

Designing Personal Embodied Agents with Personas

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Abstract— We are exploring strategies for designing novel robots, or more generally, personal embodied agents. The motivation is to open up the design space for robots in everyday environments, while at the same time grounding new designs in existing human interests. We have modified established methods from the field of Human-Computer Interaction (HCI). First, we investigated specific human interests, in this case in exotic pets, to understand and design for possible interests of future robot owners. Based on the data from interviews with pet owners, we developed four fictive characters, so called *personas*. Each persona has a specific interest in robots as personal embodied agents, which has a particular form, role and behaviour. From the resulting personas we derived a number of possible designs, where the agents take on different roles in peoples' everyday activities.

I. INTRODUCTION

WHAT different roles can robots have in everyday environments? Currently, robots intended for such environments are commonly considered as social companions [1], service or assistive robots [2][3], entertainment robots [4] or therapy objects [5]. When facing the richness of the everyday life people live both with and without technology, this overall view of robots is quite limited. Further, robot appearance and behaviour in everyday environments is constrained by the existing hardware and software robot platforms.

Many robots intended for everyday settings are designed to be socially interactive, such as in [1]. An underlying assumption of socially interactive robots is that the interaction should be similar to how human are interacting with each other [6]. However, robots with a notion of sociality, social skills and bonds with people are still more of a distant goal, than actual reality [6]. There is a big gap between the amazing robot scenarios that science fiction depicts for everyday environments, and what is technically feasible with current robot technology. In parallel to developing robots to become the future "butlers" science

fiction suggests, we want to look into alternative views of robots and interaction with them. We call them "personal embodied agents" instead of "robots", which we currently find too biased with underlying assumptions of existing forms of robots, or robots inspired by science fiction. At the ECAgents website [7], embodied agents are defined as being able to interact directly with the physical world and "to communicate between them and with other agents (including humans)". Embodied also relates to Clark's perspective of how the physical body and its senses matters when being, acting and learning in the world [8]. Further, Maes [9, p.2] gives a definition of an agent as "a system that tries to fulfil a set of goals in a complex, dynamic environment" which we find suitable here.

In our work, we take peoples' everyday life as a starting point. We want to see how different forms and behaviours of embodied agent can fit in the life and interests that people already have. Furthermore, instead of investigating possible applications for a specific technical platform, we start from a more general view of agent technology when looking into everyday objects and activities to learn about possible applications. We do not focus on sophisticated communication and entertainment features that the existing robot platforms such Aibo [4] or Qrio [1] provides. We will rather explore less sophisticated and more narrow agent behaviours that are technically feasible to implement and test in an everyday setting.

For this reason we have investigated specific human interests and how these can be used as input in the design process. We used and extended an established design method originating from the HCI (Human Computer Interaction) field, so-called *personas* [10]. We created four fictive characters – the personas – with specific personalities and interests in embodied agents. The personas were based on data from interviews with owners of pets, e.g. spiders and lizards, which we thought would be closer to existing robot capabilities than more common pets such as dogs and cats. The resulting personas illustrate potential roles, behaviours and forms for future embodied agents that we feel are both novel and plausible. In this paper, we will present the process we employed and the resulting personas, as well as the resulting design requirements for a set of specific personal embodied agents.

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II. RELATED WORK

In HRI (Human Robot Interaction), design suggestions for everyday or domestic environments often relate to interaction or technical implications for specific robot platforms [11]-[13] rather than investigating entirely new robot applications. Some more general design implications for robotic artefacts in the home have been provided for example in ethnographic studies of homes and elderly [3] and possible novel applications were investigated in the workshop “Designing robot applications for everyday environments” [14]. However, there is a lack of publications describing design methods suitable to inform new robot applications for everyday environments.

In the field of HCI and interaction design, several methods exist to support the design of an interactive system [15]. An example of such methods, and a common approach, is to use *scenarios* and *personas* [10], [16-18]. A scenario is a written story describing the future use of a system [17]. It has the traditional elements of a story: an actor (e.g. a system user), a setting (e.g. a hotel) and goals (e.g. booking a guest) with sub goals (e.g. printing the booking). The actor in a scenario can be referred to as a persona. A persona is a fictive representation of a user and should consist of a rich description of her motivations and goals [17]. The scenarios can be developed for example by users (who then write them), by conducting observations or interviews with people using an existing system, or having the designers themselves to come up with scenarios.

Scenarios can be used at many levels of the design process, illustrating users’ needs, goals and actions in the beginning of the process or to evaluate system functionality at the end of the design process [18].

Below we present our approach of using personas and scenarios to inform the design of possible applications for personal embodied agents.

III. PROCESS

Our intention when using the Personas method was to explore forms, roles and behaviours for embodied agents in everyday environments. Our aim is to design *personal* embodied agents, that would have novel functionality yet at the same time be possible to implement with existing robot technology.

As a starting point we were thinking of human interests that already involve or could involve entities or systems involving some form of autonomous or related behaviour. This was done to find human interests that have similarities with the properties of the technology, and possibly could be transferred into the design of the agent technology. Here such experiences could for example involve people working with plants, driving in traffic or owning a dog or another pet. The chosen experience would preferable not involve critical work or tasks, as the technology we would develop would be in an early technical stage. We decided to

interview people who have pets, and to come as close as possible to agent technology, we chose people owning spiders, snakes and lizards. We found it suitable to understand what makes people uphold a continuous interest for example in reptiles, even though it is often not possible to interact with them directly, or teach them tricks (as opposed to more traditional pets such as dogs). This approach of matching the technology properties with specific human interests is based on previous work where we used unconventional or users with special interest as inspiration when designing technology applications [19]. However, here we will focus on learning about specific human interests and experiences, and *how* to transfer them to the design space of the technology, which our previous work has not involved.

Our motivation for focusing on people owning pets such as reptiles is not to design robots that look and behave like the reptiles, or to design zoomorphic embodiments of technology such as in [20]. Instead, it is done to understand the core features of this specific human interest and transfer and extend it into design of personal embodied agents. We will here try see beyond the actual artefact that this interest involves, to find underlying motivations for such interests. Here, owning an exotic pet could for example involve more general underlying human motivations such as; concerns about identity, aesthetical preferences, social networks etc. Thus, we do not intend that the pet owners will become future robot owners. Rather, they will provide us with knowledge about underlying motivations for their personal interests that can match what is possible to build with current agent technology. We believe that some of the core motivations for their interest can be transferred and extended into a new domain, and even for a different group of people – in this case future robot owners.

A. Interviews

We conducted 10 interviews with pet owners in order to get the data for creating personas and scenarios. Overall, we were interested in finding out about the enjoyment of for example having one or several lizards as pets. We were also interested in the interaction between the owners and



Fig. 1. Interviews were held with people owning reptiles and other exotic pets, such as spiders.

the pets, and in related social activities. The questions we aimed to answer included:

- What they consider important qualities owners find in their pet (for example that it is easy to care for)
- Why they are interested in having this kind of pet
- What they do with their pet
- What the pets do
- How they see if a pet is sick or in different moods
- Social interaction with other pet owners.

Six male and four female subjects were interviewed. Three subjects were found through friends, one through Göteborg's Herpetological Association [21], and six through the reptile owner's website [22]. The subjects were between 17 and 55 years old (mean 25.6 years, median 22.5). Due to time and logistic restrictions, three interviews were made face-to-face, and seven by phone.

B. Development of Personas

All interviews were transcribed, printed out and read through. In the data, we for example found how some people considered their terrarium as an interior design object, and enjoyed how their pets gave the room a more dynamic impression. Some enjoyed the different personalities their lizards had, whereas others mainly were interested in breeding lizards with interesting patterns. Data illustrating qualities that the pet owners enjoyed and other specific interests and experiences were cut out on Post-it notes (see Fig. 2a). The notes were then sorted into an

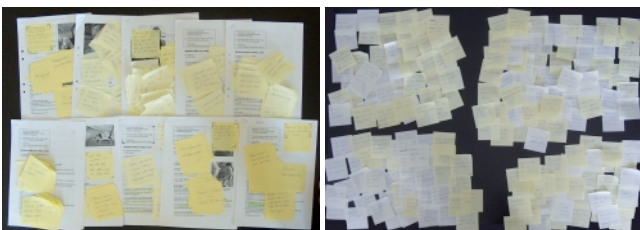


Fig. 2.a.b. Interesting data from the transcribed interviews were cut out on notes (a). The notes were sorted into four different clusters of related interests as the starting point to design Personas (b).

affinity diagram, where related interests or features were grouped together (see Figure 2b). Each cluster of notes was the starting point for a Persona. For example, data such as “I like the thought of being a bit odd or different” and “a different kind of pet” was grouped together, and data such as “I don't pet them” and “It is my hobby” were put in a different group. Then, some duplicates were removed and the diagram further structured into four separate clusters of related features.

On the basis of the resulting clusters, four personas with quite different interests and personalities were created and named: *Nadim*, *Magda*, *Christopher* and *Anne*. At this point, each persona got their first preliminary description (or scenario), focusing more on their overall relation to agents, rather than the actual behaviour and form of their

agents. Here, the interaction and behaviours that would normally have been ascribed to a pet, would instead refer to an agent. In this phase, each description was also enriched with imaginary ideas about the persona, in order to enrich and complement the interview data. Pictures representing the characters were chosen from an on-line image database [23].

After the initial phase of developing personas, we refined them as characters and further sorted out details about their specific relation to agents. Several brainstorming sessions were held, focusing on making the personas as different as possible from each other, both in terms of their interest in agents and in their interaction with them. For example, expressions such as “its fun to build their environments” were transferred to the persona Anne, strengthening her interest in agents as a dynamic interior, whereas “I like that they are dangerous” was used for Magda to reflect her interest for odd or dangerous creatures.

Behaviours and forms of agents, as well as their technical implications were specified and refined in the last phase of creating the Personas, when their overall role had been established. During the process we used large notice boards to re-arrange notes and exclude less interesting ones. The written descriptions of the personas were also updated throughout the process.

IV. RESULTS

Below we describe the resulting *Personas* created during the process; Nadim, Madga, Anne and Christopher. Their scenarios illustrate the overall relations between a person and his or her personal embodied agents, giving example of possible interaction. We also present some initial technical implications for the agents.

A. Nadim

Nadim is 32 years old and works as a network engineer, living alone in a two-bedroom flat in a small town. One of the rooms is Nadim's hobby room and this is where he keeps his agents. Most of the people in Nadim's home town do not know he owns agents; it is not something he goes around and talks about.



Fig. 3. Nadim

He has always has a great interest in collecting and exploring various things, and as he got older he became fascinated in having agents as a hobby. Nadim finds it exciting to try to understand their behaviour and sees them as a research area where there is always something more to learn. He has specialized in a type of agents that communicates through colours. He enjoys watching them communicating to each other and changing their patterns. Every single agent has its own specific

colour pattern, and when it is put closely to another agent they both start to change their individual patterns. The surrounding light, sounds and movement etc, also affects their patterns. The changes are slow, and sometimes it takes several days until it Nadim can see how an agent is reacting. The challenge is to avoid making the result turn white or not looking so nice. Nadim is however quite good in developing agents with unique interesting patterns, and he puts pictures of the agents on his website. He has the patience and knowledge it takes to continue develop interesting looking agents. The number of agents Nadim has varies, and he has never bothered to give them any names.

It was his curiosity and the fact that the agents are easy to manage that made him buy them in the first place, and this is why he still keeps them. He likes to read everything that crosses his path; Internet pages and magazines. He also frequently visits other sites to compares patterns and sometimes he writes in a forum for people with the same type of agents. They sometimes also meet to let their agents affect each other's patterns. He sees his agents as a sort of investment and likes to share his hobby with others at fairs. At these fairs he looks at other agents, meets new people, and sells or exchanges agents.

Technical Implications for Nadim's Agents

The agents can evolve interesting patterns over time, yet have a possibility of not succeeding. Agents will be equipped with a colour-display on their back and have one or more sensors for light, movement and sound. The sensing can be different for different agents. Each agent will have a unique color pattern, developed from meetings with other agents the environment it is in. By touching the agent in a particular way makes it possible to temporarily freeze a pattern. Achieving a nice pattern requires several agent-agent interactions and timing. A new agent involves a high risk of turning white, and then forcing the process to start from scratch.

B. Magda

Magda is 19 years old and lives with her mother and two brothers. When she was 7 her dad took her to a fair where they had various kinds of agents and from that point she was certain that she wanted one for herself. When she was 13 her mother finally agreed that she could buy one.

Magda's agent is an important part of her identity. Other people may have agents for practical use or to play with, but Magda's makes her feel cool and strong. She is not really an expert in general in agents, but she has learned to handle hers, and more importantly she is no longer scared to interact with it. Magda loves the fact that her type of agent is unpredictable



Fig. 4. Magda

and difficult for others to figure out. She has learned by interacting with them, taking risks, and is proud of this. She enjoys the challenge to understand the agent's behavior and likes to experiment by letting other people touch it.

The agent is with Magda wherever she goes. It usually sits like a broche on her chest, on her high boots or on her bag. Its body has a purple blinking eye, watching people pass by Magda, and often making them a bit curious. It can give a small electrical shock to people touching it, or start to sound. Magda is the only one who knows how to touch it in order not to make that happen. She can even make the eye close and relax, when she touches it. If Magda or someone else quickly pulls off the agent, it gives off loud warning sounds. This is not only a cool effect, but also makes Magda feel more comfortable whenever she walks home alone at night. Magda is proud of the fact that she has such a cool agent. She has contacts with heaps of people with the same interests but she would like to make even more contacts. She enjoys exchanging experiences and seeing other people's agents. The agents react when they come close to other agents, each having their own way of reacting. Magda's agent reacts by changing the appearance of its eye.

Sometimes she gets into discussions where people refuse to understand the importance of having such an agent. In order to spread her knowledge she chats on the web and has her own blog.

Technical implications for Magda's Agents

The eye of the agent will be represented on a colour display and around it there will be an electrical (mild) shock-giving frame. It will also be equipped with sensors for light, movement and sound. The agent should be able to attach itself to things, such as fabric or leather. The trick for the owner to learn the mood of the agent so that clamping and unclamping it does not result in shocks. Similar agents can influence each other when being in proximity, resulting in that their eyes change colour or start blinking.

C. Anne

Anne is a 41 years old physiotherapist. When she is not working she enjoys getting together with friends and family. She lives with her boyfriend in a one-bedroom apartment in the suburb of a small city. She is interested in interior design and has a wall of the living room is occupied with agents. Her fiancé is not so fond of the agents,

but he is of Anne, so the agents can stay. Anne has had the agents a long time before they got together and she is never going to get rid of them. Anne is fascinated by the feeling the agents give the interior. She believes they create pleasant surroundings to live in, as the room feels more alive and dynamic.



Fig. 5. Anne

Most days Anne gets home from work before her boyfriend. She enjoys this time on her own; she reads books, takes a bath, or feeds the agents with new data, a colour from a magazine, or some patterns that she wants them to draw. To do this, she picks up the agent, squeezes it to sample a colour, form or image. Then she puts it back on the wall, and it starts to draw decorations, using patterns or colours from the picked up data. The drawing is affected by whether the agent is touched or not, and whether there is activity in the room. Once, when Anne was hiking Norway, she didn't see her wall for three weeks and when she got home the agents had been drawing so much the wall looked like a mess. This was apparently too long time to stay away. She likes that they need some of her attention, to make something that looks nice, but she also appreciates that they don't need to be taken care of every day.

None of Anne's friends have got agents and she enjoys being the only one, it makes her stand out. When she needs inspiration for redecorating she visits a couple of sites on the Internet. Anne sees the agents as furniture but she has discovered that there are people on the Internet that talk about their agents as if they had feelings. Anne finds this slightly ridiculous - she is absolutely certain that hers only react to the environment. If she moves her hand in front of them, they simply react to the movement and change their way of drawing. Not because they recognize her, but because they can sense the movement.

Technical implications for Anne's Agents

The agents will be equipped with camera, movement sensors, sound sensors etc and combined with a projector. They let imprints emerge on the wall surrounding them. The agents are put on the wall, like a pin or a magnet. They can be picked up from the wall and be squeezed to perceive (take an image of) a pattern or color in front of it. Based on what it recently perceived, a pattern will emerging around the agent as it is put back on the wall. The agents can also detect the presence of for example a hand and can then react to it depending their state. The agents can also communicate to each other in order to tell if something is present in front of them, to collectively change the pattern.

D. Christopher

Christopher is 22 years old and has recently moved to a big city in order to study Political Science at the university. He lives in a dormitory with eleven other students. His room is quite small and he would like a pet, but that is not really possible. Instead, Christopher's agent has kept him company during his first time in the new city. It is always around if he feels lonely, and inspires him to get active. Christopher finds it fascinating to get to know his agents and find out what it likes. Every agent is



Fig. 6. Christopher

unique - you could say they have different personalities that you have to respect. He is certain that his agents recognize him but it would be nice if it could show it more.

By having an agent, Christopher has gotten into contact with other like-minded people. He has recently joined a society and they have met a couple of times and discussed their agents over coffees. Christopher finds it rewarding to get together with people who share his interest.

His agent is a kind of pedometer, measuring how much he moves. It likes to be brought along, and gives off little signs showing when it is happy. It also has contact with another twin-pedometer, and is affected by its state as well. It vibrates when Christopher has walked some kilometers, and can also communicate this to other agents. If Christopher passes someone else with a pedometer agent, his agents will react to how far the other pedometer has walked. If the other has not walked as far it can get angry or sad.

1) Technical implications for Christopher's Agents

This agent should encourage the owner to get more active by using movement sensors e.g. accelerometers. It shows an emotional state through discrete expressions, such as a tactile pulsating actuator. The state of the agent is affected by other nearby agents and when the user is active it gives out for example a weak purring noise and light as a token of appreciation. This is also amplified by the presence of other active users and weakened by not so active users. Repeated meetings between agents give rise to an extra positive effect on their behavior.

V. DISCUSSION

Even if our personas are fictive character, they are based on real data, and their description is grounded in existing needs and interests of people. However, the personas are also formed by our imagination and represent possible, but not definitive design outcomes.

The personas inform the design of different personal embodied agents. A possible role of embodied agents is to become *dynamical interior*, extending the furniture in a home or another setting. In our scenario with Anne, we show how the human interest can lie in what the agent can produce or achieve in its role as a design object. In such a scenario, the agents' are considered "things" that provides dynamical aesthetics rather than living creatures with different personalities. Agents showing less personality is also visible in the scenario with Nadim, where they are viewed as dynamically evolving building pieces in a *hobby*, requiring patience and exploration.

In another scenario, the personality is the core feature of the agent, as its role is to *extend the social identity* of a person. In our scenario with Magda, her agent has a specific personality and appearance making other people curious, and resulting in that they give its owner attention. Another form of social contact is visible in the scenario with

Christopher. The role of the agent is to motivate him to move more and make him aware of other people in a similar situation. This way, the agent acts as a *support for a specific lifestyle*, both as encouragement and as an indirect communication device for people sharing the same interest.

Our resulting scenarios show how the interviews with people owning exotic pets clearly affected the design outcome. For example, the behaviour of Nadim's agents was based some of the pet owners experiences of changing sand (different granularity) for their lizard or spider. They could only notice a few days later if the changing had been successful or not, depending on the state of the pet (for example eating normally or not). We used this as inspiration for Nadim's agents, so that they would change their visual patterns slowly over time, rather than at once. This would require similar patience and extended expectations with such agents, similar to what the pet owners currently experience when caring for their pets. Similarly, it should be possible to feel success or failure with the visual patterns that evolve over time. This is just one of several examples on how the interview data helped us to shape the personas, and the requirements for personal embodied agents. This case illustrates how possible experiences from exotic pet owners can be transferred to future robot owners. Of course we do not aim provide exactly the same experience, but rather to bring out engaging or meaningful elements that the technology can embody.

VI. CONCLUSION AND FUTURE WORK

Using personas as a method is only one of many possible approaches to explore different roles, behaviours and forms for embodied agents. Here, we have focused specifically on *personal* embodied agents, but we believe that similar transfer of experiences also could also be useful when designing other types of technology. For us this is part of an ongoing work, where we let people with special interests or activities to inform design requirements for technology development. The interviews were used as an input into the design process, and the people interviewed are not necessarily intended as (or even representative of) the actual end users. Instead we have chosen them to provide insights into specific human interests, hobbies and activities that can be transferred into the design of new technology. In this way we are learning about how to ground the design in a real human interest, yet come up with novel ideas for technology development. The next step is to implement some of the embodied agents described in our scenarios, for example by using e-puck technology developed at EPFL [24] and test the resulting designs with users.

With the work presented in this paper, we believe we have shown that this approach represents a fruitful way of providing inspiration for designing novel robot applications for everyday settings.

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