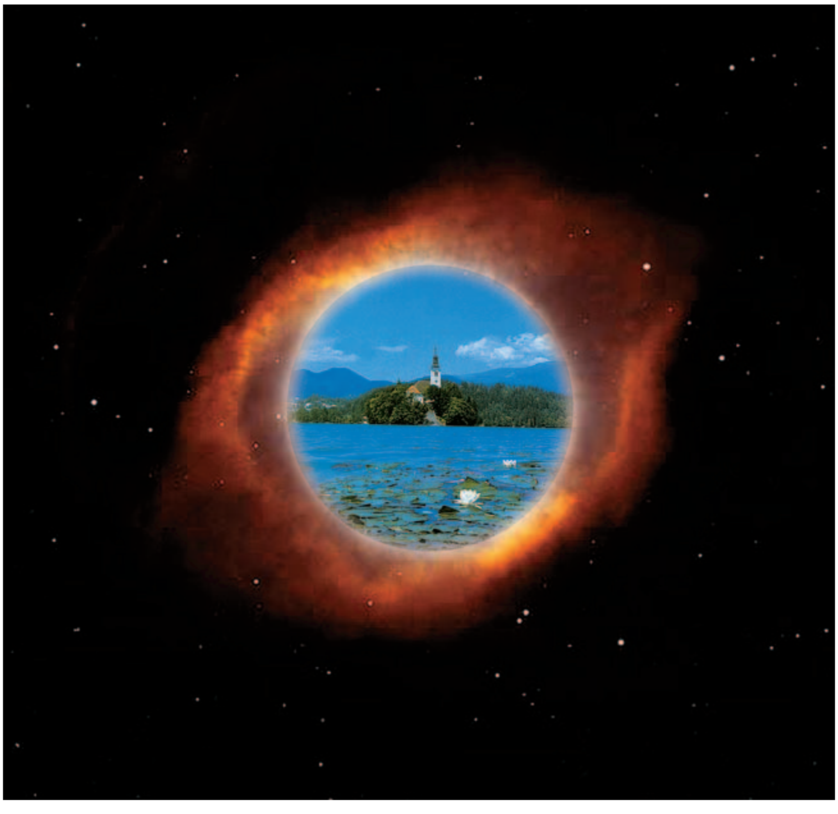
X[th] Meeting of the Child Vision Research Society

X. srečanje Društva za raziskovanje otroškega vida

CVRS 2005 PROGRAMME AND BOOK OF ABSTRACTS

Program in zbornik izvlečkov



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abnormal motion sensitivity and normal form sensitivity showed worse performances than those with only abnormal form, in the Block and the Lines, the opposite pattern was observed. No clear correlation with site or type of MRI features of the brain lesions was found.

Conclusions: The results confirm a high incidence of visuoperceptual and visuospatial difficulties in children with congenital brain damage and hemiplegia. Although selective correlations can be identified between the single tests and ventral/dorsal stream functions, both systems are involved in visual processing, with different degrees of contribution. The assessment of dorsal and ventral stream sensitivity can therefore provide important cues for the interpretation of these deficits and their treatment.

A DEVELOPMENTAL MODEL OF CONGENITAL NYSTAGMUS

MODEL ZA RAZVOJ PRIROJENEGA NISTAGMUSA

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Purpose: Congenital nystagmus (CN) is a spontaneous oscillation of the eyes with an onset in the first few months of life. In 90% of affected children there is an associated underlying sensory defect (foveal hypoplasia, cone dysfunction, cataracts, etc.). In 10% no underlying visual defect can be found, and the nystagmus is labelled as 'idiopathic'. CN appears to be a developmental anomaly of sensorimotor integration, as it is not have an onset later in infancy or beyond, but why such a wide variety of early onset visual defects should lead to life-long oscillation of the eyes is a mystery. Previous models have focussed on a systems level approach to explain *how* CN might be generated by known oculomotor circuits. We ask, instead, *why* CN might occur.

Model: Our basic tenet is that infant visuomotor development is highly plastic during some early 'critical' period. A defect of foveal vision occurring during (and only during) this period leads to an anomalous connectivity in the oculomotor circuitry, which becomes permanent thereafter. We propose that circuitry normally used for precise foveal registration of a visual object (gaze holding, fixation, and smooth pursuit) develops to maintain some degree of image motion, as this would maximise contrast for a low spatial frequency system. However, this motion is in conflict with maintaining the image on the fovea (or its remnant). We explore the best oculomotor strategy to cope with this conflict.

Results: The optimal strategy (in the least squares sense) is to oscillate the eyes in one meridian with alternating slow and quick (saccade) phases. Remarkably, the optimal waveform profile has an increasing-velocity profile. Many of the unique waveforms seen empirically in CN are also optimal strategies given realistic

uncertainty in the initial position of a slow phase. Using non-linear dynamical systems analysis, we show that these 'optimal' oscillations have similar fractional correlation dimensions to observed data. We also show that a 'null region', as commonly observed in CN, would be an inevitable consequence of a velocity driven oculomotor system.

Conclusions: We have developed a new approach to understanding oculomotor development, in which we examine the best strategy to maximise visual contrast. In a normal foveate visual system with fine oculomotor control, the best strategy is to develop good foveal registration, which we call 'fixation', and 'smooth pursuit'. If, however, the fovea is absent or not being stimulated (eg. cataracts), the best strategy would be to develop oscillations of the type seen in CN. It implies that the chaotic oscillations are the result of a physiological developmental adaptive process. This is in contrast to the prevailing view that CN is a disease that can be 'cured'. It is not surprising that CN has proven remarkably refractory to therapeutic intervention with only minimal (if any) long-term successes using drugs, surgery, or even biofeedback. We argue that CN is as adaptive and permanent as normal eye movements are in a normally sighted individual.

DEVELOPMENT OF PURSUIT EYE MOVEMENTS IN THREE DEMENSIONAL SPACE

RAZVOJ SLEDILNEGA GIBANJA OČI V TRIDIMENZIJSKEM PROSTORU

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Purpose: To maintain optimal clarity of objects moving slowly in 3-dimensional space close to the observer, pursuit eye movements are necessary that consist of smooth-pursuit and vergence; smooth pursuit system moves left and right eyes in the same direction, while the vergence system moves in the opposite direction. The purpose of this study is to investigate development of pursuit eye movements in children.

Subjects: Twenty-five healthy children aged 5~14 participated in this study. Informed consent was obtained from each subject and parent. Twenty-three adults aged 20~34 were examined as controls.

Methods: Subjects were asked to sit in front of a computer display with their head restrained. A 0.5 deg spot moved sinusoidally at 0.2 Hz horizontally or vertically. For a vergence task, LCD shuttered glasses were used to present a spot in 3-D virtual space. Subjects were instructed to pursue the target. To examine effect of distractor, two different kinds of background, homogeneous or textured with random dot patterns, were presented on the display during target movements as previously described (Takeichi et al. 2003). To examine how pursuit velocity is maintained