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# Eye Control Hints and Tips

by

the Network of Excellence on

Communication by Gaze Interaction

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## Making implementation a success: Access to mainstream software

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# User Requirements Analysis



- The EGCA should be an open system allowing the use of all functionalities of a multi-media computer.
- Every applications and functions of an application have to be accessible through the use of the pointing device
- The user has the right to use the applications he/she wants. From that point of view, the EGCA has to allow the use of any kind of application and functions without having to prepare or adapt them.

This paper addresses the problem of providing access to main stream software with Eye Gaze Communication Aids (EGCA).

Providing access to main stream software is of enormous interest given the thousands of applications readily available on standard PCs and the cost of developing specific applications.

Another strong argument in favour of access to main stream software is the equal opportunity legislations in areas such as education, workplace, etc...

Nowadays, access to main stream software is essentially if not exclusively provided through a mouse interface.

In this paper, we will present the challenges to be met in order to emulate the mouse interface with an EGCA.

We will present solutions that can be proposed and several cases of users for whom their implementation has been a success.

# Emulating the mouse 1/2



- Need for very high accuracy

*ex: button on toolbar at 45 cm  $\approx$  0.5 degree of visual angle  $\approx$  0.03 mm of resolution on the image of the eye*

Limitation due to sensor capabilities but also due to physiological factors

Solutions ?

- « aiming » compensation
- local recalibration
- zooming factor

- Need for high sampling frequency

*ex: a low sampling rate introduces a delay between the eye movement and the displacement of the cursor non compatible with a comfortable use of the computer. Comparing to a hand-driven mouse (100 ips), 30 samples per second seems to be a minimum*



Emulating the mouse interface of a standard personal computer is a real challenge for EGCA designers.

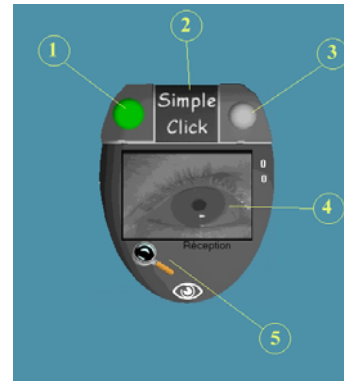
First of all is the need for very high accuracy. The size of a typical button on the toolbar of the Windows interface corresponds to a resolution of 0.03 mm on the image of the eye! Such a resolution corresponds to a sensor with more than 20 000 pixels for a viewing field allowing some movements (typically 20 cm).

Second is the need for a high sampling frequency. A low sampling rate introduces a delay between the eye movement and the displacement of the cursor. Such a delay is not compatible with a comfortable use of the computer. Comparing to a hand-driven mouse (100 ips), 30 samples per second seems to be a minimum.

## Emulating the mouse 2/2



- Avoid the « Midas » touch problem
- Controlling the different functions of a standard mouse
- Provide solutions to deal with eye movements alterations



The “Midas” touch problem is a classical problem with EGCA interfaces: the user must be able at some times to simply watch the screen without triggering commands.

There must be an easy way to switch from the “watching mode” to the ”command mode”.

The user must also be able to select one of triggering commands available on the mouse interface of a standard PC such as the right click, the left click and the drag and drop.

In order to meet these requirements, a specific mouse interface program has been implemented on the Visioboard EGCA.

This mouse interface includes a button (number 2 on the image) which allows to change from single click to double click to drag and drop.

Buttons number 1 and 2 allow for the selection of right click and left click. If both of them are deselected, the user can freely watch the monitor without triggering any action.

A real time video of the user’s eye is included in the middle of the mouse interface. It is found to be very useful in case of malfunction of the EGCA to allow the user to identify possible problems with the analysis of the image of the eye.

# Applications that have been validated



- Onscreen keyboards :  
*DonnerLaParole, Wivik, Clavicom, The Grid, CVK, Mind Express, Keyvit, Qualikey.*
- Microsoft :  
*pack Office, Internet Explorer, Outlook, MSN Messenger, Mediaplayer.*
- Free alternatives :  
*OpenOffice, Firefox, Thunderbird, VLC, VisioPlayer.*
- Specific tools:  
*Dasher, VNC, Qualiworld, RocketDock, DreamWeaver*



This mouse interface has been tested successfully with a large number of standard applications:

On screen keyboards:

*DonnerLaParole, Wivik, Clavicom, The Grid, CVK, Mind Express, Keyvit, Qualikey.*

Microsoft standard software packages:

*pack Office, Internet Explorer, Outlook, MSN Messenger, Mediaplayer*

Free alternatives to the Microsoft applications:

*OpenOffice, Firefox, Thunderbird, VLC, VisioPlayer*

And specific tools such as Dasher, Qualiworld, RocketDock, Dreamweaver.

Many games are also compatible.

## Sébastien, Planning Manager, 28



- Nearly complete tetraplegia, keeps for the moment autonomic breathing, voice and one thumb mobility.
- Amyotrophic Lateral Sclerosis: variable evolution
- Has a « contract » with his parents: they let him live alone in his own apartment as long as he is able to work.
- Was searching a « long-term » solution



We will now present several examples where this solution has been successful:

Sébastien B. is a 28 years old man has a job as planning manager, with ALS.

At present, he is affected by a nearly complete tetraplegia.

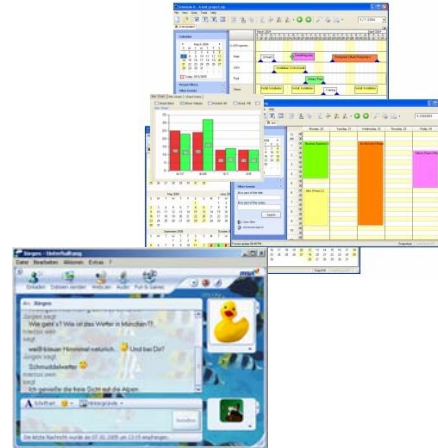
Until now he still has autonomic breathing, voice and one thumb mobility.

He lives in his own apartment and has kept his initial job as planning manager.

# Sébastien, Planning Manager, 28



- Has to use Excel and a specific intranet application developed by the company.
- Is an internet-fan : wants to browse, chat and more...
- Is a game-addict : plays several online games



Thanks to the EGCA control of his computer

He currently uses Excel and a specific Intranet application developed by his company.

He is also an Internet-fan and uses his computer to browse, chat and more...

Finally he is a game-addict and does play several online games.

## Cédric, Website Designer, 30



- Complete tetraplegia, respiratory aid, unusable voice
- Was the first student in France to pass an exam with an eye-tracker : a degree in computer science (2002).
- Works from home as website designer first as freelance and now as employee



### **Cédric is a 30 years old man**

He is affected by complete tetraplegia, with a respiratory aid, an unusable voice

He is currently employed at home as website designer

He was able to pass an exam in computer science thanks to the use of his eye-tracker (Phelopheau, 2002).

# Cédric, Website Designer, 30



- Wants to use development tools:
  - *programmation languages,*
  - *compiler,*
  - *Debugger, ...*
- Wants to use standard web design tools:
  - *visual html editor,*
  - *flash creation program*
- Realized several web sites:  
<http://cedric.druez.free.fr/>



Thanks to his EGCA, Cedric uses development tools and programmation languages (compiler, debugger, ...) as well as standard web design tools (visual html editor, flash creation program).

## Serge, company creator and manager, 29



- After a severe accident on a motorcycle, complete tetraplegia and respiratory aid.
- Weak hope of recovery : a surgical intervention improved his breathing capabilities.
- Was wine waiter before his accident. Decided to face up and lives his love for the wine



**Serge M.,  
company creator and manager, 29 years old**

**created a web company to sell wine around the world  
writes articles about wine in general press and magazines.**

## Serge, company creator and manager, 29



- Motorcycle accident
- Brainstem trauma ⇒  
Abnormal eye movements
- Diplopia due to defaults in  
conjugated eye movements
- Nystagmus



Serge is a 29 year old man who was injured in a motorcycle accident.  
He is affected not only by paresis but also by eye movement alterations.

# Serge, company creator and manager, 29



- Created a web company to sell wine around the world: he is doing all the office work with an eye-tracker.
- Continues his writing activities, contributing to specialized and general press, for instance to the magazine « Elle ».

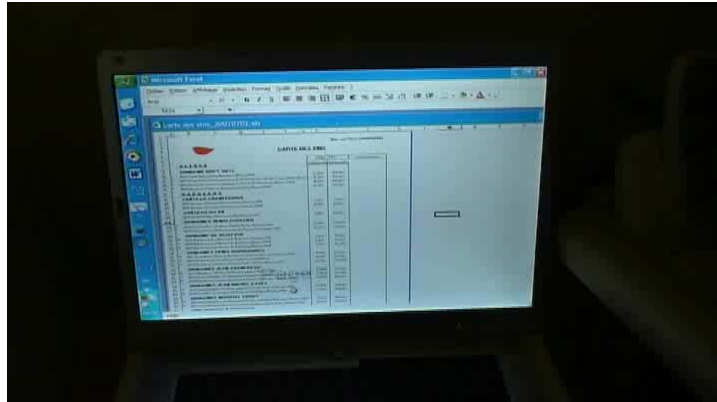


Thanks to the ECGA interface,

Serge created a web company to sell wine around the world:  
he is doing all the office work with an eye-tracker.

Furthermore, Serge continues his writing activities,  
contributing to specialized and general press, for instance to the magazine « Elle ».

## Serge, company creator and manager, 29



[Click here to play the video from web](#)

Serge in control of the ECGA interface, looking at a price list and thereafter sending a reply to an email message.

The video clips is available online at [http://www.cogain.org/user\\_involvement/eye-control-hints-and-tips/mainstream/seq002.wmv](http://www.cogain.org/user_involvement/eye-control-hints-and-tips/mainstream/seq002.wmv)

## Serge, company creator and manager, 29



This study demonstrates the feasibility of a complete emulation of the mouse interface on EGCAs. Such an interface provides access to an enormous amount of applications readily available on standard PCs and avoids the cost of development and maintenance of specific applications to meet the demand of users.



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For more information...



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GILLE F., SCHMIT J.P., MUNISSO F., CHARLIER J., VERMANDEL S., SDOGATI C., CESARONI F., GABUS J.C., DECRAUZAT V., GIROD J.P., DEGROC B. (2000). Report on specific user requirements of the disabled subjects, of their family and of medical workers in the case of severe motor handicap. Telematic project DE4211. VISIOBOARD Gaze control system to provide services and applications to severely handicapped citizens

PHELOPPEAU M.L. (2002). Cédric, myopathe et tétraplégique, passe son BTS avec ses yeux (Cedric, heavily handicapped by myopathy and tetraplegia, passes an exam in computer science with his eyes). Le Monde, June 5th.