

# Gaze-contingent multi-resolucional displays in Human visual system research

Human vision has many interesting characteristics. One of them is that Human eyes subtend a wide field-of-view and provide high resolution detail at the center of gaze (fovea) with decreasing resolution in the remaining area (periphery). This characteristic of Human vision suggests that most of our computing power can be concentrated to render the small foveal area. That is, limited computing resources are sufficient to draw low resolution images on the periphery. This would allow us to decrease (or re-orient) the computational load, especially in a CAVE system. **Gaze-contingent multi-resolucional displays** is the term used in the literature for this approach to computer graphics

But this result has also direct application in the Human visual system research field. There are many related examples: study of saccadic eye movements; development of activities and computer games to measure and improve stereopsis in patients with amblyopia (lazy eye); study of the vestibular system, which contributes to balance in most mammals.



Address:  
Universidad de Oviedo  
Edificio Departamental Oeste 6.1.27  
Campus de Gijón - 33203  
Telephone: +34 985 18 26 43  
Fax: +34 985 18 22 30  
Email: [ideascad@uniovi.es](mailto:ideascad@uniovi.es)  
N: 43,52438°  
W: -5,6362°



Universidad de  
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**IdeasCAD** started working in this field in 2012, although the project grows thanks to previous efforts. Our partners are the **University College London, UCL** (*Department of Computer Science, Dr. David Swapp*) and the **University of Santiago de Compostela** (*Department of Psychophysics, Dr. Manuel J. Blanco*).

Our main results up to now have been these. First, we have modified our computer graphic library, named **GLSve** (*graphic library stereo vision engine*), so that it is running stable on the **UCL Reactor Facilities** and also on the **Virtual Reality Room at University of Oviedo**. Using shaders technology, it is now capable of modifying in real time the properties of each eye image, taking into account the gaze point (e.g. it is possible to change in different areas of each image color, resolution, contrast, frequencies, field of view and so on).

As a second result, a modified version of the test carried out by Loschky et al. (Loschky, L.; McConkie, G.; Yand, J. and Miller, M. The limits of visual resolution in natural scene viewing. *Visual Cognition*, 12 (6), pp 1057-1092, 2005) has been successfully reproduced using that library in a CAVE environment.

At present we have successfully solved the integration of the eye-tracking system in a CAVE system. New tests of visual perception are in progress.



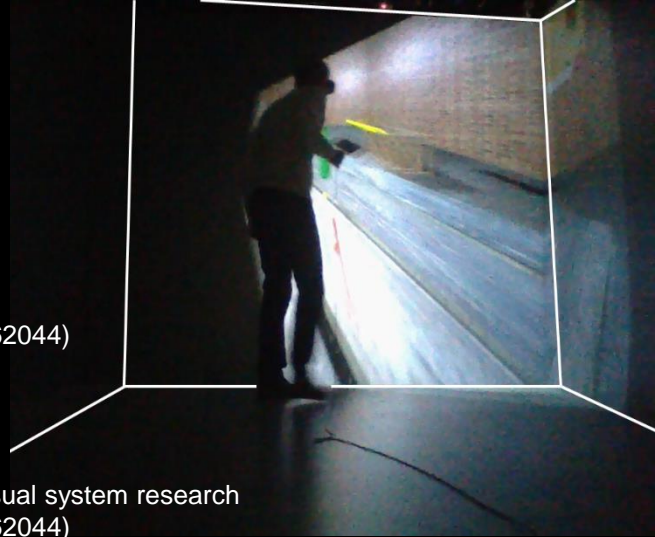
## Projects

2012

Gaze-contingent multi-resolucional graphic library  
VISIONAIR European Union project (grant agreement 262044)  
UCL facilities  
1,500 €

2014

Gaze-contingent multi-resolucional displays in Human visual system research  
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UCL facilities  
1,500 €



## Papers

Towards natural scene viewing tests: a study of limits of resolution in a CAVE system  
Santiago Martín, Manuel J Blanco, David Swapp, Ramón Rubio  
International Conference of Behavioral Optometry, Birmingham, UK; 09/2014

An Open-source C Sharp Library based on OpenGL for Stereoscopic Graphic Applications Development.  
Santiago Martín, Liudmila Pupo, Yoander Cabrera, Ramón Rubio  
Proceedings of 1st International Conference on Simulation and Modeling Methodologies, SIMULTECH 2011 - Technologies and Applications, Noordwijkerhout, The Netherlands, 29 - 31 July, 2011; 01/2011

GLSV: Graphics library stereo vision for OpenGL  
S. Martín, J. Suárez, R. Orea, R. Rubio, R. Gallego  
Virtual Reality 01/2009; 13(1):51-57.

Parallax cues in the design of graphics used in technical education to illustrate complex spatial problems.  
Santiago Martín, Ramón Rubio  
Computers & Education. 01/2009; 53:493-503.

Proposal of interactive applications to enhance student's spatial perception  
Samuel Morán, Ramón Rubio, Ramón Gallego, Javier Suárez, Santiago Martín  
Computers & Education. 01/2008;

## Links

GLSVe (<http://sourceforge.net/projects/glsve/>)  
VRPN C# Client (<http://sourceforge.net/projects/vrpnclient/>)  
UCL Department of Computer Sciences (<http://www.cs.ucl.ac.uk/>)  
Manuel J. Blanco, blog sobre percepción (<http://blogdepercepcion.es/>)  
Video (<http://youtu.be/9YC1zo9AHiY>)



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