CHAPTER FOUR

Phase Three: Pilot Study Two

4.1 INTRODUCTION

The contents of this chapter report on Phase Three of the research, which comprised a study (Pilot Study Two) that aimed to improve the filming protocol described in Chapter Three. Pilot Study Two contributed to fulfilling one purpose of the overall research project, which was to develop a measurement model with the capacity to capture details of movements used by children with cerebral palsy (CP) during task performance. Specifically, Pilot Study Two addressed the research sub-question: "*What components of a filming protocol could be developed to i) enable children to comfortably and optimally perform their targeted task, ii) maximise 'onscreen' clarity, and iii) increase the accuracy of GAS rating by 'blinded' expert raters?"*

This second pilot study aimed to test a filming protocol that was able to
a) capture details of a child's task performance with improved film clarity,
b) develop precise filming conditions that could be replicated for pre- to post-test filming in the last phase of the research, and c) utilize motion analysis software that could be used in a clinical situation to measure details of the movements used during task performance. The placement of this phase of the research is highlighted in Figure 4.1

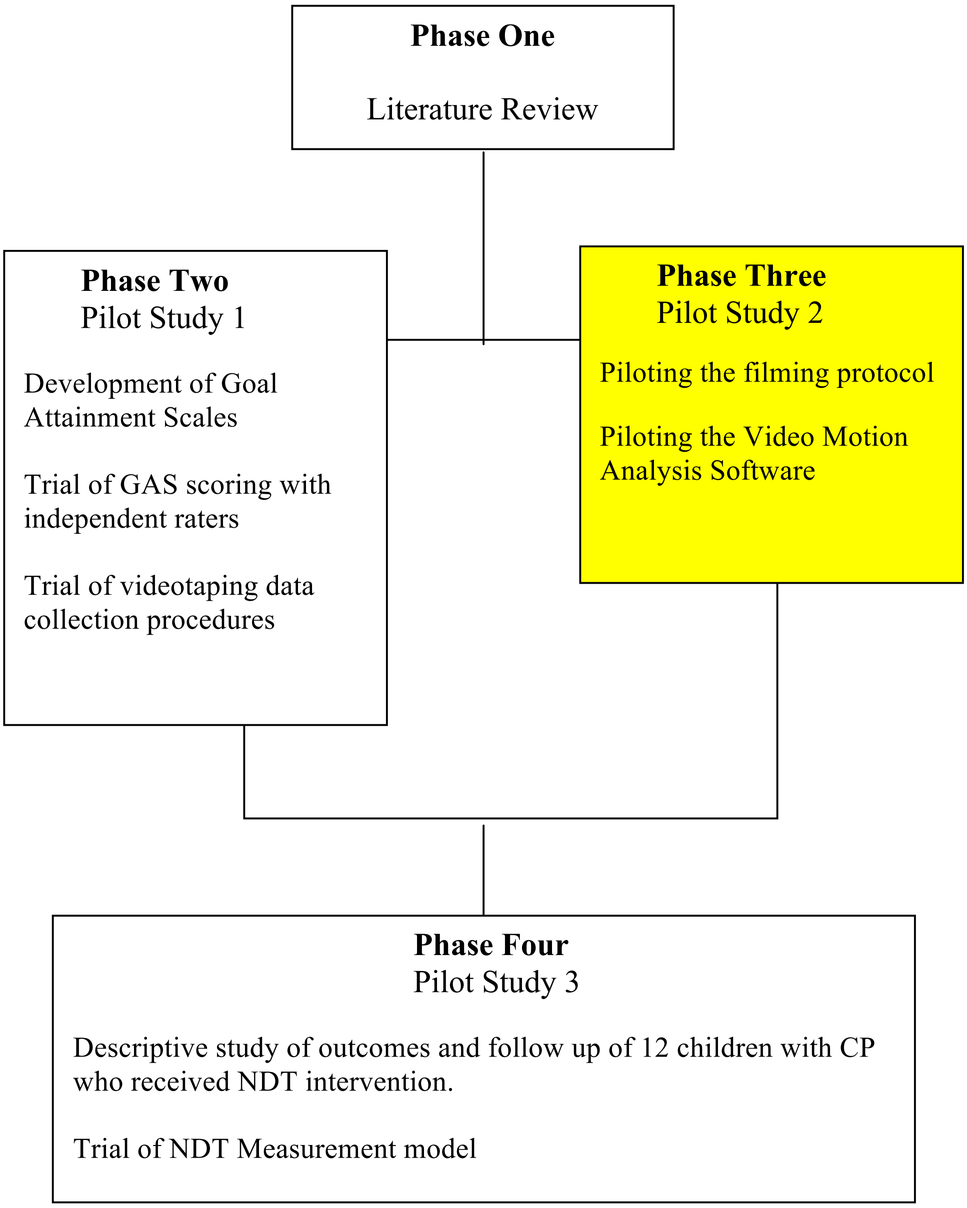

Figure 4.1: Visual representation of the four phases of the study, with Phase Three highlighted.

4.2 METHODOLOGY

4.2.1 Design

Pilot Study Two comprised two parts. The first part addressed the development and use of an improved filming procedure. The second part investigated the use of motion analysis software to extend the capacity to analyse movements used by the children during task performance.

Small ‘n’ and critical case study (Salminen, Harra, & Lautamo, 2006) methods that were described in the previous chapter were again employed to trial the combined use of GAS with a modified filming protocol (Kiresuk, Smith, & Cardillo, 1994) to describe the functional posture and movement behaviours during task performance. In this study, the case study approach was extended to include six more child participants, enabling statistical analysis that is appropriate to small ‘n’ research. Specifically, ordinal, cross-case comparison strategies were used. Ordinal, cross-case comparison entails rank ordering single cases into three or more categories based on the degree to which a given phenomenon is present (Mahoney, 2000).

Five children with CP, and one film assistant were filmed performing an everyday task. Three trials of the task were filmed in the same session, with the ‘best’ of three performances chosen for final review and conversion to DVD format. Goal Attainment Scales were generated by the researcher from each child’s best-of-three performances, utilizing the process described in the previous chapter. The level of behaviour observed for each child was entered at GAS level -2, which would approximate a pre-test level in a future pre-test post-test study. The tasks filmed reflected the parents' goals for the six children with cerebral palsy (CP), who were receiving NDT intervention in community therapy agencies at the time of the study, and who had volunteered to participate in future NDT Courses. Eight of the Neuro-developmental Treatment (NDT) Chief Instructors (CIs) from Pilot Study One were again invited to score the children's performances utilizing the newly developed filming protocol and the GAS.

In this phase of the research project, critical case study was used for two reasons. The first was to develop and trial a film protocol for use with children of different ages and motor performance abilities. Case studies can be used when an in-depth analysis of a unique condition or situation is required. In this pilot study, in-depth analysis of task performance was targeted. Each child participant was considered a 'unique situation', as they performed different tasks under conditions of different capacities and constraints caused by CP. One purpose of case study methods is to examine many aspects of the subject in question (Berg & Latin, 2008). In this part of the research, the aim was not only to maximise 'onscreen' clarity for GAS scoring for use in the final phase of the research, but to develop a filming protocol that might suit any task and any level of ability, with the capability to capture visual performance data in any relevant body segment. Second, case study was used as a means to further train expert independent raters in its use for the final phase of the research.

4.2.2 Participants

The two groupings of participants were six children with CP and their families, and eight NDT Coordinator Instructors (CIs). The six children and their families were chosen according to the same criteria as those in Pilot Study One: referral to occupational therapy for difficulties in motor aspects of daily activities; diagnosis of cerebral palsy; and family consent to participation in the study (see Appendices V and V1 for the research information and consent form sent to parents).

The eight NDT CIs met the following criteria: expert NDT practitioners and instructors; participated in the first Pilot Study; demonstrated the highest rater agreement with the researcher in their scoring of GAS using filmed material in the first pilot study; and consent to participation in the study (Appendix VII)

The children were purposefully chosen from a pool of children and families who volunteered to participate in the study, on the basis of differences in age, variety of tasks, CP classification and severity. All children were receiving NDT in community therapy settings. It was hoped that inclusion of a broad spectrum of abilities and treatment goals would assist with development of a filming protocol that would be applicable to the children of different ages and abilities who would be participants in the final phase of the research. Each child's data were assigned a code and any personal information was deleted from the data file. The children's codes, ages, diagnoses, tasks and task names are included in Table 4.1. A child with hemiplegia undertaking a task requiring hand function was to have been filmed. This child and the arranged 'substitute' child were unable to attend the filming. As it was necessary to include a hand function task to generate the appropriate hand function filming coordinates in case such a task required filming in the last phase of the research, the student film assistant ('S6') was filmed completing the nominated hand function task.

Table 4.1: Children, tasks and task names.

Child	Child's age	Child's diagnosis	Task / task name
S1	5y 1m	CP ataxia	Walking (in TheraTogs)
S2	11y 6m	CP spastic quadriplegia / dystonia	Switch access to communication device, seated in wheelchair
S3	11y 2m	CP ataxia	Cooking: stirring a bowl, sitting at a table
S4	2y	CP spastic quadriplegia	Floor sitting and playing
S5	2y 2m	CP hypotonia	Transition from sit to stand, to play at plinth
S6 ('Film assistant as substitute' for child)	*20y (estimate)*	*None*	In hand manipulation of money, sitting at table.

4.2.3 Instruments

The instruments used in this Pilot Study fell into four categories: film equipment, components of the film set, video motion analysis software, and DVD production.

4.2.3.1 Film equipment

Three regular video cameras were operated simultaneously with remote controls, to film anterior, lateral and superior views of each child's task performance. Regular video cameras and 'typical' mini (digital video) DV tapes were chosen for ease of use when applying this filming protocol in the clinic. An overhead camera was housed in a box with a lens aperture and placed on an existing overhead 'exercise mesh'. This enabled easy movement of the camera for the different children. The front and left (or right) side camera were mounted on tripods (Figures 4.2a and b).

Figure 4.2a: Front, right side and overhead cameras in situ and (right) close up of overhead camera mounted in box.

Figure 4.2b: Close up of overhead camera mounted in box.

4.2.3.2 The filming set

The filming was carried out at the Deakin University Occupational Performance Laboratory, with the signed consent from parents, following Deakin University's requirements for videotaping permission (Appendices V and VI).

Aspects of the film set were developed with a view towards obtaining optimal video footage of each child and for improving future replication of pre- to post-test conditions. The characteristics of the film set were based on a number of factors that were found in Pilot Study One to influence the validity of filmed data obtained (Table 4.2). They are summarized below, and further described in Appendices VIII and IX.

The film set in the Deakin University Occupational Performance Laboratory, was decorated as ‘the magic room’ (Figure 4.3). The venue was made welcoming and comfortable for parents and children, with the intention to create a filming context and protocol which was familiar, clinically viable, and easily transferable to other clinical settings for children, families and therapists.

A ‘waiting area’ with a few toys was created within the lab, from which the child and parents could see the film set and each other during filming. The motivation for children to make the transition from their parents to the film set was assisted by the child having to move through a series of suspended decorations (Figure 4.3).

Figure 4.3: View from waiting area to film set in the Deakin University Occupational Performance Laboratory.

Equipment and toys were made ready for each child to perform a goal related task from their current NDT program. For example, the set up for the 'sit to stand and play' task for Child S5 is depicted in Figure 4.2a.

4.2.3.3 Floor and wall grids

Taped floor and wall 'grids' were initially conceptualized by the researcher as potential reference points for measurement with the VideoPoint ™ motion analysis software. The floor grid comprised 50 mm x 50 mm cells of 25 mm tape applied to the carpet. It enabled exact replication of the child's position, the equipment and the camera placement in subsequent filming. It also provided reference points for motion analysis in the transverse plane, as filmed by the overhead camera. A green dot marked the central point of the grid (Figure 4.4).

The cell sizes within the floor grid of 50 mm x 50 mm were determined from a compromise between potential onscreen clarity and maximizing the number of cells available for a variety of reference points for use in viewing and measurement. A second consideration in choosing these dimensions, involved qualities of the tape, such as tape width, for simplicity in measuring the 'layout' for construction of the grids. For example, floor grid cells were measured to be twice the width of the tape on the x-and y-axis. Parameters of both the area and perimeter of the grids were calculated to enable a full onscreen view of each child moving on the grid. Grids constructed on the left side and back wall of the filming scene used the same dimensions. These were intended as reference points for motion analysis in the frontal and sagittal planes, respectively (Figure 4.4).

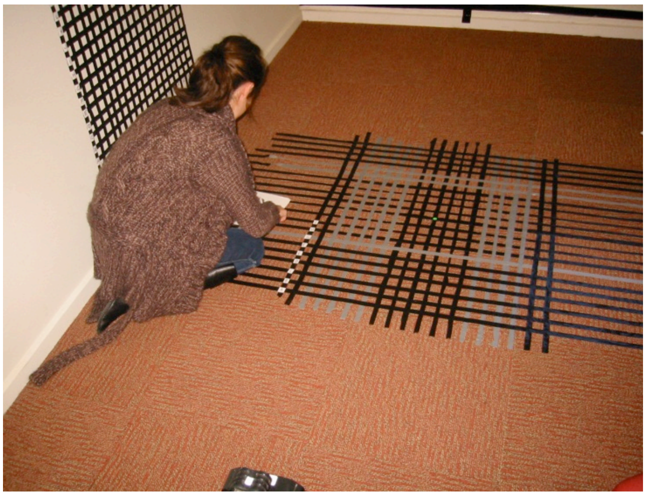

Figure 4.4: Taped floor and left wall grids under construction in the lab

4.2.3.4 Laminated floor grid sheet

To assist with accurate replication of pre-test conditions at post-tests of the same task performance, an A4 laminated 'floor grid sheet' was kept on a clipboard to record data about the exact position of each child, toys, equipment and cameras (Figure 4.5). This 'floor grid sheet' was a diagrammatic representation of the actual floor grid described above, and was made for each child (Figure 4.5). Each 'floor grid sheet' included:

- A key to symbols (such as a curved shape of red tape for toe positions, a square shape for table legs and circles for chair legs) ,
- Pre-prepared symbols for placement on the sheet,
- Spaces to record the measured distance of tripod from child in each direction, height of tripods, placement of overhead camera and the angle of each floor camera,
- Space for comments.

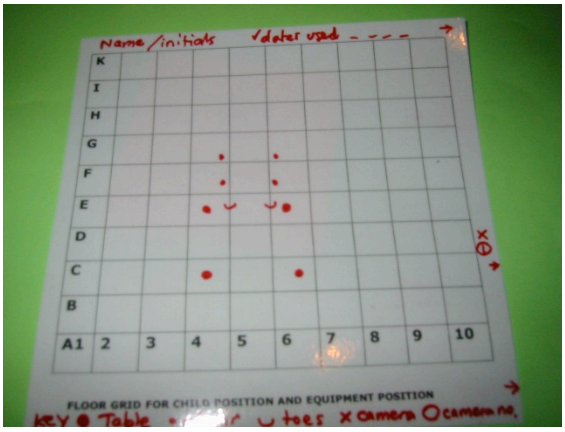

Figure 4.5: Laminated A4 'floor grid sheet'

<u>4.2.3.5 Marking bony prominences</u>

The marking of bony prominences for later VideoPoint™ (VideoPoint™, 2005) measurements, was facilitated with sticker books and music (Figure 4.6). This process will be further described in Section 4.3.6.

Figure 4.6: Stickers, stamp pad and 'lucky dips'.

4.2.3.6 Video motion analysis software

'Final Cut Pro' software (Final Cut Pro, 2007) was used to edit and convert video footage to DVD's. The software enabled each DVD to simultaneously play three views of each child's performance on the same screen: anterior view, lateral view and superior view. This allowed for a more complete analysis of movement than in Pilot Study One. For example, analysis of movement in the transverse plane, such as rotation around the body axis, was now possible.

The video footage (five minutes or less of each child's performance) was edited with this software via a video camera with a cable link to a Macintosh PowerBook G4 laptop. To improve accuracy in observation by the CIs, 'repeat, play and slow play' were included in each edited video clip.

4.2.3.7 DVD production

The video footage for each child was exported to DVD in both PAL and NTSC format to allow viewing by the researcher and CI participants in the USA. In addition, a CD of the same footage was made for each of the parents to keep, in thanks for their participation. Following viewing and scoring, the research DVD's were destroyed.

4.3 DATA COLLECTION PROCEDURE

4.3.1 Background information on videotaping

To determine the optimal filming protocol for the study, initial discussions were held at the Knowledge and Media Unit, Deakin University, and with a professional research videographer. Suggestions were made regarding the type of cameras required, and about determining the positions of the child, the three cameras and equipment on the film set, to enable optimal onscreen viewing and measurement. This 'set up' has been described in the 'instruments section' (4.1.3.1 Film Equipment). A film assistant directed the camera set up to enable the capture of simultaneous footage.

4.3.2 Controlling for possible internal and external factors that may impact on a child's filmed task performance.

As the aim of this Pilot Study was to maximize the potential of the filming protocol to capture a clearly visible and truly representative optimal task performance by each child, a number of controls were incorporated into the filming protocol, venue and appointment plan (Table 4.2).

Table 4.2: Internal and external factors that may impact on a child's filmed task performance.

Variable to be controlled	Solution to capture optimal performance
The child may be: 1. Sleepy or fatigued	Identify preferred sleep times: schedule the preferred times for younger children with parent.
2. Tired at the end of the day	Schedule older children later.
3. Absent due to illness	Identify alternate child participants who could substitute for children who were unwell.
4. Hungry or thirsty	Organise for parents to provide children with food or drink prior to filming, and for parents bring additional food and drink to session.
5. Fearful or shy in a new room	Organise for children to bring in comfort items such as 'snuggly', dummy, teddy, doll and other favourite toys / music CD. Create 'magic room' atmosphere.
6. Fearful or shy of a new room or of the film crew.	Determine during the film trial if it is possible to restrict the film crew to two people who quickly set up the cameras in a quiet and friendly way, whilst the child plays with a basket of toys in the waiting area. The toys will be of 'medium' interest only, so the child can easily leave them prior to beginning filming.
7. Fearful or shy of the film set up, including the cameras.	Point out the cameras to the child and name them, without giving them undue attention.
8. Too hot or too cold	Prepare the room temperature for 'neutral warmth' in readiness for the arrival of the child.
9. Unhappy to have outer garments removed for filming purposes.	A suggestion made to parents to prepare the child for undressing and FOR EXAMPLE THE CHILD to only wear easily removed outer garments, OR 'special picture underwear'.
10. Wary of 'dots' being applied to body.	Children could choose one of three 'animal stamps' to have applied with black ink, to help make the ink dot process appear as a 'game'.
11. Prefers to play elsewhere, rather than go to the film set.	When setting up the room, aim to keep toys in the waiting room and other parts of room to 'minimal interest' to the child, such as 'stuffed animals'.
12. Prefers to not perform the goal related task.	Talk with parents in detail about this beforehand, to help them consider and share any particular motivational ideas that could assist the child.
13. Needs a break to go to the toilet .	Suggest to the parents that the child uses the toilet prior to the appointment, as the toilets are situated at a distance.
14. Is interrupted by siblings in some way.	Ask parents to only bring along the child for filming, if at all possible. Alternatively, this could be considered during the selection process.

15. or is 'interrupted' by by family in some way.	Use of the 'reminder sheet' with parents beforehand may help (see Appendix X).
16. The positions of child, equipment or cameras may differ between pre- and post-filming	Practice a system to ensure there is no change between filming periods by using grids and markers, and a system to record the tripod position, the angle of the cameras and the exact position of the child.
17. The view of the child must also be recorded precisely the same from pre to post test.	As the starting position the front camera will be set up perpendicular to the child. From the superior view the child's head, shoulder girdle and heels should 'line up'.
18. It is possible that the tape on floor and walls could distract children.	Introduction of the child to the 'magic room' film set first, including letting the child know that 'the tape is just something for the cameras to see'.

4.3.3 Orientation to the filming process

After the six children had been selected for the study from those who had volunteered to participate, each parent was sent parking directions and a map for the filming venue, and an appointment was made for a discussion about the format of the filming session. The factors listed in Table 4.2 acted as discussion points. For example, ideas for suitable appointment times and helpful comfort items were discussed for each child. Items from home, such as necessary equipment and orthoses required for task performance, were requested for the film appointments.

4.3.4 Appointments and venue

Film appointments were scheduled and booked for the Deakin University mid-semester break in the main Occupational Performance laboratory. This room was chosen because it had an 'overhead mesh' suitable for holding an overhead camera situated in one corner (Figures 4.2b and 4.3).

Appointment times were generally spaced at 1¾ hour intervals (See examples in Table 4.3). This allowed for time to welcome and orient each child and parent. It incorporated a brief playtime, while film equipment was set up, that contributed to children becoming familiar and comfortable in the space. This length of appointment allowed for application of 'dots' to bony prominences, and up to three videoed 'takes' of each task performance until complete 'best performance' was achieved. During this time frame, allowance was made for repeat filming to overcome a comfort or compliance issue, for re-dressing, to talk with parents, and for a 'Lucky Dip' selection by each child – which served as closure to the session. Time was also allowed for preparation for the next appointment.

Table 4.3: Appointment schedule example

Date	Time	Child	Task/task name
Tuesday 19th June	2.00 PM	S1	Walking (in TheraTogs™).
	3.15PM	S2	Switch access to communication device, seated in wheelchair.
	4.30 PM	S3	Cooking, stirring a bowl, sitting at a table.
Wednesday 20th June	9.30 AM	S4	Floor sitting and playing
	10.45 AM	S5	Transition from sit to stand, to play at plinth.
	12.00PM	S6	In hand manipulation of money, sitting at table.
		S7*	

* Alternate child for emergency absence or withdrawal.

4.3.5 Preparatory session

A week prior to filming, a preparation session was held in the same venue (Appendices VIII and IX). This session focused on rehearsing the filming protocol, including trials of the camera set ups. A filming assistant filmed the researcher performing a variety of tasks.

4.3.6 Setting up for the study

Prior to the start of filming, the venue was set up with particular attention to the position of cameras and the construction of the grids. Other considerations were: establishing the waiting area with music playing for the parents and children, establishing an area to store equipment and toys needed for filming, and decoration of the 'magic room'.

4.3.6.1 The cameras

The three cameras were set to particular positions for each child and task. The overhead camera was placed on the mesh directly over the child, who was situated on the central dot of the floor grid in readiness for task initiation. The second camera and tripod was placed directly in front of the child, and distanced to capture the entire action sequence, enabling a clear view of the whole child. The third camera and tripod could only be positioned to film the left side view of the child, because the room was narrow and wall space for the grid was only available on the child's right side (Figures 4.2a and 4.3). The camera angles were measured on a circumferential scale taped around the rotational component of the tripod. The height of the tripods and their placement in relation to the floor grid was measured. For projected action sequences, such as running, filming needed to occur from left to right for using the VideoPoint™ motion analysis software. Cameras were positioned such that the child maintained a constant distance from the camera.

4.3.7 Application of 'dots' to bony prominences

As described above, stamped ink dots of 1.5 cm diameter were applied to relevant body segments to enable tracking of motion during task performance. Each child required individual placement of a series of the ink dots that suited the task that was to be performed, and the particular body segment(s) that were the target of investigation. The positioning of the ink dots was determined by considering the possible indicators of potential pre- to post-test change, which could be investigated using video motion analysis that would track the movement of these dot points. For example, a superior view of lateral displacement of the shoulder girdle in sitting could be tracked via dots applied to the most lateral part of the spine of the scapula (Table 4.4).

Table 4.4: The range of bony prominences utilized for application of 'dots'

Application of ink dots to anatomical landmarks

*FIRST

1. Head centre/top of head light sticky dots/dark hair, darker sticky dots/ light hair
2. One inch down from centre / top of head directly above middle of ears
3. One inch down from centre / top of head directly above nose
4. One inch down from centre / top of head directly above middle of neck

SECOND

Ink dots to:

1. Top / middle of ears
2. Shoulders: most lateral part of spine of scapula
3. Elbows: ulnar olecranon - superior / 'middle'
4. 2 humeral epicondyles / 'middle'
5. Wrists: two styloid processes – medial & lateral – 'middle'
6. Spine: between inferior angles of scapulas
7. Pelvis iliac crests: most lateral
8. Spine: between iliac crest points (no.7)
9. Femurs: greater trocanters - 'middle'
10. Knees: condyles, medial & lateral, - 'middle'
11. 'Middle' of patella
12. Ankles: medial & lateral malleoli – 'middle'

After the anatomical sites of the ink dots had been established, the following process of application of ink dots from the stamp pad was followed. Based on the clinical experience of the researcher, this process was followed in an attempt to preclude potential difficulties with children not wanting to undress and/or then removing an alternative of sticky dots, or resisting an alternative of picture stamps (which would also be less specific as anatomical markers). During undressing, children looked through sticker books with their parent(s) and chose stickers to take home with them at the end of the appointment. This maintained the children's focus with a minimum of movement, while the dots were applied by the researcher. To maintain a level of comfort, soft familiar music played in the background, and the children were invited to compare themselves with 'the leopard' when the process was completed (Figures 4.7 and 4.8).

Figure 4.7: Application of 'dots'

Figure 4.8: 'The leopard'.

4.3.8 Filming protocol

The filming protocol included a system to record the exact starting positions of cameras, child, equipment and toys.

Before and after filming, camera measurements were recorded by a film assistant. The researcher recorded the position of the child, equipment, and toys by placing the taped positional symbols on the floor grid. After filming was complete, these were transferred to the laminated grids for use in positioning for subsequent trials of the same task. This was completed 'quickly and quietly' to maintain a quiet comfort level for the children. The child and film set up were also photographed at the end of filming. Before the next child, the cameras were positioned according to the needs of the task described by the researcher. The code name of the next child was filmed prior to task performance and used as an 'identifier' for the tape. Each tape and tape box were labeled with the child's code.

4.3.9 Filming

A particular protocol was followed to maintain a quiet comfort level for the children. To facilitate ease and speed in the filming process, an assistant did the filming, leaving the researcher free to assist the child's performance through interactive, physical, sensory or verbal prompts and cues. The researcher settled the child on the film set, while parents viewed their child from the waiting area. Prior to filming and after the initial discussion appointment, parents had been sent a 'reminder note' about how to help their children settle (Appendix X). When cameras were ready and operating on 'play' and 'record', the film assistant gave a 'silent nod'. The researcher then used a 'Go' signal to indicate the start of the task performance and a quiet, non-distracting, ‘cough’ to signal completion of the task. This procedure ensured there would be audible cues in the three tapes at the identical points in the video footage for simultaneous editing.

Up to three videotaped ‘takes’ of each task performance were filmed until the task was fully enacted, with assistance given by the researcher as required. The position, type and amount of assistance given, was recorded in the GAS sheets, as a possible measure of change from pre- to post-test. The cameras continued recording throughout, but no longer than after a third ‘cough’, for generally the duration of a few minutes per trial. Quiet talk was possible, but not naming or distracting the child or identifying the trial being filmed.

Two further systems were trialed. First, parts of a task were filmed at different levels. This was achieved with the cameras remaining in their set positions from pre-test, for replication of the same position of cameras in post-test trials in further studies. Different levels in this pilot study involved the child who was performing a task moving from one level, or position, to another higher level ‘or position’: ‘rising from the floor’ and ‘standing to play’, for example. The distance of the cameras from the child was calculated to enable all the footage to be captured without moving the camera up or down. Therefore the camera positions could hypothetically remain identical at post-test. Second, use of the zoom function was trialed to successfully captured footage at a point in the ‘in hand manipulation’ task.

4.3.10 Editing

The audible cues, 'go' and 'cough', enabled the first complete enacted task / goal video footage from each of the three cameras to be edited using Final Cut Pro. This was repeated for six performed tasks. Footage was captured between the end of the 'go' cue and the beginning of the 'cough'. Following this editing, this footage was then burnt to DVD.

4.3.11 GAS recording sheets

GAS sheets were created by the researcher from the final edited version of videotaped performance, in the same way as was described in Pilot Study One (Section 3.2.4.3). The recorded task performances of the children were deemed to be equivalent to pre-treatment performance, and were therefore assigned a score of -2 on the GAS scales. A description of parameters that best represented the 'onscreen' task behaviour was entered by the researcher at -2 on the GAS scales. Performances that described possible changes to these parameters toward, and beyond desired changes to performance were developed by the researcher and formulated into GAS recording sheets.

Tables 4.5 to 4.8 represent three examples of the GAS recording sheets. The remainder of the GAS scales from Pilot Study Two are found in Appendix XI

Table 4.5: GAS Chart for Task 2: "SWITCH ACCESS TO COMMUNICATION DEVICE"

<u>Activity limitation</u>:
A considerable amount of time is taken to activate her communication device for sharing 'talk' in class.

<u>Functional measurable goal / outcome:</u>
By the end of her 5th weekly OT session, term 3, seated in her wheelchair using a "MiniMo" AAC device (with a dynamic display programmed for switch scan communication, accessed via a wireless "Jelly Beamer" switch - both correctly attached to mounting devices), S.2. will choose the next response (after 2nd "good morning"), with her left upper arm – (taking less than 10 seconds from initial activation of her left arm) - to press switch/activate response, whilst looking at the display throughout (that is – looking from initial arm activation to switch press).

Score	ATTAINMENT LEVEL ∗Please note: To save space, the statement at each level below is preceded by . . *By the end of her 5th weekly OT session, term 3, 2007, seated in her wheelchair using a "MiniMo" AAC device (with a dynamic display programmed for switch scan communication accessed via a wireless "Jelly Beamer" switch - both correctly attached to mounting devices), S.2. will choose the next response (after 2nd "good morning"), ...*	**Please ✓ level (ONE ONLY) Repres-ented in DVD**
+3	Performance at a higher level than +2	
+2	. . . with her left upper arm, (taking less than 10 seconds from initial activation of her left arm), to press switch/activate response, whilst maintaining her head, mouth & right arm steady & looking at the display throughout (that is, looking from initial arm activation to switch press).	
+1	. . with her left upper arm, (taking less than 10 seconds from initial activation of her left arm), to press switch/activate response, whilst maintaining her head & mouth steady & looking at the display throughout (that is, looking from initial arm activation to switch press).	
0	. . with her left upper arm, (taking less than 10 seconds from initial activation of her left arm), to press switch/activate response, whilst looking at the display throughout (that is, looking from initial arm activation to switch press).	
-1	. . with her left upper arm, (taking less than 20 seconds from initial activation of her left arm), to press switch/activate response, whilst looking at the display throughout (that is, looking from initial arm activation to switch press).	
-2	. . with her left upper arm (taking less than 20 seconds from initial activation of her left arm), to press switch/activate response, whilst looking at the display & only looking away on no more than 1 occasion.	
-3	Performance at a lower level than -2	

Table 4.6: GAS Chart for Task 4: "SITTING TO PLAY"

Activity limitation:
Inability to play with 2 hands or even with 1 hand if toys are placed away from the midline towards the right side, when sitting on the floor

Functional measurable goal / outcome:
By the end of his 5th weekly OT session, term 3, 2007, S.4. will, whilst seated on the floor with 'the bells' between his knees (flexed no more than 25% of knee flexion range), maintain a 'neutral pelvis (sagittal plane) & while reaching to play with any bell (in bottom half), with either hand, independently maintain his eyes on his hand/s & steady balance for at least 60 seconds.

Score	ATTAINMENT LEVEL *Please note: To save space, the statement at each level below is preceded by . . *By the end of his 5th weekly OT session, term 3, 2007, S.4 .will, whilst seated on the floor with 'the bells' . . .*	**Please ✓ level (ONE ONLY) Repres-ented in DVD**
+3	Performance at a higher level than +2	
+2	. . . between his knees (both hips and knees flexed no more than10% of flexion range), maintain a 'neutral pelvis (sagittal plane) & while reaching to play with any bell, with either hand, (includes left hand to bells at right upper side, with trunk rotation to the right), independently maintain his eyes on his hand/s & steady balance for at least 60 seconds (if motivated to play with the toy for this period of time).	
+1	. . between his knees (flexed no more than 10% of knee flexion range), maintain a 'neutral pelvis (sagittal plane) & while reaching to play with any bell, (excluding those at top right) with either hand, independently maintain his eyes on his hand/s & steady balance for at least 60 seconds (if motivated to play with the toy for this period of time).	
0	. .. between his knees (flexed no more than 25% of knee flexion range), maintain a 'neutral pelvis (sagittal plane), & while reaching to play with any bell, (in bottom half) with either hand, independently maintain his eyes on his hand/s & steady balance for at least 60 seconds (if motivated to play with the toy for this period of time).	
-1	. . between his flexed knees, maintain a 'neutral pelvis (sagittal plane), be able to reach to play with the bells with his left hand (bells in bottom half) & on 3 occasions with his right hand as well, & independently maintain his eyes on his hand/s & not fall for at least 30 seconds.	
-2	. . between his flexed knees – (hips flexed & internally rotated & pelvis posteriorly rotated in the sagittal plane), be able to reach to play with bells (at bottom left to midline) with his left hand, & independently maintain his eyes on his hand & not fall for at least 30 seconds.	.
-3	Performance at a lower level than -2	

Table 4.7: GAS Chart for Task 5: " TO STAND FOR PLAY"

<u>Activity limitation</u>: Inability/refusal to rise to stand to explore/play at surfaces higher than floor level

<u>Functional measurable goal / outcome:</u>
By the end of the 5th weekly OT session in term 3, 3007, in 1 of 3 trials, when placed next to a surface ('standing navel height' with visible toys), S.5., will, within 15 seconds, independently reach up to place both hands on the surface and lightly push on it to rise up to stand (from side sit to left side → to symmetrical kneeling) with medium assistance given at buttocks from kneeling to standing, then independent stepping, and to then play independently with either hand whilst looking.

Score	ATTAINMENT LEVEL *Please note: To save space, the statement at each level below is preceded by . . *By the end of the 5th weekly OT session in term 3, 3007, in 1 of 3 trials - when placed next to a surface ('standing navel height' with visible toys), S.5., will, within 15 seconds, . . .*	**Please ✓ level (ONE ONLY) Repres-ented in DVD**
+3	Performance at a higher level than +2	
+2	. . .. independently reach up to place both hands on the surface and push on it to rise up to stand (from side sit to left side → to symmetrical kneeling) with light assistance given at buttocks from kneeling to standing, with independent stepping, and to then play independently with either hand whilst looking & vocalising.	
+1	. . independently reach up to place both hands on the surface and push on it to rise up to stand (from side sit to left side → to symmetrical kneeling) with light assistance given at buttocks from kneeling to standing, then independent stepping, and to then play independently with either hand whilst looking.	
0	. .. independently reach up to place both hands on the surface and lightly push on it to rise up to stand (from side sit to left side → to symmetrical kneeling) with medium assistance given at buttocks from kneeling to standing, with independent stepping, and to then play independently with either hand whilst looking.	
-1	. . with medium physical assist, reach up to place both hands on the surface and lightly push on it to rise up to stand (from side sit to left side → to symmetrical kneeling) with medium assistance given at buttocks from kneeling to standing & stepping, & with intermittent abdominal support against bench, to then play independently with either hand whilst looking.	
-2	.. reach up with maximal physical (& verbal) assist to place at least one hand on the surface & unwillingly rise up to stand (from side sit to left side → hip extension), & then with medium assistance given at buttocks for stepping to assume standing and utilising abdominal support against bench - & 1 to 2 hands on bench, to then play independently with either hand whilst looking.	
-3	Performance at a lower level than -2	

4.3.11.1 CI Scoring of GAS Sheets

The eight CIs from Pilot Study One, who had consented to be participants in Pilot Study Two, were then posted a randomly assigned DVD of one child. Two of the six children were also randomly assigned to a second of the eight CIs (that is, each CI only rated one child but, as there were only six children, two of these children were randomly chosen to be also scored by the remaining two CIs).

Included in each DVD case were the viewing and scoring instructions, as described in the previous chapter (Section 3.3), with the relevant GAS score sheet for each child.

The CIs were asked to tick the one GAS statement that they judged to match the video footage they observed on the short clips. They were also requested to check that they had correctly included either a 'plus' or a 'minus' preceding their score and invited to give the researcher feedback on aspects of their task. CIs were asked to destroy the DVD's following viewing. They were contacted at the end of the study, when they were thanked for their participation and further research planned to complete the project was outlined.

4.4 DATA ANALYSIS AND RESULTS

The GAS scores from the CIs were entered into an Xcel spreadsheet. The scores from the eight CIs and from the researcher are presented in Table 4.8. Data analysis consisted of visual comparison of the CI raters' GAS scores to the researcher's score of -2 for each child, and computation of the overall Percentage Agreement of the eight CI raters with the researcher.

Visual analysis of the CI raters' scores and percentage agreements (Table 4.8) provide a measure of the proximity of their scores to the researcher's score. Five of the eight CI's recorded the same GAS score as did the researcher (GAS -2), and seven of eight raters scored within one point of the researcher's score of -2 for each task performance as measured by GAS.

To calculate the proximity of the CI GAS scores to those of the researcher for the eight filmed performances, *perfect agreement* of a CI with the researcher's pre-test GAS level was recorded as 100%, while other scores by the raters were represented by 0% (Table 4.8). There was 62.5% agreement between the GAS scores of the Coordinator Instructors' and those of the researcher. According to Portney and Watkins (2000), confidence intervals are not usually calculated in studies presenting direct percentage agreement with only two categories (100% and 0% in this case).

Table 4.8: Researcher and CI rater GAS scores, with percent agreement recorded in column three.

CI rater number	CI GAS Score	Researcher GAS score	Percentage Agreement
1	-2	-2	**100%**
2	-2	-2	**100%**
3	-1	-2	**0%**
4	-3	-2	**0%**
5	-2	-2	**100%**
6	-2	-2	**100%**
7	-2	-2	**100%**
8	0	-2	**0%**

4.5 VIDEOPOINT™ TRIAL

4.5.1 Introduction

The small VideoPoint™ Physics Fundamentals 1.0. software trial for possible use as an additional outcome measure for Pilot Study Three, is presented here.

4.5.2 Methodology

4.5.2.1 Design

The video footage of one child's filming in Pilot Study Two was selected, in order to measure one aspect of motion. The purpose of the trial was to both learn how to use the software and to evaluate its use as an objective measure of change in the last phase of the study.

4.5.2.2 Participants

Child four, whose task / goal was floor sitting and playing, was chosen from this Pilot Study to measure lateral displacement of the trunk, with the software. The child's parents had given signed consent for use of this video footage. This particular 'motion' was chosen as it was relatively easily viewed in the footage from the overhead camera. It was also a vital component of this child's goal, to be able to sit independently on the floor, with a steady trunk, to allow use of both his hands to play.

4.5.2.3 Instruments

VideoPoint ™ Physics Fundamentals 1.0. software (VideoPoint™, 2005) was used together with a Macintosh PowerBook G4 laptop. The video footage of task performance for S4 (Table 4.1), recorded on the three cameras, was analysed and measured by the software and guided by biomechanical task analytic methods.

4.5.3 Procedure

Assistance was sought from a computer consultant regarding difficulties related to use of the software with the MAC computer. For example, as a first step, video clips for analysis needed to be reduced to a one megabyte (MB) size or less.

The video footage from the overhead camera was then viewed within the software program, following the ‘capture’ command being enacted. The floor grid provided reference points to measure excursion of the child’s left lateral trunk displacement as he reached forward with his left hand for a toy in front of him. The body measurement reference was the child’s left shoulder ‘dot’ (most lateral aspect of the spine of the left scapula), over which the program ‘laid’ a virtual dot (Figure 4.9). The ‘calibrate movie’ command enabled software measurements to be made of movement of the left side of the child’s shoulder girdle and trunk away from and back to the midline in the sagittal plane. The data were provided in graphs and tables.

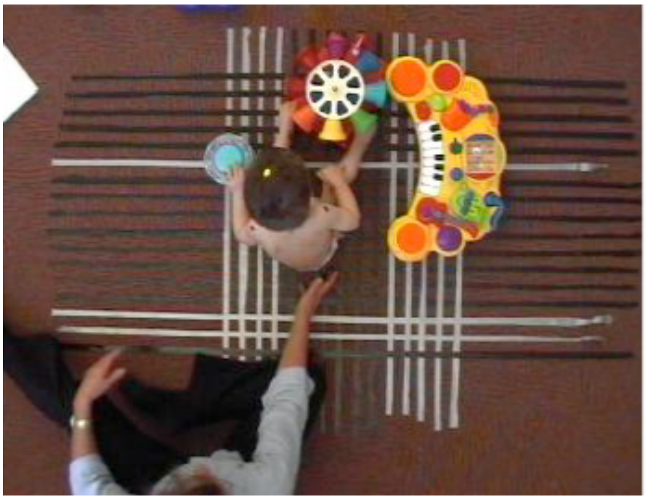

Figure 4.9: Superior view of sitting to play

4.5.4 Data analysis

Data analysis was performed by the software as described above (4.5.3). Movement of the 'dot' was tracked by the software and output provided in the form of a 'dynamic' graph – an example of which is depicted in Figure 4.10.

4.5.5 Results

The graph in Figure 4.10 shows the dot points moving mainly away from the midline in a posterior direction (sagittal plane measurement only). The measurement of displacement approximates 0.168 metres, as represented on the y-axis, and then return to the midline, over a three second time span, represented on the x-axis. This graph represents an accurate and quantitative measure of the child's trunk movement (instability) during reaching for a toy with his left hand, supporting the use of VideoPoint ™ Physics Fundamentals 1.0. software in the next phase of the research.

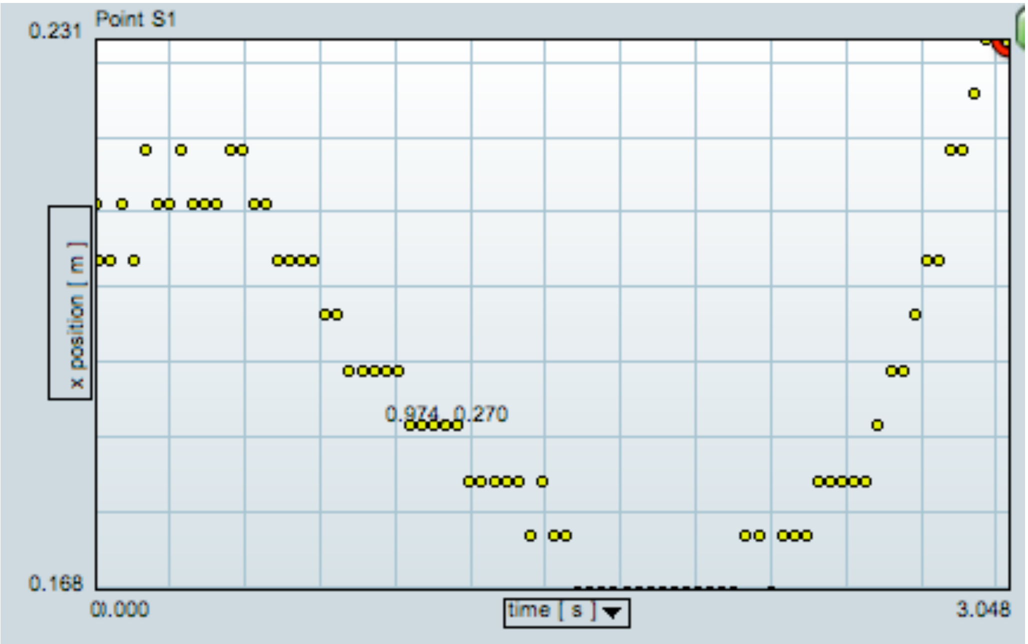

Figure 4.10: Dynamic graph - Videopoint ™ (Position versus time test).

4.6 SUMMARY OF RESULTS AND OUTCOMES

The research sub-question that was addressed in this phase of the research was: *"What components of a filming protocol could be developed to both enable children to comfortably and optimally perform their targeted task and maximise 'on screen' clarity for increasing the accuracy of GAS rating by 'blinded' expert raters.*" The study aimed to develop a low cost, 'low tech', and portable film kit and film protocol, emphasizing visual clarity for GAS rating, and use in a comfortable setting to optimize task performance (Kiresuk, Smith, & Cardillo, 1994). The findings, summarized below, indicated that a preliminary 'NDT Measurement Model' which emerged from the findings of this pilot phase would be suitable for use in the final phase of the research. Further minor modifications were identified.

Finding 4.6.1:

A film protocol was developed that enabled measurement procedures for positions of children, equipment, toys and cameras during task performance. This protocol was available for use in the next phase of this research.

Finding 4.6.2:

Children appeared to be comfortable on the film set, and it was assumed that this assisted in capturing the children's optimal task / goal performances.

Finding 4.6.3:

'Visibility' of the children's performances of daily tasks was improved from that in Pilot Study One by the incorporation of three camera angles, the procedure to capture projected action sequences such as walking and turning, and the ability to 'zoom in' for discrete viewing of body segments, for example during the manipulation task.

Finding 4.6.4:

CI blinded rater's scores in Pilot Study Two may have reflected an improvement in 'visibility', in relation to the film protocol, when compared with Pilot Study One. This was evidenced by the increased proximity of the raters' scores to the researcher's scores, where seven of eight raters scored within one GAS score of the researcher's -2 Gas rating.

Finding 4.6.5:

These findings (4.6.4) could, however, continue to indicate a need to further improve the view of task performances in the video clips, for accuracy in GAS scoring. Table 4.9 contains a summary of aspects of the film protocol that required improvements, for incorporation into the next phase of the research. The ideas from these findings were used to improve the validity and reliability of the film protocol to be used with the video motion analysis outcome measure in the study.

Finding 4.6.6:

VideoPoint ™ proved to be a useful, relatively simple, and inexpensive motion analysis software. It was easily portable to community & clinical environments, so clinically viable as a video motion analysis outcome measure for 'low tech' NDT research by therapists. VideoPoint ™ software was able to measure parameters of 'on screen' motion of the trunk and convert it to quantitative data, presented in graphs (and tables).

Table: 4.9: Summary of aspects of filming protocol that required improvement for incorporation into the next phase of the research.

No.	Modification to film protocol	Rationale
1	Allow four hours set up time	Two-three hours was required to set up the filming equipment and one hour to set up the floor grid.
2	Have three suitable cameras readily available.	Availability problems arose from reliance on hired cameras in this study.
3	An alternative to overhead mesh will be needed for placement of the overhead camera in a variety of clinical settings.	
4	An alternative to wall grids is required. See number 6 below.	Wall grids took a great deal of time and tape to construct and so were not all completed. The wall grids on cloth also failed to maintain their shape and taped grids peeled away from the wall.
5	Use cloth tape of 25 mm width.	Cloth tape was found to be the most adherent. Tapes wider than 25 mm needed to be cut to size – this was time overly consuming.
6	Grids produced on an engineers' plan printer, then laminated, were produced for Phase Four. The printer could produce and print the trial 850mm wide continual roll of two metres of 50mm squares grid, lines 20 mm wide.	Grids produced this way are transported in cardboard tubes. They can be pre-prepared in sections to suit the available wall space, and can me made to accommodate taller children.
7	Ensure the filming space is large enough to allow for filming from either side (lateral plane) and the front.	Required to view and film the whole child and projected action sequences.
8	Record the choice of 'camera side' on the child's laminated chart.	
9	Provide a privacy screen for undressing the child to underclothes.	
10	Provide towels and soapy water.	To protect children and parents from black ink on clothing when the dots were being applied.
11	Use fast drying ink that is washable and 'child safe'.	
12	Keep a supply of elastic hair bands on hand.	To tie hair back from face for all ink dots to be visible.
13	Dispense with elastic head and waist bands	These were unreliable as they moved too easily and the sticky dots adhered poorly to them.

Table 4.9 (continued).

14	Mark the position of the researcher on set onto the laminated grids.	
15	Adjust researcher position so as not to block camera views of the child (a short rehearsal prior to filming may be required), and preview the pre-test tapes before post-test filming to ensure correct positioning.	
16	Position equipment and toys so as to provide a clear view of the child.	
17	Photograph all position markers prior to filming.	To improve accuracy in replication of task initiation.
18	Consider and create all the symbols required for the laminated charts prior to filming e.g. symbols for wheels of a wheelchair and 'T' for centre point of a toy.	
19	Have a second assistant apply position marker tape once the child is on set.	It was very difficult to apply the taped position marker while supporting the child on the set.
20	If more than one task per child is to be filmed, provide a new set of marker symbols in a different colour for the additional task(s).	
21	Consider which part of the child to focus the cameras on (e.g. nose), then replicate this focus position post-test.	
22	Devise a method to record the zoom point at pre-test for precise replication in post-test	