TechnoTalk
The TASC Newsletter

Volume 16 Issue 3 May 2007

building futures

Editorial

by Jo Ford

Welcome to the May 2007 Edition of TechnoTalk.

Over many years the TASC Team have eagerly awaited the opportunity to try Eye Gaze Technology here in Australia. We have patiently watched the development of this technology overseas and finally various products have arrived on our shores. Over the past six months the TASC Consultants have met with suppliers and reviewed the eye gaze systems now available.

It has been fantastic for us to finally have this technology for our clients to trial. With the information so fresh at hand the occupational therapists on our team have put together a table which summarises the features of four systems that we have had an opportunity to look at. As with most assistive technology products the unique features of each system need to taken into consideration and trialed when exploring most appropriate solutions for our clients.

Happy reading

Jo

Eye Control Technology

Salli-Ann Craik

Petra Karlsson

Liza MacLean

A number of eye control systems (also known as eye tracking or eye gaze systems) have recently become available in Australia. The systems vary in their technology, set-up and application, however the main goal is to be able to control computer software just with movement of the eyes, allowing the user access to voice output communication, standard computer functions (e.g., word processing, email and Internet via an on-screen keyboard), and environmental controls (e.g., television, lights, etc.). These systems are designed for people who have a physical impairment resulting in limited movement, or control of movement, that can prevent them from accessing a computer (or communication device) effectively and efficiently via other input methods (such as alternate mouse options, voice control or switch scanning systems). Some of the user groups that may benefit from eye control systems are people who have motor neurone disease, muscular dystrophy, multiple sclerosis, high level spinal cord injuries and cerebral palsy.

To be able to functionally operate eye control systems, users must be able to look up, down, left and right and direct their gaze to all areas of a computer screen. They must be able to focus on a spot for at least 500 milliseconds (to select an item) in order for most systems to work effectively. Eye problems such as nystagmus, strabismus, visual acuity and medication that effects eye tracking can influence the accuracy of the access to the systems. “Eye tracking means figuring out the movement of the eye as a person is looking at something. Video-based eye tracking devices observe a person’s pupil to determine the direction of their gaze” (COGAIN website glossary). Reference points are measured to calculate the gaze point (also known as point of regard) – this is done by measuring the corneal reflections relative to the centre of the pupil. The corneal reflections are typically obtained by an infrared light source (sent from a camera to the eye). The infrared light source is not visible or damaging to the user and is reflected from the eye back to the camera to calculate the gaze point.

There are variations in how well each system can track the user’s pupil. Some systems track one eye and others track both. In order for the system to calculate the direction of gaze, the user first needs to complete a calibration process. This involves looking at a number of points on the screen, one at a time, with the duration required to look at each point and the calibration process varying between systems (including size, colour and shape of targets and choice of screen area to calibrate, or speed of calibration). The camera needs to have an unobstructed view of the user’s eye to be able to track it accurately. The user’s ethnic background may have an effect on how light is reflected from the retina. Eyelids, eyelashes, and glasses frames can obstruct the view to the eye. Some contact lenses can also cause difficulties as they can move around on the eye and the reflection is obtained from the surface of the contacts, not from the cornea itself. Calibration can fail even in able bodied people with normal vision. Other factors such as ambient light and reflections from the environment can also have an affect.

In addition, problems can occur if users have severe involuntary head or eye movements. Most systems have an optimal distance (approximately 60cm) and location concerning

where the person should sit in relation to the eye-tracking device and most have adjustable systems for the distance and angle of the tracker. Systems that track two eyes can have better accuracy for users with involuntary movements as the tracker can continue temporarily with data from one eye if the other eye is lost. However, it is cautioned that 'two-eye' systems are not necessarily appropriate for all users as some may not have good control over two eyes or may have poorer vision in one eye.

If calibration fails, some systems can be used with a default calibration setting, however, the accuracy will not be as good and screen targets will need to be larger to compensate, which can make access to systems slower as several selections are required for one command. Some systems can be set to calibrate only certain screen areas that the user can visually access, however this can also limit accuracy and make access to the system slower.

The effectiveness of eye control systems can be influenced by other factors such as:

- The lighting conditions – it is important to trial systems in all environments including outdoors in sunlight.
- The skill of the user, including factors such as their cognitive, visual and physical abilities.
- The age / mood / level of fatigue / state of health / level of motivation, etc. of the user.
- The power / features / condition of the computer being used with the eye control system – some systems work with an external computer, others are integrated systems with tablet style computers.
- The positioning of the user and the system – consider whether the user needs to access the system in a wheelchair and/or in bed and how both need to be positioned for accurate access to the system. The user will need supportive seating and positioning to ensure a stable position and to allow good head control for eye tracking. The system may need to be adjustable and have the ability to be mounted to ensure accurate access in lying positions.
- The portability of the system – this will affect how and where the user can access the system. Some systems can be mounted to a wheelchair (but may obstruct vision for driving) and others are less portable requiring mains power or access to a desktop computer.
- The ability of the system to be accessed independently by the user once set up. An important factor in this independence is the ability of the system to recalibrate if the user leaves and returns, and whether the calibration process can be accessed without external assistance. It is also important to consider whether the user can independently shut down and re-start the eye control system.
- The selection method used to activate a cell in the on-screen keyboard / software application can include using an external switch, dwell selection ('hover' eye gaze on a cell for a set time period) or even blinking. A trial of the range of selection methods is recommended for each potential user.
- The visual feedback of the eye image being tracked, can be helpful monitoring to ensure the user eyes are in the optimal position for accessing the system.
- The choice of application software available for the system, including: a choice of on-screen interface; symbols or text output; choice of symbol and text styles, sizes and colours; and the ability to customise the set-up for the user.

Each eye control system has its advantages and limitations and there is no one system better than the rest for each individual user's specific needs. This article is not intended to be a comparison of the systems and it is recommended that users consider the features of each system, talk to suppliers and trial systems before purchasing. A comprehensive assessment with an occupational therapist, speech pathologist and assistive technology specialist is recommended to determine the most effective and efficient access methods available to each user and to determine if eye control is the most suitable alternative access method to technology.

References

1. COGAIN (Communication by Gaze Interaction) website glossary - http://www.cogain.org/glossary/
2. COGAIN (Communication by Gaze Interaction) website catalogue of eye trackers - http://www.cogain.org/eyetrackers/
3. Donegan, M. et al. (2005). D3.1 User requirements report with observations of difficulties users are experiencing. Communication by Gaze Interaction (COGAIN), IST-2003-511598: Deliverable 3.1. Available at http://www.cogain.org/results/reports/COGAIN-D3.1.pdf
4. Donegan, M. et al. (2006). D3.2 Report on features of the different systems and the development needs. Communication by Gaze Interaction (COGAIN), IST-2003-511598: Deliverable 3.2. Available at http://www.cogain.org/results/reports/COGAIN-D3.2.pdf
5. Donegan, M. et al. (2006). D3.3 Report of user trials and usability studies. Communication by Gaze Interaction (COGAIN), IST-2003-511598: Deliverable 3.3. Available at http://www.cogain.org/results/reports/COGAIN-D3.3.pdf

	ERICA	The EyeGaze Communication System	MyTobii (P10) – portable (D10 Desktop model also available)	Quick Glance 3
Features				
Description	The Erica is a communication and computer access system. It can be purchased as a full standard system which incoporates a tablet PC with Windows or Macintosh software and a camera mounted to the base of the screen. It is also available as a dedicated communication system that comes with the tablet PC and camera with communication software only.	The EyeGaze Communication System consist of a computer (box), monitor, camera, keyboard and adjustable bracket. The programs included in the system are: Phrases program with speech synthesizer, on-screen keyboard for simple word processing, visual controlled games, lights and appliances program (X10 module additional). It can be used as an eye gaze keyboard and mouse to control a second computer plugged in via a serial cable and optional computer access program.	The My Tobii P10 includes a 15” screen, eye control sensor and computer integrated into one unit. It can be run via mains power, a powered wheelchair, or an external battery pack. My Tobii software allows the user to perform document editing, access email and games. A range of partner software has been MyTobii enabled to allow access via eye control, including VS Communicator, The Grid 2 or Speaking Dynamically Pro.	The Quick Glance 3 is a separate tracking module that can be added to a Windows computer. It can be purchased separately with mounting brackets for use on a users own laptop or desktop monitor or VESA mount monitor. Or it can be purchased with a tablet PC ready for mounting on a wheelchair or desktop stand.
System Specifications				
Tracking method	Infrared tracking of eye movements via a small camera at the base of the screen.	Infrared tracking of eye movements via a small camera at the base of the screen.	Two built-in infrared cameras track a video image of eye movements.	Infrared tracking of the eye movements via a small camera at the base of the screen.
Track 1 or 2 eyes (Binocular)	One eye.	One eye or binocular tracking available.	Binocular tracking.	One eye or binocular tracking available.
Display size	12.1”	15”	15”	Depends on chosen system.
Speakers	Inbuilt in the tablet PC.	Integrated in the monitor.	Integrated in the monitor.	Depends on chosen system.
Weight	4.5kg	2.7 kg (box), screen additional	5.3 kg	Depends on chosen system. Check with supplier for weight of the tracking module.

	ERICA	The EyeGaze Communication System	MyTobii (P10) – portable (D10 Desktop model also available)	Quick Glance 3
Battery Life	Up to 8 hours using extended life battery.	No batteries. Operated by mains power only.	4 hours - but the operating time is dependent on how the computer is used and accessories connected to the computer.	Depends on chosen system.
Portability	The standard system or dedicated system is a tablet PC with a camera attached to the base. It is supplied with a desktop mount for any flat surface. It can be mounted to a wheelchair using DaeSSy system mounting components. It is also wireless.	The standard system or dedicated system is a tablet PC with a camera attached to the base. It is supplied with a desktop mount for any flat surface. It can be mounted to a wheelchair using DaeSSy system mounting components. It is also wireless.	My Tobii P10 can be mounted for use at a desk, wheelchair, bed or anywhere suitable for the user.	Depends on chosen system. Available from supplier packaged with a tablet PC ready for easy mounting on a wheelchair or desktop stand.
Operating System / System Requirements	Windows XP or Mac OS X	Windows 2000	Windows XP	Windows 98 or Windows XP
Accuracy	0.5 degree	0.45 degrees	0.5 degree	1 degree
Tolerance to ambient light/ sunlight	Reported to work well under varying light conditions. Strong sunlight can be difficult.	Stray sources of infrared may degrade the accuracy.	Reported to work well under varying light conditions.	Reported to work well under varying light conditions
Tolerance to glasses/contact lenses	Reported to work well in most cases.	Reported to work well in most cases.	Reported to work well in most cases.	Reported to work well in most cases.
Accommodation to human eye variations	Reported to work well in most cases. There are settings that can be changed to accommodate for different eyes.	Reported that the system tracks 90 - 95% of the human population.	Reported to work well in all cases.	Reported to work well in most cases. There is an inbuilt “smoothing factor” to accommodate for individual “wiggle” eye movements.
Other access options	• Touch screen • Switch access (1 or 2 switches) • Voice activation (Dragon Naturally Speaking – sold separately)	Keyboard with built-in mouse for the assistant to use.	• Touch screen • Switch access (up to 4 switches)	Depends on chosen system.
Mounting options	• Comes with a stand • VESA • DaeSSy	• Comes with an adjustable monitor arm table clamp and camera bracket.	• VESA • DaeSSy	Depends on chosen system.
Selection methods	• Dwell • Switch • Direct – touch-screen • DynaVox Windows	• Dwell	• Blinking of the eye • Dwell • Switch • Direct – touch-screen	• Blinking of the eye • Dwell • Switch

	ERICA	The EyeGaze Communication System	MyTobii (P10) – portable (D10 Desktop model also available)	Quick Glance 3
Calibration – process and time	15 seconds – Calibrated by looking at a series of spots on the screen (can be as little as 4 spots).	15 seconds	A few seconds, long lasting calibration	The software displays 16 targets on the screen, which the user looks at in succession. Calibration is done once and then used for subsequent sessions.
Software Options				
Communication	Compatible with many AAC communication software programs • Speaking Dynamically Pro • DynaVox Windows software • EZ Keys • Lifemate software is included (speech software)	• Speaking Dynamically Pro	• My Tobii software • VS Communicator • The Grid 2 • Speaking Dynamically Pro	Compatible with most AAC software programs.
Computer Access	The system allows the user to access mouse functions which enables the user to use any off-the-shelf computer software packages.	The computer access program (additional) permits the eye gaze communication system to act as a peripheral keyboard and mouse interface to another Windows computer.	• My Tobii software • VS Communicator • The Grid 2	The system allows the user to access mouse functions which enables the user to use any off-the-shelf computer software packages.
Environmental Control	Available: (sold separately) • Wireless Radio Frequency transmitter. • X-10 Receiver and Lamp module. • Optional Infrared (IR) remote control Package learns IR functions from any number of IR remote controls. Includes IR remote control software.	• X10 Computer Module The X10 Computer Module plugs into the eye gaze system; add X10 Light or Appliance modules for each appliance to control. (sold separately).	Infrared and X10 capabilty built in Access through interface in: • VS Communicator • The Grid 2	Compatible with most computer-aided environmental control programs. A GEWA infrared trainable remote control (Control Prog/ Prog III) is used to send commands to infrared appliances. (Prog additional).
Approximate Price Check with supplier for inclusions and additional accessories	$15, 540.00 (standard system – ECU accessories extra) $14, 275.00 (dedicated communication system – ECU accessories extra)	$19,286.00 Eyegaze Communication System – including image processing unit, 15” monitor, mounting arm, camera and software for typing, phrases and games	$31,765.00 My Tobii P10 with VS Communicator Pro and full My Tobii Software Package.	$9,500.00 Check with supplier
Manufacturer	Eye Response Technologies www.eyeresponse.com/	LC Technologies www.eyegaze.com/	Tobii Technology www.tobii.com/	Eye Tech Digital Systems www.eyetechds.com/
Supplier	Technability www.technability.com.au	NovitaTech www.novitatech.org.au	Spectronics www.spectronicsinoz.com	Technical Solutions www.tecsol.com.au

Inclusive Learning Technologies® Conference

When: 12 - 15 May 2008.

Where: Marriott Resort and Spa
Surfers Paradise, Queensland

More Information: www.spectronicsinoz.com/conference/2008/

We welcome any feedback, good or bad, that you have on our service.
Please feel free to contact us by phone on 02 9972 8183, email at tasc@tscnsw.org.au or in writing at the address below.

TechnoTalk is available free from www.thespasticcentre.com.au/news/index.htm

the spastic centre

building futures...

For people with cerebral palsy and their families.

The Spastic Centre
189 Allambie Rd, Allambie Heights, NSW, 2100
PO Box 184, Brookvale, NSW, 2100
T 02 9451 9022
F 02 9451 4877
E scnsw@tscnsw.org.au

www.thespasticcentre.com.au