Using switch controlled software with people with profound disabilities

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ABSTRACT

Micro switches used to control sound and light displays increase the level of activity of people with profound intellectual disabilities and provide a means by which they can exert some control over their environments. This study set out to i) explore whether people with profound disabilities could learn to use a simple game controlled by a single micro switch and displayed on a normal computer monitor; ii) document what activities on the part of a tutor best facilitated the performance of the learner. Four men and three women aged between 24 and 46 years with profound disabilities completed eight twice weekly sessions when they were given the opportunity to play a computer game that could be operated by a large jelly bean switch. A tutor sat next to them throughout the sessions and each session was recorded on videotape. Tapes were analysed for the help given by the tutor, use of the switch and duration of attention. Although the game was too difficult for them, all participants increased the percentage of time during the session in which they looked at the monitor and for all of them there were at least two sessions when their switch pressing became a consequence of the tutor's activity.

1. INTRODUCTION

People with profound intellectual disabilities are unable to cope independently and their level of ability together with the presence of additional disabilities makes it difficult for them to be involved in conventional activities (Lancioni, et al, 2002). This results in their isolation, passivity and failure to obtain desirable environmental stimulation. In their natural environments they receive very low levels of interaction with others, typical exchanges lasting less than 60 seconds (Clegg, Standen & Cromby, 1991). However, more social approaches have been recorded when they are involved in some form of training (Landesman, 1987).

Clegg, Standen & Cromby (1991) demonstrated the importance of social routines in increasing positive behaviour in people with profound disabilities. They investigated the effect of five different staff strategies on behaviour and found that increased positive behaviour was associated with staff talking with them and social routines. Social routines are exchanges between individuals such as tickling games or other turn taking rituals. However, staff are often unsure of how to talk with someone who does not use verbal or symbolic communication or how to initiate social routines especially with clients with whom they are unfamiliar. This may explain why the majority of the interactions they have with those for whom they are responsible centre on physical care giving. The research by Landesman (1987) suggests that a learning task could provide a focus for developing the social routines valuable for the well-being of those with profound disabilities.

There is now considerable evidence supporting the use of computer technology for people with intellectual disabilities (Standen, Brown & Cromby, 2001) especially as an aid to learning. There has consequently been a growth in the design of multimedia tailored to their needs (e.g. Brown, Shopland & Lewis, 2002). However, these developments have overlooked those with a greater degree of motor and cognitive impairment. Micro switches used to control sound and light displays have been documented as providing a means by which people with profound intellectual disabilities can increase their level of purposeful activity and exert some control over the stimuli that the environment can provide (Lancioni et al, 2001a). Learning to use the micro switch could also act as a focus for social interactions between the person with intellectual disabilities and staff. Previous studies using micro switches (for a review see Lancioni et al, 2001b) have linked the micro switch to a series of single auditory or visual stimuli. Developing computer based software that will provide a variety of responses and displays when controlled by a micro switch could

provide just the activity that people with profound disabilities need to increase their level of activity, give them some control over environmental stimuli and provide a focus for social interaction with carers.

This study set out to

1. explore whether people with profound disabilities could learn to use a simple game controlled by a single micro switch and displayed on a normal computer monitor.
2. as a first step in examining social routines stimulated by playing the game, document what activities on the part of a tutor best facilitated the performance of the learner.

2. METHODS

2.1 Design of study

It was proposed to us a within subjects design to document changes over time in participants' behaviour and the help they received over repeated sessions with a switch controlled game displayed on a normal computer monitor. Evidence that participants could play the game would be an increase in the frequency with which they press the switch at the correct time as recorded by the score achieved on the game. Tutor activities would be considered to facilitate the learner's performance if they preceded correct switch pressing more than would be expected by chance.

2.2 Participants

Four men and three women aged between 24 and 46 years took part. They had profound disabilities but were described by their carers as having an appreciation of cause and effect. They also had sufficient vision, hearing and physical ability to press a micro switch and watch the computer monitor.

2.3 Software

The computer game displayed on a normal computer monitor was "Reign of the Flowerpots" (see Figure 1.) by RJ Games Ltd a San Francisco based company specialising in accessibility options for people with a wide range of disabilities http://www.rjcooper.com. Closure of the switch simultaneously caused a jet of water to emerge from a horizontally moving hose pipe and reversed its direction. If the jet of water hit a descending flowerpot the flowers would open in a spectacular display. If an un-watered flowerpot collided with the hose this triggered an entertaining visual and auditory signal. The speed at which the flowerpots descended could be increased as users became more familiar with the game.

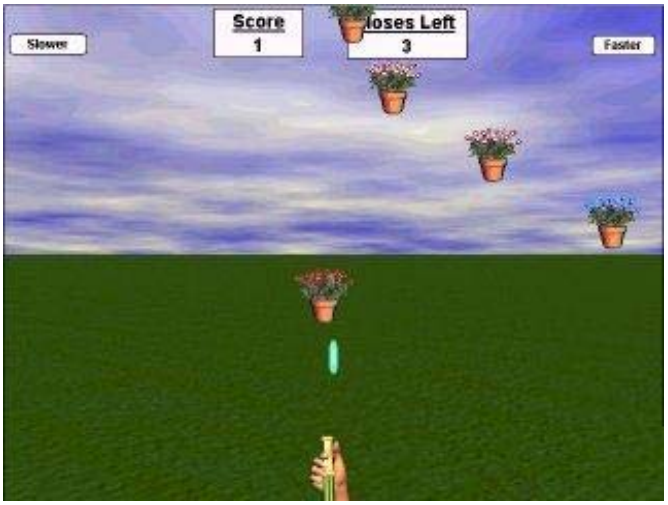

Figure 1. *Screen shot from Reign of the Flowerpots*

2.4 Data collection

Participants completed up to eight twice weekly sessions when they were given the opportunity to play the game by operating a large jelly bean switch positioned to suit their physical capability. A tutor (KA) sat next

to them throughout the sessions and each session was recorded on videotape. The camera was positioned to view both the participant and the tutor. Tapes were analysed using OBSWIN for the help given by the tutor, use of the switch and duration of the participants' attention.

3. RESULTS

3.1 Could the participants learn to play the game?

For the learner it was essential that they attended to the screen, kept their hand on the switch and pressed it. Judging when to press the switch to score was difficult especially as some of the group took time to execute a movement sufficient to close the switch. The game turned out to be far too difficult for the learners so the scores recorded by the computer could not be reliably used as a measure of achievement. Alternative ways of evaluating the game had to be utilised. These are described below.

3.1.1 Participants' willingness to spend time in the test situation. Four people completed at least seven sessions and were happy to continue for the proposed session length of ten minutes. On the other hand, one indicated that she wished to finish after four minutes on her first session and withdrew from the study after completing only four sessions.

3.1.2 Time spent looking at computer monitor. All participants increased the percentage of time during the session in which they looked at the computer monitor (see Figures 1 and 2).

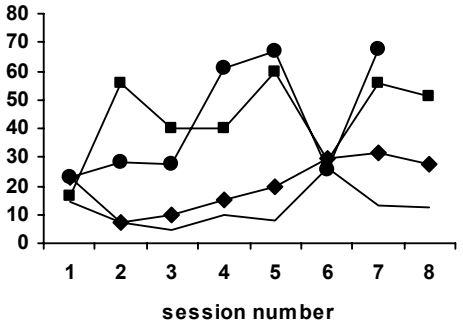

Figure 1. *Percentage of session spent looking at monitor for four participants*.

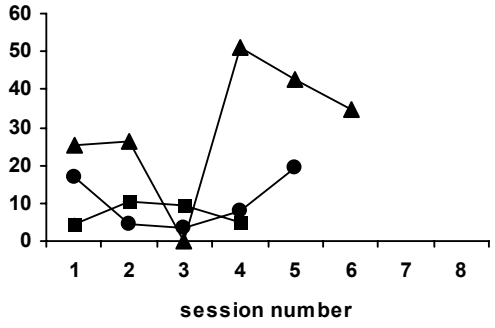

Figure 2. *Percentage of session spent looking at monitor for three participants.*

3.1.3 Rate of switch pressing. Of the six participants who completed five or more sessions, two had high rates of key pressing (20.33 and 15.96 per minute respectively) on their initial session (see Figures 4) whereas four had very low rates (1.18 – 2.6) and showed improvement over repeated sessions (see Figure 5).

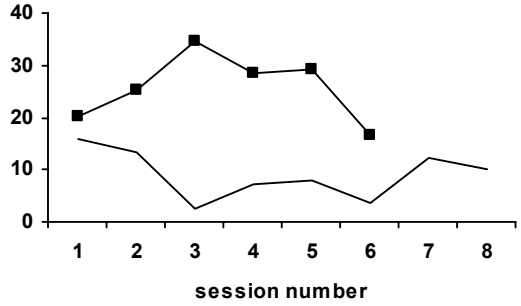

Figure 4. *Rate of key pressing each session for two participants*

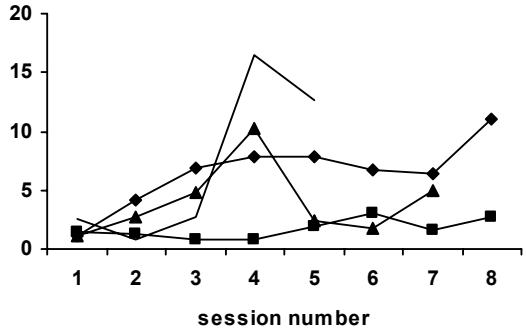

Figure 5. *Rate of key pressing each session for four participants*

3.2 What tutor activities promoted switch pressing?

Videotape analysis revealed the following actions taken by the tutor to promote staying at the computer, holding and pressing the switch and attending to the screen:

- *Verbal encouragement* (encourage)
- *Pointing at the screen* (point)
- *Pressing the switch herself* (press)
- *Placing the learner's hand on the switch* (put hand on)
- *Physically aiding them to press the switch* (press with T)
- *Telling the learner to stop injuring himself or herself or damaging the computer*

The tutor attempted to vary her strategies to suit the learner (egg trying to draw the learner's attention to the screen for those who were happy holding and pressing the switch; physically assisting them to press the switch if they failed to press it spontaneously). This is supported by an analysis of tutor activities that preceded switch pressing by the learner more frequently than would be expected by chance.

For all seven participants, there were at least two sessions when their switch pressing followed something the tutor did more often than would be expected by chance. For five of them, switch pressing followed the tutor's switch pressing significantly more often than would be expected by chance. Tables 1 and 2 illustrate this for two participants (C and M) who initially had low rates of switch pressing. Markov chain analysis was carried out on each session for each participant. Values of $\chi 2$ are given to indicate whether any of the five tutor strategies listed in the first row preceded the participant's switch pressing more frequently than would be expected by chance. Significant results are indicated in bold type: * $p<0.05$; ** $p<0.02$; *** $p<0.01$; **** $p<0.001$. If values of $\chi 2$ increase in later sessions this would indicate that switch pressing was becoming less random and more entrained to the behaviour of the tutor.

For two participants, verbal encouragement was also effective. One (Ra, see Table 3) was initially a high responder but the other was not. For another (R) who had an initially low rate of responding, his switch pressing followed switch pressing where he had been assisted by the tutor. (see Table 4). For none of the participants did this analysis suggest that their switch pressing was becoming less random and more entrained to the tutor with increasing exposure.

Table 1. *Tutor behaviours that preceded switch pressing by C.*

	Tutor action				
session	encourage	press	point	put hand on	Press with T
1		**4.14***			
2		**6.97*****	1.12	0.28	
3	0.12	0.11	2.37		
4	1.20	**6.29****	0.62		
5	0.01	**6.44****	0.91		
6	0.32	1.96	0.51		
7	2.73	2.39	0.78		
8	1.72	**11.72******			

Table 2 *Tutor behaviours that preceded switch pressing by M.*

	Tutor action				
session	encourage	press	point	put hand on	Press with T
1	0.92	**6.12****	0.64	2.68	
2	0.13		0.21		
3	1.96	0.09		2.73	
4	1.94	**10.24*****	1.29	0.80	
5	0.02	**13.60******			

Table 3. *Tutor behaviours that preceded switch pressing by Ra.*

	Tutor action				
session	encourage	press	point	put hand on	Press with T
1	0.75	**12.55****	1.24	0.89	0.83
2	**5.11***	**4.13***	0.21		
3	0.25	2.7		**5.76****	
4	0.96	**10.54*****			
5	0.35	4.18	2.25		
6	0.80	1.84			
7	**7.51*****	**17.07****	1.00		
8	**10.27*****	**5.64****	0.33		

Table 4. *Tutor behaviours that preceded switch pressing by R.*

	Tutor action				
session	encourage	press	point	put hand on	Press with T
1	0.26			**4.24***	**5.22***
2	0.81	1.33	1.10	0.17	**9.3*****
3	2.15				**16.22****
4	0.95			0.10	1.01
5	2.88	0.25			1.97
6	0.10	1.17	0.04	**11.71****	**4.89***
7	**5.30***	0.12			

4. DISCUSSION

The first aim of the study was to discover whether a group of people with profound disabilities could play a switch controlled computer game. Although key-workers of potential participants had seen the game and were asked to nominate people to take part in the study who had an appreciation of cause and effect, it soon became obvious that the game was going to be too difficult for all of those who took part. Rather than stop the sessions and disappoint both participants and day centre staff and in the absence of an easier game, it was decided to break down game playing into component skills and use shaping and reinforcement to increase the frequency of these component skills. The sub components of playing this particular game were attending to the screen, keeping their hand on the switch and pressing it at the right time.

All participants demonstrated an increase in the percentage of the session time in which they looked at the monitor. If not looking at the monitor they were looking at the switch or at the tutor, not surprising given that the tutor was a source of information about the situation as well as offering much valued social stimulation. This suggests that visual cues from the game either to indicate when to press the switch or to provide feedback, should be sufficiently salient to catch their attention.

Four of the participants also increased their rate of switch pressing. For two, their initial rate was high so the challenge for them was to press the switch at the right time. As the game was too difficult for them to discern cues signalling when to press the switch, it was essential that the tutor gave them this information. For all seven participants there were at least two sessions when their switch pressing did become a consequence of the tutor's activity be it verbal encouragement, pressing the switch herself or physical guidance. This could be seen as the rudiments of social routines or formats that Bruner (1975) originally described as developing between carers and infants. These were seen as essential steps in the development of the child's ability to communicate. The mutual ritual provided by various interactional games "scaffolds" the

child's attempt, minimising the risk of failure. The lack of a trend towards more association between the switch pressing of the participant and the behaviour of the tutor with increasing exposure may be due to the design of the study. Participants spent a maximum of eight ten-minute sessions playing the game. Most studies of micro switch use involve considerably more exposure. For example, the two boys in the study by Lancioni et al (2001) used micro switch stimulation for ten minutes, four to six times a day for about twelve days.

As the cues provided by the game were inadequate to help the participants learn when to press the switch, their learning would have been facilitated by including a much simpler level to start with where each switch press controlled only one action, not two simultaneously and where more cues were given on the correct timing of the switch press.

The nature of this type of intervention inevitably means that only a small number of participants will be involved. This study included seven people who varied in age, gender and interests although they were very similar in ability. However, presenting group results is not always useful as opposing trends associated with different individuals can cancel each other out.

6. CONCLUSIONS

The study set out to see whether people with profound disabilities could play a game controlled by a single switch. The game was too difficult but all participants increased the time they looked at the monitor. For all participants, there were at least two sessions when their switch pressing followed something the tutor did more often than would be expected by chance. This could be seen as the rudiments of social routines or turn taking. For none of the participants did this analysis suggest that their switch pressing was becoming less random and more entrained to the tutor with increasing exposure. Participants varied in the type of action taken by the tutor that preceded their switch pressing.

When designing switch controlled games for this user group, visual cues from the game either to cue switch pressing at the right time or to provide feedback, should be sufficiently salient to catch the attention of the player. Each switch press should control only one action, not two simultaneously and more cues should be given on the correct timing of the switch press.

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