Picking New Friends: Caregivers and Dementia Patients Choices of Robotic Pets

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Abstract. This study explores the possibility of alternative pet robots to be used in dementia care. It describes how both caregivers and dementia patients in Spain and The Netherlands were exposed to alternatives and asked to make a choice for the one they considered most suitable or felt most attracted to. The results indicate that this field would benefit from more diversity and more research upon the specifics of alternative pet robots. It was also established that expectations of caregivers did not entirely match the choices made by their patients and that movements and sounds of robotic pets consistently has influence on affective interaction.

Keywords: robot assisted activity, social robots, multidisciplinary research, triangulation, dementia care

1. Introduction

The use of robotic pets for older adults suffering from dementia has been extensively researched in the last fifteen years and it has been established with both short and long term research that this is a successful form of therapy (Bemelmans, Gelderblom, Jonker, & De Witte, 2012; Inoue, 2012; Wada & Shibata, 2006, 2007). Although most research has been done in Japan (especially by Wada and Shibata) and with the same seal shaped robot called Paro, it is generally assumed it improves mental and physical wellbeing and results in a more active interaction of the subjects with their environment (Broekens, Heerink, & Rosendal, 2009).

Although there have been studies with alternative pet robots (Furuta, Kanoh, Shimizu, Shimizu, & Nakamura, 2012; Kriglstein, 2005; Sherwood, Mintz, & Vomela, 2005; Wada & Shibata, 2007; Wada, Shibata, Musha, & Kimura, 2005), Paro is by far the most widely used robotic pet for this purpose. This could be due to the fact that Paro is not only especially developed for this purpose, but also commercially available. However, acquiring a Paro is quite an investment since it costs close to six thousand dollars (Japantrendshop.com). Eldercare professionals that would like to try working with a robotic pet but have a very limited budget may look for alternatives. These would be pet robots that would meet the requirements that would make them suitable for robot-assisted therapy.

In this study we address these requirements and the possibilities of alternative pets by offering pet choices to professional caregivers working with older adults who suffer from dementia and compare them to the choices that dementia patients make. These caregivers may have experience with similar types of interventions, like using real pet animals (Banks, Willoughby, & Banks, 2008), stuffed animals or other techniques that stimulate the senses

for which the term 'snoezelen' is used. It is described as a form of Multi-Sensory Stimulation (MSS), and is a widely used and accepted approach to nursing home residents suffering dementia (Spaull, Leach, & Frampton, 1998; Verkaik, van Weert, & Francke, 2005).

In the study we present here, we wanted to establish (1) the acceptability of alternative robots by dementia patients, therapists and care personnel, (2) a possible influence of experience with robotic pets or the above mentioned alternatives and (3) the differences and agreements between preferences for pet robots of caregivers and dementia patients.

FIGURE 1. Paro

In the following section we will specify the background of this study and the research questions of the presented study. After this, we will discuss the used method and the participants. The section that follows on this will feature the results of (a) the study concerning caregivers attitudes and preferences and (b) the preferred choices by dementia patients. Based on this we will draw (preliminary) conclusions and present a discussion, leading to remarks on further research.

2. Choosing robotic pets

2.1. Project framework

The "New friends, old emotions" project is a Dutch-Spanish collaboration which targets the accessibility of robot-assisted therapy for caregivers that work with older adults suffering from dementia. Dutch government funding mainly finances it. Its first aim is to establish the need for guidelines for robot-assisted therapy by caregivers.

Furthermore, it targets an inventory of (1) experiences that some caregivers already have with robotic pets, (2) available pet robots and their suitability for this form of therapy, and (3) practices by caregivers that can be related to this form of therapy (e.g. using stuffed animals, real pets and activities that otherwise stimulate the senses of the subjects). Moreover, it aims to use the findings of these studies to provide guidelines and to offer supportive workshops for robot-assisted therapy.

The consortium that carries out this project, consists of Dutch and Spanish universities that have technical experience with (pet) robots, experience with field studies concerning older adults, or specific expertise in both studying and working with older adults suffering from dementia. Also a part of the consortium is eldercare institutions in different cities of the Netherlands. The project management is carried out by the Robotics research group of Windesheim Flevoland University of Applied Sciences in Almere, the Netherlands.

In earlier studies within this project (Marcel Heerink, Albo-Canals, Valenti-Soler, & Martínez-Martin, 2013; Marcel Heerink, Albo-Canals, Valenti-Soler, Martinez-Martin, et al., 2013), we found that most of the caregivers were familiar with robot-assisted therapy. Moreover, they were generally quite willing to apply it if they did not already do. Remarkably they easily linked this form of therapy to familiar activities, like working with real pets, stuffed animals and evoking emotions by stimulating the senses.

2.2. Research questions

The questions which we would like to have answers to were the following: :
  1. Which robot do the caregivers deem the most and least suitable for use in therapy?
  2. How do they judge the suitability of a given robot? This was asked on a five step scale
  3. How many patients (out of ten) with mild dementia do they expect would like to caress a given robot?
  4. Which robots were actually preferred by dementia patients?

3. Method

To enable us to answer the first three questions we noted the reactions of people with dementia to seven different robotic animal s; a dog, a cat, a teddy bear, a seal, a monkey, a penguin and a koala bear. Not only did we observe the reactions to the animals when they did not move or make a sound (when they were switched off) but also when they did move and make sounds. The animals were all of a similar size, approximately 30 centimeters long and all were able to move their arms and heads when touched. When doing this they also made a soft squeaking sound adapted to the natural sound of that type of animal.

FIGURE 2. Available robotic pets

3.1. Participants

In Madrid, twenty care professionals of different age and educational level who attended a course were invited to take part in this research and answer the questionnaire. In the Netherlands, 29 care professionals from different care institutions all over the country were recruited to take part.

In the experiment 58 patients with dementia (GDS 4: 12%, GDS 5: 40%, GDS 6: 38% and GDS 7:10% - see *Table 2*), mean age 84.22 years (range: 68-103years), 78 % women, were included. These patients were beneficiaries from the day care center and the patients who were living in different units of nursing homes.

TABLE 1. Descriptive Statistics Patients Stage of Dementia

Patients	GDS	SMMSE			MMSE		
		MEAN	MAX	MIN	Mean	Max	Min
GDS 4	7	28,29	30	0	20,71	28	0
GDS 5	23	23,35	30	0	11,26	15	0
GDS 6	22	15,64	26	0	5,73	17	0
GDS 7	6	5,67	19	0	1,83	9	0

All persons with possible allergies or fear of the robot were discarded as participants in this study.

3.2. Procedure

All dementia patients were divided in groups of 6-9 people with similar dementia severity. Patients were seated round a big table. The robots were introduced in the center of the table and presented as 'new special friends' provided by one of the researchers. The robots were switched off. For a few minutes, patients observed them in a freely way, could touch them and ask questions about them.

Their therapist was the leader of the session and asked every patient if he/she liked the robots in general and one by one; if he/she wanted to work with them in the therapy sessions and if they wanted to repeat the experience. Subsequently, every patient was asked to select only three robots, which he/she liked more in order of preference.

The therapist invited every patient to touch or caress the robots, give a name to the robots and nd finally, if the patient did not talk about it, the therapist asked the patients if the robot seemed real.

After the switched-off phase, the switched-on phase took place. Every phase took approximately 40 minutes. The rest of the researchers took notes about the patients affective behavior and conversational expressiveness (M. Heerink, Kröse, Evers, & Wielinga, 2010), focusing on caress, cuddle, smile, talk to it, hold it tight during the session using the data collection sheets.

4. Results

As *Table 1* shows, the care professionals in the two countries only substantially differed in experience (almost twice as high in the Netherlands).

TABLE 2. Descriptive Statistics Care Professionals

	Spain					Netherlands				
	N	Min	Max	Mean	Std. Dev.	N	Min	Max	Mean	Std. Dev.
Age	20	26	52	38,35	8,768	29	22	63	46,34	9,781
Years in dementia care	20	0	15,0	6,525	4,7336	29	1	45	12,50	9,701
Experience with robots	20	1	5	1,50	1,147	29	1	4	2,00	1,069
Experience with snoezelen	20	1	5	2,05	1,356	29	1	4	2,86	,915
Experience with animals	20	0	3	1,55	,945	29	1	5	2,34	1,111

4.1. Which robot do the caregivers deem the most and least suitable for use in therapy?

The favorites in both countries together is the cat. We found 23 out of 49 people naming the cat as their first choice and another 15 as second choice. Just one person names it in last place. The seal is well liked too: 13 people rank it in first place and 10 in second. No person names it in last place. The dog follows with 9 first and 11 second places, but also ranks last 5 times (*Table 3*).

TABLE 3. First, second and last choice of robots. The first number in each column signifies the total, the second the number in Spain and the third in the Netherlands. The robots are sorted according the first preference in the upper half and last choices in the lower half since differences are more pronounced there.

Robot	First choice	second	last
cat	23, 15, 8	15, 3, 12	1, 0, 1
seal	13, 3, 10	10, 6, 4	0, 0, 0
dog	9, 5, 4	11, 8, 3	5, 1, 4
bear	4, 3, 1	9, 8, 1	8, 0, 8
koala	3, 2, 1	4, 1, 3	6, 4, 2
monkey	5, 2, 3	2, 2, 0	8, 6, 3
penguin	5, 3, 2	2, 1, 1	13, 5, 8

If we sum up first and second places per country we see an even more pronounced preference for the cat in Spain as compared to the Netherlands. For seal and dog the percentages of answers in favor of these robots are more or less the same in both countries.

For the bear we find an interesting difference between the answers in Spain and the Netherlands: whereas it is rather well liked in Spain with 3 first and 8 second places and no extreme dislike, from the Dutch caregivers it gets 1 vote for first and second and 8 for the last place. This means had we only to consider the results from the Netherlands the bear would be at the very bottom of the table.

Koala, penguin and monkey were not popular among Spanish and Dutch caregivers. The penguin is by far least liked. The monkey and koala get a few more dislikes than likes.

To obtain an indication of certainty for the ranking it can be established whether a rank obtained by addition of first and second choice per country gives the same results, or that in fact the total per country is the same. Comparison of these numbers very quickly shows that the absolute place of one robot as compared to the others is difficult to ascertain from this sample. We can, however, with certainty state that cat, seal and dog are well liked, whereas koala, monkey and penguin are less liked. Remarkably, he bear is liked in Spain and disliked in the Netherlands.

4.2. How do the caregivers judge the suitability of a given robot?

When we asked the caregivers whether they deemed a certain robot suitable or not we get the results shown in *Table 4*. The answers certainly and probably suitable were added to up positive, and certainly and probably not suitable were added up to negative.

TABLE 4. Suitability of robots for therapy according to caregivers. The first number in each column signifies the total, the second the number in Spain and the third in the Netherlands, respectively. In the last column we give the difference between positive and negative suitability. The robots are in the same order as in table 1. Note that this more or less coincides with the ranking according to suitability.

robot	positive	undecided	negative	positive -negative
cat	37, 15, 24	7, 2, 5	2, 0, 2	35, 15, 22
seal	32, 12, 20	12, 5, 7	5, 3, 2	27, 9, 18
dog	26, 14, 12	11 4, 7	11, 1, 10	15, 13, 2
bear	19, 11, 8	22, 8, 14	8, 1, 7	11, 10, 1
koala	20, 7, 13	14, 6, 8	14, 6, 8	7, 1, 5
monkey	15, 6, 9	16, 8, 8	16, 4, 12	-1, 2, -3
penguin	12, 7, 5	14, 5, 9	22, 7, 15	-10, 0, -10

The cat is considered suitable by more than 80% of the valid answers in both countries. Only in the Netherlands we find two people who think it might probably not be suitable. Seal and dog rank high, too.

When we have a look at the net suitability defined as the difference between the number of caregivers who find a robot suitable minus the number who find the same robot unsuitable we get see some interesting details: the cat is deemed the most suitable in both countries, the seal is a close second only in the Netherlands, while in Spain the dog is a close second and seal and bear are nearly equal on third place. Dog and bear are not considered as suitable in the Netherlands.

4.3. How many dementia patients do the caregivers expect would like to caress a given robot?

Table 5 shows the cumulated answers to this question. The second column tells us how many caregivers expect more than half the patients would like to cuddle or caress a certain robot. The next column gives the number of less optimistic caregivers: they expect half or less of the patients would like to touch the robot.

When we look at the last column we can directly see which group is prominent. There are only two robots for which a very optimistic expectation exists: the cat and the seal. Note that the cat again is viewed more positively in Spain as compared to the Netherlands. For the seal the picture is more comparable in both countries. For the group in the less optimistic regime, with a negative difference, there is only one that is expected to have a similar response by the patients for both countries, namely the dog. For all other types the numbers for Spain and the Netherlands strongly differ.

TABLE 5. How many patients (out of ten) would like to caress a given robot according to caregivers? We give the sums for a more positive expectation in the second column, a less positive expectation in the second column and the difference of the two in the last column. The first number in each column signifies the total, the second the number in Spain and the third in the Netherlands, respectively. The robots are in the same order as in table 1. Note that this more or less coincides with the ranking according to the positive expectation sum for both countries.

robot	6 to 10 patients	1 to 5 patients	difference
cat	26, 12, 14	19, 4, 15	7, 8, -1
seal	24, 10, 14	20, 7, 13	4, 3, 1
dog	18, 7, 11	25, 9, 16	-7, -2, -5
bear	19, 11, 8	26, 6, 20	-7, 5, -12
koala	14, 2, 12	29, 15, 14	-15, -13, -2
monkey	13, 7, 6	25, 7, 18	-12, 0, -12
penguin	9, 5, 4	36, 11, 25	-27, -6, -21

The main overall observation is that the Spanish caregivers have a higher general expectation for the robots. Whereas from the answers of the Dutch caregivers we see the only positive difference for the seal and small negative numbers for cat and koala, the Spanish respondents were positive for cat and seal, and a little less optimistic for dog and monkey.

The results for the monkey have to be taken with a grain of salt since a significant number of respondents did not give an answer for it (4 out of 20 in Spain and 5 out of 29 in the Netherlands).

In summary, we observe distinct differences in perceived suitability and expected patient response for the different robots. The ranking of robots in answer to different questions is consistent and stable. Of the robots used in this study cat, seal and dog were expected the most suitable, likable and likely to be used and accepted by the patients.

There appear to be some differences in the manner different types of animals are perceived in Spain and the Netherlands. But we would like to be very cautious at this stage and not read too much into this finding: the sample size is too small to rule out personal preferences. Further examination of this effect is certainly warranted in order to assess the transferability of research of this kind from one country to another.

The expected patient behavior for Spain can be compared to the ranking of the robots by patients. When switched off 25 out of 58 patients declared the cat to be their favorite. When switched on this number increased to 27 out of 58. The following place could not be decided from the patients answers since the number of patients who did not answer by far

outweighed the number of valid votes for any type of robot. For first place no response had only been 10 and 14 out of 58.

This shows very clearly that patients and caregivers agree in their first choice.

4.4. Dementia patients: preferences and affective behavior

The dementia patients were generally cooperative, but most of them did not make a second or third choice, mostly because they stuck to their first choice or because they reported they just couldn't choose. The first choice however, was generally made within seconds with the robotic animals switched off, except for ten participants.

After switching them on, the participants took their time to watch and listen and fourteen of them could not make a choice. In both cases, the cat scored by far the most preferential picks, although it is still not everyone's favorite. Remarkable is that the seal was not chosen when the animals were switched on.

Also remarkable is that the bear was not chosen less. While in an earlier study (Heerink et al. 2013), we used a teddy bear with dementia patients and saw them switch away when it started to move. An explanation could be that the bear in the present study has a shape that is less that of a classic teddy bear and thus it is less estranging to see it come alive.

TABLE 6. First choice of animals by dementia patients in a switched *Off* and switched *On* state.

	Off		On	
	Frequency	**Percent**	**Frequency**	**Percent**
no answer	10	17,2	14	24,1
koala	2	3,4	2	3,4
bear	5	8,6	6	10,3
penguin	2	3,4	1	1,7
dog	7	12,1	3	5,2
monkey	2	3,4	4	6,9
seal	5	8,6	0	0
cat	25	43,1	27	46,6

As Figure 3 shows, the cat also scored the highest on affective behavior, although differences are less extreme. Especially the monkey scores a relatively high number of affective behavioral ques. If we compare these preferences to the predictions that care professionals gave, we see that the extremes of the pattern is roughly the same (cat is favorite, penguin least favorite), although in details there are differences (monkey and bear score better than anticipated).
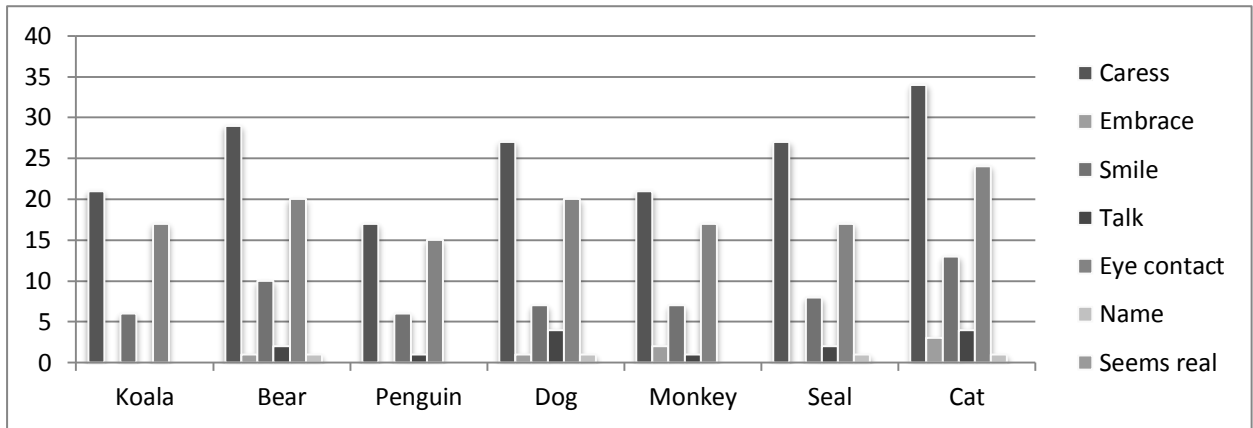
FIGURE 3. Observed affective behavior of dementia patients with robot switched off.
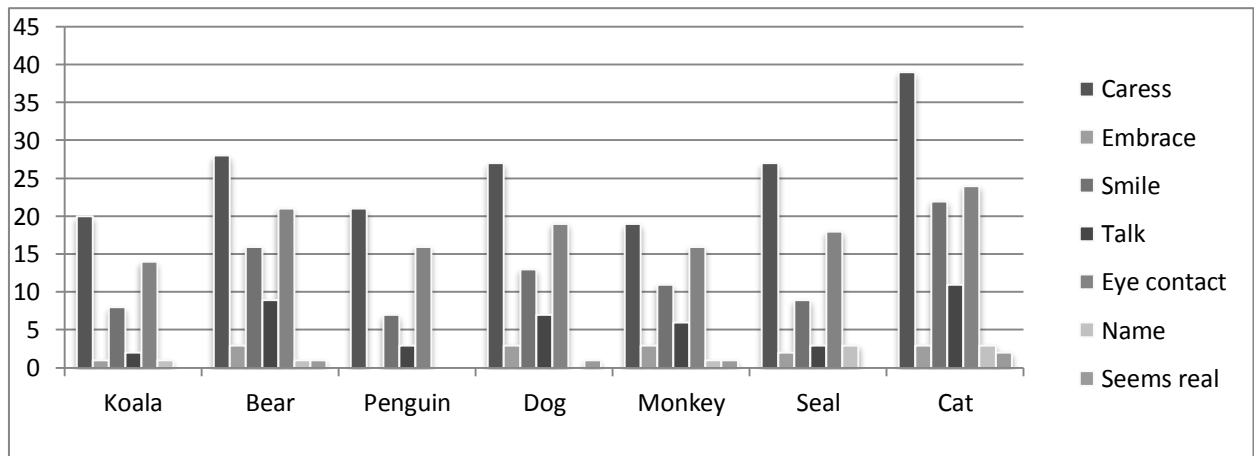

FIGURE 4. Observed affective behavior of dementia patients with robot switched off.

When we compare the scores for observed affective behavior between the *Off* and *On* state (*Table 7*), we can also see that consecutively all of these behaviors on each of the robots scored higher for the *On* state.

TABLE 7. Results of a paired T-test, comparing observed affective behavior of dementia patients in *Of* and *On* states of the presented pet robots

		Mean	Std. Deviation	t	Sig. (2-tailed)
Pair 1	Koala Off - Koala On	-,286	1,799	-,420	,689
Pair 2	Bear Off - Bear On	-2,286	3,039	-1,990	,094
Pair 3	Penguin Off - Penguin On	-1,143	1,464	-2,066	,084
Pair 4	Dog Off - Dog On	-1,429	2,507	-1,508	,182
Pair 5	Monkey Off - Monkey On	-1,286	2,498	-1,362	,222
Pair 6	Seal Off - Seal On	-1,000	,816	-3,240	,018*
Pair 7	Cat Off - Cat On	-3,571	3,505	-2,696	,036*

5. Conclusions, discussion and further research

The interest in the seal by dementia patients and its suitability as presumed by caregivers was not not greater than that in the dog or cat. The cat actually was more favored by caregivers and preferred by about half of the patients. The interest in the other robots was comparable and in an *On* state even greater than it was for the seal.

Our conclusion is that the seal is not always the most suitable form and conversations with care professionals confirmed this. Many of them seemed to have experience with cheap robots from the toyshop. Sometimes this was due to a limited budget: seal Paro cost around € 6,000, compared to the cost of a robotic animal from the toy shop at around € 50. They noticed that for many of the activities these cheap animals were effective enough, sometimes even more so due to the fact that they were much less heavy than Paro. It is however important to note that, unlike Paro, these robots have not been designed or manufactured to be used in therapy. They are not prepared for their use in groups and less for their use by people suffering from dementia

Furthermore we noticed strong personal preferences; people who hardly reacted to the seal often reacted much more positively to a cat or a dog. Even others reacted more strongly to a monkey or a koala bear. A therapist expressed that she realized she actually needed a box full of animals to be able to work with all the people in her group.

Regarding the differences between the care professionals we noticed that in general there were a lot of similarities. Where there were differences, we could not attribute them to a country, education or experience. What we can say is that volunteer caregivers who have a partner with dementia have less need for guidelines. They wanted to find out for themselves what worked for their partner since they had personal background knowledge of their husband or wife.

Considering the types of robotic pets we have used, we have to note that we cannot derive conclusive statements from the preferences other than that they differed. The presented robots differed in more than one aspect (color, sound, shape,…) and for each animal different specific choices could have led to different results (i.e. a gorilla instead of a chimpanzee, a brown seal instead of a white one, a bulldog instead of a Labrador like dog). Further research could focus on these choices and establish more detailed requirements and preferable specifications. Moreover, it could explore different settings , for example by having multiple sessions with a smaller number of robots in each session as we experienced that many participants who suffered from moderate and severe dementia found it difficult to keep attention and required multiple breaks throughout the experience.

But most of all, further research should focus on the development of alternative robotic pets, to encounter the personal differences of dementia patients and enable care professionals to offer each of them the robot that generates the most and strongest beneficial effects.

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