Robot Dog Intervention with the Golden Pup: Activating Social and Empathy Experiences of Elderly People as Part of Intergenerational Interaction

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Abstract

This paper takes an interest in examining the potential of robotic pet toys as social companions, which activate social and empathy experiences of the elderly and by doing so, increase their wellbeing. In order to study the benefits of using Golden Pup, a commercial robot dog, we designed and performed a research intervention at a senior day activity center with 10 participants of ages 65-80+ years interested in the firsthand user experiences. This study suggests how robotic pets can be used to activate the social and empathy experiences of elderly, and illuminates the role of reciprocity in building a relationship with a robotic pet. We present novel results on how a robot dog with a natural interface may evoke social and empathy experiences as part of playful, intergenerational group activities.

1. Introduction

Over the next decade, robotic pets (social robots representing animal forms) will become not only more natural and capable of action, but also more available for use [1] [2]. The shapes of the animal robots are classified into three categories: 1) familiar animals (e.g. dog, cat), 2) nonfamiliar animals (e.g seal), and 3) imaginary animals or characters. [3] Designing artificial intelligence in animal robots means to develop robotic pets, such as Huggable Bear, PooChi, Pleo, and like in this study, the Golden Pup robot dog, all of which aim to enrich the daily life of humans by a acting as playful companions. Recently, pet like robots have been introduced to reproduce four social and emotional benefits associated with the interaction and emotional bond between human and companion animals, such as entertainment, relief, support and enjoyment. [4] In our understanding, simple robotic pets function generally as entertaining entities, which provide playful enjoyment. Nevertheless, depending on their context of use, and in particular, their users, these companion animals have the potential to function as deliverers of more than temporary "fun". Previous research on robot animals demonstrate their role in education and healthcare. [5]

In fact, we believe that robot pets could assist in increasing human wellbeing, by using them as 'conversation starters' and play partners that invite embodied and multimodal interaction, even play between generations.

Many researchers in the field of Human-Robot Interaction have used the term *attachment* to describe humans' emotional responses to various types of robots. [6] Previous studies suggest that contact with robot dogs can positively affect the wellbeing of elderly people, but there is a lack of research investigating the cause of these effects [7]. In this case study, we aim to address this gap by focusing on how an entity such as a robot dog may trigger positive experiences in seniors and in this way, contribute positively on their wellbeing. We are interested in empathy and social experiences with the commercial robot dog, which activate the elderly to discuss earlier experiences with pets and to share the emotional experience that the robot dog gives them during an intergenerational group activity. The contribution of the study is to deliver new findings on human-robot interaction with a focus on social and empathic experiences of elderly people as part of casual and intergenerational group activities organized at a day activity center. We propose that robotic pets could be used as part of structured group activities, for example, to activate social experiences of the elderly by inviting the participants to interact with robot pets and form relationships that are beneficial to them.

1.1. Robot pets as "Serious Toys"

Toys are believed lead the way in the integration of social robotics into the domestic space [8]. Indeed, robot toys are the most likely application of commercial-level social robots in the near future [9]. Previous examples include the Sony AIBO robotic dog and Ugobe's Pleo, which are designed in line with the thought of functioning as artificial pets. Although the border between actual robots and contemporary, anthropomorphized toy robots seems to be blurring, one way to distinguish these two groups of "relational artefacts" [10] is their accessibility for the users.

Robot-characters have started to make their entry into institutions of pedagogy and healthcare. One trace of this development are smart and interactive toys, such as toy robots. Together with a computing and communication capability, the computational technology is in many cases so well integrated with the plaything that it becomes a "technology that disappears" [11] making robotic toys with tangible interfaces potentially more approachable than plastic-coated toy robots, such as Sony's AIBO. Tangible technologies allow the interaction and manipulation of digital information that is communicated through physical objects like toys [12]. Toy designers have understood that the natural interfaces (NUI) are the most appropriate for the interaction of players because they allow them to interact with a computer application through natural capabilities, such as voice commands and allowing, for example, the robot toys to move. The Golden Pup employed in our study, represents interactive technology of this kind and has similarities with the seal robot Paro. For example, the Golden Pup has sensors that respond to touch and sounds. "You can feel the heartbeat while touching it and it can respond back to your voice commands" [13]. The 'dog-ness' of the Golden Pup is apparent: the Golden Pup, has, to some limit, a resemblance to a well-known, domestic animal, the Golden Retriever (see Figure 1.). Despite their complex technological systems, smart toys such as the Golden Pup designed for the mass market come in relatively affordable prices for consumers of the Western world and are in this way more likely to enter more profoundly in institutions and service providers interested in the wellbeing effects of these 'serious toys', meaning *toys with a purpose*, such as human wellbeing. We believe that the attraction of robotic pets like the Golden Pup extends to users of many ages, for example, the elderly people.

Figure 1: Golden Pup robot dog by Joy for All, used in our study.

1.2. Human-robot relationships with robotic pets

According to research by Kahn et al. [14], robotic pets are described to "inform on our understanding of the human-robotic relationship". A similar description is given by Friedman et al. [15]. Robotic pets can provide companionship to older adults. [16], as suggested, for example, in a study with the iCat [17]. In particular, pets like dogs are known to form a strong social bond with their owner that manifests itself in protective behaviors or playful and excited attitudes, depending on their internal state and social cues exchanged between the animal and its owner [18]. To leverage similar benefits of human-animal interaction, the field of robot dogs draws from metaphors that highlight the similarities between the robot and known animals in order to communicate affordances and facilitate a more effective, personal, and emotional interaction [19] in various applications, such as companionship [20, 21] and therapy [22].

Social roles of robots such as robot nannies, robot caretakers of elderly people, robot teachers for children, offering comfort and companionship that promote the development of responsibility and interaction, will be more personalized and intimate [23]. Currently, some companion robots, such as the seal robot Paro awarded 'the most therapeutic robot in the world' [16] demonstrate that the area of affective computing is interested to produce utilitarian, yet toy-like, therapeutic aids for the elderly [24].

Our present study builds on the idea of seeing the possibility of elderly people to become activated by the robot pet in terms of empathic responses, which are believed to lead to emotional attachment. According to Norman [25], emotional attachment can be seen as the sum of cumulated emotional episodes of users' experiences with a device in various context areas. These user experience episodes can be categorized into three dimensions, which occur when a user uses a product or sees it for the first time. Therefore, in interaction with a robotic pet, the dimensions of the user experience can be categorized as follows:

- *Attribution of labeling emotions level*: This is the first impression of a product (robotic pet) through its appearance, as users spontaneously judge easily the products when they are first tried and used. Moreover, this describes what kind of first impression a user gets and what kind of emotion the product delivers during the first time. We consider that in research interventions using a robotic pet, the participants are likely to encounter this type of artificial entity for the first time in their life.

- *Behavioral level:* At this level participants use and experience a product (here, robotic pet). They appraise its functions, find out how well the functions fulfill their needs, and how easy it is to use the product. [26] We speculate, that in

the case of robot pets, the firsthand encounter is guided by the non-utilitarian elements of surprise and delight of experiencing the tangible interface, movement and sound of the robot pet, instead of the utilitarian perspective on its use, such as asking 'what can this robot pet do for me?'

- *Reflective level:* At this level consciousness takes part in the process. The user understands and interprets things and remembers past experiences of similar instances. In earlier studies with robot pets, study participants have reported to have reminisced the actions of their own live pets and other memorable animal experiences. [26]

In this paper, we present a case study of a robot dog intervention to receive a better understanding of the firsthand social and emotional experiences of interaction with a robot pet, which relate to Norman's three dimensions of experience presented above. In the study, we observed how a group of elderly people react and interact with a commercial robot dog, namely, Golden Pup in the free exploration mode. In the study, our goal was to understand better how robotic pets like commercial, smart toys of the present can be used to enhance wellbeing, by activating elderly at day activity center in a natural everyday context.

2. Related work

2.1. Robotic Pets for Older Adults

Melson et al. 2009 write; "Robotic pets may ultimately have a place within the complex relationships that humans have with animals" [27]. Companion robots have been designed to look like animals, which we refer to as robotic pets. Real pets cannot be present in certain settings such as hospitals [28] and are not compatible with certain lifestyles [29], yet they provide meaningful social interactions [28]. However, several studies have presented how Paro, a robotic seal, has been used in nursing homes by focusing on the introduction and acceptance of this companion robot. This robotic animal assistant is to provide emotion recognition and response (affective computing solutions) in a way that robots can respond to elderly/children's emotions with empathy and compassion. Robotic pets involve humans in personal experiences and simulate behaviors that require care and attention. A number of studies with the robotic dog AIBO have already been conducted. [14][15] Reeves and Nass [30] have shown that people behave socially towards artifacts like computers, but it can be assumed that socially designed robot pets even

intensify these effects. For example, the emotional interaction with robotic pets has been investigated in therapeutic contexts. Marti et al. [31] conducted a study about the therapeutic qualities of the seal robot Paro; their results showed a clear role of the robot in mediating social exchange and stimulating attachment and engagement. Moreover, there is research that has provided some evidence of benefits of using robotics with the elderly, particularly as a result of interacting with robot pets [32] [29] [33].

2.2. Social presence and social activity

Since it's not unusual for people to treat systems and devices as social beings [33], it seems likely that people treat embodied agents as such. This means that the extent to which they do so seems to be related to a factor that is often related to as either 'presence', or more specifically 'social presence'. Many research projects that are related to human-robot user experience incorporate these concepts [34],[35],[36]. According to Fong et al. (2003) and Breazeal (2003), social robots share a number of features that reliably elicit perceptions of animacy and causality in children and elderly: they are personified, embodied, adaptive and autonomous. Consequently, social robots can learn how to communicate, use natural cues, respond to emotions in humans, self-organize, and pull on people in psychological rather than artifactual ways. [18] [37] [38]

3. Method and Data

The methodological settings have consequences on how users/participants become emotionally attached to a robotic pet, as in this case study the Golden Pup. Here we study the responses of seniors to the persuasion strategies of a robot dog as presented in a playful group activity situation. One of the main goals was to find out how elderly people react and playfully interact with the robot toy. This group activity was carried out as a casual and intergenerational intervention, meaning that both elderly people and preschool-aged children participated in a joint play session. Despite of this particular setting, the study presented in the paper focuses only on the social and emotional responses of the elderly. This is to say that children have functioned as assistants of the study, but the findings of the case study focus on elderlys' interaction with the robot dog. However, we acknowledge how the presence of the children may have influenced the interaction of the elderly with the robot dog, especially in terms of their playing with the robot dog under the eyes of the elderly. Nevertheless, we consider the reactions of the elderly to represent their genuine and highly personal responses to the robot dog.

What guided our interest in particular was our curiosity about Golden Pup's persuasion strategies in terms of its capacity to promote social and empathic responses. Another criterion for the robot toy was that it represents a multi-dimensional experience with a tangible, natural interface (NUI). The selected robot dog represents a 'toyfriend', which, through its physical appearance, 'huggability' and through voice-recognition and sensors, calls out for friendly (tactile and mobile) interaction. In this way, the toy encourages the user to engage and interact with it playfully. In order to explore the capacity of the Golden Pup to function as a facilitator of social and empathy experiences in elderly people, the main focus of this case study was to gather first time responses of elderly interacting voluntarily with the Golden Pup in a free exploration mode. Our main goal was to assess the interaction on the behavioral and reflective level together with preschool children who frequently visit the day activity center.

3.1 Participants

This study is part of the intergenerational play research [39] interested in interaction and experiences of seniors and preschoolers. The case study was conducted in June 2019 with (n=10) elderly people (ages 65-80 years, 3 male, 7 female) at a day activity center in Finland. At times, the preschoolers and seniors do different kind of activities together. The organized group activity (the robot dog intervention), which also included an interview situation was documented in the main room of the center. The participation in the robot dog intervention was introduced as an optional activity. The authors, who functioned as the two researchers, were joined by one assistant responsible for the video-recording, and one day activity center staff member, two kindergarten teachers, and 8 preschool children. One researcher acted as the supervisor, who gave the instructions and made questions, while the other was observing and taking notes. This case study presents the results of this one time session, consisting of 80 minutes of interaction in total.

3.2 Robot Dog Golden Pup

The pet-like robot Golden Pup[1] has been selected for the trials at an elderly day activity center. We identified a low cost interactive robotic pet (by Hasbro) called "Joy for all Companion Pets" made commercially available in 2016. The battery-operated Golden Pup representing an accessible and affordable robotic dog, is suitable for multigenerational playful

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1 https://joyforall.com/products/companion-pup

interaction (it is recommended for players ages 5–105 years) and it is envisioned to create novel and meaningful play situations employing sound, haptic movements and realistic visualization.

The recommended age category is based on the Golden Pup Companion Pet's marketing materials. We want to draw attention to this new approach of targeting low-cost robotic pets: Generally toys are designed with children in mind, but the Golden Pup robot toy is marketed as an "every age-group toy". It is envisioned to transcend the traditional ways of thinking about toys as a "life-long toy", or play partner enjoyed by a broad range of users.

The Golden Pup has sensors that respond to touch and sounds. "You can feel the heartbeat while touching it and it can respond back to your voice commands", the description of the Golden Pup says [33]. The robotic pet Golden Pup responds to petting and hugging with motion sensors. With movements and sounds the robot simulates a real animal, especially through playful barks and head turning. The play patterns of the chosen robot dog present according to the toy marketer *mobile play*: The Golden Pup reacts to touch "with puppy-like movements and sounds", haptic/object play: The Golden Pup features a realistic coat"; and auditive play: the Golden Pup comes with a "simulated heartbeat, and authentic sounds and responds with 'Bark Back' technology". Despite its complex hidden technology, the Golden Pup is a non-connected toy. [40] [41]

Previously, the Golden Pup has been tested in several studies [40] [41] [42]. These studies focused on the effect of Golden Pup or Cat robot toy in long-term interaction of children, but also the elderly. Although results of earlier studies show how the Golden Pup robot toy could activate the elderly to receive social and empathy experiences, this study demonstrates novel results on how to activate elderly in a day activity center by facilitated interaction with the Golden Pup.

3.3 Design and procedure

During the group activity and interview situation, the authors first raised questions about the participants own pets and other memorable animal experiences in their lives. 8 of the 10 participants had owned pets earlier in their life. The elderly each shared their experiences with their domestic animals, such as pet cats and dogs. This conversation was carried out during some 20 minutes.

After the introductory discussion, we first introduced the robot dog to the participating preschoolers, who then introduced the robot dog for the

elderly. All preschoolers were invited to a free play session as the authors observed the spontaneous and unconstrained interaction with the Golden Pup. The experience was intended to provide the participants with an open-ended play experience, thus enhancing verbal communication with the Golden Pup. After this they introduced the robot toy Golden Pup for the elderly. At this stage, all participants had the possibility to familiarize themselves with the robot dog and to discuss the Golden Pup's actions (see Figures 2-3). The duration of this part was about 30 minutes.

When the play time was over, the researcher instructed all participants to answer some questions about the session. For example, each elderly was asked the same questions, such as: "How do you feel about this robot dog?", and "What kind of emotions does this robot dog raise in you"?

One of the researchers, two kindergarten teachers and one elderly day activity center staff member guided the interaction, while the other researcher observed and took notes of any relevant contextual information. The duration of the group activity and interview with the preschool-children and elderly was some 30 minutes. The whole experimental intervention session was some 80 minutes in length. The complete session was video-recorded for future analyses.

3.3.1. Social presence with the Golden Pup

We used two different types of questions in the group activity and interview to establish the sense of presence. The questions were divided in three parts and designed to investigate the reflective level of emotional attachment. First, we used questions interested in social presence and empathy experience related to their experiences with animals. The second set of questions was concerned with social presence, social experience and empathy. The third part of the questions based on the interaction with the robot dog, during which we observed the elderly's behavior and interaction linked to social presence [34]. The questions consisted of 10 questions addressing emotional attachment, social activity and emphatic interaction modalities with the robotic dog. (see Table 1 and Table 2).

TABLE 1. Examples of Social Presence Questions

1. What kind of feelings does the Golden Pup give you when you take it in your arms for the first time? What kind of emotions does this raise in you?
2. How does the Golden Pup respond to you? How does that make you feel?
3. What kind of social activities can the Golden Pup offer for you?
4. Which kind of interaction with the Golden Pup do you estimate as 'natural'? Which kind of interaction did you like the most?

5. Which kind of interaction and emotions could you imagine for the Golden Pup in the future?

3.3.2. Emotional responses with the Golden Pup

A second set of questions featured the attribution of labeling emotions (with one word). This methodology is used in different types of research to establish a subject perception of an artifact [42] [34]. We created a list of 10 words of emotions, which could be used to describe the interaction between the elderly and the robot toy. Half of these words referred to a social entity and empathy experiences with robot dog: joy, sadness, surprise, uncaring, emphatic, antipathy, soft, rough, active, neutral. We chose six of these labeling emotions, which arose from the data. Labels are: *joy*, *surprise*, *emphatic*, *soft, active,* and *neutral*, classified for six labels from the data. 'Joy' belongs to the 'big' emotions, while the other ones belong to 'emotion-relation/emotion -prone uses states. 'Surprise' means in this case study that elderly experienced surprises when touching and speaking to the Golden Pup. In this study, we understand that emphatic responses arise when the elderly start to reminiscence her/his own pets and treat the robot dog as a real animal (through sensitive touch). In this case study 'soft' means a situation, when the elderly starts hugging and touching the robot dog and 'petting' it as real animal. 'Active' means that the robot dog activates the elderly to react and respond by talking to the robot dog, at the same time reminiscing stories of their real pets in earlier phases of their lives. 'Neutral' in this case study, means a situation when the elderly do not react very much to the robot dog and don't care for the robot toy by, for example, 'petting' it. [43]

Figure 2. and Figure 3: The elderly experience interaction with the Golden Pup for the first time.

3.3.3. Emotional attachment with the Golden Pup

The third method featured a set of questions that could simply be answered with 'yes' or 'no'. These questions addressed specifically the

emotional attachments with the Golden Pup after the interaction.

TABLE 2. Questions in third method features.

| 1. Is it easy to communicate and interact with the Golden Pup? |
| 2. Do you think that the Golden Pup can activate you in your daily life? |
| 3. Do you think that the Golden Pup will listen to you and understand you? |
| 4. Could the Golden Pup be your play fellow/robot dog? |
| 5. Would you feel better, if the Golden Pup is with you when you are at home alone? |

3.4 Participatory Observation

To evaluate the behavioral level of Norman's emotional attachment concept, one of the researchers conducted unstructured participatory observation. Notes were taken on interesting and unexpected behavior as well as the setting in general. The observations were also documented by video-recording.

4. Results

The case study described in the paper at hand took an interest in examining the potential of robotic pet toys as social companions, which activate social and empathy experiences of the elderly and by doing so, increase their wellbeing. The main goal of this free exploration case study was to validate if a setting of a intergenerational group activity situation can help to understand elderly's first time responses to a robotic pet with a focus of activating the social and empathy experiences of elderly people. To conduct our study with elderly participants, we invited them to join a research intervention—a voluntary intergenerational activity with preschool-aged children at a day activity center. None of the participants had previously interacted with the robot dog under scrutiny, the Golden Pup.

As the participants were allowed to explore the Golden Pup playfully, they were simultaneously asked about their general experiences with domestic animals (farm animals and pets), both in the past and in the present. Most of the elderly had had a contact with both animal types in their personal lives, and most of them commented that animals played a significant part in their childhood. However, in many cases, animals acted a normal part in the lives of these people, who mostly had spent their childhood living at farms. In many such domestic environments dogs and cats served a purpose and were not necessarily simply treated as pets or companions and 'play partners' as we know them nowadays. When the discussions turned to the lives of the elderly as they live their lives now, the comments were often critical—the limited size of living spaces and the pure exhaustion of owning living pets was considered an obstacle for not being able to cater for real pets. Also, how their peers 'keep' their pets, raised some concerns. For example, one elderly person literally said that: "A dog is not a toy for the elderly". Another claimed: "Dogs do not belong to apartment buildings". Nevertheless, the reminiscing around dogs and cats as a part of their former lives prompted positive and emphatic responses in the elderly. Many said that they wished to own a pet, if it only was possible for them.

This robot dog intervention carried out as an intergenerational group activity situation worked as a rewarding experience for the elderly people, because all participants were happy to join the activity and after the intervention, asked to have more activities of this kind. Results of the present study demonstrate that elderly people were enthusiastic about the Golden Pup, they engaged actively with the robot dog, even played with it (made physical contact and talked to it) anthropomorphizing the Golden Pup as if it was a real pet.

The summarized emotions caused by immediate and automatic reactions by the elderly had in common an enthusiasm for the Golden Pup when first introduced. This enthusiasm could be observed through statements like "Oh, it looks like real dog", "Where I can buy this kind of dog, because I can't keep a real one anymore" and "May I touch him/her", as well as actions like hugging and talking with the Golden Pup as if it was a real dog. Interestingly, the positive experiences observed at the emotional level lasted even though the elderly experienced the robot dog together with the preschool children. However, when the elderly started to talk to the Golden Pup telling about their experiences with their own pets or other animals, the robot dog recognized the voice and moved its head as if it was listening to the elderly's story. The elderly described that the Golden Pup understands them and responded very personally when the robot dog moved its head to the direction where their voice was coming from. This shows the importance of a good first impression: Positive experience and emotions (like surprise and fascination) on the emotional level result in a more patient interaction on the behavioral level.

4.1. The behavioral level – Emotions through the Action

The robot dog intervention described in this paper stimulated the elderly participants reminiscing of earlier experiences of pets and other animals through interaction with the robot toy Golden Pup, and raised different emotions when they interacted with the robot dog (see Figures 2-3). Therefore, shapes, feelings of

touch, autonomous behavior, and responses that mimic animals are the features that are required to be present in the robot dog. [3]

The results of our study indicate that interaction with the Golden Pup increased elderly people's social interaction and social empathy experiences. The following behavioral patterns could be observed:

* **Joy**: This behavioral pattern is defined by emotion-relation/emotion -prone use state, when the elderly enjoyed taking care and playing with the robot dog Golden Pup. It was very clear to see, how the elderly enjoyed keeping the robot dog in their arms and at the same time, discussed their memorable animal experiences experienced earlier in their lives. For example, one elderly (male) told the following story about meeting an elk in the forest: When the elderly was a child, he went to the forest and an elk started to follow him. The elderly told that he started to be afraid and climbed on a big stone and stayed there a while, but the elk was still following him. The elderly thought that if he goes home then elk will not follow him anymore. After he arrives in the home yard, the elk is still following him. The elderly had a rifle in his arm and he shot into the sky to frighten the elk. The elk ran away and at the same time, the elderly understood that the elk was young and his/her mother had rejected it to learn to live alone. The elderly felt sad because he felt the need to drive the elk away. This moment was also very intimate because the Golden Pup was looking straight in the eye when the elderly person spoke to it. The Golden Pup opened its eyes and blinked its eyes as if it was interacting and listening to the elderly's story.

* **Surprise**: The pattern of surprise is characterized by observing the elderly's reaction of surprised emotion when touching and speaking with the Golden Pup. The elderly wanted to actively interact with the Golden Pup by touching its fur. Usually, the first reaction when the Golden Pup was looking in their eyes and looking like it listens to them and at the same time blinks its eyes, which makes an elderly become surprised. Also, when they hug the Golden Pup they can feel its heartbeat, which makes the robot dog seem alive. Some of the participating preschoolers even asked, "Is it a real dog?"

* **Empathy**: The behavior pattern is defined by showing emotional feelings for the robot dog and interacting and simulating action as interacting with a real animal/dog. For example, the behavior of one elderly addressed the positive emotions to figure out what the robot dog wants him/her to do, as the dog's eyes are blinking all the time. "It looks like it is listening to me". The emphatic experiences seem to raise with the elderly, when they interact and start to remember their own pets or animal experiences. For example, one elderly (male) said that he has once taught two parrots to speak Finnish language during his vacation in Mexico.

He really liked the parrots and left the parrots behind when returning to Finland. When the elderly shared his empathic experiences socially by telling of his previous animal experiences he was at the same time hugging the robot dog.

* **Softness**: This pattern describes the robot dog's experiencing the softness of the robot dog's natural interface. The Golden Pup demonstrates that it could be a companion for elderly people, especially those who are allergic to real dogs. The elderly expressed this experience, for example by saying: "This dog is so cute and soft", and "Where I can buy my own Golden Pup, because I can't have a real dog anymore?"

* **Active**: This behavioral pattern is defined by actively communicating and playing with the Golden Pup robot dog. When the elderly received the robot dog in their arms by the preschool children they became more active and socially present. The Golden Pup robot dog can express emotion when the elderly touch it. For example, stroking the dog activates positive empathy experiences and reduces stress. Some elderly described that this feels like stroking a real animal, at the same time holding the Golden Pup in their arms. One female participant tells us that she always has had a cat in her house. When she was a child, she fell in love with cats and if some dogs tried to chase her cat, she would run them off. She felt that when she owns a cat she needs to defend and take care of them. For her, cats have always given comfort and happiness.

Earlier research has found that "nurturing" robot pets is a consequence of increased levels of oxytocin, which appears to reduce stress. [44] To give an example, When Waba and Shibata (2006) videotaped interactions between a Paro robot seal and a group of elderly care home residents, they found evidence that the social interactions between the residents themselves increased, at the same time that physiological indicators showed reduced stress levels [45]. This means that robot pets can increase social interaction and activities especially at elderly daycare centers.

* **Neutral**: This behavioral pattern is defined by that elderly don't care or not actively play or nurture the robot dog (meaning they are less interactive with it). One of the elderly (a female) says that she did not like animals in her childhood. But even so, she had a story to tell: She describes that some boys were taking kittens that could not be found a home for in the forest, but the kittens always found their way back home. This story is to illustrate, that with robot pets, which look like a real animals and simulate human behavior generally associated with interaction with animals, we should remember that not everybody likes animals or they may even be afraid of them. In this way, it is possible to see that not all robot pets that look like a real animals do not cause the same positively pleasurable feelings.

The results of the study described in the paper at hand support the viewpoint presented by Turkle et al. [46] according to which elderly people were prepared to interact with robots: "Seniors felt social 'permission' with the robots presented as a highly valued and 'grown up' activity." Based on these findings, it seems like the elderly see that the Golden Pup robot dog could provide companionship for them. Moreover, it appears that, if used at elderly day activity centers, robot dogs of this kind could activate social and empathy experiences and give companionship, which could potentially add extra interest to an elderly person's life and might even improve their social wellbeing.

4.2 Summary of the Intervention

The purpose of the study was to investigate the firsthand responses of elderly people during a robot dog intervention organized at an elderly day activity center together with a group of preschoolers. In this paper, we aimed to discuss how robotic pets can be used to activate the social and empathy experiences of elderly, and the role of reciprocity in building a relationship with a robotic pet. To explore the impact of a robot dog when used in a group activity situation, we set out to investigate the capacity of a commercial toy robot and "companion animal", to function in causing increasing (and immediate) wellbeing. Our research employed the Golden Pup, a robot pet or companion animal, which represents a tangible interface, more exactly, NUI, or a robot with a natural (soft, fur-like) interface. The robot dog, belonging to the series of Joy for All Companion Pets has received more than 1,300 Amazon shopper left five-star review comments [47]. In our research, we position this as a "Serious Toy", meaning that the toy has a purpose outside of leisurely play.

Our study focused on Norman's categorization of user experiences: Attribution of labeling emotions, Behavioral level, and Reflective level of experience. To find out about these dimensions of experiences as part of an intergenerational group activity, we asked the participants of our study, the 10 elderly people, questions related to social presence, emotional responses and emotional attachment with the robot dog under scrutiny. More specifically, we focused on the behavioral level of experience meaning interaction with the Golden Pup. We present novel results on how a robot dog with a natural interface may evoke social and empathy experiences as part of playful group activities. Our case study shows that a robot dog intervention with the Golden Pup triggered empathic responses in elderly people. In the paper, we described the firsthand responses to the Golden Pup as experiences that were joy, surprise, empathic, soft, active or neutral. To sum up, the results show that the key dimension of the Golden Pup was its welcoming appearance (aesthetics,

soundscape and gentle movement).

5. Discussion

Based on our research, it is possible to see how robot pet toys, or companion animals like the Golden Pup can facilitate experiences of companionship and also make elderly more active in terms of reminiscing animal experiences in their earlier lives or being socially present in the 'here and now'.

The results of the study show that individuals are expected to physically interact, even play with the robot dog by touching and hugging the robot dog Golden Pup. This playful interaction is also guided by imaginative responses to the robot dog, anthropomorphized like a real pet by all of the participants in our study. The results of our case study show that the mood of the elderly people improved even during this short intervention time—the elderly relaxed and had a good time together with the robot dog. The results of our observation show that interaction with the Golden Pup robot dog made the elderly people laugh and become more active, for example, more talkative in sharing their histories with domestic and other animals. Their facial expression changed, softened, and brightened. The social interaction increased: The Golden Pup robot dog encouraged participants to communicate with each other as well when the experiences with their own pets became a common topic of conversation, which they extended by telling about their other animal experiences in the group. Thus, the general atmosphere became more reciprocal and energetic as the elderly shared socially some common feelings about the robot dog and as they shared experiences of empathy together.

Although the described research intervention was set up as an intergenerational group activity, it is apparent that a robot dog like the Golden Pup may even function as part of solitary interaction, meaning time alone with the robot dog. For example, thanks to its sensor technology, the Golden Pup reacts to movement and sound and may react by inviting its human partner to "play" with it, no matter of the player's age. We believe that these interactive affordances can encourage active participation in interaction, cause positive emotions, reduce feelings of loneliness and improve overall quality of life. The novelty aspect of the study at hand is to introduce the robot dog as an active tool, with whom the elderly can share empathy and social experiences with the intergenerational group consisting of both children and elderly.

Finally, it is in place to bring up the matter of the age of the players and the evolution of the audiences of "serious toys" like robotic companion animals of the present: According to its age recommendation, the Golden Pup is aimed for players aged 5-105 years. Although this broad target group communicates a playful marketing message, it encourages us to consider the suitability of commercial robot pets as intelligent

'toyfriends' for a much broader audience than what is consider typical for 'smart' toys, mainly targeted to young children. Potentially, this idea also mirrors the relatively long human relationships with live dogs and other domestic animals, and brings up the question: If real dogs are to be consider life-long partners, can robot dogs be considered as life-long robotic companions?

6. Conclusions and Future Work

"Pets play an important companion role whatever your age" [48]. In our study, we have focused on playful interaction of elderly people with a companion technology robot dog. The findings suggest how even momentary interaction with the Golden Pup, a commercial robot dog, not only evokes empathic responses towards the robot dog itself, but thanks to its multimodal affordances, natural interface and socially presented play session as part of a group activity, may activate the elderly to reminiscence past experiences of relationships with animals while being in the present by interacting with the robot dog—enjoying its welcoming appearance, sound, gentle movement and soft interface.

To conclude, we believe that consumer robotics such as companion technologies like robot pets can be used in elderly day activity centers to activate the emotions of the elderly, and to give them pleasurable experiences, simultaneously through activating memories of the past and enjoying the present. However, we believe that consumer robotics should offer more natural interfaces and affective interaction rather than technology convergence. In this way robotic dogs can act more like real dogs and offer experiences of empathy, compassion and companionship to their human friends of any age.

10. References

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