

## Research Question

**To what extent can a virtual art program physically engage children with disabilities?**

## Background/Rationale

**7.2% of Australians under the age of 15 have a disability**, with 3.9% reported as having a severe impairment<sup>1</sup>. These impairments make many traditional art processes inaccessible to these children.

Art plays a vital role in the development of communication, problem solving, social and emotional skills as well as motor control, creativity and self expression<sup>2</sup>. Designing a system to enable creative expression and to encourage physical engagement can improve quality of life. This study aims to provide a new way of engaging children in therapeutic recreation.

Adapted art methods exist but there are **no commercial virtual art programs** for children with impairments.

### Benefits of a Virtual Program:

- **No mess** -> quick, easy set-up and pack up
- **No ingestible products** -> less supervision required
- **Low material cost** -> choose which pictures to print
- **Impairment compensation** -> programmed for specific needs



Figure 1: Finger painting

## Technology

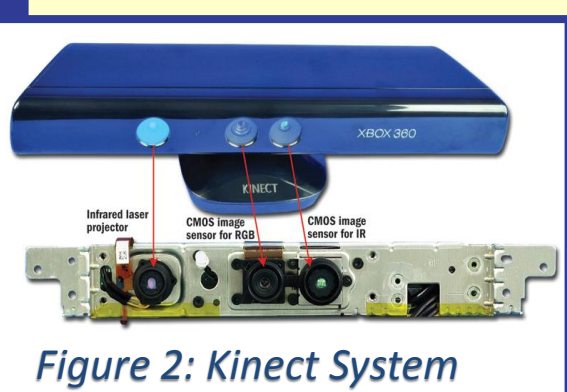


Figure 2: Kinect System

The Kinect Virtual Art Program is written in C++ using the Kinect For Windows SDK V1.0 in Microsoft Visual Studio 2010. The Kinect sensor contains cameras and an infrared laser projector to enable collection of **depth, movement and colour** information.

## Prototype Design

**3 depth regions** for accessing different menus and functions.

- **Region 1** (< 1.5m) – access menu to set modality
- **Region 2** (1.5m to 2m) – special effect menu appears
- **Region 3** (2m to 3m) – Paint/erase region

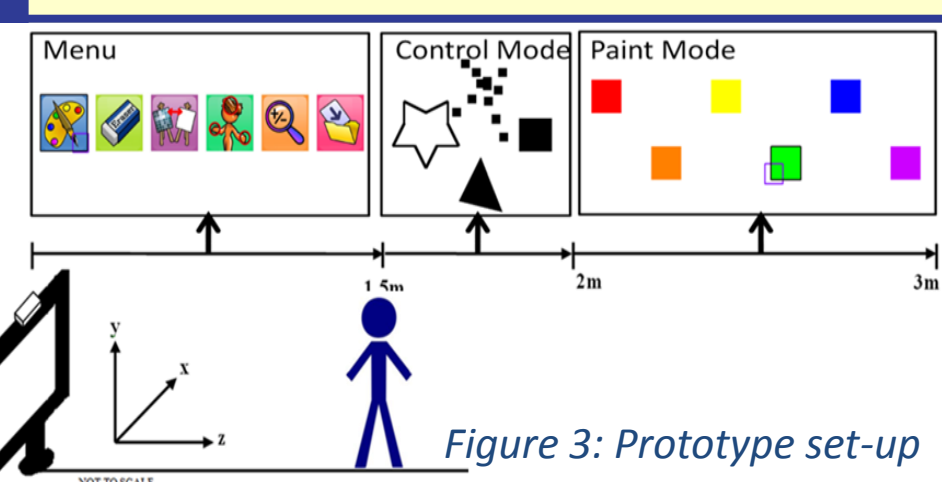


Figure 3: Prototype set-up

### Issues

- Confusing depth regions
- Difficult to select menu items
- Difficult to activate special effects
- Easy to accidentally change settings
- Lag
- No audio feedback

## References

- <sup>1</sup> Australian Bureau of Statistics, 2012, Children Aged 0-14 Years with a Disability – 2009, 4102.0 - Australian Social Trends, Jun 2012 [online] Available at: <<http://www.abs.gov.au/AUSSTATS>> [Accessed 30 July 2012].
- <sup>2</sup> Kohl, M., 2011)The Importance of Art in a Child's Development, [online] Available at: <<http://www.barnesandnoble.com/u/maryann-kohl-importance-of-art/379002442>> [Accessed 2 March 2012].

## Software Development

The following features are now incorporated in the program:

Performance enhancements	Function Enhancements
<b>Microsoft SDK V1.0 instead of Beta</b> <ul style="list-style-type: none"><li>- Improved compatibility and tracking</li></ul>	<b>Single depth region</b> <ul style="list-style-type: none"><li>- Cognitive simplicity</li></ul>
<b>Reduced Lag</b>	<b>Improved visuals</b>
<b>Keyboard and mouse controls</b> <ul style="list-style-type: none"><li>- Therapist can control functions and positioning</li></ul>	<b>Auditory feedback</b> <ul style="list-style-type: none"><li>- Extra sensory feedback</li><li>- Inclusion of visually impaired people</li></ul>
	<b>Gesture activated special effects</b> <ul style="list-style-type: none"><li>- Encourage movement</li><li>- Easy activation</li></ul>

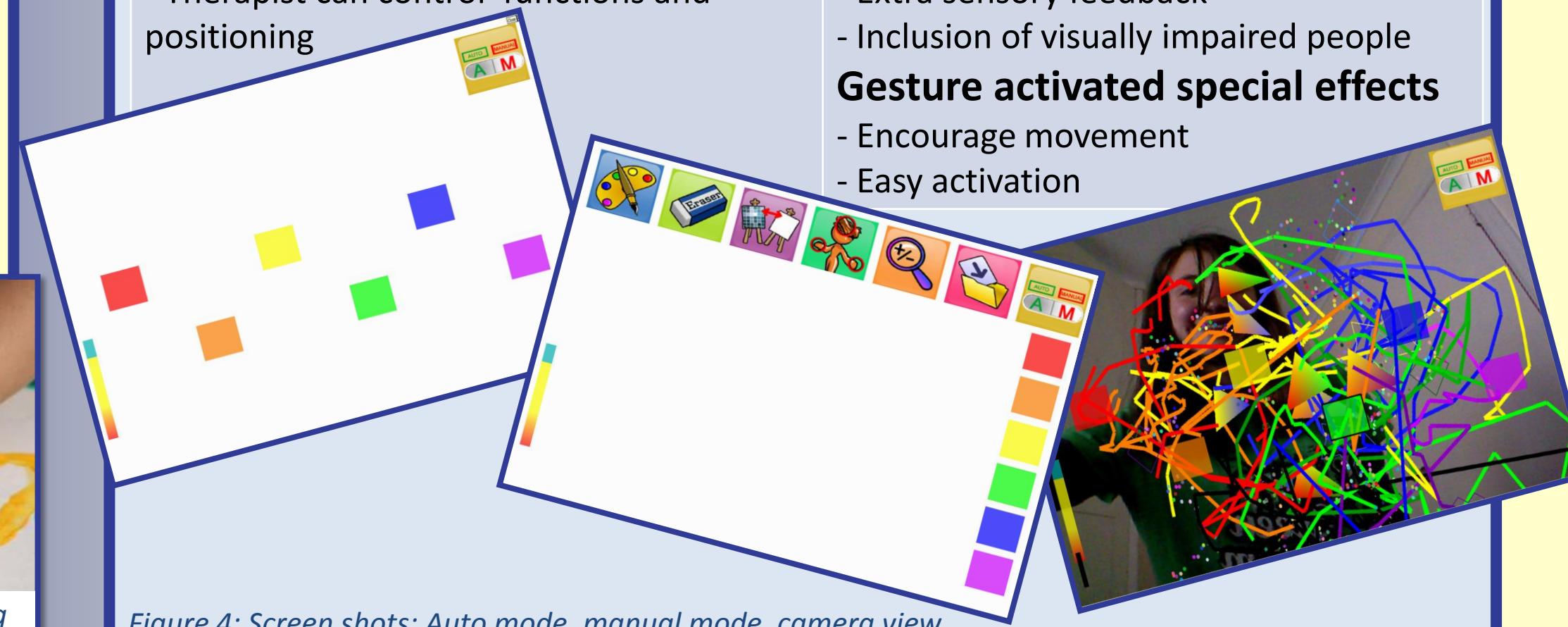


Figure 4: Screen shots: Auto mode, manual mode, camera view

## Clinical Trial

• **5 participants** aged 5 - 10 years old from Trinity Gardens Primary School, St Morris Unit.

- Level IV- V GMFCS<sup>A</sup>
- Level IV MACS<sup>B</sup>
- Non-verbal

• **5 sessions** with each participant

- 1<sup>st</sup> session to demonstrate program and examine best set-up
- 2<sup>nd</sup> to 5<sup>th</sup> sessions to collect quantitative and qualitative data

Quantitative	Qualitative
Limb position on x, y & z axes	Signs of:
Time	- Enjoyment
No. of button activations	- Frustration
No. of activated special effects	- Fatigue
Image at 3 minute intervals	- Other emotions
Session length	
Size and speed of movements, percentage of screen covered	

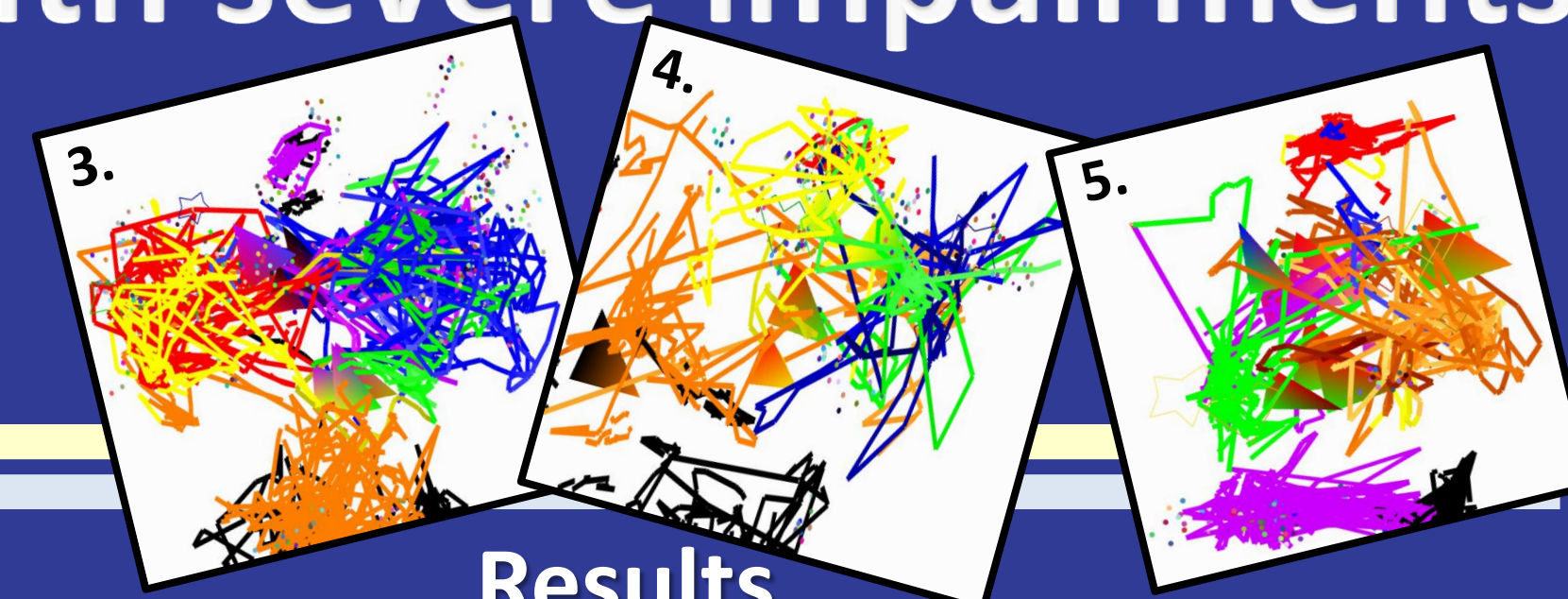
<sup>A</sup> Gross Motor Function Classification Scale

<sup>B</sup> Manual Ability Classification System

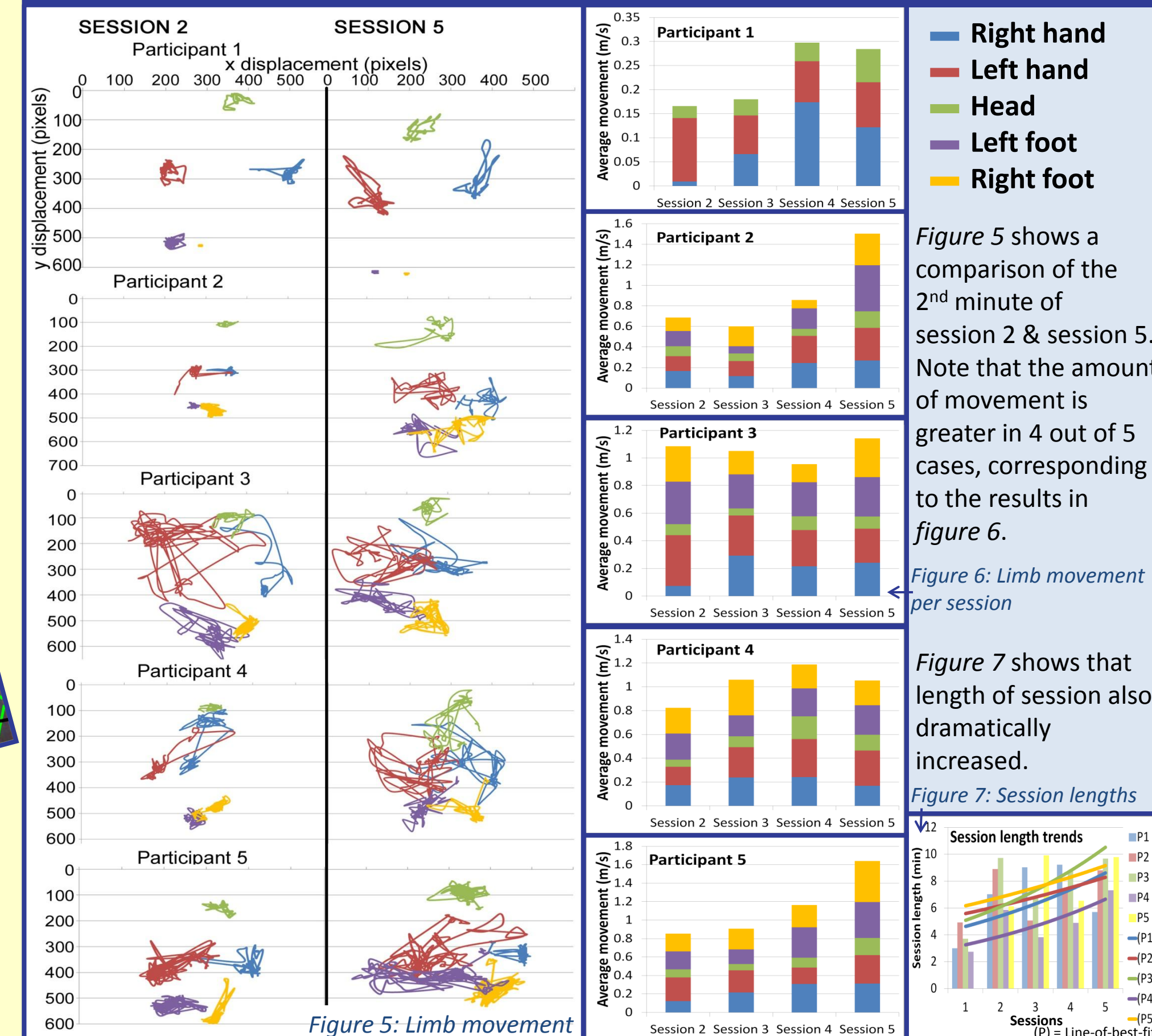
Both scales are between 1 and 5 with 5 being the most severe level of disability.

## Acknowledgements

Special thanks to those in the Paediatric Rehabilitation Intelligent Systems Multidisciplinary (PRISM) Lab, those at Trinity Gardens Primary School, Caroline Ellison and to my supervisors, David Hobbs and Tom Chau.



## Results



## Discussion

### Trends over the sessions:

- Movement increased for 4 out of 5 participants
- Enjoyment increased for 4 out of 5 participants
- 2 out of 5 participants got excited in anticipation
- Session length increased
- Less verbal prompting was required
- Responsive to both visual and audio feedback but particularly audio

### Possible further uses for the Kinect Virtual Art Program:

- **Therapy** -> increasing range of motion and activity levels
- Physiotherapist and occupational therapist analysis tool

## Conclusion

This study shows that the Kinect Virtual Art Program has successfully engaged children with severe impairments, enabling them to create their own works of art and encouraging physical activity. A larger study would be required to gauge the extent of the program's use on a broader spectrum.