Personal Robot User Expectations

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Abstract

This is a report on the expectations of future users of personal robots based on a survey of respondents from a combination of age groups. A questionnaire was designed using a "text open ended" approach to the questions. The questions along with an introduction and sketch of a humanoid robot in a home were used to "paint the picture" of the subjects having a robot at home. They were then asked what they would ask the robot to do at various times of the day, at weekends and while away on holiday. 442 subjects from five age groups were questioned. The results were then normalized so as to balance age groups. The task category of "Housework" was the most popular out of a total of ten categories with 35% of the overall answers. "Food Preparation" and "Personal Service" were the second and third most popular categories with 20% and 11% respectively. The five most popular individual tasks from all categories were prepare tea, tidying, schoolwork, general cleaning, and make drinks. Most respondents treated the robot as a servant. Some, mostly children, also used it as a game partner.

Keywords

Personal robots, User expectations, User survey, Household tasks, Robot tasks.

1. Introduction

What tasks should a personal robot be able to do around the home? The true answer to this question will only be found when personal robots actually are in our homes. Nevertheless, it is of value to find out what expectations potential users have. The robotic market has been predicted to boom in the near future, especially in the personal and service sectors (Dan Kara, 2003). For this boom to actually happen, robot engineers need to be informed about what consumers expect from personal robots in the home, and develop appropriate functionalities. This research was undertaken with the aim to answer the question of "What household tasks should personal robot engineers be concentrating on?".

Previous work has only provided limited insight into this question. In Dautenhahn et al. (2005), subjects were asked to select from a list of 6 applications (Household (vacuuming etc.), Gardening, Guarding the house/family, Looking after children, Entertainment, and an open category "other". The paper only reports results of the five named applications as representing the users' "preferred tasks". In Oestreicher and Eklundh (2006), subjects had to select tasks from a list of 28 tasks that the literature usually assigns to assistant robots. These studies were strongly biased by the views of the researchers on tasks for personal robots. In contrast, this study, conducted during the Spring and Summer of 2007, uses an open question format. All age groups were surveyed, from children to retired persons. A study by Takeyama et al. (2008) investigated the perceived suitability of robots for a range of existing human professions listed in the US Dictionary of Occupational Titles. An analysis of the selected professions indicates that "public opinion favours robots for jobs that require memorization, keen perceptual skills and service-orientation". The study does not list the selected

professions. It does not address the question of what tasks are most likely to be assigned to personal robots by their owners. Therefore, there is a need for an open-question survey of user expectations.

2. Method

Surveys can be carried out using a variety of methods. Here we need to discover uses of a "really new" product that is not an evolution of an existing product. In such a case, "information acceleration" methods are used, bringing the future to the respondent, or projecting the respondent into the future (Urban et al, 1996).

Personal robot user expectation survey

You have been given a robot as part of a trial program. It is yours to live with for one year.

1. You get up and get ready for your day, what will you ask your robot to do today?

2. The evening comes, what will you ask your robot to do during the evening?

3. You are going to bed, what will you ask your robot to do before you go to sleep?

4. It is Sunday morning. What will you ask your robot to do?

5. You have booked two weeks holiday and plan to go away. What will you ask your robot to do while you are gone?

6. You can "upgrade" your robot by teaching it new activities. 6 months have passed since you got your robot have you upgraded your robot by teaching it anything?

7. Instead of a robot you have been given a trial of an intelligent appliance. Which appliance would you choose and how would it be intelligent?

Sex: Male [ ] Female [ ]
Age: 18 – 20 [ ] 21 – 30 [ ] 31 – 40 [ ] 41 – 50 [ ] 50 and over [ ]
Nationality:_____
Do you have any of the following?
Cleaner [ ] Helper [ ] Nanny [ ] Gardener [ ]

Figure 1: The questionnaire form

To implement information acceleration, an in-depth questionnaire (figure 1) was designed to induce the subject to imagine life with a robot and "day dream" interactions with the robot, and the working day of his or her robot. The introduction to the questionnaire included a short sentence to describe how the subject has been given a robot and that it is theirs for a year. In addition a sketch of a humanoid robot in a domestic setting was supplied to enhance the subjects "mental picture" before answering the questions. A humanoid shape was selected to avoid suggesting any functional limitation that may bias the answers. The questions were of type "text open ended" (Creative Research Systems, 2006), giving the subject freedom of expression and allowing for multiple answers per question. The level of detail gathered in each question was decided by subject himself. Additional multiple-choice questions were used to gather information on the subject's age, sex and if they have any help from helpers, nannies, cleaners or gardeners.

Three surveying methods were chosen for this questionnaire, personal interviews, paper questionnaires and internet survey. In total 442 subjects completed the questionnaire. 55 aged 6 to 7, 29 aged 10 to 11, 260 aged 11 to 17, 87 aged 18 to 60 and 11 aged 61 or above. 6 to 7 year olds and 10 to 11 years olds were children attending primary school. 11 to 17 year olds were children attending secondary school. 18 to 60 year olds were considered adults and 61 years or above were considered as Retired/Elderly. The data for 15 subjects were collected using the personal interview methods and all fell under the adult and elderly age groups. Data for 21 subjects was collected using the Internet survey method and all were adults. The remaining 406 subjects were asked to fill out a paper questionnaire

3. Results Analysis

Due to using the open-ended question method it was important to find the right approach to analysing the results. Here we focus on the overall level of interest for various robot tasks. All tasks mentioned by respondents were recorded and the number of references to that task was counted. When a respondent mentioned the same task several times, e.g. in the response to different questions, each mention was counted separately and added to the total. This was to reflect the higher interest for such a task. The answers to question 6 on "what task would you teach your robot" were amalgamated with the answers to the other questions on "what tasks would you ask a robot to do", as both answer groups reveal tasks of interest to the user. The answers to question 7 "what kind of intelligent appliance would you like instead of a robot" are only briefly summarized in this paper.

The number of subjects questioned in each age group was unbalanced. Therefore a normalization technique was utilised to scale the amount of answers for each task to a common level. All the answer data for the age groups were normalized to a population of 100 subjects. For example for 6 to 7 year olds, where the final respondent count was 55, the total number of answers for a particular task was scaled up by a factor of 100 divided by 55. If the scaling did not produce a round number the value was rounded to the nearest integer. The normalization process meant that all the age groups would have the same impact on the results. To clarify, due to there being a total of five age groups there was a normalized total of 500 subjects, 100 subjects per age group. If all subjects in the survey had mentioned the same task three times each that would mean the total count for that task would equal 1500. Our results therefore give an indication of how popular tasks were.

4. Results

Figure 2 shows the normalized quantitative data recorded from the survey. It contains data from questions 1 to 6 from all age groups. The chart shows the most popular tasks and the amount of times they were mentioned in the survey by all subjects. General cleaning for example was given as an
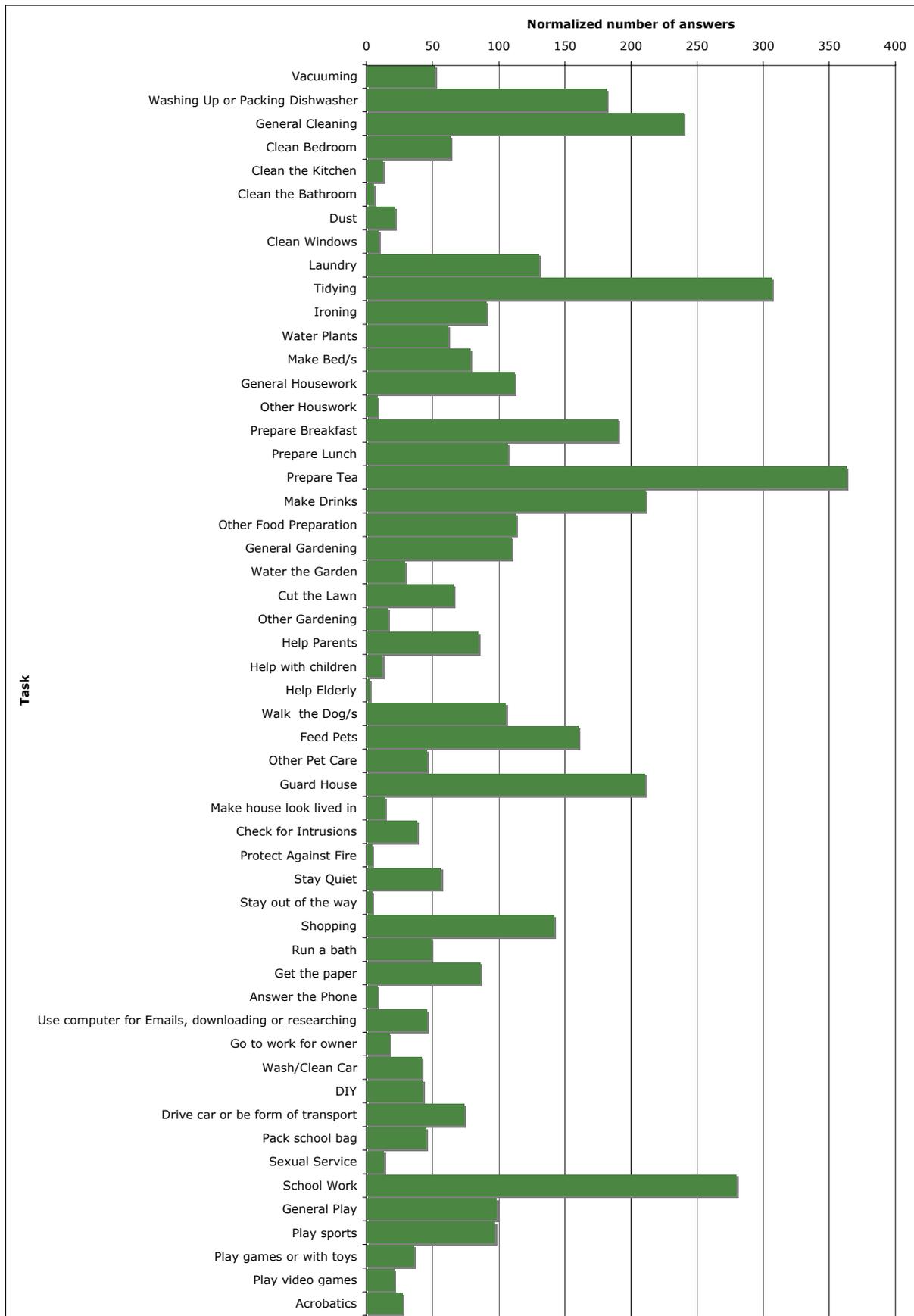
Figure 2: Quantitative results for all age groups showing the totals for all tasks

answer 240 times by the subject population of 500. As mentioned in section 3, this does not necessary mean that 240 separate subjects mentioned general cleaning. Some subjects could have mentioned the tasks more than once during the questionnaire. The chart in Figure 1 gives a very clear indication of the most popular answers subjects gave. The five most popular tasks were; prepare tea, tidying, schoolwork, general cleaning, and make drinks with 363, 307, 280, 240 and 211 answers respectivelyThe tasks included in the chart are varied. Therefore this made it important to group them into categories. Categorising the data meant that an analysis could be done into the common areas which the robot would be asked to perform tasks in. The tasks were grouped into the following categories; Housework, Food Preparation, Gardening, Family Help, Pet Care, Security, Stay Quiet, Personal Service, School Work and Play. These categories were derived from the collected data and were not pre-decided at the start of the research. Table 1 below shows which tasks came under which category.

Housework
Vacuuming, washing up or packing dishwasher, general cleaning, clean bedroom, clean the kitchen, clean the bathroom, dust, clean windows, laundry, tidying, ironing, water plants, make bed/s general housework, other housework.
Food Preparation
Prepare breakfast, prepare lunch, prepare tea, make drinks, other food preparation
Gardening
General gardening, water the garden, cut the lawn, other gardening
Family Help
Help parents, help with children, help elderly
Pet Care
Walk the dog/s, feed pets, other pet care
Security
Guard house, make the house look lived in, check for intrusions, protect against fire
Stay Quiet
Stay quiet, stay out of my way
Personal Service
Shopping, run a bath, get the paper, answer the phone, use computer for emails, downloading or research, got to work for owner, wash/clean car, DIY, drive car or be form of transport, pack school bag, Sexual Service
School Work
School work
Play
General play, play sports, play games or with toys, play video games, acrobatics

Table 1: Tasks Categories

The popularity of each task category was then represented using the pie chart shown in Figure 3. Housework had the largest number of answers with 35%. Food preparation, personal service and play also had relatively high portions with 20%, 11% and 10% respectively.

Question 7, concerning the interest for intelligent appliances, was only posed to adults and elderly in its form of figure 1. The replies cover almost all current appliances, with the most mentioned being hoover/cleaner, iron, cooker, television, fridge/freezer and food preparation devices. The latter are an exception in that they do not cover existing appliances. How would appliances be intelligent? Typically, a hoover should be capable of regular daily cleaning, sensing of dirt or spills, opening of doors automatically, emptying itself and to differentiate between types of dirt. An iron should iron cloth, fold and put away the clothes after ironing, the iron should detect fabric types and

automatically adjust its temperature. A cooker should detect when food is burning or boiling over, automatically cook a meal for a specific time and create an entire meal from scratch including preparation and cooking. A television should sense when the user is in the room so that it only switches on when the user is present, fast forwarding through advertisements without prompting and operate by voice control. A fridge should keep an inventory of what is inside it, defrost meat in time for cooking, give the user suggestions of recipes based on its contents, dispose of spoiled food or even be able to prepare meals itself. General food preparation devices were varied and included appliances which would provide healthy meals to the user, tell the user what is in their cupboards and what they need to replenish (all based on a specified budget), a steamer which would wash, peel, cut and steam vegetables and a drinks maker that can be sent text messages from a mobile to create drinks.
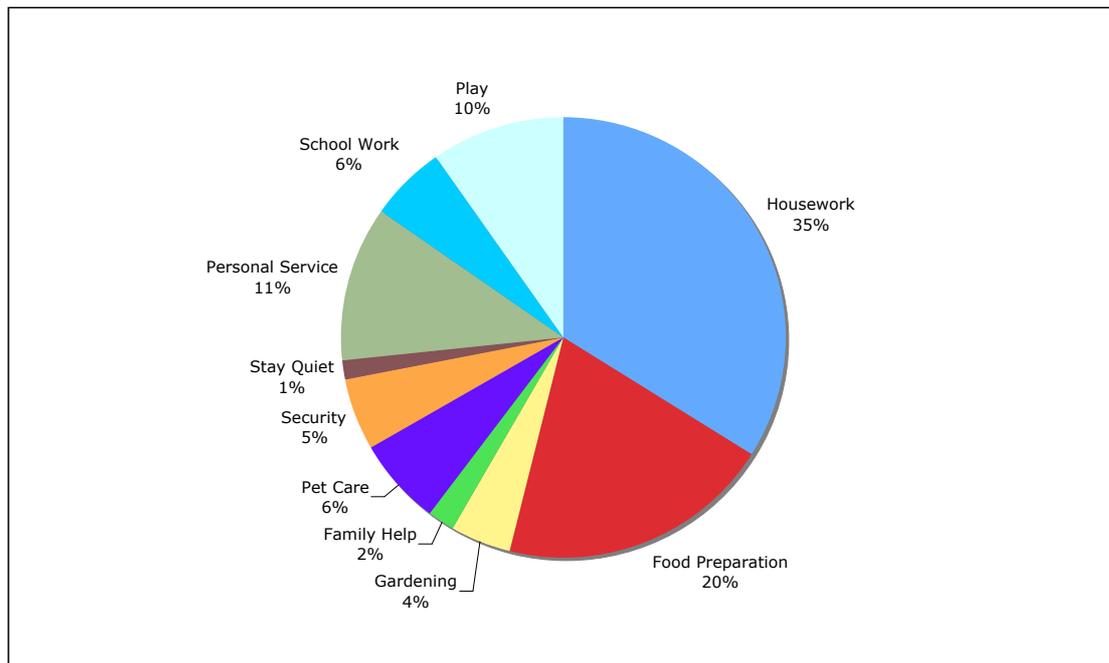

Figure 3: Popularity of task categories

5. Discussion

The results show that people have an overall positive attitude towards living with robots. Although there was no question to ask if the subjects would accept the robot into their homes, it is clear that they were all willing to give answers when asked what they would ask a robot to do for them. A previous survey conducted at a robotics exhibition in Switzerland backs up this view (Arras and Cerqui, 2005). In the survey of 2000 people, 71% of them answered "yes" to the question "could you imagine to live on a daily basis with robots which relieve you from certain tasks that are too laborious for you?". It is shown from the popularity of the housework category that people are looking for solutions to the "laborious" jobs around the home. Another survey into the top ten most dreaded household chores highlights cleaning the kitchen, cleaning the bathroom and washing the dishes as the three most dreaded chores (CEA, 2007). In the results in Figure 2 cleaning is also the task most asked of the robot under the housework category. However it is general cleaning, which has been mentioned most often and subjects were not specific to exactly what rooms they wanted cleaning. Some subjects did state they wanted the kitchen or bathroom to be cleaned however this represented a very small number of replies compared to general cleaning. It is unclear whether the

subjects had bathrooms or kitchens in mind when answering "do the cleaning". However, in a list of tasks that a household robot should be able to do, cleaning is of high priority. Washing up was very popular in the survey and is seen to be the third most dreaded chore. The survey results in this research seem to back up the attitudes to certain chores. However preparing tea was, by a high margin, the most popular task seen in the data in Figure 2, while cooking only ranked 9th out of the ten most dreaded chores. There seems to be a contradiction here, as food preparation is a high priority task for household robots even though it is not as dreaded as others. People may not dislike cooking meals, but would nevertheless be happy letting the robot prepare their evening meal. Meal preparation also appears in the replies to the question on intelligent appliances. To highlight another difference between the two surveys, tidying was not included in the top ten list but was mentioned 307 times in the housework category. People do not seem to dread this tasks very much but would still pass it off onto their robot.

There seems to be two types of tasks the robot could do for the owner. Tasks which remove labour from the owner and tasks which add to the owners life. Housework, gardening or food preparation all relieve work from the owner whereas playing adds to the person's life through entertainment. The DIY task also adds something as it could be decorating and making the house environment a better place to live. In general however, peoples expectation mostly seems to be help in doing jobs. The subjects are benefiting from the robot by it giving them more free time that would otherwise be spent doing jobs around the home. The robot is considered as a servant. It should be noted that the questions never said that the robot was there to do work for you. People just assumed that is its purpose. There were a percentage of subjects that did want to play with the robot, whether it was sports, games or video games. These subjects were mostly children who have a more fun outlook on life in general. It could be said that adults have the pre-conception that robots are designed to work for us, ignoring interactive applications with possible emotional involvements. This conforms to a distinctly western view on robotics suggested by Sparkes (2006): If a robot does not do specific tasks, it is not useful.

There were some interesting results for certain tasks which should be mentioned. Schoolwork was the third most popular tasks overall. This task was only requested by children up to the age of 17, 300 of the 500 subjects. Therefore unlike the majority of tasks it is not an answer spread over all of the subjects. It is not surprising that children want to have help with schoolwork or in fact to have it done for them. These results could be highlighting a need for children to have more support when doing their schoolwork. The form of this support is not revealed by this study. Another interesting task was sexual services. Whether subjects which mentioned a sexual service in their questionnaires were serious or not, the fact is sex was seen in the results. Sexual robots have already been seen in Hollywood, e.g. in the 2001 film "AI" by S. Spielberg, and it might just be a matter of time before robots made for sex become a reality. The results however show that many other tasks are of a higher priority than sexual services. Playing with the robot was also seen in the results. The results for the child age ranges showed that they are very willing to play with a humanoid robot. The majority wanted to generally play with the robot or play sports with it. Males were the subjects that wished to play sports and also wished their robot to perform acrobatics. Playing video games was also solely a male answer. Females answered to generally play with the robot or to play games or with toys. Some adults also wanted to play with the robot, with sports, card games and video games all being mentioned. These results show that the tasks required from the robot were not always "work".

Another interesting feature from the results was time frames. The questions were designed to guide the subject though their day and during a weekend and holiday. There was a definite relationship between the time of day and the tasks answered. Obviously food preparation was already governed by the time of day however other tasks like gardening or washing up were answered in the questions

corresponding to periods when the subject themselves would perform these tasks. For example, gardening was mentioned most often in the weekend question. A robot could perform these tasks at anytime but the subjects chose to ask the robot when they would normally do them. This trend could simply be a bias introduced by the way the questions were worded and the questionnaire design but may also reveal an attitude of the respondents towards cohabitation with robots. It may be significant that several respondent wanted the robot to "be quiet" during the night.

A quantitative approach was user here when presenting the results. Was this the best method to take? To find the most popular tasks the answer is yes. On the other hand the results showed that they could be analysed qualitatively, especially when looking at attitudes towards the robot. Quantifying the results proved challenging for such open-ended questions, as task categories had to be determined after the survey. The use of multiple-choice questions may have been simpler, but it was important not to influence the subject by giving them answers to choose from. At the same time, subjects were probably influenced by the introduction and sketch. These were deemed necessary to put the subject in the "mind set" of having a robot at home. Would a different introduction have led to different results? Most probably. It can be assumed that the picture of a robot with two wheels and no manipulators would have reduced the range of tasks requested. This could be confirmed by a future survey to investigate how different introductions and sketches lead to different results. For this survey however the introduction served its purpose and very few subjects questioned the robot being in their home or its functionality. As for the suggestion of desirable robotics research topics, the study is probably not specific enough in certain areas. A follow-up study should reveal what subjects mean by "tidying" or "cleaning". Other tasks such as "prepare tea" or "feed the pet" probably pose more clear challenges.

6. Conclusion

The aim of this research was to document user expectations from personal robots in the home. A questionnaire was created using open-ended questions and subjects ranging from age 6 to 60+ were questioned. The data was then quantified and it was discovered that preparing tea, tidying, schoolwork, general cleaning and making drinks were the most popular tasks. Subjects mostly viewed the robot as a servant and, to a lesser extent, as a play partner. In terms of functionality it is suggested that robot engineers should be concentrating on solutions for cooking meals, tidying up, general cleaning and the preparation of drinks. Overall the research produced unique data on peoples' expectations from robots in the home.

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8. Acknowledgements