being designed: health and photography. It allowed us to achieve the functionality design of Companions linked to the technologies used and getting conceptual and functional models as a result. This phase was developed not only by meeting experts, but also by preparing reviews and having qualitative interviews with designers. This permitted us to design the first conceptual and functional model of Companions : Photopal .This phase was tested in qualitative terms.

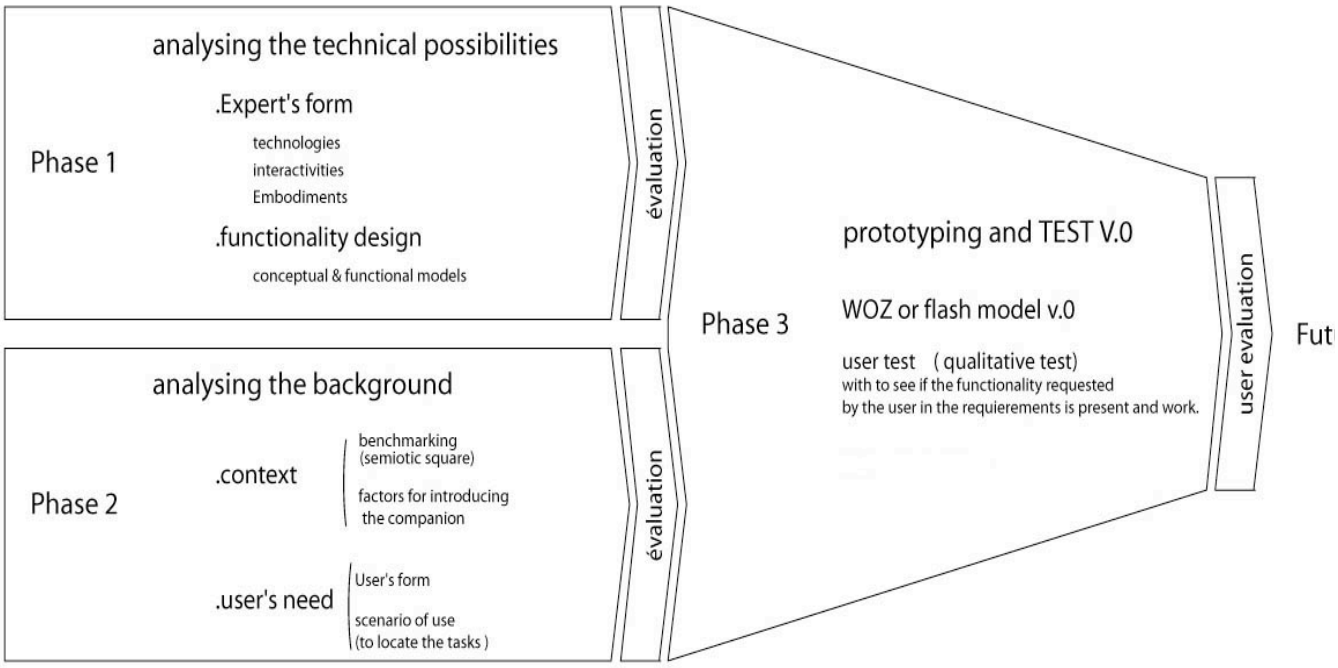


Figure 1: Steps of process of design of Companions

Phase 2 within the Companion Project, was the opportunity to meet future users in order to generate the requirements for these Companions. In this phase the semiotic square used by

industrial designers to delimit the two more important semantic dimensions to be explored with Companions: materiality (the embodiment) of the Companion, and affectivity (feelings) that these Companions are able to evoke in users. The user form, necessary to develop a scenario of use for Companions must take into account the semantic meaning people associate to these Companions – as a whole- and, to the new modalities of interaction they offer. There is little feedback about the feelings of people concerning these new artefacts. Therefore understanding how the mental construction of users works regarding Companions seems to be a good starting point.

In Phase 3 we expect to work with a Wizard of Oz (WoZ). It is an experiment whereby users interact with a system that people believe is autonomous but is in fact controlled by a hidden operator [16]. Particularly useful for emergent or no mature technologies, this kind of experiment is used in HCI at the very early stages of projects in order to design a new form of interaction and to create a prototype. It enables user feedback to be gathered when the technology is not yet available. The WoZ experiment allows potential users to interact with the new technology whilst design is ongoing and before the first prototype has been finished. This process aims to address complex issues related to the use of interactive systems such as perception, acceptability, emotions, understanding and trust. The data gathering techniques suggested in these 3 Phases are focused in people and their expectation regarding technology, because the physical and social context have a strong impact on the user's attitudes towards these systems. In the context of the user experience, emotion and feelings during the interactions process seem to be crucial to persuade or discourage the use of these systems.

2. PERCEPTIONS OF COMPANIONS

2.1. Discovering the semantical world of Companions, first steps

Previous studies have investigated users' response to interfaces like Companions. Some have remained at a conceptual or simulation level, while a few others have evaluated fully functional prototypes. See for example work done on the Rea system [4]. Little is known regarding the response of people to interfaces like Companions, as they remain either fictional or theoretical. Gathering more information on this question is a crucial first step towards the design of Companions. To accomplish Phase 2 of our methodology tests were implemented in order to understand people's global perception of Companions as interfaces. The data gathered was analyzed in order to identify the dimensions used by people to conceptualize Companions. Moreover we investigated terms used by respondents to assess the function of a companion and the relationship between the embodiment of Companion and its function. We have used the repertory grid or Kelly's grid [13]. According to Kelly's Theory, people are observers of the world around them. Like scientists, they draw up hypotheses, which they check with life experiences to elaborate their own theories, to construct their own vision of the world. In other words individuals have concepts or references (called constructs), which allow them to make sense of the world. These constructs also help people's environment become more predictable to them. This process has an important impact on the user's decisions. The repertory grid is a technique that is helpful to uncover people's concepts, the values they call on to understand something, which dimensions people are attached to and what their influences are. In short, how their mental

constructs work. Because of the rich variety of Companions available as part of the project, this study only selected nine of them . As mentioned in Phase 2 our classification of the presented Companions, was made from two dimensions: materiality (the embodiment), and affectivity (feelings) based on users' response. In the experiment, materiality was considered as the tangible package of Companion and not materiality as the opposite space. One of our goals was to evaluate users' affective responses to different embodiments, while using features such as voice, lighting, facial expressions and gestures.

2.2. Experiment

Fourteen individuals were invited to participate in this experiment. The experiment had 3 sections. First a system simulation was showed to participants, then an open-ended interview has been done and then a grid was provides to collect a complementary information. In this way 94 grids and 7 hours of interview were gathered. In the first section, a system simulator (video recording) with a panel of nine selected Companion images each one linked to a short video presenting the Companion in a real-life context, was proposed. Participants were presented with this panel and were free to watch the videos as many times as they liked. When participants felt comfortable with the technologies showed by the simulator system, they were invited to fill in the grid. Then, they were interviewed. When they looked uncomfortable with technology we suggested to start by doing the interview and finally top up the grid. When using the grid, participants were asked to choose several sets of three companions (triads). For each chosen triad participants were asked to provide an adjective to express how two Companions of the triad were similar and how the third one was different. An example was provided in the grid as showed in Figure 3.

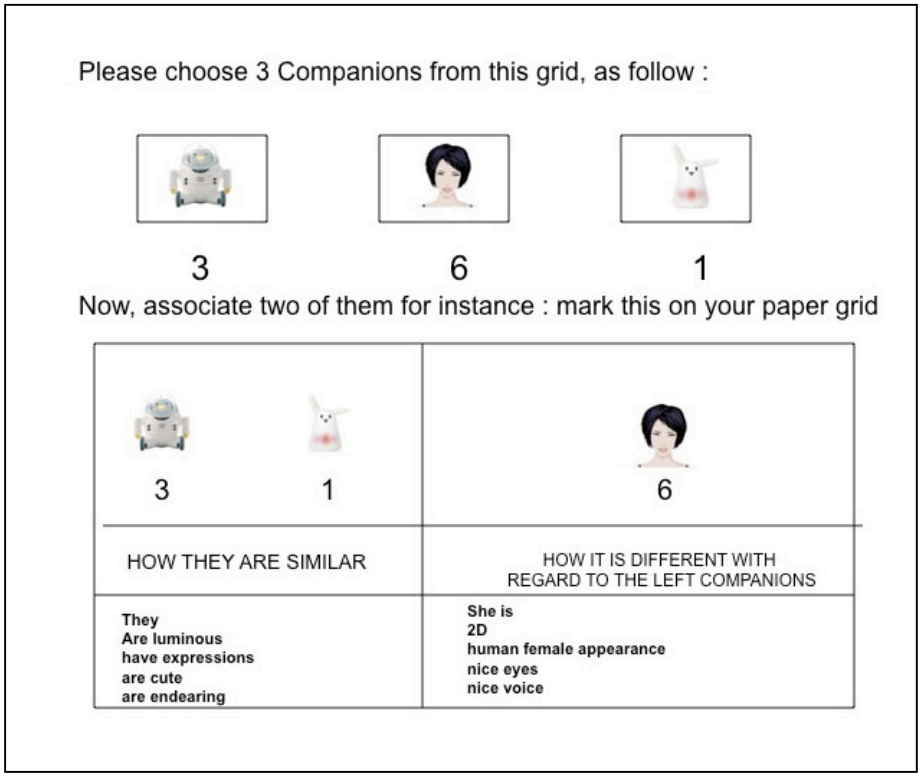
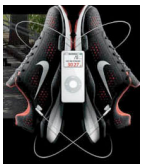


Figure 2: Model of Grid for experiment

The work was conducted in French, results have been translated into English. The results of the grids were gathered in Table 1, where is shown the different adjectives that people provide to point out these Companions.

Table 1: Results gathered by the whole grids

Companion		Adjective
1	 NABAZTAG	Toy, uninteresting, colorful light, radio substitute, luminous, help to search without tiredness, robotic, like animal, for children, kindly, cute, make signs with his body.
2	 AIBO	Toy, dog, dog with expressions cute, funny, no noisy, obey to orders, facial light, luminous, timekiller, virtual answer, animal, for children, submissive, mime the beings, expressive, expression on the eyes, able to be tame, make signs with his body, express emotions.
3	 IFBOOT	Obey to orders, light, facial expression, no noisy rounded head, soft colors, easy communication, timekiller, virtual answer, like animal, for children, kindly, have body movements, have expressions.
4	 Samuela	Female face and style, Female-eyed, pretty character, pretty face, sympathetic to listen, female voice, voice-interacting, could be asked to, useful, like female speaker, pretty and young, sexy, helpful in everyday life , interesting, ask &answer, virtual look, express emotions, presence like a company, provide advice in everyday life, have interactions.
5	 PATACHON	Cute, funny dog with expressions, no noisy, funny, useless, express emotions, presence like a company, light, have body movements, have expressions.
6	 ENRICA	Female face, pretty face, female-eyed, sympathetic to listen, female voice, , helpful in everyday life , interesting, ask & answer, like female speaker, pretty and young, sexy, mime the beings, expressive, human voice, no a real dialogue, intimidating because no interaction, provide advice in everyday life.
7	 Pivo 2	Obey to orders, light, facial expression, rounded head, soft colors, easy communication, help to search without tiredness, robotic, mechanic, related to another machine, non anthropomorphic expression, like an speak toy, more virtual, personal use.
8		Pretty shoes, for sportive people, efficient, without dialogue, user could decide to use or not, non humanlike
9		Depressing, ugly looking, human voice, no a real dialogue, intimidating because no interaction, virtual, speaking machine, spy camera, frightening, human less.

2.3. Discussion of Results

The conclusions presented here are a result of the gathered interviews and of the adjectives people used to describe Companions within their mental meaning presented in Table 1. An important result revealed by the survey was that people have some difficulty allocating adjectives to Companions that they had just watched in a video presentation. People seem to need time to speak freely about this approach to technology. As mentioned by Baudrillard, objects not only take their meaning by their materiality and their functionality. Objects are part of a very complex system, in which their technological framework is necessary to understand how they are consumed, owned and personalised [14].

Analyzing the examples participants gave provided an insight into the societal impact and the new relationships people want to develop with Companions as a new interface involving emergent technology. People described their social interaction with Companions and drew a singular approach to how the "Companion's hierarchy" could work (my Companion, your Companion, the Survey Companion that belongs to a company and so on), illustrating their expectations of the 'technology promises' in which the future becomes an object of desire. They also described the level of technology and multimodal exchange they wanted with Companions.

The arrival of Agents endowed with human attributes (voice, recognition abilities) and different embodiments (robots, screen avatars, communicating things) are changing the hierarchy people have given to objects in the past. This is evident in the interviews even if people can not explain it directly. For this reason they used a lot of metaphors. This is probably because these changes are very diffuse and perhaps because we do not yet have the words to define the feelings elicited by these new artefacts. As a result of these interviews we are able to present this shift. Nevertheless these anthropomorphic attributes seem to be insufficient when transforming an object in a Companion. In the same way, only body movements and facial expressions do not update an object to be a Companion, as a result Companion 1 is considered to be uninteresting, Companion 3, a timekiller, Companion 9, depressing despite his mellow human voice and Companion 8, only technological pretty shoes. Unusual modes of interaction create people's disorientation regarding Companion 6 which is able to address to people by speaking but people need to answer to, by computer keyboard. As a result, this Companion is considered as 'intimidating because no interaction'. People seem to be interested when these characters are able to have direct interactions with them. Aibo, Companion 2, is an interesting example: because of his particular features this Companion is very successful with the feeling of attachment by displaying his emotional state through his owner, but a number of interviews show that these same people consider this object like a toy and not as a Companion because of his unknown utility.

Companions are expected to have a human behaviour and an agent behavior. It means that people are trying to invent a relationship with a Companion, which is somewhere between the human relationship and object relationship. The participants' reactions around Samuela are the best example of this evolution and of the personification of these emergent technologies. Several interviews confirmed this, as for example this 25-year-old participant, who stated during her interviews that she would like Samuela (as her Companion) to live with her. She imagined Samuela (inside her screen, no matter which screen: computer or mobile phone or both) at parties that she would organise at home. For example, they would

be able to choose dresses together, as well as the music, and she may ask Samuela to perform several tasks at the same time, something which humans can not do. Samuela would also be expected to disappear (by herself) when her owner does not need her anymore. This participant has said: Samuela must 'feel' when the right moment is to appear and to disappear. In their interactive relationship, the user will extend and copy the structured behaviour as regard people and objects. The grid confirms that Samuela was the only artefact considered by people as able to provide 'a presence like a company'. In addition she holds other features, that people mentioned like suitable for a Companion: helpful in everyday life, having interactions, expressing emotions, providing advice (which means a personal helpful). Furthermore, people expressed very human aesthetic preferences regarding what they would like their companion to look and be like: Female style, pretty character, sympathetic to listen, female voice, voice interacting, pretty and young, sexy. Then, Samuela is expected to have a human behaviour and an agent behavior. This seems to be a mental model people have of an ECA able to be a Companion. The semantics of these artifacts is emerging; only a long-term relationship with a Companion would be able to explain this. The 'human side' of Companions expected by people seems to be similar to human strategies to capture audience involvement such as: interaction, humor and contextualization. Other elements of human strategies of communication and involvement such as body language, stance, facial expressions, use of space, and gesticulations, appear to be likely. It confirms recent theories concerning body communication, which consider the system of gestures as a complement to speech production [15]. This study also reveals that people attach particular importance to subtle signs like gaze or intonation, facial expressions and body gestures working together and toward their role when showing emotions. Samuela is expected to be a Companion as well, because she expresses emotions as showed in Table 1. Mainly because that it is indicative of the Companion's human-like interest in the user as confirmed by interviews: '……when she comes trough in her screen, she gives me the impression that she is listening to me and that she is interested in what I 'm telling her'. There is an expectation of this form of human behavior from people. The Companion proactive involvement in the interaction is perceived as a sign of empathy in this context.

3. CONCLUSION AND FUTURE WORK

Analyzing the examples participants gave provided an insight into the societal impact and the new relationships people want to develop with Companions as a new interface involving emergent technology. People described their social interaction with Companions and drew a singular approach to how the "Companions' hierarchy" could work (my Companion, your Companion, the Survey Companion that belongs to a company and so on), illustrating their expectations of the 'technological promises' in which the future becomes an object of desire. They also described the level of technology and multimodal exchange they wanted with Companions. A WoZ experiment is as a part of the next step of our process, in order to observe people interacting face to face with these Companions.

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REFERENCES

[1] Huhns M., Munidar P.S(1998) Readings in Agents, Morgan Kaufman Publishers, San Francisco, USA.

[2] Companions Project, (2009) Retrieved 3 July 2009 from http://www.companions project.org/

[3] Cassell, J. (2000). More than Just Another Pretty Face: Embodied Conversational Interface Agents. Communications of the ACM *43*(*4*): *70-78*

[*4*] Benyon, D. and Mival, O. (*2007*). Introducing the COMPANIONS project.In Proceedings of Artificial Intelligence and Simulation of Behaviour Convention on Artificial and Ambient Intelligence, Newcastle University, United Kingdom

[5] Bates J. (1994) The role of emotion in believable agents Communication of the ACM, *37*(*7*), 122-125

[6] Creeds C. (2008) Affective Agents for Long –Term Interaction, unpublished thesis Birminghan.

[*7*] Schütte, S. (2005).:Engineering Emotional Values in Product Design- Kansei Engineering in Development. Doctorate Thesis Institute of Technology, Linköping.

[8] Levy P., Yamanaka T.(2006) Towards a définition of Kansei, in Design Research Society International Conference in Lisbon

[9] Nagamachi, M. (1995) "Kansei Engineering: a new ergonomic consumer-oriented technology for product development", International Journal of Industrial Ergonomics, 15, 3-11.

[10] Schutte, S. Eklund, J. (2005) "Design of rocker switches for work-vehicles: an application of Kansei Engineering", Applied Ergonomics, *36*, *557-567*.

[11] Roa-Seiler, N., Benyon, D., & Mival, O.(2008) An affective channel for Photopal in Proceedings *4*th Workshop on Emotion in HCI of the Annual Human Computer Interaction Conference, Liverpool, United Kingdom.

[12] Roa-Seïler N., Benyon D., and Leplâtre G. (2009) An Affective Chanel for Companions, Emphatic Agents Workshop Electronic version of Proc. of 8th Int. Conf. on Autonomous Agents and Multiagent Systems AAMAS, Budapest, Hungary.

[13] Kelly George, 1991. The Psychology of Personal Constructs, Volume One : Theory of Personality. London : Routeledge

[14] Baudrillard, J.(1968). Le système des objets. Paris : Gallimard.

[15] Beattie, G. (2003). Visible Thought: The New Psychology Of Body Language. Routledge: London.

[16] Bradley, J., Mival, O., and Benyon, D. 2009. Wizard of Oz experiments for Companions. In Proceedings of the 2009 British Computer Society Conference on Human-Computer Interaction, Cambridge, United Kingdom, September.