

# HOMIE: An Artificial Companion for Elderly People

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## ABSTRACT

In this paper we present “Homie” an artificial companion for elderly people. Our approach emphasizes amusement and benefit - amusement in form of entertainment and benefit in terms of medical care. The key to awake elderly people’s emotional engagement in an artificial companion is its emotional behavior. Therefore, we propose a companion that does not look technical, which is mostly associated with the words cold and impersonal. Furthermore it features facial expression and gesture. An important design aspect was that it is no additional burden for elderly people. Engaging with it is free and fun.

## Author Keywords

Artificial companionship, elderly people, emotion, relationship, entertainment, medical care.

## ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

As people grow *older they become isolated and lonely* [3] due the fact that more and more friends *move away, become disabled or die* [3]. Moreover, different studies show that the population is ageing. By 2050, about 37% of Austria’s population will be over 60 years [2], which corresponds to an increase by about 50%. For these and other reasons it is essential to consider artificial companionship for providing amusement and benefit to older people.

The idea of artificial companionship has already attracted great interest in recent years. However, prior concepts were not focused on older people. One of the first attempts was the highly successful Tamagotchi from Bandai, which is an easy to care for pet. It looks like an egg-shaped electronic device with an LCD display and buttons-enabled interaction with the virtual pet. The next big step was the development of an artificial pet, called Furby (from Tiger Electronics), without any kind of graphical interface or buttons. It interacted with the environment through sight, touch, hearing, and physical orientation. They could also interact with each other, but they served no real purpose which

made them obsolete soon. Sony’s AIBO is a technical very sophisticated artificial pet, which is able to mimic dog movement in a very realistic way and responds to a variety of commands. AIBO can be used in a very flexible manner, for example it can be used as a remote web cam or for reading out emails. However, we believe that the major flaw, in regard to emotion, is its cold and mechanical look. Many other artificial companions have been developed in recent years (see [1, 9] for a comparison).

Our approach is an artificial dog called “Homie” which emphasizes safety, warmness and physical closeness. We believe emotions are one of the most important aspects in designing artificial companions to awake feelings in older adults.

## INITIAL IDEAS

One of our first attempts was some kind of artificial friend for a computer. However, after talking to elderly people we quickly discovered that most of them do not own a computer and considered them too difficult to handle. On the other hand they do have a TV and enjoy watching various TV programs. So we concluded that we should combine the artificial companion with the TV. We discarded the idea, because in other conversations it turned out that the approach had some major problems. It was pure virtual, so the elderly could not touch it and therefore could not build up an emotional relationship. It was “a friend behind a glass wall“. Furthermore it had a smack of technology.

## DESIGN PROCESS

Our design process consisted of four steps. First we reviewed available literature and conducted a user study. Based on the results from the study we developed our concept. Finally, we built a prototype and evaluated our concept with elderly people.

## Method

We interviewed eight people (six women and two men) who were older than 65 years. Seven of them lived in a flat and one in an old people’s home. Two of them lived alone, five with his/her spouse and one with his/her son. To decide on the questions for the interviews we made a literature review. We read different sociological and psychological studies about aging and human development concerning the elderly. Some selected studies are [2, 3, 5-8, 10-13]. A discussion which summarizes the results of this evaluation

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follows later on. Furthermore, we conducted a brainstorming session and focused on the following topics: What is interesting for older people? How can we ease their lives? What would make them happy? Accompanying to the interviews we carried out cultural probes [6]. These probes consisted of 17 postcards with tasks and a disposable camera. The tasks for taking pictures included instructions like “Please take a picture of your favorite place in your flat”. The intention of these probes was to show us the world through the eyes of elderly people and help us to understand them better. First we tested these cards with five persons to see if they understood the tasks correctly. The conclusion was that some tasks had an ambiguous wording and we had to rewrite them.

## Results

Seven of the interviewed persons are at home most of the time, whereas five out of this seven have health problems and therefore leave their homes rarely. Every person said that watching television is enjoyable. Three of them added that they used the television mainly as source of information. One person had a pet, but three out of four would like to have one, if they were no burden for them. Most of them mentioned the problem of not knowing what to do with the pet when they were ill, in hospital or died. The favored pets were (the number of people who had chosen this pet and the associated characteristics are stated in brackets): a dog (four persons; faithful, intelligent, always there for me), a cat (two persons; faithful, lovely), a bird (one person; faithful, trusting), and any pet (one person). One of these persons had an artificial cat, which was a present from her daughter. She liked it very much, because she had no effort and enjoyed giving the cat its (artificial) milk. All but one had no interest in having a computer or similar devices. Three of the interviewed persons did not care about computers; the other four would be interested in trying it, but were anxious about it. The cultural probes brought us the following insights. Every person had a television at home and in most of the cases it was a modern one. The favorite place at home was the living room and the couch. Reading and watching television were the two top rated hobbies.

## CONCEPT

From the conducted study we knew that many of the interviewed persons would like to have a pet, but were not able to care for it. This led us to the idea of an artificial pet. Another consideration was that *pet ownership can lead to enhanced emotional status* [9]. Mival et al. stated that *the difference between a tool and a companion is a set of characteristics, a personality, which transforms an interaction into a relationship and evokes an emotional investment* [9].

We decided to use a dog as companion for the following reasons. First, cats and dogs are the most popular pets. Second, it is natural for us that dogs obey commands (e.g. Heel!, Sit!, Down!). Third, cats in opposition to dogs are

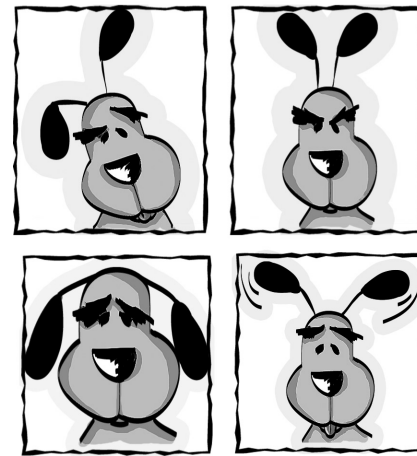


Figure 1. Examples of emotions. From upper left corner in clockwise order: interested, angry, happy and sad

one’s own man. Last but not least, dogs can be trained to help people (e.g. guide dog, police dog) and they are men’s best friend. The dog itself should not have a realistic look, so people would not have too high expectations. Therefore we decided to design a kind of cartoon dog which reacts to commands. To strengthen the relationship between human and “Homie”, it can be personalized, for example by giving it an individual name. This has the effect that the dog follows only instructions of its owner. Furthermore, “Homie” is not a burden for older people - to engage in it is voluntary without consequences. Another important issue is the hidden technology which makes the dog look like a “non-technical” product. The entire “Homie” system consists of four parts, “Homie” itself, a console, which is plugged to the television, a dog bed, and a bracelet/collar, which will be explained in detail later.

## Emotion

*To form a relationship, the user needs to care about the interaction, to invest emotion in it. Artificial companions aim to evoke the emotional investment through replicating recognizable real world behavior* [9]. Our dog can be happy, interested, hopeful, relaxed, alert, sad and angry. We picked these emotions because they represent a broad range of prototypical pleasant and unpleasant emotional states [11]. To accomplish these emotions “Homie” can move its ears, eyebrows, mouth and tongue, head, arms, legs and tail. We chose to use more positive emotions, because it is more motivating and gives a sense of pleasure.

Some examples for activities that awake “Homie’s” emotions (see figure 1):

- **Happy:** When its owner hugs, pets or tickles it, after it got its bone, or when its owner is laughing.
- **Interested:** When it gets a command, hears noises, or it is waiting for an answer.
- **Hopeful:** Before it gets its bone.
- **Relaxed:** When it is talking. (Standard state)
- **Alert:** Reminder or no reception.

- **Sad:** Battery low.
- **Angry:** If something is wrong with it (from a technical point of view).

These emotions should yield emotions in the “Homie’s” owner. For example, a happy dog should make the owner feel good. Lonely people sometimes need a hug to feel loved. If “Homie” gets hugged, you can feel its heart beating. The more you press the harder it beats. This and its soft fur should evoke feelings of warmth and safety and counteract loneliness. Gemperle et al. [7] used a similar approach, but they emphasized communication between family members. Additionally, you can tickle it or play with “Homie” and its bone. This should contribute to a more intense and deep relationship.

### **Entertainment**

The connection between “Homie” and the TV can be used to view pictures. Family and friends can send text messages and MMS messages to “Homie”. For vision impaired people “Homie” has the feature to read out text messages. After a text message has been received “Homie’s” nose goes to call the attention of the user. If he/she presses the nose, the dog tells the owner which message it has received. With a certain command “Homie” can record notes and appointments (which consist of a date and a note). The history can be viewed on television. The dog can also be used as a remote control for the television controlled by speech, e.g. just saying the number of the desired channel. “Homie” remembers and learns the television habits of its owner. If the person always watches the same channel on the same time, it can automatically turn on this channel, if this function is activated. In our interviews we found out, that the elderly like quiz shows very much. That led to the decision to provide a quiz game. “Homie” asks questions, also shown on television, and waits for the answers.

### **Medical Attendance**

Doctors can send medical information and dates for consultation via text message to “Homie”. Medical information includes critical pulse, critical blood pressure and other medical data which is important in case of emergency. Dates of consultation are stored automatically in a diary. A bracelet measures the owner’s pulse rate continuously and blood pressure by command. When the pulse rate is critical blood pressure is measured automatically. Furthermore, the bracelet reminds the owner about taking his/her medicine. The owner just tells “Homie” when he/she has to take it. When the bracelet becomes the collar of “Homie” the information from the bracelet is transferred. The dog retrieves all information about blood pressure and pulse rate, which can later be seen on television. Inversely the bracelet gets medical information (specified by the doctor). If information changes “Homie” tells the owner to place the bracelet around its neck for updating all necessary information. The artificial dog has a medical box integrated in its stomach. This box can be filled by the owner and opens

automatically on the specified times accompanied by a spoken message. These messages can be recorded during adjusting the medicine information. If the owner takes the last pill, “Homie” reminds him/her to refill the box for the next day.

### **Commands**

It was important for us that the command set is small, context sensitive and simple. All commands are given by speaking to “Homie”. The user interface for the television output is designed in a way that available commands are visible to the user. This serves two purposes. On the one hand the elderly can simply read them off loudly. On the other hand it is an aid to memory. If a command is not valid, appropriate feedback is given by “Homie”. Below is an example illustrating how the commands work on the basis of the television remote control. The remote control necessitates five commands: turn on TV, turn off TV, next, previous, and numbers. Next and previous switch to the succeeding and preceding channel respectively. If you tell “Homie” a number it directly switches to the according channel. To avoid the problem that “Homie” reacts to a command, heard in a conversation not meant for it, you have to hold one of its paws while telling it a command. An additional side effect is that physical contact is raised.

### **Technical Considerations**

The console is connected to the television via SCART or composite and handles visualization of the diary, text and MMS messages, and the quiz show (due to technical limitations speech messages are not viewed as text, see future work for details). Information can be received through radio communication with the dog bed.

The bracelet determines the location of the wearer via GPS if an emergency situation occurs. “Homie” immediately sends an emergency call which contains the location and other medical data which is stored in the bracelet (e.g. pulse rate).

The dog bed can be seen as the “distributing center” between the components. It has a data storage on which all information is stored. Information includes dates, speech messages, text and MMS messages, questions and answers for the quiz, and medical data. The dog bed is also an inductive charging point of the artificial dog. Because of inductive charging the dog only needs to be placed in the bed. The elderly do not have to plug it in.

“Homie” itself can communicate with the dog bed via radio communication. The artificial dog includes speech synthesis and of course is able to bark. Speech synthesis is used to read out data, which is stored as text information. For example, text messages can be read out to the older people. The dog can receive short commands from the owner via a microphone. Furthermore, the dog has movement sensors and audio sensors to react to the user. These sensors provide it with the information from which direction sounds come or where the user is located.

Therefore it can raise the ear which is closer to the sound source or the user. With the help of pressure sensors distributed across the body it can determine whether it gets hugged, tickled or petted. Information which is received from the user is transmitted to the dog bed. If “Homie” needs information it also receives it from the dog bed. Charging the bracelet is accomplished when it is around the dog’s neck. To reduce power consumption the dog switches to standby mode after some time of inactiveness. Low power is visualized by floppy ears.

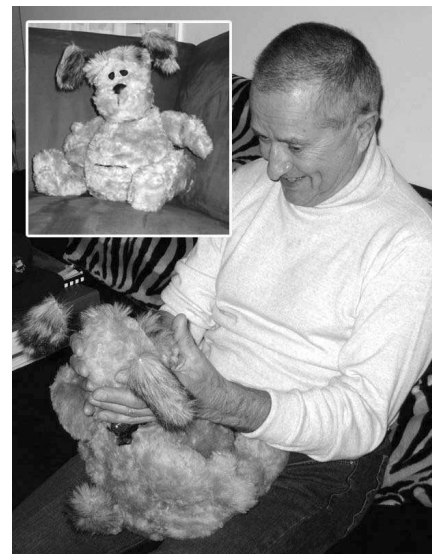
## DISCUSSION

It was very important for us to take the psychological background into account, to adapt “Homie” to the needs of older people.

Our interviews with elderly people showed that the elderly are often limited in physical capabilities or suffer from health problems which lead to lesser mobility. For many this is a problem because they cannot perform hobbies or other activities and they feel lonesome or redlined from the environment. They get depressed, demotivated and sad. “Homie” should compensate these tendencies and give them positive feelings.

Moreover, it was discovered, that older people, especially those who are more bound to their homes, *mostly have contact to society through mass media, primarily television, radio and newspapers* as stated by Schaefer. According to [2] *elderly people are among the most intense users of television and it counts as one of their favorite hobbies*. A survey from Austria [2] in 1998 claims that 98.3% of people between 60 and 69 years and 96.8% of over 70 years old own a television. Furthermore, it was observed that televisions can be found in all social groups. Therefore we took the decision to use television as one of the output channels. This survey also shows that women, who have a higher expectation of life, are watching television more often than men. The majority of old men are living in a relationship, in contrast, women tend to live in single households more often (as stated in [2]). Our artificial dog is intended for people home alone and may therefore be better adopted by women. Siu et al. show *that the amount of contact with friends has been found to be positively related to well-being*. Furthermore, *friend relationships are more important to life satisfaction because there may be greater similarity in attitudes and interests with friends* [10]. This accounts especially to *women [who] are more involved and more oriented toward friendship than are the men* [3]. To support this kind of psychological well being “Homie” is intended to become a friend. It is worth mentioning that *75% in old age say most of their friends are old friends* [3]. To consider this, our dog looks like an old dog, to assure better identification.

Speaking of friends, many old people need somebody who cares about them. This leads us to one of the many domains of caring about older people: psychosocial care (e.g. spiritual support, listening, offering advice) [5]. Moreover,



**Figure 2. The picture in the upper left corner shows the stitched prototype. The big picture shows one of our participants during the evaluation**

*the majority would be glad, if somebody would visit them from time to time to ask about their well-being* [12]. Our dog should therefore give a sense of delight that it cares about other people and it is listening to them. Furthermore, “Homie” should assist successful aging, and therefore facilitates health and happiness, which are *more important than others, such as social activity and sense of purpose* [8]. Last, we found out during our talks that oblivion is something to consider. They said it is difficult to keep something in mind, remember things or to concentrate. We assist this by supporting audio notes, which can be played back anytime. In the interviews some people told us, that they fight their oblivion by putting things always on the same place. Therefore “Homie” was designed to stay where it was put.

## EVALUATION

After we knew which functions “Homie” should have and how it should look like, it was very important for us to analyze how elder people would react and what they would think about it. We decided to stitch a prototype (see figure 2) without any technical functionality. It was important for us to see how the elderly would react to a soft toy. Would a soft toy be accepted by them? Or would they find it too childish? Could it awake emotions only with its appearance? We asked two elderly people, one woman and one man (see figure 2), to verify the appeal to both gender.

The reactions were very positive. Both found it appealing. They said it had the right size and lay good in their arms. “Homie” also raised a smile in their faces, which showed us “Homie’s” potential to awake emotions. One person immediately began to speak with it. After we explained the several functions, one person meant: “I would like to have one, because it helps me to recall things, and I believe it could be a great help.” This person also brought up the question, how “Homie” addresses him, a question which we

did not consider before. For now we decided that it would address the owner with “you”. As speech to text software improves, telling “Homie“ the owner’s name would yield better personalization (see future work for details). The second person told us that it would be useful to refill the medicine box weekly. Some elderly people can not do it alone anymore and this way somebody could refill it for them once a week. Another proposal was that the emergency call of the bracelet could be sent on demand if a situation occurs were the old person cannot reach the telephone (e.g. broken hip). The next suggestion was related to our television remote control feature of “Homie”. He mentioned it would be better to tell the name of the channel instead of the number, because numbers are difficult to memorize.

### FUTURE WORK

Due to technical constraints in speech to text software nowadays, converting a speech messages to text (e.g. for showing it on TV) could lead to a tedious involvement for the elderly. For example S. Furui [4] stated that technological ability for recognizing *spontaneous speech is still limited. Spontaneous speech is ill-formed and very different from written text [4]*. We cannot demand from elderly people to frame their messages ad hoc in a way they would write it down. As the quality of such software improves that feature could be integrated.

In our interviews, the elderly people often mentioned anxiety about their security. Such security issues could be addressed in future, for example, by offering home security equipment, controlled by the dog bed. To gain acceptance from medical doctors support for Interactive Voice Response (IVR) should be provided. This would lead to some interesting possibilities for the doctor. He may provide additional information for the consultation, which then could be told to the elderly and/or shown as text, when appropriate speech to text software is available.

Suggestions from evaluation could be integrated in the following ways. To support weekly filling of the medicine box it could simply be extended to a pill dispenser for seven days by providing 7x3 slots instead of three (morning, noon, evening). Sending an emergency call on demand can be simply accomplished by providing a button which can be pressed in case of an emergency. Telling “Homie” a TV channel’s name instead of the number should be possible with further technical effort.

### CONCLUSION

Based on our user studies we presented an artificial companion dog called “Homie” for elderly people. It facilitates health and happiness in various ways: medical assistance, entertainment, and emotions. Emotional investment of elderly people is one of the most important aspects of the design, because it is the key to a deep relationship. We chose a dog, because dogs are considered as men’s best friend and giving commands is a natural way

of talking to a dog. To avoid too high expectations it looks more like a cartoon dog than a real dog. In contrast to other approaches it is useful and emphasizes safety, warmth and physical closeness.

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