Background

The continuing educational needs of people with learning disabilities have been recognised by the Tomlinson Report (1997). This highlighted the need to provide courses which taught independent living and communication skills to people with learning disabilities, which would enable them to access a wider range of other courses and facilities being offered elsewhere in the community (Harrison, 1996). Day centres have a responsibility to provide training programmes in the development of daily living, social and educational skills (National Development Group for the Mentally Handicapped, 1977). So far, computer delivered training packages have played a limited role in this.

Computer delivered instruction already contributes to the education of children with learning disabilities (Goldenburg, 1979; Dube, Moniz and Gomez, 1995; Chen and Bernard-Opitz, 1993). According to Hawkridge and Vincent (1992) it enables pupils to take charge of their own learning and interactive software encourages active involvement in learning (Pantelidis, 1993). This is especially important for people with learning disabilities who have a tendency to behave passively (Sims, 1994). The learner can work at his or her own pace (Hawkridge and Vincent, 1992). They can make as many mistakes as they like, become engrossed in particular details and attempt the same task over and over again without irritating others (Salem-Darrow, 1995).

As an example of interactive software, virtual environments which are three-dimensional can be displayed on an ordinary computer monitor with standard computer input devices such as keyboard and mouse. In addition to being more easily available, one of the advantages of this “desktop system” is that the public nature of the display permits interactions between the learner and a tutor or a peer. Bruner (1968) attributed importance to the social context out of which skills develop, highlighting the value of joint attention, shared activities and sensitive and responsive adults prepared to assign meaning to the learner’s behaviour.

Cromby, Standen and Brown, (1996) draw attention to three characteristics of virtual environments in addition to those shared with other forms of computer delivered education, which make them particularly appropriate for people with learning disabilities. First, virtual environments create the opportunity for people with learning disabilities to learn by making mistakes but without suffering the real, humiliating or dangerous consequences of their errors. People with learning disabilities are often denied real world experiences which might promote their further development because their carers are scared of the consequences of allowing them to do things on their own (Shakespeare, 1975). Accompanied visits to a real environment sufficient to learn a skill may be impossible to arrange. However, in the virtual environment they can go where they like even if they have a mobility problem. Secondly, virtual worlds can be manipulated in ways the real world cannot be. In the real world the beginner can be provided with scaffolding in the form of add-ons like self-help manuals because the world cannot be changed. As she becomes familiar with elements of the task the scaffolding or training support is removed little by little until finally when the task is completely learned all scaffolding has been removed and the apprentice is on her own doing the job (Middleton, 1992). In a virtual environment worlds can be constructed in any way the builder requires. A simple world can be constructed within which the task could be performed and as the user becomes more familiar with the task the world can become more complex. Features to which the learner needs to pay attention can be made more prominent (McLellan, 1991).

Thirdly, in virtual environments rules and abstract concepts can be conveyed without the use of language or other symbol systems. Virtual environments have their own "natural semantics" (Bricken, 1991): the qualities of objects can be discovered by direct interaction with them.
Studies with school aged students with severe learning disabilities suggest that virtual environments are effective in facilitating the acquisition of living skills for example shopping and navigating new environments (Standen, Cromby and Brown, 1997, 1998; Standen and Cromby, 1997) and Makaton sign language (Standen and Low, 1996). This work suggests that virtual environments could help in the development of these skills for adults with learning disabilities and thus facilitate community inclusion.

However, while there appears to be potential in this particular aid to learning, more needs to be known about the best way to exploit it. Talking about computer use in schools, Hope and Odor (1981) report a growing suspicion that teachers will be merely transferring old instructional techniques onto the new medium and not fully exploiting its potential. To avoid this happening with the introduction of virtual environments Salem-Darrow (1996) exhorts educators to take a proactive planning stance in the growth of this important technology rather than the reactive stance many have taken with other developments in educational technology in the past. “If educators want virtual environments to meet learning needs especially of those students who have unusual learning needs they must play an active role in the development of applications offering to developers their unique understanding of learning styles and good teaching practices” (Powers and Darrow, 1994).

Computers are highly motivating but Rutkowska and Crook (1987) caution against the naive belief that unguided interaction can effectively exploit their educational potential (p91). There are two ways that interaction can be guided in this form of learning. The first is through the involvement of a human tutor while the second would be to incorporate some of the tutor’s functions into the software. Rostron and Sewell (1994) advise that they are not there to replace human teachers, just to provide them with additional teaching aids. However, in both schools and day centres staff are responsible for too many students to be able to give one-to-one tuition on a regular basis and when they are able to provide this function need guidance on effective strategies.

According to Hawkridge and Vincent (1992) teachers need help and encouragement to build their confidence and skills in using computers and deserve proper training opportunities. Resolution of this situation involves a consideration of the functions of the tutor. One of the primary functions of tutoring according to Wood, Bruner and Ross (1976) is to allow the learner to make progress by initially providing scaffolding, for example by controlling those elements of the task that are initially beyond the beginner’s capability. As the beginner becomes more familiar with elements of the task and develops the ability to carry it out independently the tutor intervenes less or, in other words, exerts less control. A study by Standen & Low (1996) examined the strategies employed by teachers who were encouraging school aged students with severe learning difficulties to use a virtual environment to learn Makaton sign language. They found that teachers contributed significantly less as sessions progressed selectively dropping the more didactic and controlling behaviours in their repertoire.

Another function of the tutor is to maintain the learner’s interest and motivation, marking relevant features of the task and interpreting discrepancies between the learner’s productions and correct solutions. As proposed by Slator et al (1999) the first of these functions could be incorporated into the software. This would be either in the form of unintrusive tutoring (giving advice but not preventing actions) or intelligent software tutoring (providing feedback based on the tutoring agent’s experience of the task and the learner’s behaviour). Such a software tutor would enable a less experienced person, even a peer to carry out the function of maintaining the learner’s interest and motivation.

In order provide some support for staff using virtual environments with people with learning disabilities and to inform the design of the software tutor, the study was designed to identify what strategies human tutors used when working with adults who were learning to use virtual environments and to investigate their effectiveness by examining changes over time in both tutor and learner
behaviour.

Objectives

The original aim of the study was to produce a repertoire of effective tutor strategies that could be evaluated in a systematic intervention study. Effectiveness was defined as being able to engage the individual and promote their self-initiated movements in the virtual environments. Three steps were taken to achieve this:

1. Reliable categories of tutor and learner behaviour were developed.
2. Whether these categories differed in their frequency of occurrence over time was examined in order to validate their differentiation. Categories that appear to be more controlling should decrease over time in line with the observations of Wood, Bruner and Ross (1976) and Standen and Low (1996).
3. An attempt was made to determine effectiveness by relating occurrence of different tutor behaviours to learners' goal achievement.

Methods

Participants 20 people took the role of learners. They were ten women and ten men attending a social services adult training centre for people with learning disabilities. Their ages ranged from 20 to 65 with an average of 40. A copy of the AAMR Adaptive Behaviour Scale (Nihira, Leland & Lambert, 1998) was completed for all of them by the deputy manager. This provides information on a number of subdomains for example independent functioning, language development, numbers and time. Scores are converted to standard scores which allow comparison with the normative group (4,000 people with learning disabilities). Standard scores are banded into seven bands ranging from "very superior" to "very poor". None of the members of the group received scores in the lowest two bands for any subdomain but very few obtained a rating in the highest band. The learners worked with four tutors. Initially, it was hoped that all tutors would be recruited from the staff at the adult training centre. However, due to restricted availability of staff only 2 tutors were recruited. One worked with one learner, the other with three. The other 2 tutor roles were filled by the research assistants working on the project. One worked with seven learners, the other with nine.

Design Each participant completed a minimum of 12 sessions but 19 wished to continue for longer with 17 completing 15 sessions and one completing 23. Most learners worked with the same tutor throughout although a change in personnel part of the way through the project necessitated some learners completing their sessions with a new tutor.

Virtual environments Four virtual environments were used. They were developed by Brown, Neale, Cobb and Reynolds (1999) in order to teach skills for independent living to adults with learning disabilities. Each environment had a set of learning objectives which were translated into goals and used as a measure of the learner's achievements. Road crossing involved finding the correct place to cross, pressing the button at the pelican crossing and crossing at the right time. The goals for the virtual café included finding a vacant table, ordering a drink and meal from a menu, paying and using the toilet. The virtual supermarket was designed to promote basic shopping skills. Goals included putting a coin in to obtain a trolley, finding the required items from the shelves and paying for them at the checkout. The virtual factory was designed to help those entering sheltered employment to learn health and safety skills. Goals included selecting the correct clothing, avoiding a moving trolley, identifying hazards and finding a number of COSHH forms.

All of these environments were displayed on Pentium II with 17” monitor, operated using a standard 3 button mouse or trackball.
Procedure Service users who had not used virtual environments previously and who had sufficient visual skills to use the monitor had the study explained to them by their key worker. If they were interested they were allowed to watch sessions with service users who were already familiar with the system. If they still wished to take part they then spent a session using a two dimensional routine (selecting items from an icon based shopping list) to learn how to use the mouse. Once this had been mastered they moved on to the other environments in the same order (road crossing, café, supermarket, factory) only progressing to the next once a defined level of mastery had been achieved. Sessions were scheduled as close as possible to twice a week and lasted approximately 30 minutes. They were recorded on videotape, the camera positioned to view both the learner and the tutor sitting next to them.

Results

1. Developing reliable categories of tutor and learner behaviour

Initial viewing of the videotapes made it clear that the tasks facing the tutor and learner were threefold:
1. master the input devices of mouse and joystick,
2. navigate and conceptualise the environments (eg knowing where fruit and vegetables are in the supermarket) and
3. carry out tasks in the environments (eg put a coin in the trolley before entering the supermarket).

This description of the learning situation is useful if the results are to be compared with or contribute to the analysis of teaching in other situations.

Categories of tutor behaviours were developed by one of the research assistants from those used in a previous study (Standen & Low, 1996). Three different phases of modification occurred before a satisfactory level of repeat reliability was achieved (see below).

The following 5 categories of tutor behaviour were recorded

- **Specific information** given to learner about achieving a goal and was further categorised as being about the mouse, the joystick or the environment (eg “go over to the bar now”).
- **Non-specific information** did not provide the help a learner needed to achieve a goal but made the learner aware of possibilities and was similarly categorised as concerning the mouse (eg “where are you going to click then?”), the joystick or the environment.
- **Gesture** covered any movement made by the tutor for example pointing to direct attention to the screen or to instruct movement of the arrow on the screen or to direct movement through the environment.
- **Touching** controls included the tutor putting their hand over the learner’s or taking over the input device to demonstrate and was further categorised as concerning either the mouse or the joystick.
- **Feedback** could be either positive such as praise or reassurance (eg “well done”, “that’s good”) or negative (“no, not like that”).

Learner behaviour was categorised in terms of the number of goals they achieved in an environment and could be either positive (finding an item on the shopping list) or negative (stepping into the road before the light has turned to green).

The categorisation follows work on children’s learning (Wood, Bruner and Ross, 1976) where different levels of control exerted by the tutor were distinguished. Specific information and touching are considered to display higher levels of tutor support or control. Non-specific information, gesture and feedback cover those behaviours that serve the function of the tutor to maintain the learner’s interest
and motivation, marking relevant features of the task and interpreting discrepancies between the learner’s productions and correct solutions.

**Reliability** Sessions were divided into 10 second intervals and whether or not a particular behaviour started during this interval gave it a score of 1. Therefore the maximum score for a behaviour for any one session could not be greater than the number of 10 second intervals in that session. Calculations of reliability using Cohen’s kappa were carried out on these scores. Repeat/intra rater reliability for the first RA at the beginning of the study was calculated on sessions of four learners or a total of 201 ten second intervals (kappa = 0.81, SE = 0.02, z = 42.16). This researcher was responsible for coding for the first half of the study. To determine whether the coding had drifted, before she handed over to the second coder, more repeat reliability assessments were done on four learners’ sessions giving a total of 324 ten second intervals (kappa = 0.77, SE = .021, z = 36.00). Before the second coder took over, inter rater reliability was established on the same four sessions (kappa = .78, SE = .018, z = 43.83). To determine drift over time, at the end of the study the second coder repeated the coding on five sessions giving a total of 465 ten second intervals achieving a kappa of 0.70 (SE = .020, z = 35.49). For goals achieved by the learner assessments of repeat reliability for both coders and inter rater reliability were 100%.

2. Changes over time

To examine changes over time medians for the first twelve sessions are included as these sessions were completed by all 20 participants. Scores for each session were converted to rates per second to take account of differences in the duration of sessions. Data were skewed so regression analysis could not be used to calculate a slope. Instead, the difference between pairs of sessions were examined using the Wilcoxon test. Differences between tutors were examined using Kruskall Wallis one way analysis of variance and Mann Whitney. Summary data are expressed as median rates per second.

**Differences between tutors.** For all behaviours the pattern of change over time did not differ between tutors so scores from all tutors are grouped together. However, for three behaviours there were consistent differences over time between tutors in the rate at which it occurred. There was a significant difference between tutors for positive feedback (χ² = 68.2, df = 3, p<0.001). Pairwise comparisons revealed that one of the tutors had a significantly higher median rate (.047) than the other three. The two members of staff had the lowest rates of .007 and .005 with the research assistants employed on the project achieving higher rates (.016 and .047).

There was also a significant difference between tutors for rate of positive goal achievement (χ² = 15.43, df= 3, p<0.001). The member of staff who worked with only one learner obtained a significantly lower rate of positive goal achievement (median = .006) than the three other tutors (medians = .013, .016, .016). However, this could be a function of characteristics of the learner rather than the tutor and does not reflect the differences found in rates of positive feedback described above.

Finally there were differences between tutors in the rate at which they gave specific information about the virtual environment (χ² = 35.23, df = 3, p<0.001). The two members of staff had lower median rates (.027 and .028) while the research assistants were higher (.042 and .048). This difference may have arisen as the research assistants were more familiar with the environments as both completed more teaching sessions than the two members of staff who may have felt as unaccustomed with the software as the learners with whom they worked.

**Learners’ achievement of goals** All learners spent the first session using the two-dimensional shopping list for which no goals were specified as it was introduced to help mastery of the mouse. To give context to the activity of the tutor, it appears that most learners were achieving goals at a steady rate
(see Figure 1) with no significant change between session two (median = .025) and session twelve (median = .013). Rates of negative goals were very low producing medians for the group of zero for all sessions.

Figure 1. Rate of goal achievement by learners over repeated sessions

![Figure 1](image.png)

Help with input devices. One of the tasks of the tutor was to assist with mastery of the input devices. All learners spent the first session using the two-dimensional shopping list for which the joystick was redundant. This was effective as there was a significant ($z = 3.53$, $p<.001$) drop in rates of giving specific information about the mouse from first session (median rate per second = .013) to the second (.008) from when there was no subsequent reduction in rate of specific information given by the tutor. Similarly, although rates of touching the mouse did not change significantly from the first to the second session they had significantly ($z = 2.44$, $p<.015$) reduced from the first (median = .004) to the twelfth (median = .002). Learners were not introduced to the joystick until their second session when they also encountered the virtual environments for the first time. In contrast to the mouse, rates for the joystick failed to drop significantly ($z = 1.85$, $p<.07$) from then (median = .007) to the twelfth session (median = .004). Similarly there was no drop in rates of the tutor touching the joystick from the second session (median = .01) to the twelfth (median = .01).

Tutors' strategies Although learners' goal achievement was remaining at a steady level, tutors provided less and less specific information, whether about input devices or environment, as sessions progressed (Figure 2). The drop from session two (median = .062) to session twelve (.051) was significant ($z = 2.48$, $p<.013$). In spite of having to give high rates of help (specific information and touching) with the joystick throughout, this did not prevent tutors from giving consistently high levels of non-specific information although this largely consisted of information about the virtual environment. There were no significant decreases in rates of non-specific information from the second (median = .046) to twelfth (median = .049) sessions. As with specific information, rates of gesturing also declined from the first (median = .03) and second (median = .031) sessions to the twelfth (.022). Both drops were significant ($z = 2.26$, $p<.024$ and $z = 2.92$, $p<.004$ respectively). However, rates of both positive and negative feedback showed no significant change from either session one (medians = .002 and 0) or session two (.029 and 0) to session twelve (.017 and 0). These findings can largely be explained by Wood et al.'s (1976) description of the role of the tutor in that the less directive and controlling behaviours would decrease as the learner became more proficient while the motivating/focussing behaviours would remain at the same level or even increase. The drop in rates at which gestures occurred suggests that tutors were using this behaviour to fulfil the more directive or controlling aspects of their role.
Figure 2. Rates of specific and non-specific information provided by the tutor over repeated sessions

1. Relating types of tutor behaviour to frequency of goals achieved by learner.

To examine the effectiveness of the different behaviours recorded for the tutors, all sessions completed by all 20 learners were included. The analysis was completed on each of the four virtual environments separately as it was not known to what extent the differences between them might be influential. Data from session one which utilised the shopping list, was omitted as no goals were recorded for this task. Sessions were divided into 60-second intervals and the number of intervals this produced for each environment are shown in Table 1. For each tutor behaviour category in turn, each 60 second time interval was categorised along two dimensions. These were the number of goals achieved (ranging from 0 to 5) and whether it contained the behaviour category under examination or not. As low expected frequencies for the higher number of goals precluded the use of chi square, cells for 3, 4 or 5 goals were combined to produce 2 x 4 matrices. However, this occasionally produced a significant association when there was no linear relationship between presence of the behaviour and number of goals. Therefore data were reduced to a 2 x 2 matrix to look for an association between presence of the behaviour and achievement of no goals or any goals.

Table 1. Number of sixty second intervals analysed from each of the four virtual environments.

<table>
<thead>
<tr>
<th>Environment</th>
<th>road crossing</th>
<th>cafe</th>
<th>supermarket</th>
<th>factory</th>
</tr>
</thead>
<tbody>
<tr>
<td>no. of intervals</td>
<td>557</td>
<td>1025</td>
<td>1307</td>
<td>1379</td>
</tr>
</tbody>
</table>

The resulting pattern of associations does not produce a clear picture. Only one tutor behaviour, positive feedback, had a significant positive association with goal achievement in all four environments (see Table 2). These were road crossing ($\chi^2 = 53.26$, df = 1, $p < 0.001$), café ($\chi^2 = 48.24$, df = 1, $p < 0.001$); supermarket ($\chi^2 = 95.85$, df = 1, $p < 0.001$) and factory ($\chi^2 = 141.21$, df = 1, $p < 0.001$). Gesture was significantly associated with goal achievement in three environments although for two, road crossing ($\chi^2 = 4.25$, df = 1, $p < 0.04$) and café ($\chi^2 = 11.54$, df = 1, $p < 0.001$) the association was
negative. Only in the supermarket was there a positive association ($\chi^2 = 5.56, df = 1, p < 0.018$) between gestures and goal achievement.

Help with the input devices was also influential, once again underlining the significance of this task for the tutor. Although specific information about the mouse and touching the mouse declined after the first two sessions, these types of help were both associated with goal achievement. Specific information about the mouse was positively associated with goal achievement in the supermarket ($\chi^2 = 71.69, df = 1, p < 0.001$) and the factory ($\chi^2 = 20.98, df = 1, p < 0.001$). However, the association for road crossing was negative ($\chi^2 = 4.54, df = 1, p < 0.04$). Touching the mouse was negatively associated with goal achievement in the supermarket ($\chi^2 = 5.56, df = 1, p < 0.03$) and the factory ($\chi^2 = 11.97, df = 1, p < 0.001$) with goal achievement in the factory. Touching the joystick was also negatively associated ($\chi^2 = 15.5, df = 1, p < 0.001$) with goal achievement in the supermarket ($\chi^2 = 15.5, df = 1, p < 0.001$). While it may safely be concluded that giving positive feedback is an effective strategy, the negative associations do not indicate that those behaviours should not be used. If a particular behaviour is not associated in time with goal achievement the explanation could be that the tutor has to use more of this type of behaviour when a learner is experiencing difficulties.

The research has produced a rich database on which only limited analyses have been completed. Individual differences between the learners have not been examined and could yield more information about efficient tutor behaviours when combined with information from diaries that were kept on each learner containing a qualitative description of each learner’s experience including particular likes, dislikes, difficulties and aptitudes.

Several statistical comparisons were made and normally, to avoid Type I errors, alpha should have been adjusted. However, as this was an exploratory study all results with an associated probability less than .05 have been discussed.

Changes over time were examined without controlling for the environment on which learners worked nor which goals they were attempting and this may have masked some important effects of tutors’ behaviour.

The examination of effectiveness was crude in that no determination of causality was possible: association in time could have resulted from the learner’s goal achievement preceding the tutor’s behaviour. The lack of a coherent pattern in the results suggests two possible explanations. Either the categories lack validity which seems unlikely given the changes observed over time or the method of analysis is too superficial. Effectiveness may not best be described in terms of individual behaviour patterns but in the responsiveness of the tutor. In other words, acting at the appropriate time and using the appropriate behaviour at that time. The method of analysis in the current study could not encompass those dimensions of tutor behaviour. Additionally with the limited software available it was not possible to carry out the time lag analysis used by Standen (1980) which would have determined what tutor behaviours preceded the achievement of a goal by examining varying time intervals before the occurrence of a goal.

In summary, the project has described a set of behaviour patterns that can be helpful in outlining the tasks facing potential tutors but these behaviour patterns cannot be described in terms of their individual effectiveness. The description of behaviours will, however, be useful in deciding how much of a tutor’s role can be built into the software and how much needs to be left to a human tutor.
### Table 2. Probabilities for tutor behaviours associated with achieving goals

<table>
<thead>
<tr>
<th>Specific info re mouse</th>
<th>Road crossing</th>
<th>Cafe</th>
<th>Supermarket</th>
<th>Factory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>0.04</strong></td>
<td>-</td>
<td>.135</td>
<td><strong>.001</strong></td>
<td><strong>.001</strong></td>
</tr>
<tr>
<td>Specific info re joystick</td>
<td>.669</td>
<td>873</td>
<td><strong>.023</strong></td>
<td><strong>.001</strong></td>
</tr>
<tr>
<td>Specific info re VE</td>
<td>.084</td>
<td>618</td>
<td>.463</td>
<td>.254</td>
</tr>
<tr>
<td>Nonspecific info re mouse</td>
<td>.952</td>
<td>144</td>
<td>.059</td>
<td>.127</td>
</tr>
<tr>
<td>Nonspecific info re joystick</td>
<td>.55</td>
<td>348</td>
<td>.289</td>
<td>.518</td>
</tr>
<tr>
<td>Nonspecific info re VE</td>
<td>.118</td>
<td>385</td>
<td><strong>.001</strong></td>
<td>.972</td>
</tr>
<tr>
<td>Gesture</td>
<td><strong>.04</strong></td>
<td>-</td>
<td><strong>.001</strong></td>
<td>.155</td>
</tr>
<tr>
<td>Touch mouse</td>
<td>.987</td>
<td><strong>.001</strong></td>
<td>-</td>
<td>.688</td>
</tr>
<tr>
<td>Touch joystick</td>
<td>.225</td>
<td>157</td>
<td>943</td>
<td><strong>.001</strong></td>
</tr>
<tr>
<td>Positive feedback</td>
<td><strong>.001</strong></td>
<td><strong>.001</strong></td>
<td><strong>.001</strong></td>
<td><strong>.001</strong></td>
</tr>
<tr>
<td>Negative feedback</td>
<td>.207</td>
<td>920</td>
<td>.728</td>
<td>.153</td>
</tr>
</tbody>
</table>

*Activities* Dr Brown was co-chair of the Enter 2000, Mencap-organised conference and is on the committee of the British Computer Society Disability Group. Dr Standen is co-chair of the 4th International Conference on Disability, Virtual Reality and Associated Technologies (2000).

*Outputs* The dataset has been lodged with the ESRC Data Archive. Although data collection had not been completed, presentations were made by the principle investigator at the 11th World Congress of the International Association for the Scientific Study of Intellectual Disabilities (2000) in Seattle; Enter 2000: Virtual Reality and Assistive Technology in London and at the 3rd International Conference on Disability, Virtual Reality and Associated Technologies (2000).

*Impacts* The initial results concerning the description of the behaviour categories were instrumental in writing the successful application to the EPSRC for funding to develop an input device for use by people with learning disabilities.

*Future research priorities* In addition to the project on input devices described above we plan to take the research in the following directions:

- To use the information on tutor behaviour to refine the software and to build software tutoring devices.
- To use this knowledge to produce software that would appeal to the increasing elderly population of people with learning disabilities who need rewarding daytime activities as well as an opportunity to practise and maintain independence skills.
- To produce software and input devices that allow some of the much less able individuals to access this technology and to explore the potential for cognitive rehabilitation that it may offer.

*Ethics* It is difficult to obtain informed consent from group of people who may use no verbal language. We have used this opportunity to develop a procedure whereby a key worker explains to potential participants as much as they can and then they may watch other participants taking part before they agree to try the two-dimensional introductory session before committing themselves to the programme. This does involve exposure to the test situation before they take part which may not be practical for other types of research.

An additional ethical concern is that our team has spent much time at the day centre and joined in some social activities which helped us to learn how to communicate with clients but also gave them the
opportunity to get to know us before working with us. We provided a computer and software for the duration of the project. Luckily, we have obtained further funding and will be able to maintain a presence there. If funding had not been forthcoming we would have had to move out with our equipment and break off relationships with welcoming staff and clients. This latter group in particular already suffer from few social contacts and frequently changing carers and our departure would add to that. Staff too can become further demoralised when we depart taking our resources with us.
References


