ASSISTIVE TECHNOLOGY FOR COMMUNICATION, MOBILITY, AND COGNITION
–
A SNAPSHOT OF CURRENT RESEARCH AT CEREBRAL PALSY ALLIANCE RESEARCH INSTITUTE, AUSTRALIA

Dr. Petra Karlsson
May 2024
pkarlsson@cerebralpalsy.org.au


Christmas Island
Ashmore and Cartier Islands
Cocos (Keeling) Islands
Northern Territory
Queensland
Western Australia
South Australia
New South Wales
Victoria
Jervis Bay Territory
Australian Capital Territory
Tasmania
Coral Sea Islands
Norfolk Island


Cerebral Palsy Alliance – Head office Sydney
Cerebral Palsy
ALLIANCE

The McLeod's motto 'Nothing is Impossible'

Cerebral Palsy ALLIANCE

Audrie , Jennifer and Neil McLeod

Cerebral Palsy Alliance

Cerebral Palsy Alliance is a ground-breaking, global centre of expertise for cerebral palsy services and support, research, technology and innovation, and advocacy. Our alliance of great minds work together to deliver a world of opportunity for people with cerebral palsy and similar disabilities, and their families.

Services & support

Providing services and strategies for every stage of life.

Learn more

Research

Finding ways to prevent, treat, and cure cerebral palsy.

Learn more

Technology & innovation

Developing technologies to improve how you live.

Learn more

Advocacy

Becoming a champion for changes that matter.

Learn more

THE UNIVERSITY OF
SYDNEY

Our four research programs

Our research priorities, informed by people with cerebral palsy and their families, are;

Early Detection & Intervention

Detecting, diagnosing, and intervening early to make a lifetime of difference for children with cerebral palsy and their families.

Learn more

Epidemiology

Unearthing trends, prevalence and causes of cerebral palsy.

Learn more

Technology

Pioneering innovations to support inclusion for people with disabilities.

Learn more

Regenerative Medicine

Leading the way in stem cell clinical trials for cerebral palsy and exploring the frontier of new therapies.

Learn more

PROGRAM OF TECHNOLOGY TEAM

AHa Engineering Lab

DR PETRA KARLSSON, PROGRAM LEAD, TECHNOLOGY

PROF ALISTAIR MCEWAN, CHAIR OF INNOVATION AND TECHNOLOGY

DARRYL CHIU, RESEARCH ASSISTANT

AMELIA MITCHELL, RESEARCH PSYCHOLOGIST

ANNEMARIE MURPHY, RESEARCH OFFICER

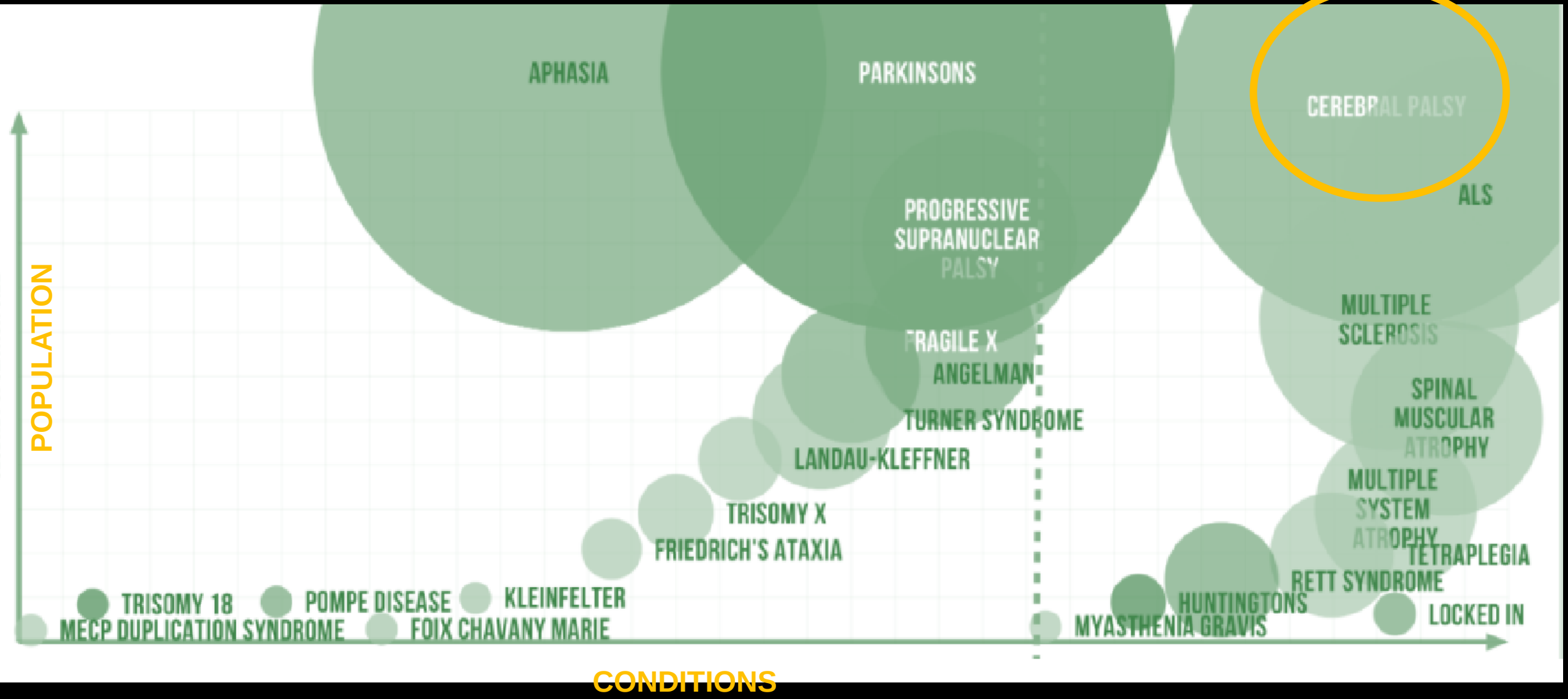
DR INGRID HONAN, SENIOR RESEARCH FELLOW

DR NICOLA POSTOL, RESEARCH FELLOW

1917

2024

HIGH TECHNOLOGY NEEDS IN THE DISABILITY FIELD



AHa Engineering Lab

PRIORITY 1 COGNITION

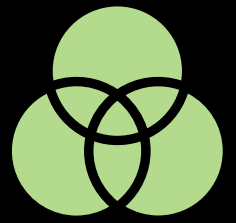
- CogTEST-Children
- Brain-Computer Interface

PRIORITY 2 COMMUNICATION

- My Voice Library
- SwitchApp
- Eyes On Communication
- Eyes On Communication - Clinicians
- Eye-gaze technology and tele practice

PRIORITY 3 MOBILITY

- Car Survey
- Soft Robotics



VENN OF THEMES

- TechToys

COGNITION

CogTEST-Children

Neuropsychological Assessment for Children with Cerebral Palsy and Severe Motor Impairment

CogTEST-C

Cognitive Testing on Eye-gaze and Switch Technologies - Children

Ingrid Honan, PhD, MClinNeuroPsy

Amelia Mitchell, MClinPsych, PgDipPsych, BPsych(Hons)

Petra Karlsson, PhD, Ms(OT)

Cerebral Palsy ALLIANCE

What does this all have to do with Neuropsychology?

- Less than 1/3rd of children with CP have undergone standardised cognitive assessment
- Most standardised cognitive assessment tools require:
  - Verbal responses
  - Fine motor control
  - Are timed
- These are inaccessible for many children with CP, especially those with severe motor and/or speech impairment
- Assessment using these tools would be expected to under estimate ability

Menu

I don't know

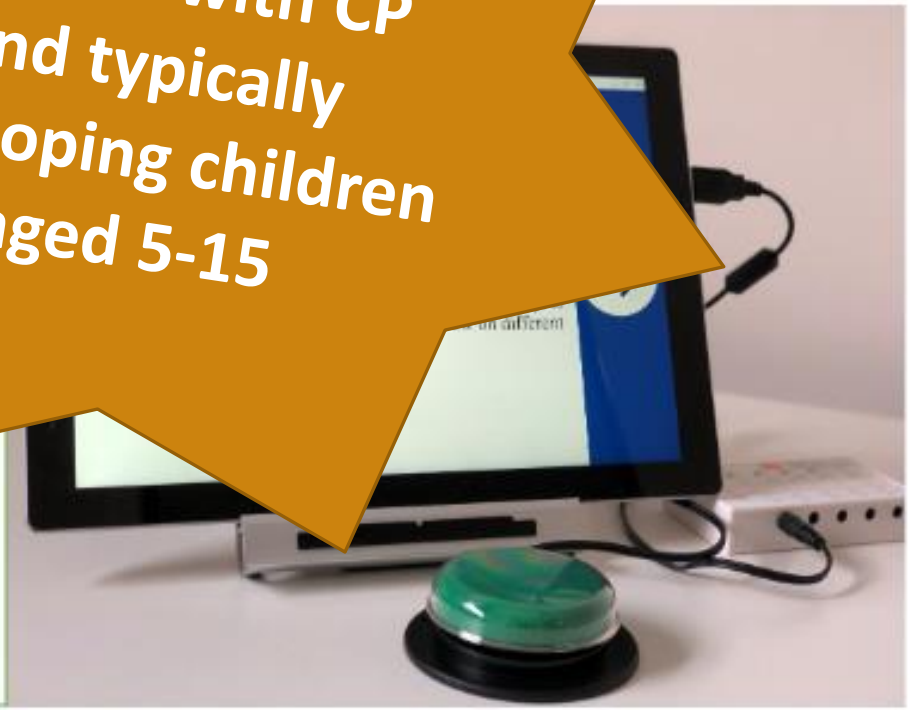
We are researching how typically developing children comple ...nking

Who can be involved?
Typically developing children aged 5-15 years.

What's involved?
Your child will come in for 2 sessions of approximately 3-hours each.
In one session they will complete the measures using paper and pencil, and
other session they will complete the same measures on the computer using s
eye-gaze technology. We will teach them how to use the technology. You
also be asked some questions.

What are the benefits of the study?
You will receive a copy of a report outlining how your child did on each task they complete in the first session. While this will be done for research purposes, it can be useful information for teachers, parents and therapists.

Recruitment of children with CP and typically developing children aged 5-15



To find out more and to get involved please contact Petra Karlsson by phone: 0447 508 661 or by email: pkarlsson@cerebralpalsy.org.au

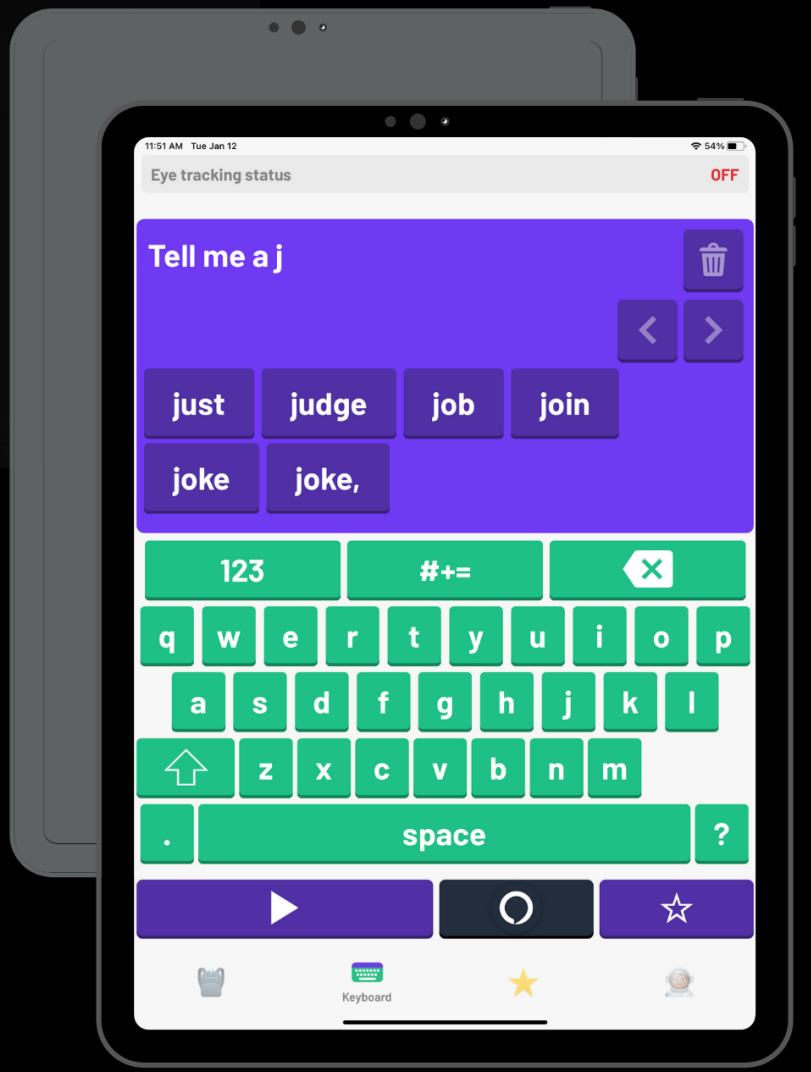
Brain-Computer Interface

Participant number	Age (Mean age: 26yrs, 5mth)	Gender	Able to complete the dichotomous choice screen	Able to try BCI	Able to try eye-gaze technology	GMFCS Level	MACS Level	CFCS Level	VSS Level
310	20	F	✓	✓	✓	IV	IV	IV	III
311	14	F	✓	✓	✓	IV	IV	IV	III
318	21	F	✓	✓	✓	V	V	V	IV
319	43	M	✓	✗	✓	V	V	V	IV
320	22	F	✓	✓	✗	V	V	V	IV
321	42	F	✓	✗	✓	IV	IV	IV	IV
373	14	M	✓	✓	✓	V	IV	IV	IV
375	26	M	✓	✗	✓	IV	V	IV	IV
378	34	F	✓	✓	✓	IV	V	IV	IV
383	29	F	✓	✗	✓	V	V	V	IV

ADVANCEMENTS IN AAC

COGNIXION

- BCI with AR wearable speech generating device
- Wireless headset
- 8 dry passive non-invasive electrodes – no gel needed
- 3 different predictive keyboard options
  - Alphabetical
  - QWERTY
  - Linotype
- Save and access favourite phrases



COMMUNICATION

My Voice Library


torgo
idea
speech
dysarthric
Database
voiced
nemours
euphonia
whitaker


stardust
voiceitt
vivoca
homeservice
corpus
capisciame


ioice

MY VOICE LIBRARY RESEARCH TEAM


DR PETRA KARLSSON


PROF ALISTAIR MCEWAN


MRS MARIA DALMON


A PROF MICHELLE MCINERNEY


A PROF SILVIA ORLANDI

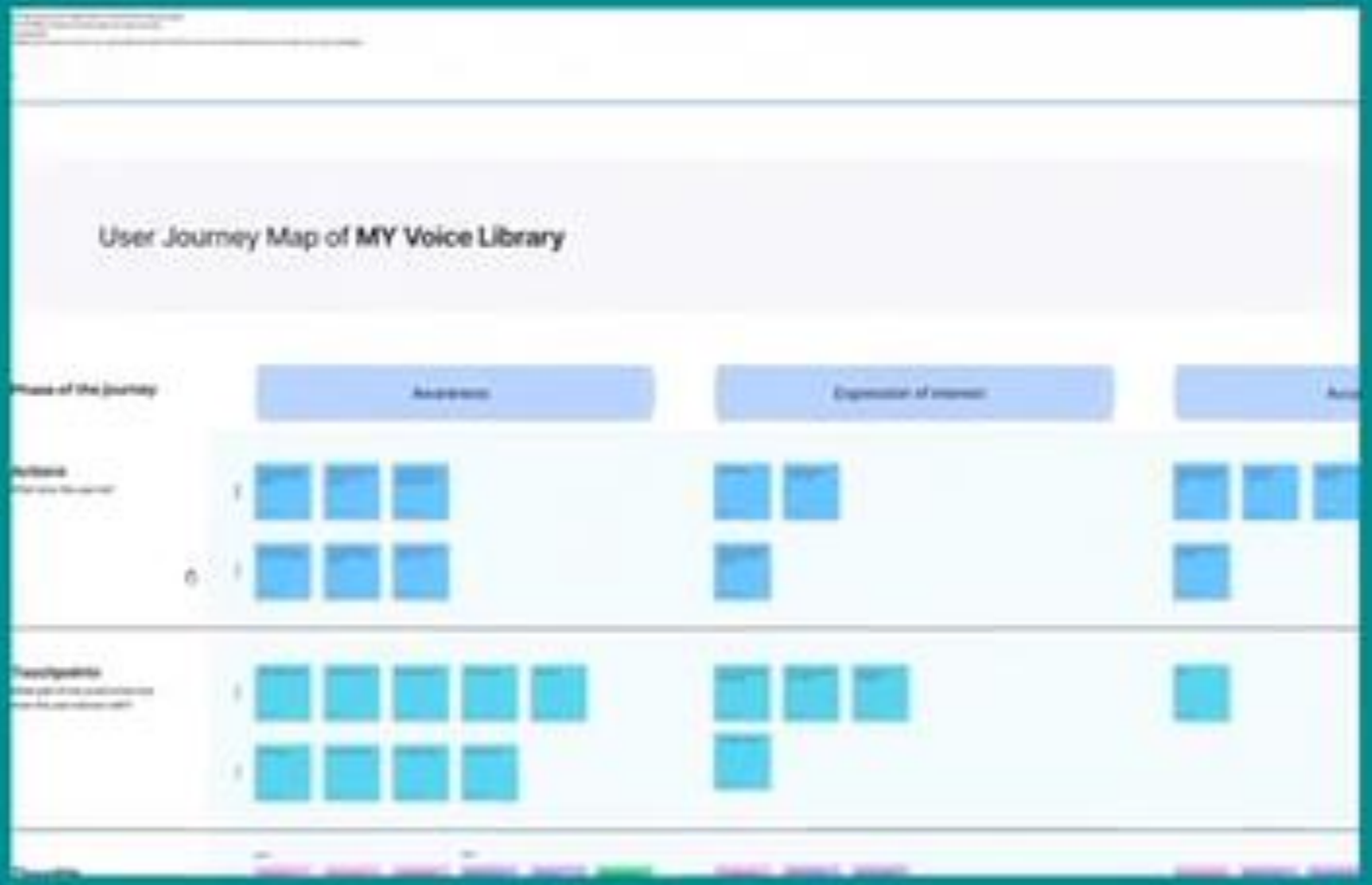

A PROF ANDREA BANDINI

MY VOICE LIBRARY SOFTWARE DEVELOPMENT TEAM - KABLAMO

UX PROCESS

Discovery phase

through our research and discovery process




Break preferences
Cancel
I'D LIKE TO..
Watch animal videos
We've got a selection of funny
I'D LIKE TO..
Be surprised
Not sure what you're looking for?
and exciting
I'D LIKE TO..
Watch video games
Sit back and relax with videos about Minecraft, Super Mario, and everything in between.
and crafts, get inspired with some fun activity videos.
I'D LIKE TO..
Practice mindfulness
Practice your breathing with these fun mindfulness exercises.
I'D LIKE TO..
Listen to music
Take a breather with some relaxing tunes, or have a dance with our popular playlists.
Save changes
Empowering players

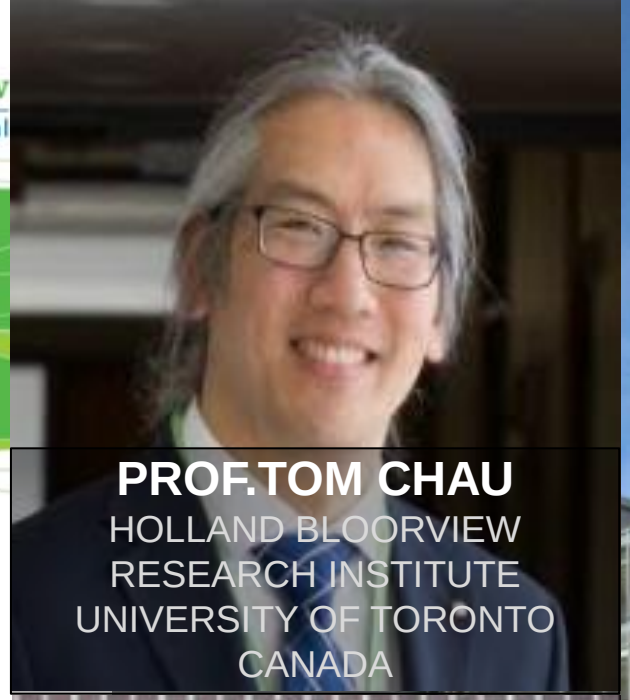
“My cerebral palsy is who I am and I am very proud of it. I really can’t imagine life without cerebral palsy. But my biggest disability is my speech, and not being able to have instant communication without planning the best way to get my message across. In future**, our My Voice Library** research will make communication easier for people with cerebral palsy, and I’m proud to be involved.”

Maria

SwitchApp

Holland Bloorview
Kids Rehabilitation Hospital

SWITCH-APP

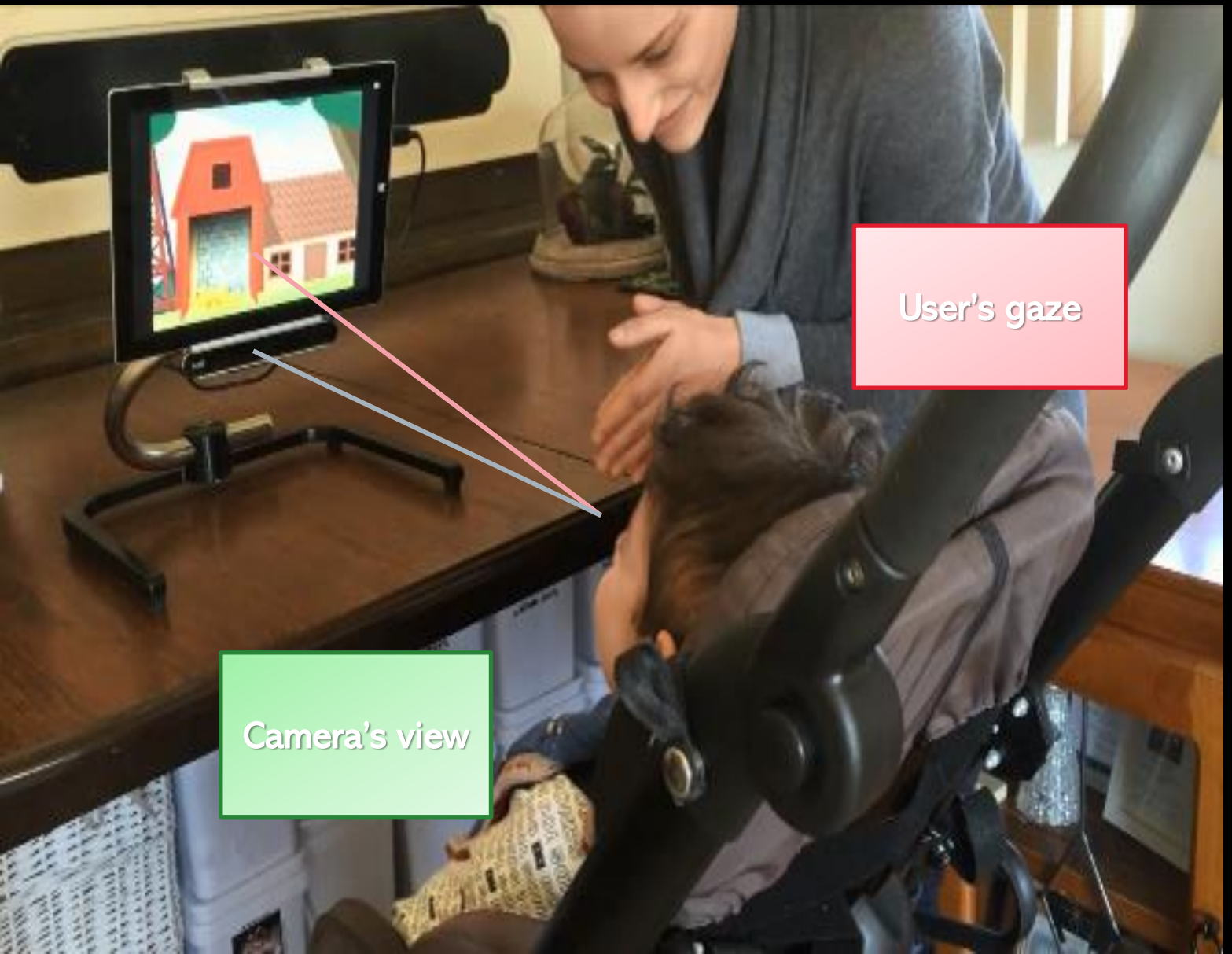


PROF.TOM CHAU
HOLLAND BLOORVIEW
RESEARCH INSTITUTE
UNIVERSITY OF TORONTO
CANADA

A PROF. SILVIA ORLANDI
HOLLAND BLOORVIEW
RESEARCH INSTITUTE
CANADA

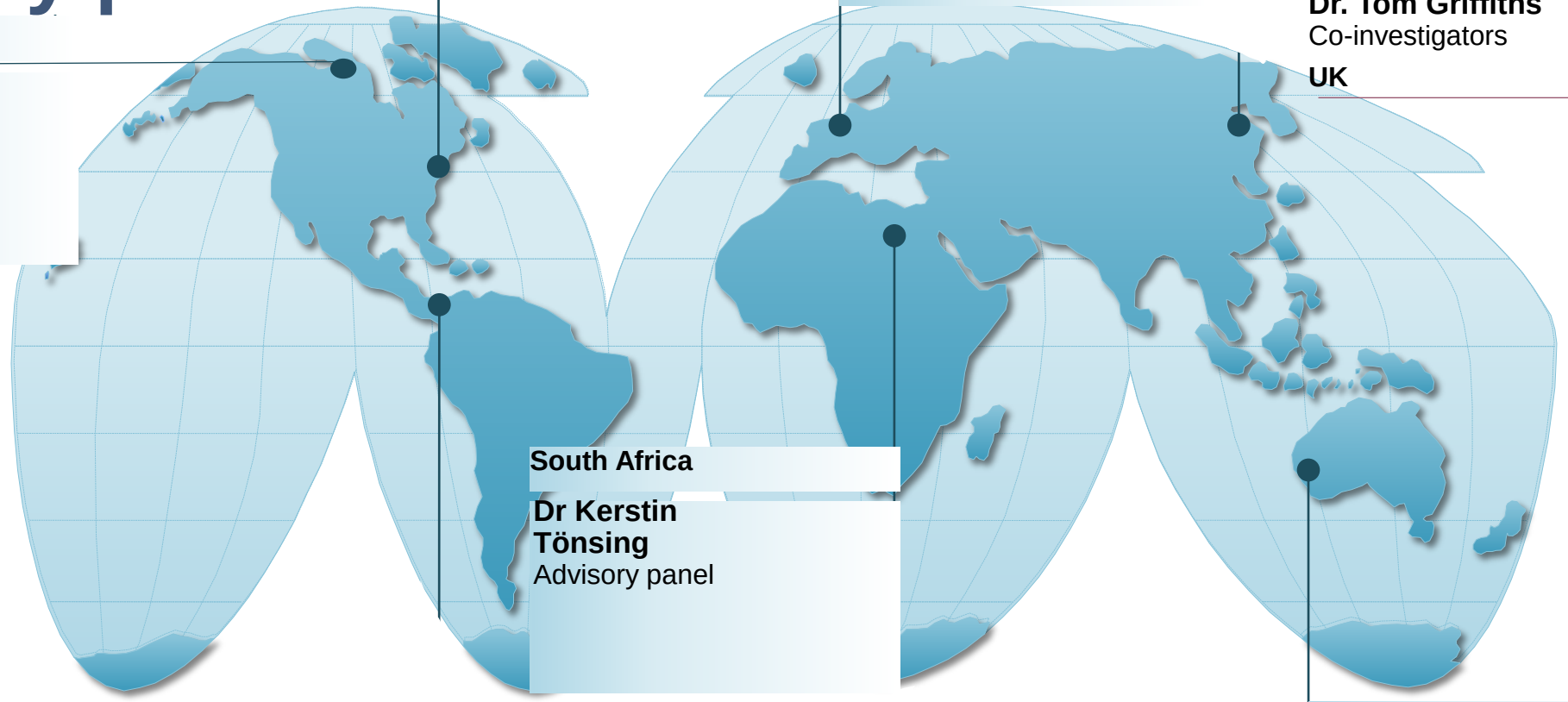
Eyes On Communication

THE NEED FOR CLINICAL GUIDELINES FOR EYE-GAZE TECHNOLOGY



- Who does eye-gaze control technology work best for?
- How much time will it take?
- What to assess?
- How to set up a trial?
- How to evaluate if a trial was successful to inform a funding application?
- How and where to start upon receiving the technology?

Research team and Advisory panel



USA

Pennsylvania

Sandra Masayko
Advisory panel

Europe

Sweden

Belgium

UK

Norway

Canada

A Prof. Beata Batorowicz
Advisory panel

A Prof. Claire Davies
Advisory panel

South Africa

Dr Kerstin Tönsing
Advisory panel

Prof. Elegast Monbaliu
Saranda Bekteshi
Co-investigators

Belgium

Dr. Mike Clarke

Dr. Tom Griffiths
Co-investigators

UK

Andreas Larsson
Eye-gaze control technology user
Advisory panel

Eva Holmqvist
Occupational therapist
Advisory panel

Maria Borgestig
Advisory panel

A Prof. Kate Himmelman
Co-investigator

Sweden

Dr. Kristine Stadskleiv
Advisory panel

Norway

Rachelle Baldock
Advisory panel

Abigail Allsop
Co-investigator

Noah Callan
Eye-gaze control technology user
Advisory panel

Shelley Hansom-Brown
Parent to an eye-gaze control technology user
Advisory panel

Belinda Deramore Denver
Occupational therapist
Advisory panel

Karyn Muscat
Advisory panel

Claire Galea
Statistician
Co-investigator

Nicky Arthur
Speech pathologist
Advisory panel

Kayla Chapman
Advisory panel

Rene Perekles
Parent to an eye-gaze control technology user
Co-investigator

Australia

Sydney

Melbourne

Western Australia

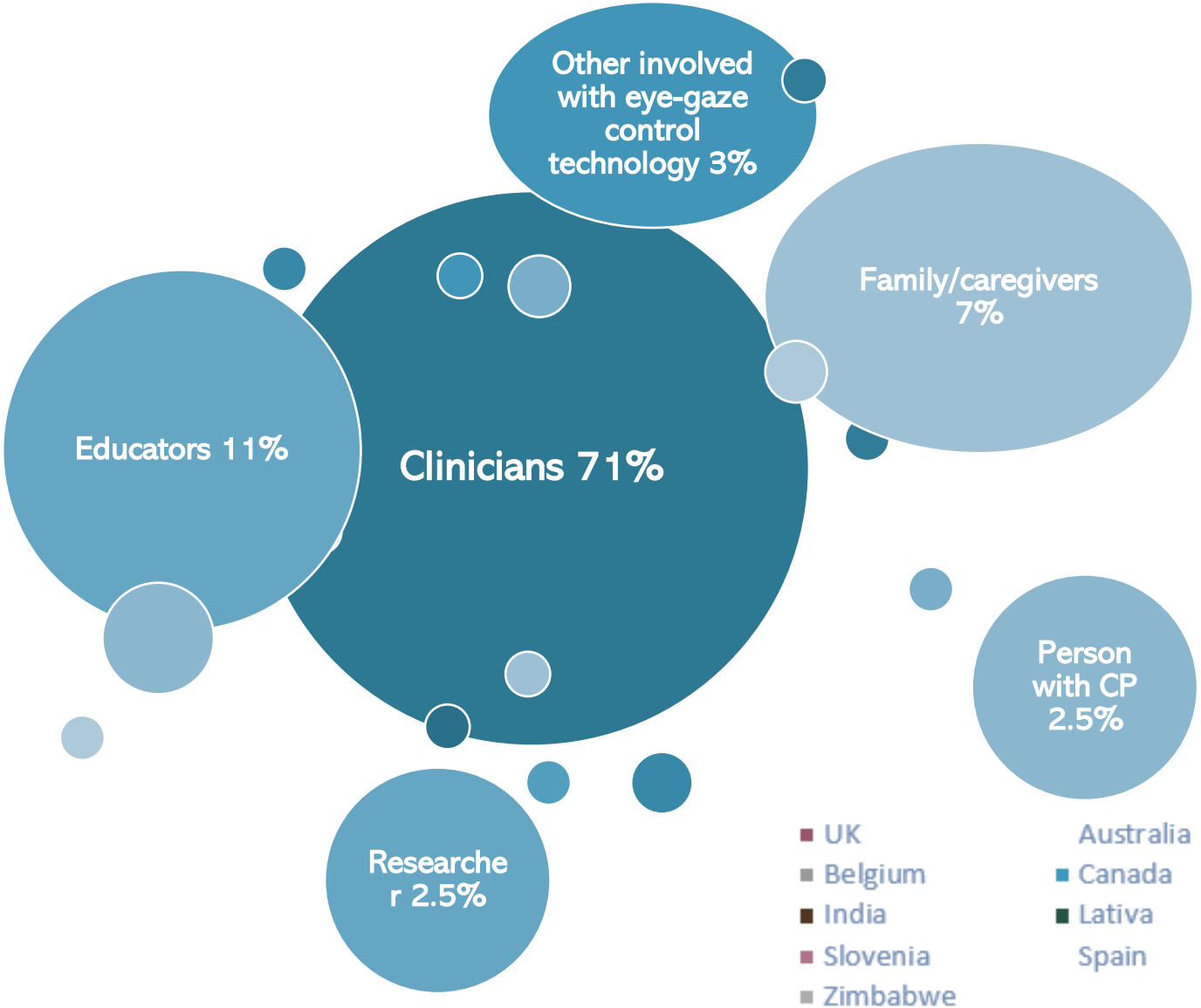
Tasmania

Dr. Petra Karlsson
Principal investigator and Project Lead

Dr. Margaret Wallen
Co-investigator

Australia

Who heard our call to take part in the Delphi study?



- UK
- Australia
- Sweden
- USA
- Belgium
- Canada
- Afghanistan
- Croatia
- India
- Lativa
- Malaysia
- Norway
- Slovenia
- Spain
- Turkey
- Virgin Islands
- Zimbabwe

Eye-gaze control technology for people with cerebral palsy

CLINICAL GUIDELINES

2021

@EyesonComm

Eyes on Communication

Cerebral Palsy Alliance · The University of Sydney · ACU · Region Västra Götaland · KU Leuven · UCL · Queens · easterseals · RockyBay · st.giles · Oslo University Hospital

Eyes on Communication

Eye-gaze control technology for people with cerebral palsy – Clinical Guidelines

This document sets out guidelines for the assessment, trial, implementation, support and review of eye-gaze technology and discusses recommendations for when eye-gaze technology is not currently an appropriate access method. The Clinical Guidelines are the result of extensive consultation with many stakeholder groups including people with cerebral palsy, their families, professionals from health and education, researchers and biomedical engineers.

The Clinical Guidelines are intended for use by people with cerebral palsy, their support networks and professionals making decisions about eye-gaze control technology.
Download a free copy here:

For those interested in learning more about how the guidelines were developed, the paper explaining this is available free here:

THE CONTENT FOR THE CLINICAL GUIDELINES

Unique features of eye-gaze control technology Section 1	
Assessment	Initial assessment Section 2
	The trial Section 3
Implementation	Learning, practise & support Section 4
	The follow-up Section 5
	Outcome measurement Section 6
	Funding considerations Section 7
Preparation for future use of eye-gaze control technology Section 8	

EXAMPLE OF RECOMMENDATIONS FOR

Learning, practise & support
Section 4

WHAT IS IMPORTANT TO KNOW ABOUT THE **RESOURCES** NEEDED	
4.3.1	a) guidelines for the assessment of eye pointing

WHAT IS IMPORTANT TO KNOW ABOUT THE PERSON'S **FREQUENCY OF PRACTISE AND SUPPORT**	
4.3.2	a) in regular, frequent sessions
	b) in short sessions, to reduce the effects of fatigue
	c) start by focusing on skills (e.g., cause and effect, targeting, dwell) through activities or games
	d) be supported by professionals who will guide direction and identify areas to work on
	e) receive face-to-face support (through tele-health or in person) using the technology in their usual settings
	f) be provided with clear modelling, demonstration and direction
	g) have an individualised practise plan
	h) have practise embedded in their current routines

WHAT IS IMPORTANT TO KNOW ABOUT THE PERSON'S **ENVIRONMENT AND SUPPORT NETWORK FREQUENCY OF PRACTISE AND SUPPORT**	
4.3.3	a) should receive regular training and support to use, repair and upgrade the technology and the support the person
	b) training in technical aspects of the device
	c) timely technical support in person / by phone / online
	d) support from multiple professionals as relevant and required (speech language therapist/speech pathologist, occupational therapist, physiotherapist/ physical therapist, psychologist, assistive technology consultant, education professional)

EXAMPLE RESOUCE PAGE FOR

Learning, practise & support
Section 4

Parent perspective of helpful activities when learning to use eye-gaze control technology

https://www.dropbox.com/s/n06ogd4z7bv0azy/Delphi%20interview%204.mp4?dl=0

EXAMPLES OF ONLINE RESOURCES

Freely available resources for communication and learning

- https://www.vgregion.se/ov/dart/dart/forskning/projekt/delaktig-i-ogonblicket/ [in Swedish]
- https://www.cogain.org
- https://staging.ilc.com.au/wp-content/uploads/2016/12/Keys-to-Developing-Eye-Gaze-Skills.pdf
- https://www.rockybay.org.au/resources/aackit/

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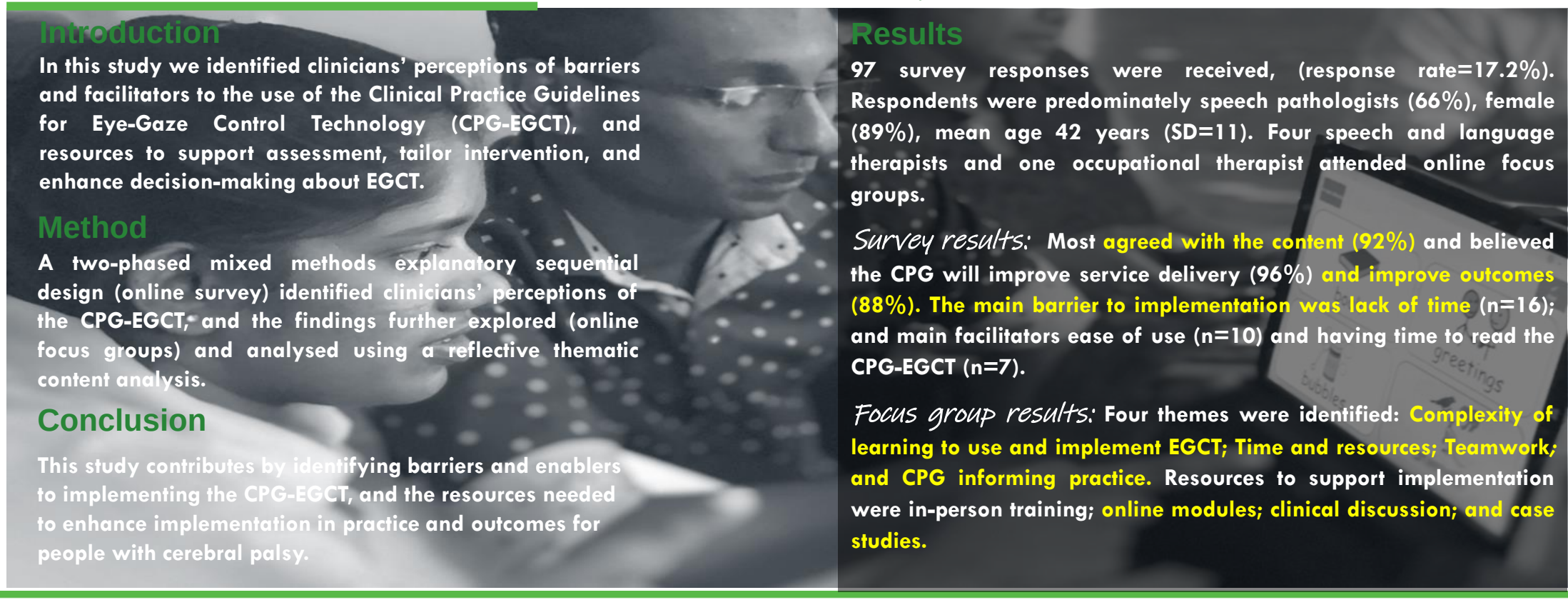
Eyes on Communication - clinicians

Implementation of Clinical Practice Guidelines of Eye-Gaze Control Technology for People with Cerebral Palsy: *Barriers and facilitators identified by clinicians*



Introduction

In this study we identified clinicians' perceptions of barriers and facilitators to the use of the Clinical Practice Guidelines for Eye-Gaze Control Technology (CPG-EGCT), and resources to support assessment, tailor intervention, and enhance decision-making about EGCT.

Method

A two-phased mixed methods explanatory sequential design (online survey) identified clinicians' perceptions of the CPG-EGCT, and the findings further explored (online focus groups) and analysed using a reflective thematic content analysis.

Conclusion

This study contributes by identifying barriers and enablers to implementing the CPG-EGCT, and the resources needed to enhance implementation in practice and outcomes for people with cerebral palsy.

Results

97 survey responses were received, (response rate=17.2%). Respondents were predominately speech pathologists (66%), female (89%), mean age 42 years (SD=11). Four speech and language therapists and one occupational therapist attended online focus groups.

Survey results: Most agreed with the content (92%) and believed the CPG will improve service delivery (96%) and improve outcomes (88%). The main barrier to implementation was lack of time (n=16); and main facilitators ease of use (n=10) and having time to read the CPG-EGCT (n=7).

Focus group results: Four themes were identified: Complexity of learning to use and implement EGCT; Time and resources; Teamwork; and CPG informing practice. Resources to support implementation were in-person training; online modules; clinical discussion; and case studies.

Breyana Stevens-Hofer [3], **Petra Karlsson** [1,2] Michell McInerney [4], and Margaret Wallen [3]

1. Cerebral Palsy Alliance, Australia
2. The University of Sydney, Australia
3. The Australian Catholic University, Australia
4. The University of Limerick, Ireland

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Cerebral Palsy ALLIANCE

THE UNIVERSITY OF SYDNEY

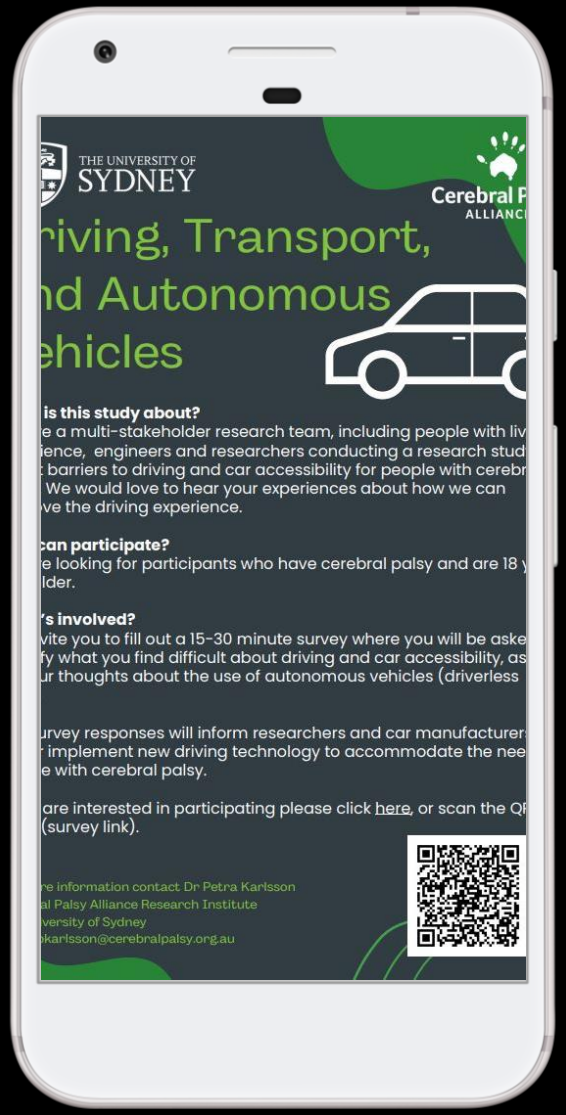
Cerebral Palsy ALLIANCE

Eye-gaze technology and tele practice

Collaboration with Joshua Aaron,
Founder of SQUIDLY EYES

MOBILITY

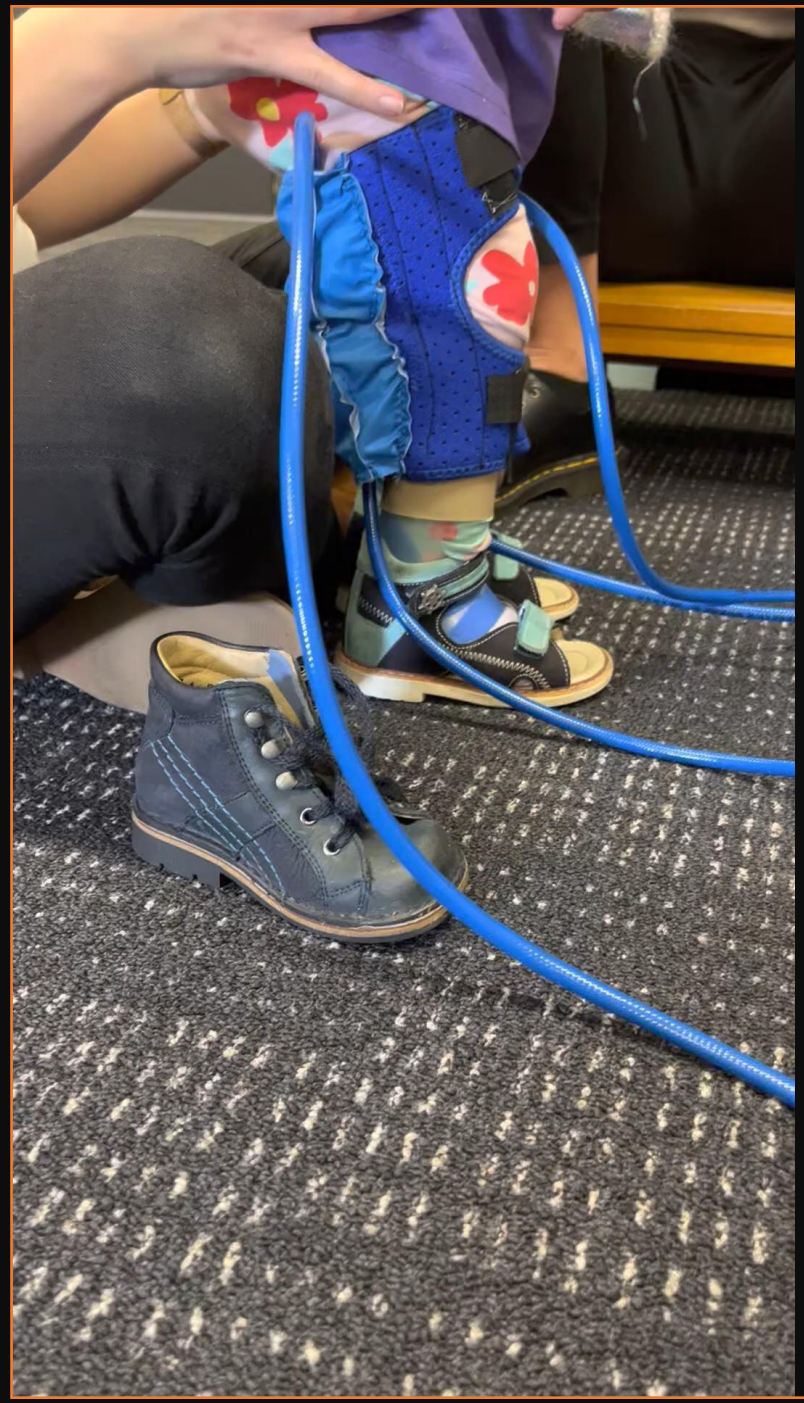
Car Survey



SURVEY RECRUITMENT

Investigators: Dr. Petra Karlsson, Darryl Chiu, A Prof. Silvia Orlandi, Ismail Sadozai, Jerusha Mather, Kiara Dolso, Prof Alistair McEwan

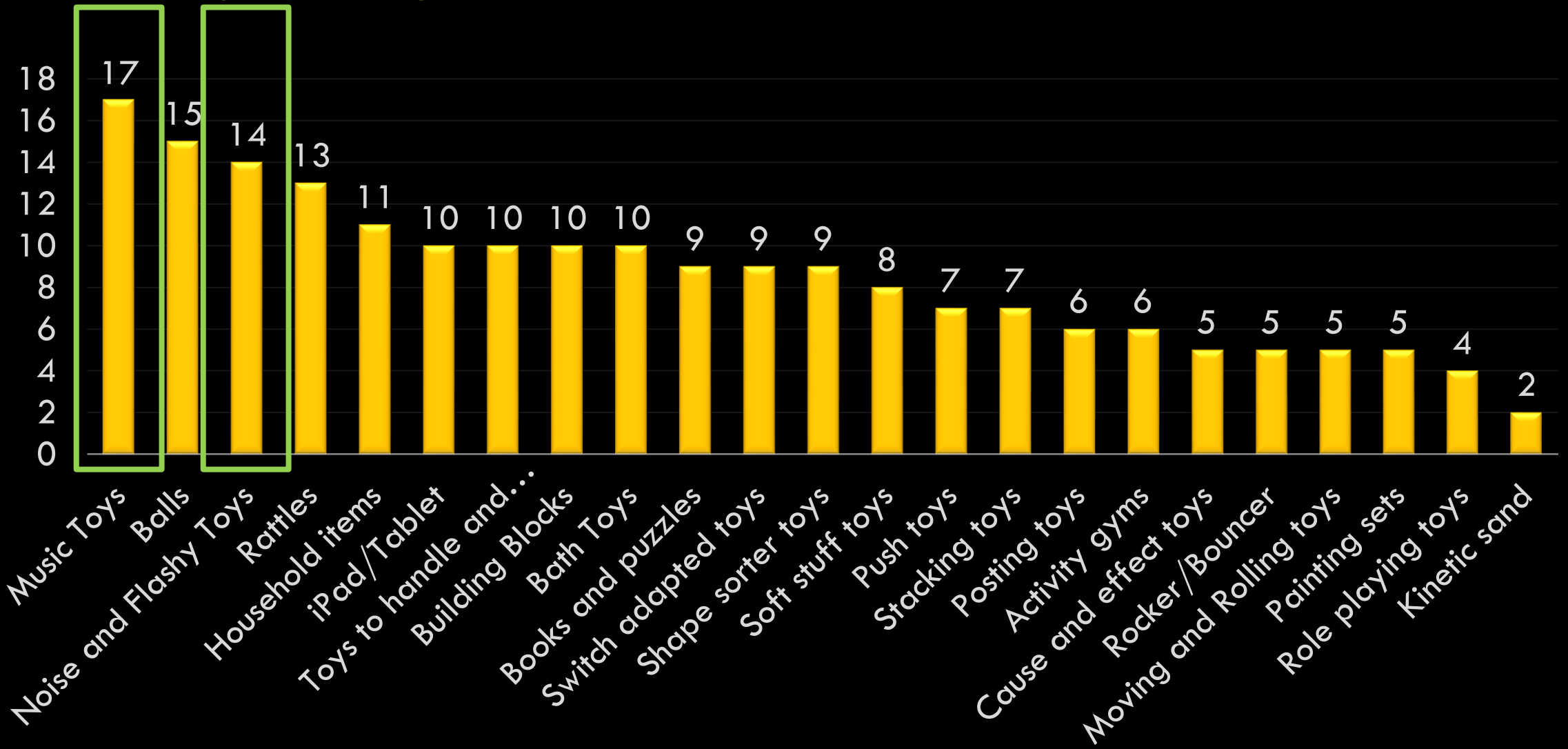
Soft Exoskeleton



SOFT ROBOTICS

TechToys

TechToy survey results



Frequency count from 31parents n2= 6 -11 months old's; n=15 1-1year 11 months old's; n=14 2- 2 years 11 months old's; Mini-MACS: III=16; IV=10; V=4; GMFCS E&R: II=1; III= 9; IV=16; V=4.

Music Toy - Theramin

Biomedical engineering - Internship: Michael Laporte

Biomedical engineering - Honours student: Wesley Zhang