A Pilot Evaluation of the Practicality of the Surrey Virtual Rehabilitation System: Perspectives from End-Users

Abstract

The Surrey Virtual Rehabilitation System (SVRS) was developed for clinical use in physiotherapy for children with cerebral palsy (CP). The overall aim of this work was to evaluate the practicality of the SVRS for three simple lower extremity exercises. Two children with CP, two clinical engineering trainees, and a physiotherapist performed the tests whilst parents and a paediatric physiotherapist observed the exercise sessions. The feedback collected during an open-discussion and the descriptive analysis of responses to 15 closed-ended questions suggest that the participants were satisfied with the practicality of the SVRS. Outcome measures derived from data collected during the sessions indicate that the SVRS may provide clinically relevant feedback on the performance of patients for themselves and their treating clinicians. In conclusion, the SVRS appears practical for rehabilitation purposes and is worthy of further evaluation and development.

Keywords: Surrey Virtual Rehabilitation System; cerebral palsy, hip and knee flexion exercise; and obstacle clearance exercise

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1. Introduction

Cerebral Palsy (CP) is a set of chronic disorders primarily affecting the progress of movement and posture, often resulting in a limitation of activity, and is caused by damage to the brain occurring before it is fully mature(Bax, Goldstein, Rosenbaum, Leviton, & Paneth, 2005; Berker & Yalçin, 2010; Gage, 1991). A common feature in children with CP is imbalance in muscles that govern posture and gait, increasing the effort needed to undertake activities of daily living and the risks of falls(Berker & Yalçin, 2010). Clinicians have therefore proposed a number of physiotherapy approaches that are targeted at improving motor capacity in children with CP and increasing their interaction with the environment and able-bodied peers(Berker & Yalçin, 2010; Dodd, Taylor, & Imms, 2010). However, there is no definitive evidence supporting a specific physiotherapy approach for children with CP(Anttila, Autti-Ramo, Suoranta, Makela, & Malmivaara, 2008; Larsson, Miller, Liljedahl, & Gard, 2012). Therefore, in clinical practice specific functional activity tasks are often adopted based on the physiotherapist's experience and their interpretation of the theory of motor learning (Berker & Yalçin, 2010; Dodd, et al., 2010; Larsson, et al., 2012). Hip and knee flexion exercises are used by physiotherapists based on the theory of motor learning, which is described as a useful approach to assist children with CP in reducing muscle stiffness, improving balance and consequently enhancing walking function(Steele, Damiano, Eek, Unger, & Delp, 2012). Obstacle clearing exercises are also being used clinically in order to increase stance balance and consequently improving walking stability, which can lead to a decrease in the risk of falling(Woollacott & Shumway-Cook, 2002).

The clinical benefits of any physical exercise are typically shown following intense involvement in the intervention (Anttila, et al., 2008; Dodd, et al., 2010; Larsson, et al., 2012) and if it is being delivered with minimal risk of injury and fear of embarrassment. The inclusion of virtual reality (VR) environments into rehabilitation is a possible strategy to engage children who might otherwise lack the motivation needed to undertake rehabilitation(Snider, Majnemer, & Darsaklis, 2010). Previous research(Kott, Lesher, & DeLeo, 2009; Snider, et al., 2010) that focused on determining the effectiveness of VR based lower extremity rehabilitation of children with CP involved the use of VR systems that were either not developed for rehabilitation purposes or were too expensive, limiting their use to a research laboratory environment(Al-Amri, 2012; Galvin & Levac, 2011).

The issues outlined above guided the design and development of the Surrey Virtual Rehabilitation System (SVRS) for the rehabilitation of children with CP in collaboration with a clinical team based in the rehabilitation centre in Queen Mary's Hospital, Roehampton, London(Al-Amri, Ghoussayni, & Ewins, 2011). The SVRS has been designed to provide a range of rehabilitation programmes including standing and walking exercises. Prior to using the SVRS in a clinical environment, its safety and the performance were examined in a study with young adults(Al-Amri, 2012).

Before evaluating the clinical effectiveness of the SVRS it was decided to examine its practicality during simple hip and knee flexion, and clearing obstacle exercises in order to confirm the direction of further development for the SVRS. In this context practicality refers to satisfaction (how enjoyable it is to use the SVRS); comfort (how easy it is for participants to complete tasks, once they have learned the system); safety; and to some extent utility (is it considered that the selected scenarios will benefit the gait rehabilitation of children with CP). This paper presents results from a preliminary study with two clinical engineering trainees, a physiotherapist, and two children with CP and their parents/guardians, investigating the practicality of the SVRS. In addition to evaluating the practicality of the system, the work aimed to investigate whether outcome measures from the SVRS were feasible and had a role in reviewing user performance.

2.Method

2.1 Development of Rehabilitation Feedback

Three virtual scenarios were developed using the Vizard Virtual Reality Toolkit (version 3.18.0002, WorldViz LLC, USA) that runs on a personal computer (PC1). An algorithm to generate a pelvis and lower limb only virtual stick-figure was also implemented in Vizard using lower body marker-based kinematic data.

The Qualisys optical infrared tracking system (Qualisys Track Manager, version 2.4.546, Qualisys AB, Sweden) was used to track marker positions. This system ran on a second personal computer (PC2) and transmitted motion data to PC1 via a TCP/IP communication protocol. To increase the safety of the SVRS, a function was implemented in Vizard to freeze the virtual world if PC1 did not receive complete kinematic data from PC2. A real-time algorithm was also implemented in Vizard to provide an approximation of the knee flexion-extension movement as the angle between the 'thigh' and 'shank' vectors(Al-Amri, 2012). The shank vector was defined using the markers placed on the lateral malleolus and the lateral femoral epicondyle. The thigh vector was defined using the marker on the lateral femoral epicondyle and one placed approximately half way on a line between the greater trochanter and the epicondyle.

2.2 Research Participants

Ethical approval was granted by the National Research Ethics Services (NRES) NHS Committee with a restriction to recruit children with CP who have previously visited the Gait Laboratory at Queen Mary's Hospital. Criteria for inclusion of children with CP in this study were: female or male; a consultant's diagnosis of diplegic or hemiplegic of CP; aged between 12 and 17 years; Gross Motor Function Classification System (GMFCS) rating of level I to level III; and no evidence of photosensitive epilepsy.

2.3 Study Protocol

The investigation was conducted in the Clinical Gait Laboratory at Queen Mary's Hospital and divided into three tests. Before performing the tests, the study was discussed with participants and the parents of the children, and they were encouraged to ask questions prior to signing the consent forms. During the tests the laboratory lighting was dimmed to minimise any other visual distractions. A three part questionnaire consisting of 15 questions in total, based on the study of Witmer and Singer(1998) and the VR literature as detailed by Al-Amri(2012), was used to evaluate the practicality of the SVRS during this investigation.

In the first two tests, participants controlled their virtual lower limb stick-figure. In the first test, participants were asked to stand in front of the screen (see Figure 1) and then to pop virtual balloons with a virtual knee. A sequence of balloons separated by 15 m appeared as moving toward the participants over a 2 minute period. The participants were asked to perform the test by bending the appropriate knee by raising it up to reach the balloon that appeared on the screen in selected random positions; these were normalised based on the height of the knee and pelvic markers on the participants' body. A real-time approximation of the knee flexion-extension angles was presented on the screen. At the end of this test, the participants were asked to complete the first part of the questionnaire that consisted of five closed-ended questions.

The first test was developed to be performed whilst standing still. The second test extended this by encouraging the participants to change standing position prior to each hip/knee flexion movement for popping the virtual balloon with a knee. Four virtual balloons were generated at selected random positions in the virtual room (see Figure 2). The positions were determined to be 0.5 m from both sides of, and between 0.5 m and 1.2 m from the front of the virtual stick-figure in its user-set starting position. The height of the balloons was normalised following the procedure used in the first test. In order to help the participants to identify the depth of these balloons in the virtual room, four dancing avatars also appeared inside the virtual room and around the balloons. At the end of the test, the participants were asked to complete the second part of the questionnaire, which consisted of five closed-ended questions.

The third test aimed at providing a clearing obstacle exercise while standing. In this test, participants were asked to stand on the floor in a pre-set position, which was used to normalise virtual ducks in the virtual environment. The participants were then asked to help the virtual ducks avoid colliding with virtual obstacles that appeared as hemispherical stones of diameter 250 mm, while the ducks were walking in a virtual park (Figure 3). To achieve this, the participant had to raise the right foot up to help the virtual duck on the right side or the left foot to help the virtual duck on the left side at the appropriate time and then return the foot back to the original position once the obstacle had been cleared. A sequence of virtual stones separated by 15 m was presented as moving toward the participants for a 2 minute period. If there was a collision between the duck and the stone a point was deducted from the starting scores and an "uh-oh" sound was played for one second. At the end of the test, the participants were asked to complete the last part of the questionnaire that also consisted of five closed-ended questions. This was then followed with an open discussion between the first and the last authors of this paper and the participants, and in the case of the children with their parents/guardians, in order to gather further information on their perceptions on the system during the tests. Participants were asked at the end of each test whether they felt dizzy.

2.4 Analysis Strategy

The investigation was based on responses to 15 questions that were divided into three parts; each consisted of five closed-ended questions which relate to the first three components of the

SVRS practicality: satisfaction, safety, and comfort. The fourth component (utility) was evaluated based on information gathered during the open discussion. Responses to the 'Smileyometer' scale that was developed by Read et al. (2002) and used for the closed-ended questions for each test are represented in a descriptive table based on the following strategy: "Brilliant" or "Good" responses are considered as a positive response; an "Ok" response is considered as a neutral response; and "Bad" or "Awful" responses are considered as a negative response. The question asking participants if the scenario made them feel dizzy is not reported in the descriptive table, but these responses are reported in the Results section.

Motion capture data from the participants were saved automatically in Excel spreadsheets using code that was implemented in Vizard. The saved data were both knee angle and marker positions in 3D space. The data were then analysed using Microsoft Excel 2007 to examine if the SVRS can provide the following outcomes that may show participant performance during the first two tests: knee angle used to touch a balloon; time taken to bend the leg up to reach the knee angle; and completion time to touch all balloons (only in the second test). In the third test, the following outcomes were considered: number of unsuccessfully cleared obstacles; peak foot height achieved and normalised to the obstacle height; and time taken to raise the foot up in order to clear the obstacle.

3. Results

Two children with CP (labelled as C1 and C2), a physiotherapist (labelled as A1) and two clinical engineering trainees (labelled as A2 and A3) participated in this pilot study. Participants A1-A3 had no past or present issues with mobility and were considered to be able-bodied. Participant details are summarised in Table 1.

3.1 Perspectives on the Practicality of the SVRS during the First Test

Five closed-ended questions were asked to determine the perspectives on completing the first hip and knee flexion exercise using the SVRS. The questions and the responses are summarised in Table 2. With respect to the comfort component of the SVRS practicality, the results show that able-bodied volunteers were positive about controlling the virtual stick-figure to pop balloons (Q1 and Q2), while the children were neutral. The satisfaction of the SVRS (Q3) during this task was positive for able-bodied volunteers and C2, whereas C1 was neutral. It is worth noting that due to marker drop-outs in the motion capture data, the virtual stick-figure 'froze' with C1 more than with other participants. With regards to the safety (Q4 and Q5) of the SVRS all participants responded positively.

The participants' performance in this exercise was evaluated based on computing the median and the range of knee angle used to pop a balloon and the time taken to bend the leg up to reach that angle (Table 3). In the open discussion able-bodied volunteers commented on the distraction that occurred when the virtual stick-figure froze during the task. This happened, due to the fact that markers were occasionally "lost" when participants bent their right leg. A1 stated that the scenario seemed very interesting and challenging in training hip flexion. She was also impressed with the way real-time feedback of the knee angle was provided on the screen. She felt that such feedback would encourage patients to improve their movement; however, the position of the feedback on the screen was not in the direction of eye-sight. In a direct question whether the SVRS made the participants feel dizzy during this exercise; none of them felt dizzy all commented that it did not.

3.2 Perspectives on the Practicality of the SVRS during the Second Test

To evaluate the perspectives into the practicality of the SVRS when participants performed the second test, five closed-ended questions were asked. The responses of the participants to these questions are summarised in Table 4. The results show that A2 and A3 were positive and the children with CP and A1 were neutral with the comfort with which they controlled the virtual stick-figure to pop virtual balloons (Q6). All participants were neutral with level of comfort in popping virtual balloons (Q7). From observation, they were unable sometimes to pop virtual balloons due to lack of the ability to judge how close their stick-figure was to the balloon. All participants were therefore asked to repeat the task once more and they showed better ability to judge how close their stick-figure was to the balloon. The results suggest that the participants were positive in their satisfaction with this exercise (Q8). The participants were also positive with the safety of the SVRS during this exercise (Q9 and Q10).

In this test, the outcome measures outlined in the previous test together with time to complete the test were determined (Table 5). The results show that the range of completion time was between 7 s and 20 s.

During the open discussion, those who commented on the previous test also made the same comments on this task. A1 added that this exercise was more challenging than the first as it required movement in order to reach the balloons, which is useful for lower extremity rehabilitation. In terms of potential cyber-sickness from using the SVRS, participants stated that they did not feel dizzy. The participants also reported that they did not feel there was a delay between their actual movements and the control of their virtual stick-figure.

3.3 Perspectives on the Practicality of the SVRS during the Third Test

To gather the perspectives into the first three elements of the practicality of the SVRS when participants performed the clearing obstacles exercise, five closed-ended questions were asked. Table 6 shows a summary of the participants' responses to these questions. The results indicate that all participants were positive with the practicality of the SVRS during this test.

The participants' performance in this exercise was evaluated based on computing the median and the range of peak height the foot reached to clear obstacles and the time taken to reach that height (Table 7). The results show that the able-bodied volunteers cleared all (19) obstacles successfully. C1 and C2 did not clear two and four obstacles that appeared on the left side, respectively. The results also suggest that the children with CP cleared obstacles with their affected legs with less height in comparison to their non-affected leg. The results, as shown in Table 7, indicate that able-bodied volunteers took longer than the children with CP to clear obstacles. This might be due to the fact that able-bodied volunteers kept testing the response of the virtual ducks with their actual foot movements.

In the open discussion A1 and A3 stated that this third exercise would help patients develop skills in clearing obstacles within a safe and motivating environment. A3 added that performing this exercise using the SVRS would not only improve motor function but it might also help the decision making skills in children with CP.

The participants reported that the SVRS did not make them feel dizzy during any of the above three tests.

3.4 General feedback

A physiotherapist, PH, who observed C1's session was satisfied that the tests would be relevant to routine clinical rehabilitation sessions for children with CP. PH mentioned that the motivation and confidence of C1 when she was performing the exercises were excellent. This was also supported by the parents who wondered if the SVRS can be used in the future within the home environment. PH also wondered how easily the sceneries could be personalised for children based on their needs and level of disability. For performance evaluation, PH suggested that automated performance measurement for each user in each session would be very relevant and would enable clinicians and patients to review their progress.

4. Discussion and Conclusions

The first aim of this study was to evaluate the practicality of the SVRS. The results presented in this paper are primarily derived from the responses to the questionnaires as well as to the information gathered during the open-discussions with the SVRS end-users (participants, their parents (if appropriate), and a treating physiotherapist). It was important to get the SVRS end-users' feedback during its development stage because they may have alternative perceptions as to what should be considered in order to provide an effective virtual rehabilitation system. It was also essential to define technical issues that may distract users when they use the SVRS for rehabilitation in the clinical setting. The results presented in this paper indicate that the participants enjoyed performing the exercises using the SVRS and that there was an adequate level of safety in controlling the virtual stick-figure and virtual ducks. These results suggest that satisfaction and safety of the SVRS during the first two tests were more acceptable than its comfort. In these two tests, however, on several occasions the virtual world 'froze' due to marker dropout. This distraction might have affected the children perspectives on comfort of the SVRS as they were less aware of the technical reasons for stopping them from controlling the virtual stick-figure. For the third test, the participants were satisfied with all the practicality elements of the SVRS. As to whether the VR scenarios investigated were clinically relevant for motor skills and balance rehabilitation for children with CP, the discussion with the physiotherapists indicated that children with CP might likely benefit from these scenarios with the added fun element in performing these motor challenges.

The second aim of this study was to learn how the SVRS can in addition to providing virtual scenarios for rehabilitation, generate relevant feedback to clinicians, children with CP, and their parents. With regards to the first two tests, children with CP and A2 made extra effort to flex the knee in order to touch the balloons. In the case of A2, this additional effort might be because she wished to examine the response of the virtual stick-figure into the actual movements to get a better understanding of how the system worked. A1 took longer than the other participants to touch all balloons during the second test, which may be due to the fact that she does not play computer games; that might affect her navigation experience inside the virtual room. In the case of children with CP, the extra effort might be due to the fact that some balloons appeared at a height that required more effort to reach it. Overall, the results suggest that motion capture data can be manipulated in order to be used for providing, for instance, user performance and progression over time. This feedback may be used in rehabilitation contexts if we are, in collaboration with clinicians, able to determine which outcome measures are the most appropriate in order to aid in improving physical therapy strategies.

In conclusion, the SVRS appears to be practical and to offer some advantages in maintaining the motivation of participants and providing scope to be flexible in the design of exercise programmes compared to conventional therapy approaches. It is important to highlight, however, that this is only a preliminary study and the participants may have been positively biased; for example, they were keen to be involved in the project and may have wished 'to please' the authors through their responses. Further evaluation with more subjects would be necessary to confirm our preliminary findings.

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Competing Interests

The authors report no financial or other conflict of interest relevant to the subject of this article

Authors Note

Part of the results obtained during the first two tests was first presented at the International Conference on Virtual Rehabilitation, Philadelphia, USA, 26 to 29 August 2013.

Figures and Tables

Figure 1: A clinical engineer trainee using the SVRS to perform the first test of hip and knee flexion exercise. A: during the actual test and B: a screenshot of the VR environment.

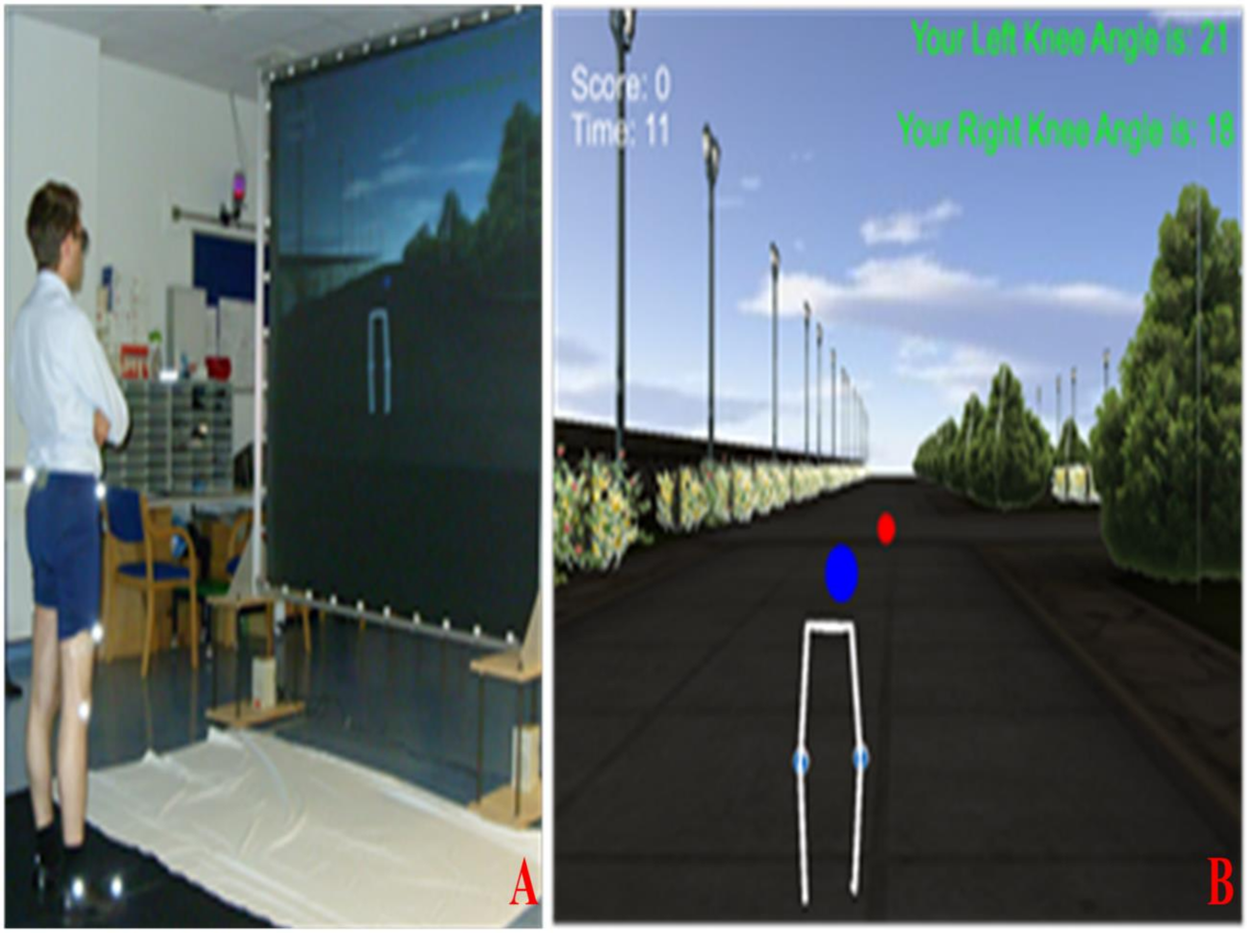
A
Score: 0
Time: 11
Your Left Knee Angle is: 21
Your Right Knee Angle is: 18
B

Figure 2: A clinical engineer trainee using the SVRS to perform the second test of hip and knee flexion exercise. A: during the actual test and B: a screenshot of the VR environment

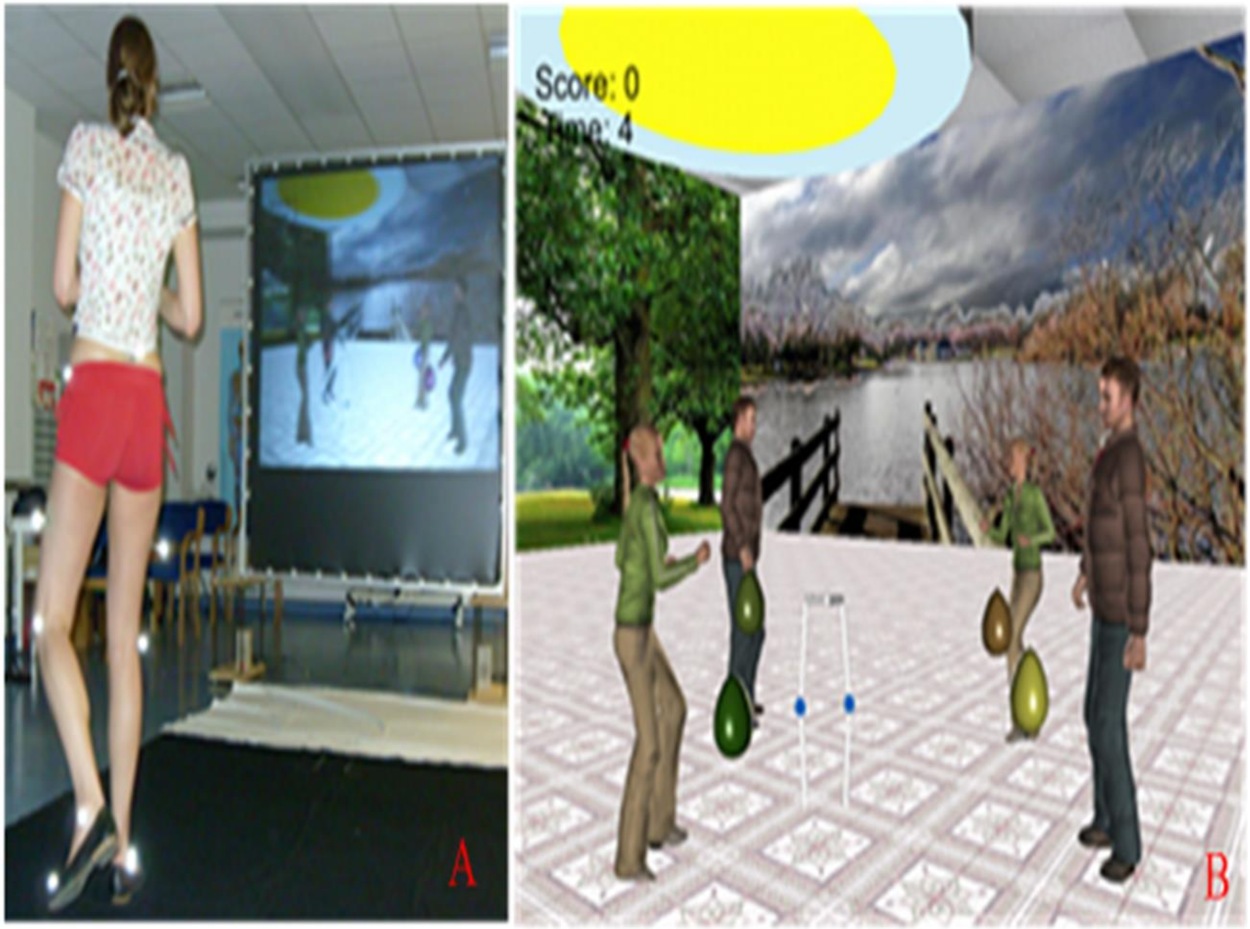
Score: 0
A
B

Figure 3: A clinical engineer trainee using the SVRS to perform the third test (clearing obstacles exercise). A: during the actual test and B: a screenshot of the VR environment.

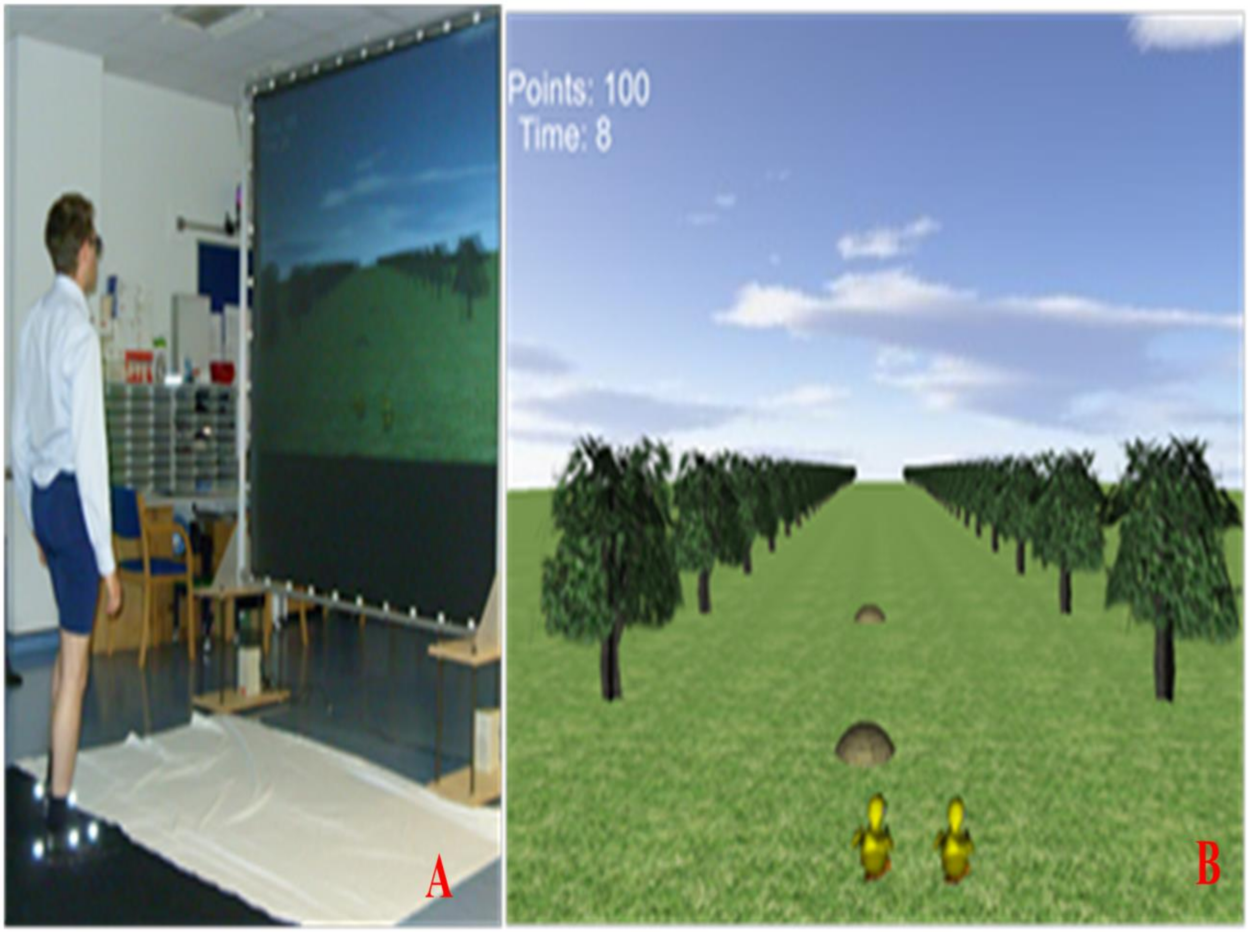
A
Points: 100
Time: 8
B

Table 1

A summary of general information about the participants. A1-A3 refers to able-bodied participants, while C1 and C2 refer to children with CP.

	C1	C2	A1	A2	A3
Age (years)	14	16	42	23	24
Gender	Female	Male	Female	Female	Male
Height (cm)	168	177	180	190	169
Arm length (cm)	60	70	73	80	70
Plays computer games	Yes	Yes	No	Yes	Yes
Receives on-going Rehabilitation	Yes	Yes	N/A	N/A	N/A
Side affected (arm and leg)	Right	Left	N/A	N/A	N/A
GMFCS	I	I	N/A	N/A	N/A
CP type	Hemiplegia	Hemiplegia	N/A	N/A	N/A
Vision deficiency	No	Yes	No	No	No

Table 2

The participants' responses to closed-ended questions relating to the SVRS practicality during test 1. A1-A3 refers to able-bodied participants, while C1 and C2 refer to children with CP.

	Brilliant	Good	Positive	OK	Poor	Awful	Negative
Q1. The ease of controlling the virtual stick-figure was:	A3	A1&A2	3	C1&C2	None	None	0
Q2. I would rate my ability to touch balloons by the virtual knee as:	None	A1,A2&A3	3	C1&C2	None	None	0
Q3. How enjoyable was it to touch balloons with the virtual knee?	A2	C2,A1&A3	4	C1	None	None	0
Q4. I thought my safety when controlling the virtual stick-figure was:	C2 ,A1, A3&A2	C1	5	None	None	None	0
Q5. My overall confidence when controlling the virtual stick-figure was:	A1	C1,C2, A2&A3	5	None	None	None	0

Table 3

Results of participant performance during the first hip and knee flexion-extension exercise. Knee angle refers to a maximum flexion when participants popped a balloon. A1-A3 refers to able-bodied participants, C1 and C2 refer to children with CP, and L and R refer to left and right legs, respectively.

		C1		**C2**		**A1**		**A2**		**A3**	
		L	R	L	R	L	R	L	R	L	R
Knee Angle (degree)	Median	93	81	65	97	73	65	92	92	73	65
	Range	78-103	71-118	55-73	76-107	66-76	54-68	55-95	87-95	72-83	53-69
Time (s)	Median	0.8	1.2	1.2	1.3	1.7	1.5	0.8	1.0	0.8	0.7
	Range	0.3-1.3	0.6-1.9	1.0-1.6	0.9-1.7	1.5-1.9	1.4-3.12	0.7-1.3	0.9-1.5	0.5-1.9	0.4-1.3
Affected		No	Yes	Yes	No	No	No	No	No	No	No

Table 4

The participants' responses to questionnaires relating to the SVRS practicality during test 2. A1-A3 refers to able-bodied participants, while C1 and C2 refer to children with CP.

	Brilliant	**Good**	**Positive**	**OK**	**Poor**	**Awful**	**Negative**
Q6. I would rate my ease in controlling the virtual stick-figure as:	None	A3&A2	2	C2,C1 & A1	None	None	0
Q7. The ease of touching the virtual balloons inside the room was:	None	None	0	C1,C2, A1,A3, & A2	None	None	0
Q8. My enjoyment in touching the virtual balloons inside the room was:	None	C1,C2, A1,A2,&A3	5	None	None	None	0
Q9. I would rate my safety in controlling the virtual stick-figure as:	A3	C1,C2, A2,& A1	5	None	None	None	0
Q10. My overall confidence when controlling the virtual stick-figure was:	None	A3, A1,A2,C1,&C2	5	None	None	None	0

Table 5

Results of participant performance during the second hip and knee flexion-extension exercise. Knee angle refers to a maximum flexion when participants popped a balloon. A1-A3 refers to able-bodied participants, C1 and C2 refer to children with CP, and L and R refer to left and right legs, respectively.

		C1		**C2**		**A1**		**A2**		**A3**	
		L	R	L	R	L	R	L	R	L	R
Knee Angle (degree)	Median	96	91	63	92	79	58	90	85	86	74
	Range	90-106	88-94	63-66	90-122	70-79	57-62	90-95	85-86	67-90	65-74
Time (s)	Median	1.1	1.2	0.7	0.7	1.4	1.6	0.4	0.4	0.2	0.2
	Range	0.9-1.2	1.1-1.5	0.6-0.9	0.6-0.7	1.0-1.5	1.3-1.6	0.3-0.4	0.3-0.4	0.1-0.3	0.2-0.4
Completion Time (s)		15.0		9.0		20.0		8.0		7.0	
Affected		No	Yes	Yes	No	No	No	No	No	No	No

Table 6

The participants' responses to questionnaires relating to the SVRS practicality during test 3. A1-A3 refers to able-bodied participants, while C1 and C2 refer to children with CP.

	Brilliant	**Good**	**Positive**	**OK**	**Poor**	**Awful**	**Negative**
Q11. How easy was it to control the virtual ducks?	A1	C1, C2,A2, & A3	5	None	None	None	0
Q12. My ability to stop collisions between the virtual ducks and the virtual obstacles was:	A1	C1,C2,A2, & A3	5	None	None	None	0
Q13. I would rate my enjoyment in helping the virtual ducks to not collide with the virtual obstacles as:	C2 & A1	C1,A2, & A3	5	None	None	None	0
Q14. I thought my safety when helping the virtual ducks to not collide with the virtual obstacles was:	A1 & A2	C1, C2, & A3	5	None	None	None	0
Q15. My overall confidence when helping the virtual ducks to not collide with the virtual obstacles was:	A1	C1, C2,A2, & A3	5	None	None	None	0

Table 7

Results of participant performance during the third test (clearing obstacles exercise). A1-A3 refers to able-bodied participants, C1 and C2 refer to children with CP, and L and R refer to left and right feet, respectively. (100% refers to the height of the obstacle, which was 250 mm)

		C1		C2		A1		A2		A3	
Highest (% of obstacle height)		L	R	L	R	L	R	L	R	L	R
	Median	177	135	128	188	168	160	164	168	192	168
	Range	81-211	127-166	71-133	140-220	138-180	148-168	152-196	152-196	160-200	128-212
Time (s)	Median	0.6	0.8	0.8	0.6	0.9	0.8	0.9	0.9	0.7	0.7
	Range	0.3-0.8	0.4-1.0	0.7-1.1	0.4-0.9	0.8-2.0	0.7-1.2	0.5-1.4	0.6-1.3	0.5-1.3	0.4-2.0
Touched Obstacles		2	0	4	0	0	0	0	0	0	0
Hemiplegic side		No	Yes	Yes	No	Not Applicable					