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## PROJECTE DE DOCTORAT INDUSTRIAL EXPEDIENT 2015 DI 051

### DADES DE L'EMPRESA I DE L'ENTORN ACADÈMIC

**Títol del projecte**

Development of improvement attention measures by novel eye tracking Technology

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### BREU DESCRIPCIÓ DEL PROJECTE DE RECERCA

The aim of this project is to investigate the discovery of the novel role for attention-related eye vergence [So13] in cognitive processing and to assess its relevance for the development of innovative software solutions for smart eye tracking technology. Near-future and long-term applications will use eye tracking technology for interacting with consumer electronic devices, be they mobile phones, tablets, game consoles, or laptop & desktop computers, and will provide an interface to enhance assistive applications in fields as varied as the automotive or the health industries.

Current eye tracking systems track the positions of the eyes while the observer is scanning visual information but do not reveal whether the information is actually processed by the viewer. Watching a scene for a brief period yields many eye gaze points, all considered as equally relevant locations. Yet that same observer may only consciously perceive a few items. Thus, current eye trackers reveal where the eyes look at, but not what the mind sees.

Recent neuro-scientific discoveries demonstrate that during gaze fixation the eyes briefly move in opposite directions in what is called a vergence eye movement. The occurrence of this eye vergence is closely linked to the allocation of visual attention, so that the size of the vergence is a function of the saliency of the gazed object as well as of its task relevance [So13a,b]. Measuring eye vergence, therefore, identifies whether and how a gazed object is processed by the viewer. This novel role for vergence is termed "Cognitive Vergence". Attentional status is a



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central determinant of further cognitive processing, and as such provides a direct window into the viewer's mind.

In this project, we aim to improve the accuracy of Cognitive Vergence as a ground-breaking new solution to the as yet unresolved problem of understanding what information is actually processed as a viewer observes a complex natural scene. To achieve this we use machine learning techniques to improve classification accuracy of vergence responses. Also we will record brain responses (EEG) and eye vergence in humans while performing cognitive test. Testing a large number of subjects permits to establish a best estimate of cognitive processing by vergence.

The results of this project will impact on the development of the next generation of eye tracking technologies. Eye trackers systems that use Cognitive Vergence will have the power to display information according to what the observer truly processes. Smart eye trackers of this kind can then be used as objective screening tools to detect cognitive abnormalities, but also to provide real-time feedback to train viewers to modify their attentional status and thus their cognitive behavior. Integrated into purposefully designed training software like a video game, this would be a cheap, easy-to-use, efficient tool to enhance the mind's eye.

Braingaze is collaborating with Consortio de Maresme in Mataro, Hospital Sant Joan de Deo, Hospital Vall d'Henron in Barcelona, Kings Collega in London and Goethe-Universität in Frankfurt am Main.