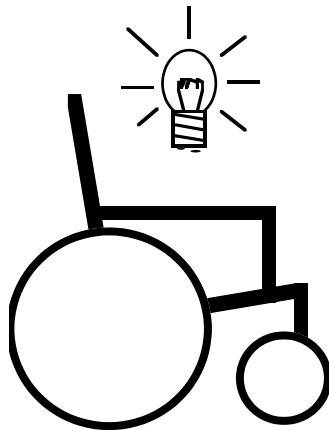


# Smart Wheelchair



## Playbook - first games with the Smart Wheelchair

Version 1.5





## ABOUT THIS BOOK

This booklet was originally created in 1993 for a research project which evaluated twelve Smart Wheelchairs in three Edinburgh schools. The chairs then were not as smart as the one you have just purchased: there was no line follower or scanner, no programming switch, and a very limited set of bump tools.

We have not yet had time to create a new up-to-date version of the Playbook that includes ideas and activities for the new Tools which are available on your chair. When we do, we will send you a copy.

If there is anything you'd like to see covered in the new Playbook, or any activities which you have found work well, we would be pleased to hear from you.

Also, if you have devised your own new activities we would be very keen to put them in the Playbook.

At the back of this booklet are certificates for you to award when the pilot reaches particular milestones - for example, the first 'solo' drive; the first successful drive from one room to another; the first drive with two/three/four switches, etc.

There is also a sample diary sheet for you to use to record what happens in each Smart Wheelchair session so that you have a record of progress.

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# Contents

<b>Contents</b>	<b>5</b>
<b>Introduction</b>	<b>7</b>
<b>First Stages</b>	<b>8</b>
Activities	
Observing the child	
Judging the results	
A note on our suggestions	
<b>Activities</b>	<b>11</b>
<b>Activity 1: Introducing the chair Assessing motivation</b>	<b>11</b>
Activity 1.1	11
Activity 1.2	12
Activity 1.3	13
Activity 1.4	13
Activity 1.5	14
Observing, and judging the results	14
<b>Activity 2: Going Solo</b>	<b>15</b>
<b>Assessing confidence, initiation, control abilities</b>	
Aims	15
Setting up	15
Action	15
Activity 2.1	16
Observing	16
Judging the results	17
Activity 2.2	17
Activity 2.3	18
Activity 2.4	18
Activity 2.5	18
Activity 2.6	19
Activity 2.7	19
<b>Activity 3: Skittles</b>	<b>20</b>
<b>Introducing the bump and stop tool</b>	
<b>Assessing intentionality, use of controls, and attention</b>	
Aims	20
Activity 3.1	20
Activity 3.2	21
Activity 3.3	21
Observing	21
Judging the results	22
Activity 3.4	22

<b>Activity 4: Multi - skittles:</b>	<b>23</b>
<b>Introducing Bump &amp; Turn tools, and simple steering</b>	
<b>Assessing controls, and attention to more complex sequences</b>	
<b>of activities</b>	
Aims	23
Activity 4.1	23
Observing	24
Judging the results	24
Activity 4.2	25
<b>What Next?</b>	<b>27</b>
<b>Adapted Games for use with the Smart Wheelchair</b>	<b>29</b>
1 Leaping Frog	29
1a Stepping stones	29
2 Colour Selection	30
3 Statues	30
4 Pirates and Brigands	30
5 Man the Ship	31
6 Tangle	31
7 Mill and Grab	31
8 Push the Ball	31
9 Build a House	32
10 Change Places	32
11 Treasure Relay	32
12 Train Game	33
13 Hanging out the Washing line	33
14 Listening	33
<b>Treasure Hunts</b>	<b>34</b>
15 Animal Hunt	34
16 Go and Find	34
17 Paper Chase	35
18 Story Time	35
19 Moving Monster	35
20 Traffic Lights	35
21 Crossing the Road	36
22 Highway Patrol	36
<b>Operating Limits and Safety Notes</b>	<b>37</b>
<b>Sample Certificates</b>	<b>38</b>
<b>Sample Activity Log</b>	<b>40</b>

# Introduction

We built the Smart Wheelchairs to provide people (especially children) with many new ways to explore and learn. The chair allows physical exploration where it might not otherwise be possible, by acting as a collaborative partner in the job of controlling powered mobility.

The chair can be used for many things but we divide them into three broad areas: mobility, communication and learning.

## **Mobility**

The Smart Wheelchair can offer some degree of independent mobility to almost anyone, regardless of their physical difficulties. It can also be used as a mobility training aid, to develop new driving skills (See *'Smart ' Wheelchairs Mobility Training*, included in this pack).

Many things can be altered to meet the developing needs of the child. The maximum speed of the chair can be limited, as can the distance it moves for any control demand. Collisions can be dealt with in many ways, or avoided altogether using the line follower. The driver can have full control, or only be in charge of a limited number of wheelchair movements. Their control can be any combination of switches, joysticks, scanner, communication aid or external computer.

## **Communication**

It also encourages the user to communicate, both directly and indirectly. Direct communication involves allowing the chair to speak to the child; the ability to link augmentative communication aids to the chair; and ways of letting the child use the wheelchair controls to link to external word processors, computer-based learning packages, and all the other interactive curriculum enhancers which computer systems allow. Indirectly, communication opportunities increase with increased autonomy of movement, and so do the range of things to talk about.

## **Learning**

Being mobile offers new opportunities for learning. The Smart Wheelchair can be used to create lots of different and exciting learning experiences for children. For example, basic cause and effect can be explored by using the chair and a set of simple controls; short-term memory and problem solving can be assessed and developed by creating and travelling over set routes; distance and number work could be tackled by setting the chair to 'Timed' control and estimating and measuring the school in terms of smart wheelchair 'steps'.

You can see from this brief description that the chair is much more powerful than as just an aid to mobility. Nonetheless, for most children, learning to use the chair to get about will be the doorway to

broader uses. We believe that mobility is a powerful motivator, and that we can capitalise on this to encourage the child to develop control skills, and encourage exploration and play.

This booklet makes some suggestions for activities which will both help children to develop a new range of skills, and will let us monitor their progress. These first activities are concerned with introducing the wheelchair, setting up the best working environment, and training the child in to use that setup. Each activity is presented in three sections: the first sets out the aims and goals, the second suggests things to look for during the action, while the third tackles interpreting the results. The suggestions below aren't exhaustive or definitive: we want to extend the Playbook as time goes on, and we value your ideas and comments.

## **First Stages**

### **Activities**

Our initial aims will usually be to build up motivation, and work on the control skills the child will need later. To do this, we'll try to:

- present the chair as a fun activity
- give the child a sense of power and control
- introduce the idea that the chair can be changed to do different things

It is vital to avoid the child becoming afraid, or passive. This means choosing activities which are non-threatening, and in which the child is the controller (even if this means them initially working through another person).

### **Observing the child**

Meanwhile, we will be using these activities to

- assess and refine the seating and positioning arrangements
- make some initial judgments of the child's abilities in this new setting, and in particular
  - their ability to handle the control systems,
  - the degree of self - determination and initiation
  - motivation, and special interests and dislikes refining the system and activities accordingly

### **Judging the results**

We will consider that the aims of the first stage will have been met when:

- we are sure that a control system has been chosen which makes best use of the child's abilities, and offers most opportunities for future development (in particular, avoids locking us out of making future use of skills which are latent, or underdeveloped)
- the child can, using this control system, make appropriate choices for what he or she wants to do, and execute those intentions effectively

What this means will differ with different children. In some cases the child might not, at the end of the phase, be able to use more than one switch. In others, they may be able to use a modified, full joystick. This is not a difficulty: both can move on to broader curricular activities. It merely means that there needs to be less modification of the wheelchair itself in the case of the second child. What matters is the development of their keenness to use the chair to do new things, and their ability to control it effectively using their current abilities.

### ***A note on our suggestions***

*Working on the assumption that you will not have used the Smart Wheelchair before, we have described the early activities in some detail. You will probably find it helpful to refer to the User*

*Handbook whilst you are working through the introductory activities. Later on, when you are comfortable with the system and the thinking behind it, we'll be much terser.*

# Activities

## Activity 1: Introducing the chair Assessing motivation

It is worth spending a fair amount of time in introducing the chair to the child. Remember your first driving lesson? It was probably terrifying. For all sorts of similar reasons, the Smart Wheelchair will be frightening to young children. If you can recall your own fears, you'll help them to deal with theirs.

- The car was BIG - you couldn't imagine subduing that much power. It was metal, and could crush people: it could damage you, too, if you got things very wrong. Someone helped by showing you that it could be geared to go slowly, that there were three ways of stopping it, and that no-one wanted you to go at top speed immediately, or park in small gaps on day one.

*Reassure the child of these things. Show them (WITH THE CHILD OUTSIDE THE CHAIR) that it can go slowly, stops when told to, and stops when it hits things. Take your time. Get them to tell you when the chair is to go, and to stop. Begin the process of empowerment here, in safety.*

### Activity 1.1

Aim: To introduce the Smart Wheelchair to the child

- a) Introduce the chair with both you and the child on the outside, using momentary mode with the joystick, move the chair backwards and forwards in front of you. Encourage him to tell you to go and to stop.
- b) Sit in the chair with the child watching you. Drive around in it in the momentary mode using the joystick. You can drive with the wheelchair Observer on or off. If the latter, tell the child what the chair is doing and what you see.
  - It was expensive, and complicated. What could you damage if you hit the wrong lever? What were all the knobs, dials and pedals for?

*What helped you then will also help the child. You found out that you didn't need to know everything, all at once: you could build up your skills over time. Show the child (again, with them as a outside observer) that something useful can be done with just one switch action. Again, negotiate with the child about when things should happen.*

## Activity 1.2

Aim: To give the child limited control of the chair with you driving it

- a) Sit in the chair. Play a game, telling the child that he is a policeman who can control the traffic. Give him a policeman's hat, if available and sing a song. The child vocalises and lifts an arm at the appropriate part of the song. If the child does not indicate to you to stop, then keep the chair moving until he does. Tell him, "I'm going to bump into something" etc.
- b) Sit in the chair. Play a game, telling the child that he is a mechanic in the pit of a race track. You are driving the racing car which requires frequent pit stops. As the mechanic, the child has to call you in for pit stops. You drive round the room, waiting for the child to shout to you to drive up beside him. Once there, a 'pretend' check of the chair is the pit stop.
- c) Sit in the chair using the joystick with the timed mode selected. Play a game of 'Tell me where to go now'. After each timed move of the chair, give the child choices between 'this way' and 'that way' using gesture to demonstrate, also forwards and backwards so that he can tell you, gesture or whatever which way to go.

- When you started to drive, a lot of things were happening at once. How could you tell what was going on?

*Part of the support you got was from a driving instructor, who told you what was happening, and helped you sort out what was important (that roundabout) from what was not (that funny clicking noise). S/he took over when the going got rough, and kept constant watch.*

*Introduce the child to the wheelchair Observer: this, too, gives helpful feedback. Do this by letting them listen to the 'Moving...' and 'Stopping...' messages from the speech synthesiser. Show that the chair itself can sense when it is in difficulties: let the child see it deal with a collision (but again, from the outside).*

- Whilst driving certainly wasn't the same experience as sitting in the passenger seat, it helped to have done so. It was good to have someone else in charge, and you could see a little of what was expected of you. This experience can't be got from the outside of a vehicle, though.

*To reassure children, (particularly younger and more timid children) try the two seat ride. Sit with the child in your lap, and one very big button, (or a joystick if you think the child can cope with the notion of direction - but don't hurry this). Ride together, and talk. Emphasise the button/go idea, and build confidence in the chair's stop mechanism.*

### Activity 1.3

Aim: To let the child ride in the chair, reassured by the company of an adult

Sit the child on your knee, or on the seat beside you. Using the joystick on timed mode, stimulate his interest and involvement in the activity.

- a) Place a selection of musical instruments around the room, talking to the child throughout the activity. Drive to each instrument, allowing him to play the instrument - ask if he's had enough of the instrument, and if so, does he want to move to something else?
- b) Place a selection of instruments around the room. Move the chair, asking the child to shout when he sees an instrument he'd like to play. Move the chair to the instrument, and let him play it.
- c) Investigate the room, naming a variety of objects around the room that the child might want to look at. Encourage the child to tell you which he'd like to go and look at, and move the chair over to where that object is - again active participation is encouraged.
- d) Place a selection of toys around the room, talking to the child throughout the activity. Drive to each toy, allowing him to play the it - ask if he's had enough of the toy, and if so, does he want to move to something else?
- e) Place a selection of toys around the room. Move the chair, asking the child to shout when he sees an toy he'd like to play with. Move the chair to the toy, and let him play with it.
- f) Sit in the chair. Play a game of stop and go. The child has to tell you what to do in the chair, whether to go or to stop; you must respond to his commands.
- g) Investigate the room with the child. Encourage him to tell you where he'd like to go and move the chair over to wherever he wanted.

### Activity 1.4

Aim: To encourage the child to have some control of the chair by vocalising while sitting in it with an adult

Set the chair to timed and use the child's own switch. Encourage the child to vocalise in order to make the chair move ie. you use his switch when he vocalises. When the timed sequence is finished, encourage him to vocalise again in order to make the chair move such as, "Giddy up, chair!" or, "Come on chair, move!" We're aiming here to have the child will take vocal command over the chair. Try leaving a time lapse between the chair drawing to a halt and your prompting the child to shout to see if he might vocalise without the prompt.

## **Activity 1.5**

Aim: To let the child have control of the chair while sitting in it with an adult

Set the chair to timed, letting the child use his own switch. The adult, encourages the child to move the chair across the room in order to get to a toy etc. by activating the switch himself. We're aiming here to make the child feel at ease with taking command of the chair.

### **Observing, and Judging the results**

At this stage, you will be looking for signs of interest, fear, engagement, and appropriate communication. (If you can, have a video camera running.) Excitement tinged with a little fear is a fine basis for the next step. If you get lots of keen interest, move straight onto Going Solo (Activity 2).

## Activity 2: Going Solo

### Assessing confidence, initiation, control abilities

This is a critical phase for the child. It may take only a moment, or a lot longer, depending on how nervous he or she is.

#### Aims

The child will see the exercise as mastering a new set of experiences: of being put into the chair, starting it, seeing that it stops as advertised, and being taken out. This will be their first taste of this kind of power, and it should be a positive experience. They ought to emerge knowing that it doesn't hurt, that it can be enjoyable, and that it is probably worth learning more about. A bonus might be the understanding (however vague) that the chair can be changed to suit their needs

The aims for the team are to see that seating and switching set-ups are as intended, and to get a first impression of the child's control skills, interest, and confidence, to introduce the first *motion tools* of the chair.

#### Setting up

Have everything ready before the child arrives. There will be enough tedious delay for them during the first fitting and setup, without them having to endure the adults suddenly rushing off to find screwdrivers or straps. Try to keep the crowds down. Imagine your first driving lesson, then try to visualise what it would be like surrounded by mechanics and family well-wishers. Two people would be about right, with one well in the background.

Put the chair in the centre of the largest open space you can find, so that the child can see that no collisions will take place. If you can manage it, have a camera to hand.

Choose an appropriate switch: preferably one which the child already knows from other activities.

Tell the child that this time, the chair will go when they operate their switch, but only for a short way, then it will stop. Stress that they shouldn't worry about bumping into things-the chair will stop in plenty of time. Remind them of what they saw in the first sessions. Assure them that you can always turn the chair off if problems arise.

Set the chair to:	<i>bump tools</i>	-	'Bump and Stop'
	<i>motion tools</i>	-	<i>timed</i> position
	single 'Go' switch	-	forward socket.

Set both the *speed* and *time* controls to be fairly low. (The User Handbook will help you with details).

Tell the child what you are doing. Show them the controls, the motors, and all the other bits of magic which they otherwise don't see. The object is for them, over time, to come to recognise that the chair is just a machine. Start the process of demystifying right away. If you feel that the child might have too much to deal with all at once, turn off the speech synthesiser.

Put the child in the chair, and again describe what you are doing. Set up the switch.

## **Action**

We want to seed the idea that the rider will eventually be in full control, even though at the moment, they can't be.

## **Activity 2.1**

Aim: To have the child operate the chair from the driving seat

Negotiate with the child which direction they want to go, and point the chair that way. Then stand in the path of the chair, to encourage the child to look where she or he will be going. Encourage the child to operate the switch, and be prepared to wait until they do. When it happens, take a photograph. Give lots of verbal encouragement. In particular, say that they are now nearer the target they identified, and ask if would they like to go nearer still? In this way, relate the switch action not only to the sense of motion of the chair, but to their negotiated goal. If they are nervous, suggest turning the chair into a larger space.

## **Observing**

If their switch control is even moderately effective, try again, until the child is relaxed with what happens. Stop immediately the child looks bored, and tell them about the next activity.

If the child cannot control the switch, don't try to fix it on the spot. Instead, note the problem, tell the child that you'll find a better switch, and offer to operate the switch for them, on their say-so. The idea is for them still to get some feel for how the chair feels. Get the second person to stand ahead as the marker. When the child indicates to go, both you and the child operate the switch. Again, give verbal feedback.

The child might do nothing at all. If so you need to know why before you take the next step. If the child acts fearful, then you may want to go back a stage, and ride with them for while longer, but with the child operating the controls. Or you may want to negotiate 'just one try', if you feel that their fears can be turned round this way. In all cases, make it clear that the child is in charge: if the answer is 'no', then don't force the issue.

On the other hand, the child may not be engaged because they either don't see what is wanted of them, or don't see what the payoff might be. In this case, you should talk them through a few moves, with both of you operating the switch. Don't go on too long with a passive child, though: move to the next activity, which might have more meaning for them.

Give the photograph to the child, as a Going Chair Solo Certificate. (You'll find a template at the back of the Playbook). Talk about the next game.

## Judging the results

At this stage, it might be hard to know what will motivate the child. They, in turn, don't know if the chair is going to be fun. This is why we have suggested going for a mix of intrinsic motivation (coming from power over the chair), and extrinsic motivation (from your verbal encouragement and the photographic record). Later, we want to wash out the extrinsic motivation in favour of what the child gets from the chair itself.

Switch control is also hard to judge just yet. It may be that even a child who apparently has severe control problems will eventually become very competent, once they see the value of trying. Hence, we suggest not rushing in too quickly with changes which compensate for failure, but rather of making small changes, and between sessions.

What if a child manages a switch well? Again, don't be too hasty in increasing the number of controls. If the child is timid, then let them build up a sense of achievement before moving on.

Careful choice of motion tool will help you understand the child's control skills. For example, choosing the *timed* tool means that the child has to release and reselect, in order to keep moving. This helps the child who would otherwise crash the chair by 'locking on' to the switch. Choosing the *momentary* tool lets you explore to what degree a child can release at will, by setting finer and finer distance targets. *Momentary* switching also makes clear to the child the disadvantages of repetitious hitting of the switch: kangaroo motion is all they will get.

During all these explorations, you should be making it clear to the child that the object is to find their personal best strategy: they should be left with the impression that the chair can be adapted to meet their needs, rather than that they have to meet a set of performance criteria before they can continue.

Games to help further work with these aims (fuller versions in appendix 1):

### Activity 2.2

#### a) Leaping Frog Game

This game is best played with an adult alongside. All participants are frogs who want to get from the middle of the pond to dry land. The frogs don't want to go into the water, because it's too cold today, so they must get to land by hopping from leaf to leaf.

The room is set out with paper lily leaves taped to the floor in a straight line distanced according to the distance set by the **Timed** modality of the chair. The child will therefore cover the distance between lilies with one hit of the switch. To move over two lilies, he must hit the switch twice.

Negotiate with the child how many leaves he wants to move in one turn: say he chooses 2, he moves over the distance of 2 lily leaves, the adult then makes the same number of moves

b) The game can be adapted by replacing the lilies with paper stepping stones to be called the Stepping stone game.

### **Activity 2.3**

#### Colour Selection

The room is set up with four large coloured 'doorways' down the length of the room. The adult has four pieces of paper, matching the four doorways. The child chooses a colour and moves his chair in order to steer to the same colour of doorway. Some negotiation would help him to be able to drive through the doorway. Behind that particular doorway there might lie a sweet, or story book or toy.

### **Activity 2.4**

#### Statues

Chair user plays the game along with an adult. The child sits at one end of the room. The 'catcher' stands at the other and turns his back to the child. He recites a rhyme (try to catch me, it can be done. If I see you you'll turn to stone), during which the other child advances as far as he can. By the end of the rhyme he must be very still. The catcher tries to catch him moving.

### **Activity 2.5**

#### Pirates and Brigands

Chair Setting	Timed
User	One or multi-switch user
No. of children	Group of children

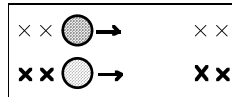
The children are divided up into two teams. The teams are lined up, approximately three metres apart, facing each other. The person in charge instructs one team to move ie., "Pirates move 2 paces forward, Brigands, move 3 paces back." Generally attempting to move the groups closer together. Once the two groups are within touching distance of each other, the person in charge shouts, "Pirates (or Brigands) attack!". The Pirates then reach out attempting to touch the Brigands. Those touched (caught) become Pirates.

- a) One switch user moves forwards only, and therefore must reach out to touch his opponent at the appropriate time.
- b) A multi switch user can have the game adapted so that he can move forwards, backwards, and can attempt to run away from whoever is 'attacking'.
- c) Timed - the child moves the number of paces instructed by the person in charge, the timed distance being equivalent to one pace.

## Activity 2.6

### Push the Ball

The group is divided in two, and each team divided into two. One half of each team sit at one end of the room, and the other half sit facing them at the opposite side of the room. Each team is given a large ball. The child uses his chair to push the ball over a short distance with to his team mate who then pushes the ball back across the room etc. until all the children in the team have done it. The first team to complete the task are the winners.



## Activity 2.7

### Change Places

Children sit in a circle. Their names are put into a hat, and drawn out two at a time. On their name being called out, two children change places in the circle. The Child uses his wheelchair to move to another part of the circle.

**If you feel that the child needs to feel safe when encountering objects, move on to Section 3, Bump and Stop. If the child is quite happy and confident in the chair, progress on to Section 4, Bump and Turn.**

### Activity 3: Skittles

#### Introducing the bump and stop tool

#### Assessing intentionality, use of controls, and attention

The idea that something as mechanical and utilitarian as a wheelchair can make decisions is a complicated one. Nevertheless, if the child is to view the chair as a collaborative partner, it is important to introduce the thought early, through practical experiences. The previous activities have shown the child that they can control the chair through *motion tools*. Now we will let them discover one of the *bump tools*, and use it to build their confidence up.

#### Aims

Again, there is a difference between our view of what is going on, and what the child is engaged in.

The child will be aiming to ‘win’ at a very simplified game of skittles. To do this, s/he will have to drive the chair into a large pile of objects, and knock them over. No steering is needed for this game, but there can and should be negotiation between the child and the adult about ‘aiming’ the chair in the first place. This game gets harder as time goes on, because we move further back from the target: the child and adult have to get better at aiming, and the child has more work to do to make the chair run up to the target.

Our aims are to refine our assessment of the child's attention, control skills and motivation, and to introduce the idea that the chair can be fun.

**NB.** When using Bump and Stop the chair will not move forward after a bump. There are therefore limitations to using bump and stop with single switch users: it requires adult intervention to reset, reverse and move the chair. To avoid the child becoming frustrated, the activities in this section are best used on a once only basis moving quickly onto Section 4, Bump and Turn.

#### Activity 3.1

Aim: To introduce the ‘Bump and Stop’ tool to the child

Into a wide open space stack a tall pile of objects (at least at eye level with the child), polystyrene packing block would be fine. The bottom one should be reasonably heavy (so that the bumpers will work when they hit it). The ones above should be very light (so that no one is hurt when they fall - especially the child). Stack the pile precariously, so that any jarring knocks it down. In this kind of game, success is somewhat marred by the skittle stubbornly staying upright after a good clout.

If the child is already showing good control, set the *motion tool* to momentary. Otherwise, stick with timed. Make the time fairly small, so that a fair amount of effort is needed. Set the *Bump* tool to ‘Bump and Stop’. This time, turn on the speech synthesiser.

Introduce the game to the child by walking into the pile, showing them that it can be knocked over (and stress that the blocks are light, and didn't hurt you). Tell him that his job is to do the same, but that you will make it easy to start with: put him right in front of the blocks and encourage him to knock them over. Point out that the chair has stopped for him when it hit the skittle. If he successfully achieves this, go on to the next task.

### **Activity 3.2**

Aim: To use the 'Bump and Stop' tool making the task a little harder

Pull the chair back a little, and turn it away from the blocks (turn them such that to see their target, they have to make some effort to overcome any motor difficulties they may have which tend to rotate them the other way). Now negotiate how they want to be aimed before they operate the switch, and inch the chair round until they indicate that they are where they want to be. During this aiming period, they should discover that pressing 'go' too soon doesn't have the desired effect.

Now say you will make this harder: pull the chair back further, and repeat the game. If possible, encourage them to get you to adjust the aim if it is wrong. Again, stress that the chair has stopped when the object has been hit.

Introducing the bump tool this way is less threatening than simply letting the child run into a wall. However, the object is to ensure that the child knows that the chair will stop whatever it is run into, including humans. However, although you should be talking about it, avoid using a person as a target just yet - see Jo Douglas and Martina Ryan's paper<sup>1</sup> for a discussion on children's ideas about pain. There are plenty of other opportunities within the activity for the child to disobey.

### **Activity 3.3**

A useful variation is 'Goodies and Baddies'. One of a pair of masks (say, Batman and the Joker) is put onto the pile of objects forming the skittle: the mask is then covered with a cloth. The object is to knock over only the bad person. As the child and chair are moving toward the pile, the mask is uncovered. The child has to observe, make a choice, and act appropriately. (Beware of misinterpretation of the results though - some of us really like the Joker)

### **Observing**

- Watch for when the switches are closed: is the action controlled?
- Does the child stop appropriately? Should the control strategy be changed?
- Does the child get enjoyment out of the game? Was he bored, or afraid, or indifferent? Would

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<sup>1</sup> Douglas and Ryan, 1987, 'A preschool severely disabled boy and his powered wheelchair: a case study'. in 'Child Care, health and development', **13**, 303 - 309

there be any advantage in introducing other children into the game?

- Did he make choices? Were they appropriate? How effective was his or her communication?
- What attention was the child paying to the task? What was the child looking at?

### **Judging the results**

You might begin to get a better picture from this game of whether the wheelchair motivates the child or not. If so, fine - the more effort they put into controlling the wheelchair, the more information is available about how to refine the system to meet their needs.

However, if the child didn't respond, it might be worth considering something less boisterous. For timid children, it is even more important that they are aware that they have control over the chair, and that it will help to avoid accidents by stopping at an object.

### **Activity 3.4**

Aims: To encourage the more timid child to use the 'Bump and Stop' tool

Set up an alternative straight line game, called 'Waiting in a queue'. Form a queue of three people, heading for a counter. Put something on the counter which the child likes a lot. Have the child at the back of the queue. The game is simple: when a person gets served, the queue moves up a step. Encourage the child to discover that the chair will stop and start under their control, but that if they slip up, and hit the person in front, or the counter, the chair will help. There is less violence, with the reward of the object on the counter used instead of the skittle - fall: the safe involvement of other people might help reassure the child.

Again, use the effects of the *motion tools* to get better insights into the control skills of the child.

**Activity 4: Multi - skittles:  
Introducing Bump & Turn tools, and simple steering  
Assessing controls, and attention to more complex  
sequences of activities**

**Aims**

Up to now, there has been no opportunity for the rider to be completely in charge, because of the lack of steering. This next activity both allows complete autonomy (at least during the game), and introduces the *bump and turn* tool.

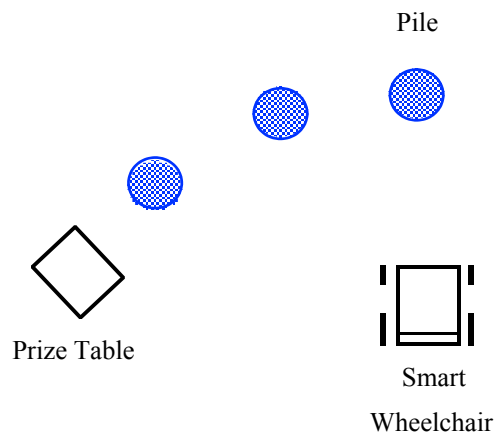
The child's aim will be to win at an extended version of the Skittle game, by knocking down a number of skittles and then stopping.

Our aims are to introduce the new tools, and to observe whether the child can make appropriate use of them in a situation which demands attention and choice. To 'win' at the game below, the child will, as well as being able to operate his or her controls, have to concentrate on his or her surroundings, and make correct decisions about when to stop and go. We also continue to monitor their use of the chosen controls.

**Activity 4.1**

In the same space as before, set up two more piles, and a low, heavy table. Arrange them as shown below. The idea is that after hitting the first pile, the bump and turn tool will back off and rotate the chair so that it aims at the next; then the next; and finally the table. (Some experimentation is going to be needed to get the angles right). On the table, put the Prize: this can be anything you like, but should be arranged so that if the table is bumped, the Prize falls over.

As with earlier tasks, encourage useful head movement by laying out the set of piles so that the child has to make an effort to turn to see them. This will not only help the child, but it will give more observational clues as to intent.



Again, if the child is by now showing good control, set the *motion tool* to momentary. Otherwise, stick with timed. Make the time fairly small, so that a fair amount of effort is needed. Set the *Bump* tool to 'Bump and Turn', and turn on the speech synthesiser.

Introduce the rules of the game. Tell the child that the skittles have each to be knocked over as before, whereupon the child gets the Prize. However, the Prize is only won if it isn't knocked over!

Tell him that instead of the adult turning the child, the wheelchair will help. Aim the child and chair at the first pile, and stand in their line of vision, so that they are aware that no - one else is steering the chair. Encourage the child to knock over the first pile, and talk through what happens next. Get them to concentrate on the chair's comments, and the direction they are turning in. Help them with the sequence, and especially with the final task, which is not to run down the table.

Now try it again, but this time with less prompting. If the child succeeds, hand over the Prize.

### **Observing**

- Did the child attend to the task? Was s/he making appropriate choices? Was the experience enjoyable? For the Prize, or for the ride itself?
- After a while, did the child anticipate the turn by looking in the appropriate direction?
- How was their control ability affected by having to concentrate on the choices?

### **Judging the results**

This activity marks the beginning of building steering skills, and with them, the ability to pay attention, anticipate, and make choices. If the child enjoyed this activity, and was even moderately good at it, then the time is ripe for some free exploration mixed in with the games.

If not, what are the problems? If they are due to timidity, then you should consider using other tools than collision detectors: a really nervous child might be much happier knowing that the chair will slow down and stop before an object is actually hit.

Is the child able to deal with the task complexity? If not, stay with the simpler activities, but mix in a some semi - free exploration. You could do this by, say, going for a walk with an adult helper: the child determines forward motion, and both negotiate direction.

Can the child see what is happening? Are you sure that both sight and visual perception are up to the task?

Are the problems still to do with control? If so, choose the most enjoyable of the activities (i.e. the one which gives you most time on task to try out changes), and investigate other input devices and motion tools. The ones currently on the chair are not exhaustive: talk to the engineers if you think that other controls might help.

## **Activity 4.2**

Another similar activity is a simplified 'Hide and Seek'. This also requires observation and problem solving skills and introduces steering ideas. Set the piles up as before, but without the Prize table. Tell the child that you will be hiding a favourite toy (or, if you can get broad enough piles, a human) behind one of the piles. The child has to knock over the piles to seek the hidden partner.



## What next?

The 'first stage' activities above should lay the foundations for further work. We suggest that once the child has mastered these simple controls, he should be encouraged to roam freely in a good - sized space, both to give him a sense of mastery and freedom, and to allow you to observe how effectively he explores and the degree of motivation to use the chair.

We aim to extend these booklets to include:

- Further work on mobility, aiming to:
  - introduce steering
  - introduce reversing
  - develop finer control, or coping strategies, or both
  - improve planning skills
  - encourage exploration

All of this involves improving the chair/child collaborative partnership by:

refining the input device,  
improving feedback  
introducing other user and chair tools.

- For some children, extended work on communication skills. This might take the form of setting up communication - rich settings for unaided communication, or it may lead to integrating communication aids into the wheelchair system.
- Activities designed to encourage learning in a broader curriculum. As with the aims for communication , the chair can act as a facilitator (say, in getting children into rich learning settings with their peers), or it can be the basis for specific work (say, in maths, using Logo - like approaches)

All of the above depend on continued development of switching and control skills, and maintaining interest and motivation through fostering successful and enjoyable play and learning.

The next steps in investigation of control skills will probably be chosen from:

- Further one switch games
- Two switch games, introducing choice of direction
- Either:

Multiple switch systems leading to control of direction, or

Activities to explore and develop scanning

One switch scanning

Two switch scanning

Depending on the child, the activities themselves which support these developments will be extended beyond direct use of the Smart Wheelchair for mobility, to include:

- Using the wheelchair with a communication aid
- Using the wheelchair with other computers
- Logo and the wheelchair

### **What kind of activities will work best?**

Here are the principles that we keep in mind when we are planning activities.

Firstly, we believe that empowerment motivates. So we aim to put the child in charge wherever possible, and to suggest activities which give the child maximum opportunities for self - determination, and thereby gives us the best chance of observing the development of exploratory and problem - solving skills. This in turn means not seeing the wheelchair as a shared resource, but rather one which is morally owned by the child, and available as much as possible.

Secondly, it is clear that if children are well motivated by success with mobility aspects of the chair, rich communication possibilities will result, as well as broader curricular opportunities. We therefore try to develop activities which consciously try to draw these areas together, enabling us to look for broad developments rather than narrow ones.

We also believe that many skills are transferable between communication, mobility, and general educational tasks, and that by carefully setting up activities which bring these regularities to the surface, we can encourage the child to recognise these and benefit accordingly.

# **ADAPTED GAMES FOR USE WITH THE SMART WHEELCHAIR**

## **1 Leaping Frog**

### **Setting**

You are a frog who wants to get from the middle of the pond to dry land. You don't want to go into the water, because it's too cold today, so you must get to land by hopping from leaf to leaf.

Chair Setting	Timed/Momentary/Latched
User	One switch user
No. Of children	Any number
Other Equipment	Pointer board, with numbers 1&2 / pictures of lily leaves

The room is set out with paper lily leaves taped to the floor. The controller of the game spins ( or child themselves with switch attachment to pointer board) the pointer, indicating to the child to move 1 or 2 lily leaves nearer the land. The child moves his chair for the appropriate number of moves.

The winner is the first child to reach dry land.

- Initially begin the game with the stepping stones in a straight line
- Timed - the lily leaves are distanced according to the distance set by the timed modality of the chair. The child will therefore cover the distance between lilies with one hit of the switch. To move over two lilies, he must hit the switch twice
- Momentary - the child must judge the distance between lily leaves himself, and move over the number of leaves accordingly
- Latched - the child again must judge the distance between lily leaves and use the switch accordingly
- Steering can be introduced by moving the lily leaves off the straight

### **1a Stepping stones**

The previous game can be adapted by replacing the lilies with paper stepping stones.

## **2 Colour Selection**

Chair Setting	Timed/Momentary/Latched
User	One switch or multi-switch
No. of children	One or more

The room is set up with four doorways at the bottom of it. The child is shown a colour. He moves his chair in order to be able to go through the same colour of doorway. Behind that particular doorway there might lie a sweet, or story book or toy.

## **3 Statues**

Chair Setting	Timed/Momentary
User	One or Multi switch user
No. of Children	Any number

a) Chair user plays game along with other children

The group of children stand at one end of the room. The 'catcher' stands at the other. He turns his back to the group of children. He recites a rhyme, during which the other children advance as far as they can. By the end of the rhyme they must be standing very still. The catcher tries to catch anyone moving.

b) Chair user as catcher

This time the chair user is the catcher. He recites his rhyme, and uses the switch to turn himself around to catch anyone moving.

## **4 Pirates and Brigands**

Chair Setting	Timed/ Momentary/ Latched
User	One or multi-switch user
No. of children	Group of children

- One switch user moves forwards only, and therefore must reach out to touch his opponent at the appropriate time.
- A multi switch user can have the game adapted so that he can move forwards, backwards, and can attempt to run away from whoever is 'attacking'.
- Timed - the child moves the number of paces instructed by the person in charge, the timed distance being equivalent to one pace.
- Latched/ Momentary - the child can move in what is considered to be one pace.

## **5 Man the Ship**

Chair setting	Timed/ Momentary/ Latched
User	3-directions, or joystick
No. of Children	Any number

Form a single line down the centre of the room.

The leader shouts:

‘Starboard’ - everyone moves right.

‘Port’ - everyone runs left.

‘Man the Ship’ means back to the centre.

‘Choppy seas’ - move in a circle

‘Cook’s coming’ - say ‘Yum-yum’ (AAC)

‘Form twos (3’s, 4’s etc.) in lifeboat’ - form a group of that number

## **6 Tangle**

Chair setting	timed, momentary, latched
User	joystick, 3-directional switch user
No. of children	any (well- controlled)

The group links up in some way, with the wheelchair user as the leader. The second person holds onto the back of the wheelchair. The first person leads the chain through itself, under arms etc. taking care not to drive over anyone’s toes! Tangle ends when the group of too tightly packed to move. One person then untangles the group.

## **7 Mill and Grab**

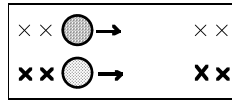
Chair setting	Timed, momentary, latched
User	One or multi-switch user
No. of children	More than 5

The child moves around in wheelchair. Leader calls a number (eg. 5), members move to make groups of five . Those left over, perhaps can form another group. Leader waits until all the groups are ready, then calls another number.

## **8 Push the Ball**

Chair Setting	Timed, momentary, Latched
User	One or multi-switch user
No. Of children	Any number
Other Equipment	Large ball (physio. ball)

The group is divided in two, and each team divided into two. One half of each team sit at one end of the room, and the other half sit facing them at the opposite side of the room. Each team is given a large ball. The children have to push the ball over a short distance with their chairs to a team mate who then pushes the ball back across the room etc. until all the children in the team have done it. The Smart Wheelchair user uses his chair to push the ball. The first team to complete the task are the winners.



## **9 Build a House**

Chair Setting	Timed, momentary, latched
User	One or multi-switch user
No. Of children	Any number
Other Equipment	Set of pictures/ drawings for each group depicting the following: walls, windows, door, roof, chimney, garage, garden.

The children are divided into two groups. The children take turns at collecting one piece at a time taking it back to their group where they build up a picture of a house. The Smart Wheelchair user uses his chair to collect an piece of the picture. The game ends when the house is built properly.

Try using a different picture for a change, eg. Post Office, Fire Station or pictures of body parts that fit together in jigsaw form to make the picture of a person.

## **10 Change Places**

Chair Setting	Timed, momentary, latched
User	Single or multi-switch user
No. Of children	Any number

Children sit in a circle, well spaced out. Their names are put into a hat, and drawn out two at a time. On their name being called out, the two children change places in the circle. The Smart Wheelchair manoeuvres his chair to into the place vacated by his classmate.

## **11 Treasure Relay**

Chair Setting	Timed, momentary, latched
User	Single or multi-switch user (negotiate turns if using one direction only)
No. Of children	Minimum of 6
Other Equipment:	One container per team with the appropriate number of bean bags per team

There is a basket of treasure at the bottom of the room. On a signal the first child goes to the treasure

chest and removes a piece of treasure (beanbag) and then returns to his team . The next child does the same and so on. Game ends when the last child arrives back to the team.

## **12 Train Game**

Chair Setting

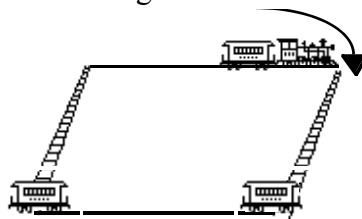
User

No. Of children

Other Equipment

No Equipment

Single switch user in one direction: The user moves the chair down the length of the room and picks up a classmate at regular intervals down the length of the room.



Switch enabling a change of direction: Divide the children into groups of three or four. Each group is a train set. Each corner of the room is a station and a group (train) is assigned to each station. One child (the engine) per team, on a signal, moves around the room in a clockwise direction. As he passes the station, picks up one carriage; he does this until he has collected all his carriages. When the train is complete it does a further trip round the room finally arriving at its station. First train home is the winner.

## **13 Hanging out the Washing line**

Chair Setting Timed, momentary, latched

User Single or multi-switch user (negotiate turns if using one direction only)

No. Of children Minimum of 6

Other Equipment Clothes line, assorted clothes - enough for 1 per child, pegs

Fasten the clothes line to the two chairs and fasten on the 'washing'. The Leader says "Bring me a ...". The first child in each team goes to the line, unpegs the right article and brings it back to the group - a point for each correct article.

## **14 Listening**

Chair Setting Timed, momentary, latched

User Single, or multi-switch user

No. Of children One or group

Other Equipment Tape recorded sounds and associated pictures

- (a) in the home, eg. doorbell, 'phone, vacuum, toilet flushing, filling kettle
- (b) animal noises
- (c) transport noises

Single switch user in one direction: The pictures are placed down the length of the room. The user listens to the noise and moves his chair to the appropriate picture

Multi switch user: The pictures are placed around the room, so meaning the child has to search out the appropriate picture

## **Treasure Hunts**

These can be great fun, but do need very careful preparation beforehand and must be suitable for the ability of the child. The following idea can be adapted to suit the child's aims and abilities.

### **15 Animal Hunt**

Chair Setting	Timed, momentary, latched
User	Multi switch
No. Of children	Any number
Other Equipment	As many cut out 'animals' as possible (cut form card). Could use animals cut form old birthday and Christmas cards

Before the game, go and hide the animals in around the area. Children (accompanied by leaders) go and find the animals.

### **16 Go and Find**

Chair Setting	Timed, momentary, latched
User	Multi switch
No. Of children	Any number
Other Equipment	Each group has a small box and a set of cards

Before the game, Leader hides objects around the area. Children in groups with one Leader per group. Leader shows the children first card and says "Go and find a....." (hold up card for children to see picture, or diagram, or drawing of what is to be found).

Children find the items and gather them in a box

## **17 Paper Chase**

Chair Setting	Timed, momentary, latched
User	Single or Multi switch (negotiate turns if using single switch)
No. Of children	Any number

Leader (one for each group) sets a trail

Children (and Leader preferably) are told what colour trail is and set off to follow it.

## **18 Story Time**

Chair Setting	Timed, momentary, latched
User	Single or Multi switch working on turning round
No. Of children	Any number

A story is told and everyone present is allocated a character or object in it (eg. Robin Hood, Friar Tuck, the sheriff, the sheriff's horse, the river, the town walls, etc.). Every time their character or object is mentioned they turn around.

## **19 Moving Monster**

Chair Setting	Timed/Momentary
User	One or Multi switch user
No. of Children	Any number

a) Chair user plays game along with the other children

The group of children stand at one end of the room. The 'Moving Monster' stands at the other. He turns his back to the group of children and moves to his right or left taking small side steps. While he does this, the children move towards him as far as they can. They must watch him carefully because he will suddenly stop moving and turn around - when he does this they must be standing very still. The monster eats anyone he catches moving!

## **20 Traffic Lights**

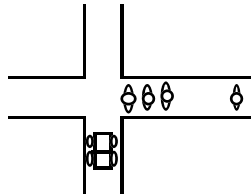
Chair Setting	Timed, momentary, latched
User	Single or multi-switch user
No. of Children	A group of five or more

The children move around the room in a random fashion. When the Leader shows them a red light, the children stop moving. When the Leader shows them a green light they may start moving again. Any child 'who gets it wrong', is penalised - put out, loses a life etc.

## **21 Crossing the Road**

Chair Setting	Timed, momentary, latched
User	Single or multi switch user
No. of Children	Any number of children or adults to be traffic or turn take to cross the road

The child drives his wheelchair up to a crossroads. He must wait for a break in the traffic (other people), before proceeding over the crossroads to his destination.



## **22 Highway Patrol**

Chair Setting	Timed, momentary, latched
User	Single or multi switch user
No. of Children	Any number of children or adults to be traffic or turn take to stop the car

Before the game starts, the child is told that he must retrieve an article from one of the cars that will drive up the road. The child drives his wheelchair up to the junction of the road. He waits there until he sees the person in question come alongside him. Once that person is level with him, he shouts (or drives his chair forward in order to grab them)

# Operating Limits and Safety Notes

The Smart Wheelchair is intended as an augmentative mobility aid and trainer. For two reasons children should not ride chairs unattended.

- the child is still learning and might drive the chair into dangerous or at best uncomfortable situations
- the wheelchair electronics might fail, leading to a runaway

## The wheelchair must not be operated

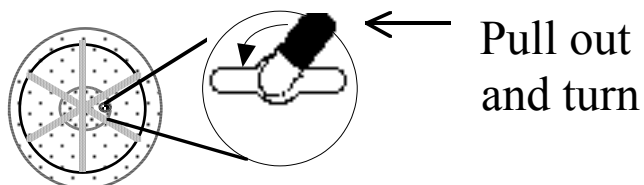
- near ponds, lakes, pools or other water masses
- near roads
- on steep or slippery slopes
- near fires or similar hazards (such as chemical or electrical laboratories, or where heavy machinery is in use)

## In case of fire

### First preference is to move child and chair

The procedure for the chair is

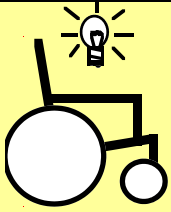
- switch off
- unlock the rear wheels



- push

### Second preference is to remove the child

Unstrapping might take longer, but there are situations when the chair could not be pushed over obstacles



# Smarty Award

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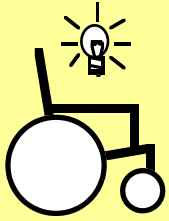
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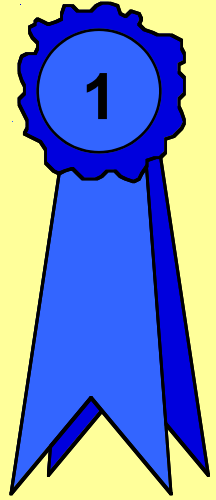
# Gone Solo!

*in*

# The Smart Wheelchair



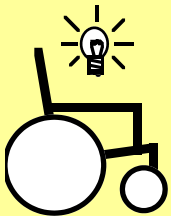
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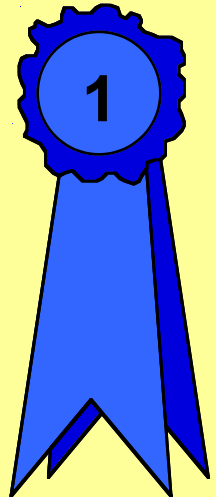
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**The Smart Wheelchair**



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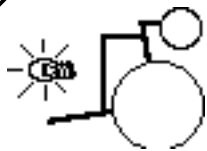


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**The Smart Wheelchair**

**Smart Wheelchair Activity Log**



Name:

Date:

Time session started

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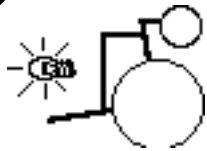
Duration:

With:

Aim(s) of session:

Observations, comments, success, difficulties, etc:

**Smart Wheelchair Activity Log**



Name:

Date:

Time session started

:

Duration:

With:

Aim(s) of session:

Observations, comments, success, difficulties, etc: