A User’s Perspective on the Handy 1 System
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Abstract
The Handy 1 was developed in 1987 by Mike Topping to assist an 11-year-old boy with cerebral palsy to eat unaided. The system is the most successful low-cost, commercially available robotic system in the world to date, capable of assisting the most severely disabled with several everyday functions such as drinking, washing, shaving, cleaning teeth and applying makeup [1]. This paper outlines the development of the Handy 1 and provides a case history of Stephanie O’Connell, one of the Handy 1 users, in which she gives her views of the system and how it has altered her life.

Development of Handy 1
The Handy 1 was initially developed to enable a child with cerebral palsy to eat unaided. The early version of the system consisted of a Cyber 310 robotic arm with five degrees of freedom plus a gripper. A BBC microcomputer was used to program the movements for the system and a Concept Keyboard was utilised as the man machine interface [2], [3].

The first prototype was completed within three months and placed for trials in the boys home. The system worked successfully and was liked by the user, however some design weaknesses were noted:
- The system was too bulky making it impossible for the boy to eat with his family in the dining area [2].
- Although simple to operate, the robot required a skilled carer to set it up
- The pressure sensitive interface was suitable for someone with cerebral palsy, but would not have worked successfully with less dexterous disability groups [2].

Fig. 1 The first Handy 1 prototype

In 1989, work commenced on improving the Handy 1 specification in order to create a multi-functional system capable of helping a number of different disability groups with basic everyday tasks [2].
The next version of Handy 1 was much more advanced. The interface between Handy 1 and the disabled user became a single switch control known as a ‘wobble switch’ which can be placed at wherever the user has the most useful movement. For example, for an amputee with no arms the switch could be placed at the side of the head. This switching arrangement has been successful in the majority of cases and has enabled the system to be used by many different disabled groups including, cerebral palsy, motor neurone disease, stroke, muscular dystrophy, multiple sclerosis and people involved in accidents [4]. For people so disabled that they do not possess even the slightest movement required to operate the wobble switch, switches are available which can be operated by the blink of an eye, thus enabling most people access to the equipment.

During the early Handy 1 trials, it emerged that although the Handy 1 enabled them to enjoy a meal independently, the majority of subjects wished that they could also enjoy a drink with their meal. Thus the design of Handy 1 was altered to incorporate a cup attachment. The cup is selected by knocking the switch when the green light is lit in the centre of the dish. The green light is included in the scanning light sequence. The cup can be emptied either by drinking from a straw or by using a unique tilting device, which allows the user to tilt the cup using their own head movements to remove the liquid [5].

Close user involvement in the development and evaluation stages of the project have contributed significantly to the success of the Handy 1 eating and drinking system. By maintaining close contact and

Control of Handy 1
When Handy 1 is powered up, seven Light Emitting Diodes (LEDs) positioned integrally behind the eating dish begin to scan, one after another from left to right across the back of the serving dish [5]. The method of making a choice of food is as follows:

- The user waits for the LED to be lit behind the section of food they want to eat.
- The user then activates the single switch and the robot scoops up a spoonful of food from the chosen area of the dish and delivers it to a comfortable mouth position.
- The user then removes the food from the spoon, then the LEDs begin to scan again allowing the procedure to be repeated until the dish is empty.

Fig. 2 The Handy 1 system today
encouraging feedback from our user groups, several suggestions for development of additional attachments have been highlighted [4].

As a direct result of this feedback the Handy is now being further developed to enable severely disabled people to achieve independence in other important daily living activities.

Designs were produced which took the form of three detachable slide-on tray sections (eating/drinking, washing/shaving/teeth cleaning, and cosmetic application) which could be supplied according to the users requirements [6]. This flexibility was considered important as the Handy 1 would be used by people with a range of different disabilities who may want to add or remove attachments to accommodate gains or losses in their physical capabilities.

It is important that each prototype is tested by disabled users to ensure that they are able to use it easily and effectively. One of the Handy 1 users is Stephanie O’Connell, a 24-year-old lady with cerebral palsy.

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Figure 3 Various tray attachments for Handy 1
Stephanie O’Connell has used the Handy 1 system for three years (fig.4). Throughout that time she has been actively involved in the development of Handy 1, trialing new Handy 1 features and giving detailed feedback. Stephanie is also Editor of the Handy 1 users newsletter which provides users with up to date information on the developments of the Handy 1 system. Stephanie’s experiences of the Handy 1 system have been included to give the perspective of a rehabilitation robotics user.

Stephanie says, ‘I lost the ability to feed myself in 1992 at the age of 18, due to cerebral palsy, stiffness and my age. I try to be as independent as possible, I have a Cheater electric wheelchair to which I also connect my Possum. The Possum is an environmental control system which controls my whole house, helping with tasks such as opening, closing curtains, switching lights on and off, television control etc. However, despite help in these activities, I was desperate and determined to feed myself again.

Before I came to the conclusion that the Handy 1 was the right machine for me I did lots of research and tried different things such as the ‘Neater Eater’ (The ‘Neater Eater’ is a mechanical feeding system which uses pivoted damping mechanism) and various spoons. However, the ‘Neater Eater’ needed too much physical movement which made me too tired and gave permanent backache. Finally, after lots of consideration and exhibitions we came to the conclusion that the Handy 1, which I have affectionately named ‘Albert’, was the best machine for me, mainly because the amount of movement required to operate it was minimal.

I came across Handy 1 at the Naidex ‘95 exhibition, which is the leading UK based trade show for technical aids for disabled people, and since purchasing a system for myself I, along with other users of the Handy 1 have been involved in its ongoing development. I am now also the editor of the Handy 1 users newsletter which keeps Handy 1 users informed of the latest developments to the system.

The first meal I had with Handy 1 left me pleased and excited. It had been 3 years since I had last fed myself and the freedom to do so again was extremely satisfying. Of course, my ability to operate the system has improved with practice. Meals with Handy 1 were initially slow but I
persevered until meal times became a union between Handy 1 and I. I experimented with various foods and soon became aware of what Handy 1 is capable of. Oriental food was difficult to manage and so was pasta and rice in the beginning, but thanks to practise and perseverance, I never go without my spaghetti bolognaise! I also found that combinations of food worked well, such as beans on toast or cereals with milk. Mixing the foods seems to help bind them together and make them easier to pick up. As long as the food is cut into sensible bite sized pieces Handy 1 copes well with almost any food type.

The appearance of the Handy 1 system has changed greatly during the last 3 years. When I first received the system it was larger and more awkward looking. It also had material covers. However now that the system is equipped with plastic covers the appearance is much improved and is available in a range of colours. The plastic surfaces also mean that the system is far easier to keep clean and therefore more hygienic.

Also I have found that the Handy 1 has provided a sort of physiotherapy for me. The spoon always presents the food at the same place and therefore you train yourself to move to that position. Persistence is required at first but it is well worth the effort. When I first used the system I easily became very tired but now I feel that I tire less easily. My posture has improved and my movements feel more controlled and less jerky than when I first began using the system. When using Handy 1 I feel totally in control of my feelings again. I need something that requires a very light touch so the single switch control is ideal and very easy to use.

The updated Handy 1 system is much more user and carer friendly than the version that I had initially. The system now sets itself which is definitely greatly beneficial and it is simple and quick for my carers. I also find that I am able to remove the detachable eating tray myself as it is quite lightweight.

The attitudes of carers to the Handy 1 have overall been mixed. Some carers will do anything so that you can help yourself, whereas others prefer to feed as they think that it will be saving them time. With the my initial version of the system, carers knew that it would take several minutes to correctly set up the system, however, with the new system there is no longer a problem as my carers only have to turn the system on as they would do a television set. I find that the satisfaction of being able to feed myself when I am at home makes me feel more comfortable when asking for help with eating when I go out. When I am out sometimes I feel as if people are watching me whilst I am being fed, I wish then that they could see me using the system and eating by myself.
My initial experiences with the washing and toothbrush attachment.

In May this year I began trying out a tray attachment for the Handy 1 system which enables users to clean their teeth, and wash. The system had been developed through the European Commission DGXII Biomed II program and was called the RAIL project (Robotic Aid to Independent Living) and I was involved in the evaluation stage. When I first saw the toothbrush attachment during the early stages of the project I felt that I might not be able to use it but after a few more adaptations had been made I was able. Even though the prototype version of the system was not perfect it was nice to be able to try it out and do another activity for myself. As I used the system, it became apparent that some changes to the design were required and after using the attachment for 5 days I had a clearer idea of what I could and could not achieve when using the system and of what improvements I thought could be made. I gave my suggestions to the developers of the system and I know that these suggestions will be considered and incorporated into the design if appropriate.

I think that rehabilitation robotics could be extremely useful in helping severely disabled people achieve independence in daily living activities. If someone were to say that I could not use Handy 1 it would be as if they were taking my arms away. I have become so dependent on the system and have only been aware of this when I have been unable to use the system at times such as holidays away from home.

Some people have thought that £4000 seems a lot of money to pay for a piece of equipment when carers are available who could do the job. However, I feel that no one can put a price on the ability to feed yourself or on how nice it feels to be able to put a toothbrush to your mouth or wash yourself. I personally feel that it is harder if, like me, you have once been able to feed yourself and then your condition deteriorates and you can’t. If you have had the ability and then you lose it I think that gives you the drive and determination to achieve this again.

I feel that Handy 1 is the best piece of equipment for me. At ICORR’97 I felt that this was confirmed as I looked at the other equipment available and was still happy that the £4000 I spent was not a waste of money. It was not until then that I became entirely sure that I had not made a mistake. I felt when choosing the system that it was the most suitable for me and I still believe this. I am so familiar with the system and I have not yet come across anything else on the market which has such a light touch’.

References


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