



Università di Pavia

FIRB Project

*Software and Communication Platforms for
High-Performance Collaborative Grid*

(application level)

Tunis, March 29th, 2007

Main research directions

- Vision-based perceptive interfaces for explicit and implicit communication
- Graphic learning approaches
- Eye tracking for evaluation of E-learning environments and development of eye-based perceptive interfaces
- (future) Computer-supported 3D virtual environments for collaborative learning

Vision-Based Perceptive Interfaces

Subset of perceptive interfaces
the computer “sees” the user...

Recognition of:

- hand/arm gestures and postures
- head movements and postures
- gaze direction
- face expressions
- whole body movements



Explicit vs. implicit communication

Explicit communication (\Rightarrow control)

users are fully aware that their actions will be interpreted as direct commands



Implicit communication (\Rightarrow awareness)

users' behaviour is indirectly observed to draw information about their activities and "emotional" states

E-learning and machine perception

Does the quality of interaction matter in e-learning?

yes! (of course): yet, many e-learning systems are still based on complex procedures and unusable interfaces...

More natural interaction = better interaction
for any application, but especially for e-learning

Vision-based interfaces for e-learning

can help to improve **user** \Rightarrow **computer** communication
(i.e. *learner* \Rightarrow *virtual teacher* communication)



Example: Gesture-Enhanced Mouse



Perceptive interface for explicit communication

Hand gestures performed nearby the mouse are interpreted as specific input commands



Graphic learning approaches

Example:
*GraphSQL
Builder*
(a graphic
transposition
of SQL)

GraphSQL Builder - [C:\Documents and Settings\Marco Porta\Documenti\Didattica\Tesi Studenti\Cerullo\Esempi di interrogazioni\es_...]

File Edit DataBase View About

ToolBox

- Select
- Table
- Attrib
- Condition
- AND
- Join
- Count
- Constant
- Exists
- Any
- Having
- IN
- Union

Properties

- Appearance
 - Color **Black**
 - Rotate **False**
- Behavior
 - Alias ----
 - Condition
 - Group **False**
 - Name **State**
 - Order **False**
 - OrderType **ASC**
- Layout
- Location **447; 140**

Possible link:

- Select
- Table
- Condition
- Exists (name = "x")

Query

```
SELECT Name, State
FROM Publishers
WHERE PubID = ANY (SELECT PubID
                   FROM Titles)
```

DataBase: None

Eye tracking (1)

The Tobii 1750 Eye Tracker is integrated into a 17" TFT monitor. It is useful for all forms of eye tracking studies with stimuli that can be presented on a monitor, such as websites, slideshows, videos and text



Eye tracking (2)

Usability studies

analysis of eye scan paths, fixations, ...

The screenshot shows the homepage of the Corriere della Sera website on December 15, 2006. The main headline is "Territori, scontri a fuoco Hamas-Fatah" with a sub-headline "Tensioni e sparatorie fra le due fazioni palestinesi. Gravissimo un bambino". The page features a navigation menu on the left, a search bar, and various news sections. Blue dots and lines represent the eye-tracking paths of a user, showing a focus on the main article and the "FOTO DEL GIORNO" section.

This screenshot is identical to the one on the left but includes a red heatmap overlay. The heatmap indicates areas of high visual attention, with the most intense red areas concentrated on the main article's headline and the "FOTO DEL GIORNO" image. Other areas of moderate attention are visible on the navigation menu and the "VIAGGI" section.

Eye tracking (3)

Perceptive interfaces

- implicit communication

- emotional status: is the user "getting nervous"?
- learning constraints: has the user read an important part of a tutorial?

- explicit communication

- new eye-based interaction modalities for disabled users
- new eye-based interaction modalities to be integrated with ordinary input devices (keyboard, mouse, ...)

3D Virtual environments

- E.g. "virtual set" - Both virtual and real objects mixed into a 3D computer generated space
- Main problem: occlusions between actors and virtual elements

