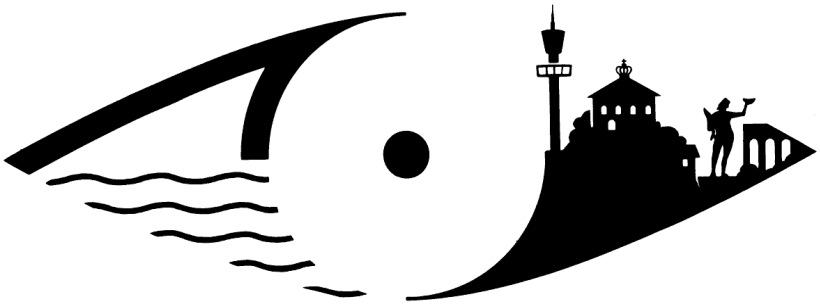

9th meeting CVRS
Child Vision Research Society
12-14 June 2003
Göteborg, Sweden

Program 9th meeting CVRS

Thursday June 12, 2003

8-10 Registration
Coffee
10.30-10.45 Welcome
10.45-12.00 Papers Session I "Amblyopia"
Lunch
13.30-14.45 Papers Session II "Visual tracking"
Coffee
15.15-16.30 Papers Session III "Accommodation"
16.30-18 Conclusion and planning of next meeting
18.15 Welcome reception including visit of art exhibition "Nordic light"

Friday June 13, 2003

9-10.15 Papers Session IV "Eye movements"
Coffee
10.45-12.00 Papers Session V "Screening"
Lunch
13.30-14.45 Posters

18.30-22.30 Archipelago excursion

Saturday June 14, 2003

9-10.15 Papers Session VI "Diagnostic electrophysiology"
Coffee
10.45-12.00 Papers Session VII "Miscellaneous"
Lunch
13.30-14.45 Papers Session VIII "Visual perception"
Coffee
15.15-15.45 Conclusion
15.45 -? SIGs (Special Interest Groups)

General
Each session starts with 5 minutes introduction and ends with 10 minutes of general discussion. Session V starts with a review by the moderator. Each speaker has 10 minutes at his/her disposal for the presentation and 5 minutes for questions and/or discussion. It is the responsibility of both the moderator(s) and the speakers that the time limit is kept!
The poster session will start with a brief (approx.3 minutes per poster) walk-through of the exhibition.

Session I: Amblyopia

10.45-12.00
Thursday June 12

Moderators: Merrick Moseley & Josefin Ohlsson

Treatment dose-response for amblyopia: results from the MOTAS study

Catherine E Stewart*, Alistair R Fielder*, Merrick J Moseley*, David A Stephens# & the MOTAS cooperative.
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Purpose. To determine the dose-response relationship of occlusion therapy for amblyopia.
Methods. Data were obtained from 94 subjects (mean age = 5.1 ± 1.4 years) with amblyopia associated with strabismus (n=34), anisometropia (n=23), and with both anisometropia and strabismus (n=37). 86 subjects required refractive correction and underwent 18 weeks of spectacle wear ('refractive adaptation'). Subjects whose amblyopia persisted were prescribed 6 hours of occlusion per day. Outcome variables (logMAR visual acuity, log letter contrast sensitivity) were assessed at two weekly intervals until gains in visual acuity ceased to be statistically verifiable. Patch wear was objectively recorded using an occlusion dose monitor (Fielder AR, et al. Lancet, 1994;343:547).
Results. Mean visual acuities in amblyopic eyes at the start and end of refractive adaptation were 0.69 ± 0.38 and 0.44 ± 0.42 logMAR respectively. Thirteen subjects who gained normal visual acuity during this phase were not occluded. Mean visual acuities at start and end of occlusion were 0.50 ± 0.36 and 0.15 ± 0.16 logMAR respectively. 85% of the improvement occurred in the first 6 weeks of occlusion. The relationship between visual acuity gain and total occlusion dose is described by a monotonic function, which for all categories of amblyopia appears to be linear up to 400 hours of total recorded dose. This provides a dose-response rate of 0.1 log unit improvement per 80 hours of occlusion.
Conclusions. Refractive adaptation is a distinct component of amblyopia treatment, the benefits of which should be fully differentiated from those of occlusion. Visual outcome is positively correlated with dose. Occlusion therapy is most effective in the first few weeks of treatment.

Objective monitoring of compliance with the Occlusion Dose Monitor in ERPAS, reproducibility and reliability

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Introduction: In a prospective randomised study ways of enhancing compliance cost-effectively with occlusion therapy for amblyopia are determined and risk-factors for non-compliance are identified. Since January 2003 additional children for this study are recruited in Frankfurt, Leicester, Liverpool and Bristol. The question was raised whether the data retrieved from the ODM's are reproducible and reliable.
Method: Compliance is measured in all newly diagnosed amblyopic children in The Hague, half of which receive a compliance-enhancing programme. Risk factors for non-compliance are identified by means of 3 questionnaires. 2 Tests were performed to determine whether the data retrieved from the ODM's are reproducible and reliable. Firstly, 2 ODM's were worn on 1 patch during 1 week. Secondly, 1 ODM was worn on the eye and 1 ODM on the arm for 24 hours, these registrations were analysed and compared.
Results. Overall compliance is 63%. 13% of the children are teased when wearing the patch and 28% of the parents do not like the look of their child wearing a patch. 75% finds it difficult fitting the therapy into their daily routine. The difference in data between 2 ODM's on 1 patch was minimal. Wearing the ODM on the arm resulted in a lower and more fluctuating temperature difference.
Conclusion: Logistical factors and perceived social barriers by parents seem to be important determinants for compliance. The ODM's were found to be sufficiently reliable.

Visual acuity at different observation distances in children with normal vision and with amblyopia

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Purpose. Recent studies have revealed that independence of visual acuity (VA) of distance could only be found in 10% of children (Rozhkova et al, 2001 Sensornye Sisitemy 15 257-263). In most adults and school children with normal vision, VA changes with observation distance exhibiting a few categories of distance dependence [Heron et al, 1995 Ophthal. Physiol. Opt. 15 23-30; Rozhkova et al, 2002 Perception 31 Suppl. 168). At the same time, it was shown that amblyopic eyes could have different VA at near and far distances. Our purpose was to compare distance dependence of monocular VA in preschool children with normal vision and with amblyopia.
Methods. Visually normal children and children with strabismic or anisometropic amblyopia aged 5 to 7 years were examined. Their VA was measured at 5 viewing distances (0.5-1.0-2.0-3.5-5 m), using the original charts with tumbling-E optotypes.
Results. In all subjects with normal vision, the two eyes exhibited identical or very similar dependence of VA on distance. In about 70% of all eyes, VA reached its peak value at some intermediate distance (1-2 m). The typical difference between the peak values and the values obtained at the extreme distances was about 0.4 (in decimal units). In patients with amblyopia, the same types of distance dependence were registered. However, the curves obtained for the left and right eyes often indicated different degrees of visual deficit at different observation distances.
Conclusion: Measurements of VA at several observation distances seems to be useful for better diagnostics and optimal treatment of amblyopia.

[Supported by the RFBResearch, grant 01-04-49484.]

Consecutive Exotropia 40 years after surgery for esotropia in childhood

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NU health Organisation, Ophthalmology department, Sweden

It is known that between 4-20% of children who have undergone surgery for esotropia in childhood develop consecutive exotropia many years after the surgery. There is a necessity to study the long-term post operation result. However to our knowledge no study has been reported 30-40 years after surgery for esotropia in childhood.
In our area, strabology was well developed in the 1960s by Late W. Nordlöw M.D., Ph.D. Early surgery and orthoptic training was performed. Documentation was excellent

We are interested to find out the long-term results in a well-treated group of children. The study aims to answer following questions:

- How many:

developed consecutive exotropia?
have residual esotropia?
have any kind of binocular function?

- How

well was visual acuity maintained in well- treated amblyopia?
do the patients regard their own eye
results in aesthetic terms today?

- What are the common criteria for those who developed exotropia?

All medical records were found in the local archives. The Swedish person numbering system enabled us to find the patients. All the patients are from the Älvsborg County and had been operated on by W. Nordlöw.

We will report the first long-term results from this study of patients operated from 1960 until 1969 in Vänersborg.

Session II: Visual tracking

13.30-14.45
Thursday June 12

Moderators: François Vital-Durand & Gustaf Gredebäck

The influence of abstract and meaningful stimuli on shifts of visual attention in infancy

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Department of Developmental and Experimental Clinical Psychology, The Netherlands

Disengaging from and shifting gaze to a salient stimulus is a prerequisite for early exploration and communication and contributes to the cognitive and social development of the infant. The efficiency of disengagement increases in the first few months after birth.
Previous research on disengagement has used abstract stimuli with no meaning for the subjects. Little is therefore known about the effect of different stimuli, in particular whether differences in ecological relevance affect disengagement during the different stages of its development.
Twenty infants were examined in an intensive, longitudinal study. They were tested every 4 weeks from 6 to 26 weeks of age. The frequency and latency of shifts of gaze to peripheral targets were measured in a competition situation, in which the target stimuli appeared while the infants were fixating a stimulus in the centre of their visual field. In contrast to earlier studies, different combinations of stimuli were used. The stimuli used were a short video of the baby's mother's face and an abstract video. Both of the stimuli appeared as central stimulus or peripheral target, which resulted in four different conditions (face-face, face-abstract, abstract-face, abstract-abstract).
Infants were more likely to shift their gaze when the central stimulus was a face and the peripheral target was abstract, while they moved their gaze least frequently and most slowly in the opposite condition (abstract-face). The general frequency of disengagement increased rapidly between 6 and 22 weeks of age. The differences between the four stimulus combinations were most marked between 10 and 18 weeks of age. This suggests that the sensitivity to context variables is highest when disengagement is not yet well established.

Two-dimensional eye-tracking

Helena Grönqvist, Gustaf Gredebäck, Claes von Hofsten
Dept. of psychology, Uppsala university, Sweden

Human gaze is composed of three parts; saccades, smooth pursuit and head movements. Adults can track a vast variety of moving objects requiring coordination and compensation between different parts of the perception-action system to be successful. Gredebäck, von Hofsten and Boudreau (2002) have shown a maturational lag in 9-month-olds vertical component during two-dimensional circular tracking. The purpose of the present study was to investigate the development of vertical and horizontal tracking from 5 to 9 months of age. Gaze was measured with ASL 504 eye tracker and head movements with a Flock of Bird (Ascension). The target, a small, 3D happy face, moved in one of three trajectories (circular, sinusoidal horizontal or vertical) over a vertical surface. Each presentation lasted 20 seconds and was randomly shown 4 times in 2 different speeds 0,2 and 0,4 Hz. Result show that horizontal tracking develops earlier than its vertical counterpart. These data show that earlier studies of one-dimensional horizontal tracking do not seem to be representative of the ocular-motor system as a whole.

The development of reactive saccade latencies during infancy

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Adults have a saccade latency of 180-220 ms (Engel, Anderson & Suechting, 1999). Until now, most studies have used the same criteria for infants (von Hofsten & Rosander, 2003). The aim of this study was consequently to measure RT of reactive saccades in 3-, 5- and 7-month-old infants. By measuring gaze with an ASL 504 infrared tracking system, we were able to observe the infant's saccades. A round happy face descended a vertical trajectory at 16 isolated cases. At one of two central positions, either at 7.5, or at 15 °/s, the object changed direction, and moved diagonally towards one of the four corners of the screen. Result showed that infants' saccadic latencies easily surpass the 200 ms in adults, and the age difference was evident. 3 month-olds had an average tracking latency of 462 ms (horizontal) and 507 ms (vertical). At 7 months, infants decreased their average tracking to 362 ms (horizontal) and 415 ms (vertical).

Directional asymmetry in smooth pursuit in children

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College of Medical Technology1, Department of Physiology2, School of Medicine, Hokkaido University, Sapporo, 060-8638 Japan

Purpose. The smooth pursuit system moves the eyes in space accurately while compensating for visual inputs from the moving background and/or vestibular inputs during head movements. To understand the mechanisms underlying such interactions, we examined the influence of a stationary textured visual background on smooth pursuit tracking and compared the results in young and adult humans and monkeys.
Methods. Human eye movements were recorded using infrared oculography and scleral search coils were used for monkeys while they tracked a target presented on a computer display or tangent screen. The target moved in a sinusoidal or trapezoidal fashion with either homogeneous or stationary textured backgrounds. For monkeys, whole body rotation was also applied during target movement in the same plane.
Results. Children showed asymmetric eye movements during vertical pursuit across the textured (but not homogenous) background; upward pursuit was severely impaired, and consisted mostly of catch-up saccades. Adults showed no asymmetry during pursuit across the two backgrounds. Monkeys behaved similarly; with the textured background, upward pursuit was severely impaired in young (but not adult) monkeys. Selective impairment of upward pursuit was correlated with impairment of downward VOR cancellation during upward whole body rotation in young monkeys.
Conclusions. These results indicate that proper compensation for accurate pursuit tracking matures later in the face of conflicting visual and vestibular inputs.

Session III: Accommodation

15.15-16.30
Thursday June 12

Moderators: Hans Richter & Bertil Sterner

The effect of visual display unit near work on the progression of refractive errors in myopia for three age groups of asthenopic pre-presbyopes: A retrospective longitudinal follow-up study

Hans Richter[1, 2] and Arne Elfström[2]
Department of Psychology, University of Gävle, Gävle Sweden[1]; Department of Optometry and Optical Science Faculty of Physics and Mathematics, University of Latvia, Riga, Latvia[2]

This study quantified the frequency and the rate of progression of myopia in a homogenous sample of asthenopic visual display unit (VDU) workers. The optometrical standard procedure of subjective refraction estimated with the method of Donders was used to determine the direction and the magnitude of the dioptric errors. Sixty-six males and females (n=132 eyes) between 20-40 years of age presenting with a self-reported asthenopia where included in the data bank. In the cross sectional phase of the study a longitudinal retrospective design recorded changes in the individual refractive errors as observed over time (in variable time-windows). In the second phase of the study the retrospective time-window was narrowed down into a 10-year period of observation and included 40 myopes (n=81 eyes) divided into three age groups (20-25: 25-30; 35-40 years) were the progression of the refractive errors where examined by linear regression analysis.
Results showed the following two main characteristics. First, myopia was present by a conspicuous high frequency and myopia was also the type of ametropia that increased in frequency the most; second, the progression of myopia showed age dependence. Linear regression analysis selectively performed on the myopic refraction data within the three age groups showed excessive progression of myopia in the middle-age group (25-30 yr.): -0.036 D/ month, no myopic progression in the young group (20-25 yr.); +0.005 D/month and minimal progression of myopia in the older group (35-40 yr.); -0.011 D/ month. These findings will be discussed from the point of view of age related changes in the accommodative/vergence system and from a general developmental framework.

Impaired relative accommodation - evaluation of accommodative facility training

Bertil Sterner, Maths Abrahamsson , Anders Sjöström
Dept of Ophthalmology, Göteborg university, Sweden.

Purpose. The purpose of the present work is to evaluate an accommodative facility training technique by studying the effect of the training on relative accommodation and related symptoms among otherwise healthy young pre-presbyopes with impaired relative accommodation.
Subjects and Methods. Children aged 9-13 years, referred by School Health Care for near work-related problems and complaining of headaches, blurred vision, asthenopia, loss of concentration, and avoidance of near activity, were selected. Only children with reduced negative relative accommodation (NRA) and positive relative accommodation (PRA) and/or very slow accommodative facility were included. For accommodative facility training, the subjects used an accommodative facility training technique until they reported that the symptoms had disappeared.
Results. In all children, the symptoms gradually decreased and finally disappeared during the training period. Despite some individual variations, our data show a significant increase in both mean NRA and mean PRA among all children in the study group.
Conclusions. The results indicate that accommodative facility training is an effective method resulting in loss of symptoms and that it also has a real effect on the amplitude of relative accommodation in children with impaired relative accommodation.

Dynamics of accommodation in children with Down's syndrome

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Purpose. Static measures show accommodation is reduced in children with Down's syndrome (DS). This study aimed to measure the dynamics of accommodation in this group, by recording the response of the children to a target moving in depth.
Methods. Seven children with DS aged from 3 to 13 years participated. A group of age matched controls were also tested. The children watched a cartoon film on a small display screen while their accommodation, gaze direction and pupil size were measured using eccentric video-refraction (Multichannel Systems Power Refractor). The motion of the screen described a sine wave of amplitude 1.5 Dioptres and frequency 0.2 Hz. Multiple recordings were made and the responses averaged. A sine wave was fitted to the experimental data allowing the phase and amplitude of the accommodative response to be estimated.
Results. The phase of the accommodative and pupil responses in relation to the stimulus was comparable in the DS and control groups. The magnitude of the accommodative response was reduced in many of the children with DS when compared to controls. Accommodative hysteresis was seen in both groups.
Conclusion: The dynamics of the accommodative response in DS appear largely normal. Under-accommodation in DS could be due sensory deficiency earlier in the visual system, rather than a result of poor control of the accommodative system.

What can the normal development of accommodation and vergence tell us about abnormal development?

Patricia Riddell1 & Anna Horwood1, 2
1School of Psychology, University of Reading & 2Orthoptics Department, Royal Berkshire Hospital, Reading, UK

In a series of studies over the last 5 years, we have been investigating the normal development of accommodation, vergence and the linkages between these systems in normal human infants. These studies have demonstrated that there is a great deal of variability in normal development. For instance, we have shown that the comparative rates of development of the vergence and accommodation systems vary across infants. Additionally, the linkage between accommodation and vergence (AC/A ratio) appears to be innate in infants in whom vergence and accommodation are sufficiently developed to demonstrate this linkage. However, many infants seem also to depend on vergence in order to control their accommodation.

We have used neural network models to model the development of the linkages between vergence and accommodation. These studies have led us to much the same conclusions – that the linkages between accommodation and vergence form a fuzzy system with many initial starting points leading to normal developmental trajectories.

Finally, in our large database, we have sufficient data during which the vergence system has failed (neonatal misalignments) to determine the most common correlates of abnormal behaviours in normally developing infants. This has shown that abnormal vergence is not the result of abnormal accommodation, is partially prevented by binocular viewing and occurs most often when targets move from near to far.

We have used this data to formulate a theory which accounts for both normal, and some instances of abnormal, development of the vergence and accommodation systems. We will present this theory showing how our data has led us to this particular account.

Session IV: Eye movements

9-10.15
Friday June 13

Moderators: Claes von Hofsten & Zoï Kapoula

Coherence sensitivity of two motion systems in the infant

A J S Mason1, O J Braddick2, J Wattam-Bell1 1Visual Development Unit, University College London; 2Dept of Experimental Psychology, Oxford University

Purpose. Infants show optokinetic nystagmus (OKN) from birth, but no preferential looking (PL) responses based on directional discrimination before about 7 weeks. This suggests development of two different directionally sensitive systems. We tested whether these developing systems could be distinguished by their sensitivity to global motion.
Methods. Individual infants aged 6-27 weeks were tested with two types of display containing random dots moving at 9.6 deg/sec amid dynamic noise (a) forced-choice PL, where one side of the display contained a strip oscillating in counterphase to the remainder of the display. (b) forced choice judgment of OKN direction, where the entire display moved in the same direction. OKN display dimensions were matched either to the whole PL display or to the counter-oscillating strip. In each case coherence thresholds were estimated by varying the proportion of noise dots according to a staircase rule.
Results. Mean OKN coherence thresholds remained close to 20% throughout the age range. PL coherence thresholds were higher than for OKN at all infant ages, and decreased steadily with age. Experiments varying direction reversal frequency and stimulus area indicated that these differences did not result simply from the spatial and temporal non-uniformity of the PL stimulus.
Conclusions. OKN and preferential looking reveal different coherence thresholds for global motion, and markedly different age trends. We conclude that the directional mechanism underlying the discrimination in PL is largely independent of that underlying OKN in early development. We shall discuss evidence that these are cortical and subcortical mechanisms respectively.

Supported by MRC programme grant G7908507

Early development of visual-vestibular interaction

Kerstin Rosander and Claes von Hofsten
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Is development of VOR and smooth pursuit (SP) parallel? How are head movements involved in gaze fixation in situations of VOR or smooth tracking? How are the VOR and SP coordinated when the infant is oscillated in synchrony with the object? This condition is a challenge for the gaze control process. Vision directs the eyes to the object straight ahead but the VOR drives the eye in the opposite direction. Consequently, if VOR is inhibited then gaze will remain stationary. This is valid for adults. We studied a group of infants between 2 and 10 weeks of age. We designed three conditions (0.25Hz): an object moves in front of the infant (SP condition), the infant oscillates while the object is stationary (VOR condition) and, finally, the object and the infant oscillate in synchrony (VORINHIB condition). The eye movements were measured by EOG, and the head+object movements by an optoelectronic system with passive markers (Qualisys, Gothenburg, Sweden). The results show that at 2 weeks of age the gain of the smooth pursuit component was low (0.1) in the SP condition but increased significantly at 8-10 weeks of age. At 2 weeks of age the gain of the counter-rotations of the eyes was high in the VOR and VORINHIB conditions but increased significantly at 4 to 6 weeks. The saccades decreased the gain in the VORINHIB, and increased the gain in the SP and VOR.

Development of latency accuracy characteristics of saccades and vergence in children

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Purpose. When exploring the 3D visual space we perform saccades, vergence and most frequently combined movements. This study compares the characteristics of the three types of movements in children and in adults.
Methods. Fourteen normal children (4.5-12 years) and 14 normal adults (22-44 years) were studied. LEDs were used to elicit horizontal saccades of 20°, pure convergence or divergence along the median plane (between 20 et 150 cm), and saccades combined with vergence. Eye movements were recorded binocularly with a photoelectric device.
Results. Latency: for both children and adults, convergence latency is the longest; combined movements have longer latency than pure movements. All latencies are significantly longer in young children and reach adult levels at 10-12 years. Initiation of combined movements: the rate of asynchronous initiation of the two components is higher in children than in adults (77% vs 66%). Speed-accuracy: for all three types of eye movements, peak velocity and accuracy are similar in children and in adults. Saccade-vergence interaction: saccade components are slower than pure saccades, and vergence component are faster than pure vergence; the interaction is similar for children and adults. Binocular coordination of saccades: it is poor in children, particularly at close distance.
Conclusions. Long latency and poor binocular coordination of saccades in children could be due to progressive maturation of the cortical circuitry involved in the control of these parameters. In contrast the absence of difference in speed and accuracy of saccades and vergence indicate early maturation of the distinct brainstem structures controlling these movements and their interaction.

Spatio-temporal characteristics of saccades, vergence and combined movements in children with vertigo

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Introduction: Clinicians reported the existence of a children population with symptoms of vertigo, headache, in the absence of vestibular dysfunction; interestingly orthoptic evaluation showed vergence abnormalities (Anoh-Tanon et al., 2000). This study examines in such children the speed-accuracy characteristics of vergence and saccades, and the effect of orthoptic vergence training on these parameters.
Methods. LEDs were used to stimulate saccades, pure vergence along the median plane and combined saccade - vergence movements. Movements from both eyes were recorded with a photoelectric device (BOUIS) before and after orthoptic training.
Results. Similarly to normals, latency of convergence was longer than that of divergence and of pure saccades; combined movements showed longer latencies than pure movements. In contrast to normals, these differences were more accentuated. Particularly convergence latencies were 100 ms longer than that of divergence while in normals this difference is only 30 ms. Convergence duration was abnormally long in children with vertigo (573 ms versus 360 in normals); divergence and convergence along the median plane as well as convergence combined with saccades were highly hypometric in children with vertigo (the percentage of hypometria was 21%, 36% and 42% respectively). After orthoptic training vergence latencies reached normal levels; convergence hypometria was significantly reduced but its duration did not change significantly.
Conclusions. The latency and accuracy abnormalities indicate poor cortical control of eye movements specifically for convergence, that could be due to deficits in visual attention affecting target localisation and thus movement initiation and accuracy. Orthoptic training would improve these functions thereby leading to shorter latencies and better accuracy.

Session V: Screening

10.45-12.00
Friday June 13

Moderator: Peter Jakobsson

Vision screening in 3-year old children. Comparison between the Lea Symbol chart and HVOT (LM) chart

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Purpose. The aim of this prospective study was to compare visual screening at 3 years and at 4 years.
Material & Methods. At four Child Health Care Centres (CHCC) 513 children were tested at the age of 3. Of these children, 466 were tested again at the age of 4. Another group, consisting of 184 children, was examined at the age of 4 only.
All children were tested with two different charts: The HVOT chart and the Lea LH symbol chart. Half of them were tested with HVOT first and the other half with the LH chart first.
Results. The testability rate for 3 years was almost the same for both charts (slightly more than 80%) and for 4 years (slightly more than 90%) and for the 4 years not tested at 3 years around 90%.
Mean testing time was somewhat shorter for the LH-chart in all 3 groups but not statically significant. The testing time was significantly longer at 3 years than at 4 years. Children who had been tested at 3 years had a significantly shorter time at 4 years than children who had not been tested previously. There was no statistical difference in the assessment of visual acuity between the two charts.
Conclusion: Three year old children cooperate well in visual acuity testing. However, the examination time is a little longer and the testability rate is 10% lower than at 4 years. They can be tested equally well with the HVOT and the LH-chart.

Visual outcome measures from a non-cycloplegic videorefractive population screening programme

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1Visual Development Unit, Dept of Psychology, University College London, U.K.; 2Department of Experimental Psychology, University of Oxford; 3Institute of Ophthalmology, London UK

Purpose. The Second Cambridge Videorefractive Population Screening Programme was conducted over a two year period, to identify infants of 8 months of age with significant hyperopia. We have reported on their visuo-cognitive and attentional abilities. Here we address the effectiveness of an early partial correction for hyperopia.
Methods. Infants were identified at screening and confirmed on cycloplegic retinoscopy as having at least +4D hyperopia at age 10 months. These infants were entered into a controlled trial of partial spectacle correction, and followed up in our unit until 5-6 years of age. Here we report acuity measures made with the Cambridge Crowded Cards from age 3.5 years onwards.
Results. Children were divided into (1) untreated hyperopes, (2) treated, compliant spectacle wearers, and (3) treated but non-compliant spectacle wearers, (4) non-hyperopic controls. The data has been analysed in terms of pass/fail on acuity at and after 3.5 years. Untreated or non-compliant hyperopes were 4 times more likely than compliant spectacle wearers to fail the acuity test; both differences were highly significant ($p < 0.001$). Overall, there were also significantly fewer failures in the 'intention-to-treat' groups taken together than the untreated group. Strabismus in each group is being analysed separately and will be reported, as will the results for anisometropia detected at screening.
Conclusions. These results show that, as for our earlier cycloplegic screening programme, non-cycloplegic refractive screening can identify children at risk of poor vision and that partial spectacle correction can reduce this risk.

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Evaluation of screening procedures for congenital cataracts

G Magnusson, K Thiringer, P Jakobsson, U Kugelberg, A Lundvall, E Maly, K Tornqvist, M Abrahamsson, B Andreasson, M P Borres, U Broberger, L Hellström-Westas, R Kornfält, N Nelson, J Sjöstrand

Dept. of Ophtalmology, Sahlgrenska University Hospital and Division of Neonatology, The Queen Silvia Children´s Hospital Göteborg, Depts. of Neonatology and Ophthalmology, University Hospitals of Linköping, Lund and Malmö, St Erik´s Eye Hospital, and Dept. of Neonatology, Astrid Lindgrens Hospital Stockholm, Sweden.

Purpose. To evaluate the efficacy of two different Swedish screening procedures for early detection of congenital cataracts and compare with no screening.
Methods. Children born between Jan. 1992 and Dec. 1998 in Swedish regions with an established eye-screening routine procedure, diagnosed with congenital cataract, and operated on before the age of one year, were included in a retrospective study. Age at referral and operation were compared between the regions using different screening procedures; screening at the maternity wards (Region 1); at well-baby clinics (Region 2) and one region without any screening (Region 3).
Results. Seventy-two children were included in the study. With respect to early diagnosis and surgery, Region 1 differed significantly from Regions 2 and 3, which shared greater similarity and were combined for further analysis. The difference in detected cases was greatest at the age of 21 days (55% vs. 18 %; $p<0.001$), but persisted even at 100 days of age (78% vs. 64%; $p<0.02$). The Region 1 screening resulted in more and earlier detected cases than the two other regions (22 vs. 15 per 100,0000 births). In 72% of all cases, surgery was performed in response to referrals from either maternity wards (36 %), or well-baby clinics (36%). However, half of the well-baby clinic cases were detected too late, i.e. at >100 days.
Conclusion. Eye screening at the maternity ward is preferable to well-baby clinic screening and to no screening at all, since it leads to early detection. Screening should also be made routine performance at well-baby clinics within the period where successful treatment is possible.

Posters

13.30-14.45
Friday June 13

Moderator: Janette Atkinsson

Poster A

Dyslexia and pseudoneglect

Ralf Goertz, Timo Wandert, Ruxandra Sireteanu
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Purpose. In the neglect syndrome, neurological patients suffer from an attentional deficit towards the left side. In healthy subjects there is a related phenomenon called pseudoneglect which can be thought of as an overattending of the left side. It is usually measured using a line bisection task where normal subjects tend to bisect a given line left of the true centre. Since this effect is assumed to be polymodal, we developed an auditory version of the line bisection task. According to the attentional nature of the pseudoneglect, it should be less pronounced in subjects with attentional deficits. As attention seems to be one problem in dyslexic subjects, we hypothesize that their visual leftward bias is smaller.
Methods. 40 normal adults and two groups of children (12 dyslexic and 12 control, between 9 and 12c years) were tested. In the visual task they had to decide which side of a pretransected line was longer. In the auditory task they had to locate short burst of white noise presented in headphones. The subjects' responses were fit to psychometric functions.
Results. There were significant leftward biases in both domains for the adult subjects. Furthermore, the same effects were found in both normal and dyslexic children. However, whereas the auditory bias was the same in both groups, the visual bias was significantly smaller in the dyslexic group.
Discussion: Attentional deficits seem to be one symptom of dyslexia. Due to the nature of this disorder, it is primarily expressed in the visual domain.

Poster B

Two to six-month-olds' visual behaviours as a function of the attractiveness of stimuli in a detection task

F. Gamé, I. Carchon, & F. Vital-Durand
Laboratoire de Neuropsychologie des Fonctions Visuelles, Laboratoire de Psycho-Biologie du Développement.

Young infants can detect stimuli provided the stimuli are large enough and presented at appropriate eccentricities. They also exhibit preferences for some shapes, particularly faces and face-like stimuli, while other shapes are less attractive to them and elicit shorter looking times. The purpose of the study was to determine how the attractiveness of the stimuli presented in a detection task affects different components of the visual behaviours of infants two to six months old. Young infants seating in an infant chair were presented a « central » stimulus, located in front of them. When they had looked at it for three seconds, either a second, « peripheral », stimulus was presented during 7 seconds (Addition Condition), or the central stimulus remained presented alone during 7 seconds (Control Condition). Three different shapes of various attractiveness were presented : a face-like stimulus (highest attractiveness), a cross (intermediate attractiveness), and vertical lines (lowest attractiveness). Each shape was presented once in the Control Condition (3 trials), and all the possible arrangements of two of the shapes were presented in the Addition Condition (9 trials). In the Control Condition, the face-like stimulus is fixated during greater amounts of time than the cross and the vertical lines. Moreover, more eye turns to the peripheral (unlighted) setting are observed when vertical lines are presented. In the Addition Condition, results show greater amounts of fixation for the face-like stimulus than for the cross and for the vertical lines, in the central position as well as in the peripheral position. The highest percentages of detection of the peripheral stimulus are obtained when vertical lines are presented in the central position, and when a face-like stimulus is presented peripherally. It is also notable that young infants always look significantly more at the central stimulus than at the peripheral one during a trial, except in the trials with vertical lines or a cross as central stimulus and a face-like as peripheral stimulus. (The data are at the moment further explored, to evaluate the effect of the attractiveness of the stimuli on the delay before young infants turn their eyes from the central to the peripheral stimulus, and on the mean amount of time of each fixation on each stimulus).

Poster C

Impact of milk feeding type on early infant visual tracking

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Laboratoire de Psycho-Biologie du Développement, EPHE, Paris, France.

Purpose. The essential unsaturated fatty acids (linolenic acid and other omega-3 unsaturated fatty acids made from arachidonic acid) present in breast milk are essential for the multiplication of neurons and probably retinal cells as essential membrane components. The aim of this study is to analyze the effect of infant feeding mode on infant visual development as assessed using the tracking task in 2- to 6-month-olds.
Methods. 80 infants 2 to 6 months were classified with respect to mode of feeding using mother's breastmilk or artificial formula. All infants had a complete pediatric, neurologic and visual examination.
The tracking task was used as a test of visual development using a geometric target which consisted of three stimuli (illuminating subsets of red LED lights) with varying in attractiveness. The stimuli were face-like, a cross or vertical lines. These visual stimuli were moving along a horizontal circular arc from 0 to 90 degrees on the subject's right-hand field of view in 10 seconds. The infant's gaze and facial expressions were recorded using a digital video camera.
Results. The attractivity effect was confirmed with the face-like stimulus eliciting more ocular tracking than the cross or the vertical lines. More precisely, for the face-like stimuli, there was no difference in tracking for the breast-fed /formula-fed infants while for the less attractive stimuli, the breast-fed infants showed an increase in tracking response as compared to the formula-fed infants. These results seem to achieve statistical significance
Conclusion. These preliminary findings seem to show that visual development, as measured by visual tracking response, is shorter in artificial milk fed infants than breastmilk fed infants. These findings imply that studies of early-infant vision should take into account the type of milk intake in order to be valuably comparable. These findings, if confirmed, by further studies imply that all infants should receive these essential fatty acids for optimal visual development.

Poster D

Contribution of binocular mechanisms to the visual acuity in children

N. N. Vasiljeva, G. I. Rozhkova*
Chuvash State Pedagogical University, Cheboksary; *Institute of Information Transmission Problems, RAS, Moscow, Russia

Purpose. Theoretically, transition from monocular to binocular perception could provide significantly larger increase in visual acuity than it is usually assumed. In view of some recent data on the development of phoria (Wallineet al. 1998, Optometry and Vision Science 75 605-610) and on age dynamics of the binocular integrative mechanisms (Rozhkova et al., 2002 Perception 31 Supplement 158) we tried to re-examine the ratio of binocular to monocular visual acuity (BVA/MVA) in children evaluating its dependence on subject age and observation distance.
Methods. BVA and MVA were measured at 3-5 observation distances (from 0.5 to 5.0 m) in about 1000 5-17 year-old children.
Results. The data obtained revealed significant individual variability and dependence of BVA/MVA on age and distance. Although in the majority of children this ratio did not exceed 1.2, in some cases it reached 2.0. Over the whole age interval from 9 to 14 years, the amount of children with BVA/MVA>1.2 exceeded 20% both in far and near vision. The largest percentage of children with high BVA/MVA values was found at junior school age for the distances 0.5-1 m. As a rule, high values of BVA/MVA were associated with lowered MVA values (negative correlation).
Conclusions. The revealed dependence of BVA/MVA on age and observation distance might reflect developmental changes in phoria and maturation of binocular integrative mechanisms in children. Large percentage of children with BVA/MVA>1.2 at junior school age should be taken into account during visual screening.

[Supported by the Russian Foundation for Basic Research, grant 01-04-49484.]

Poster E

Method of visual perceptual training for children with sensory disorders

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Computer method was developed and experimentally verified in our studies aimed at solving the problem of compensation for the disorders of perceptuocognitive development of preschool and elementary school children with severely decreased vision, decreased vision combined with decreased hearing and attention deficit. Compensation for the visual attention and perception disorders was carried out during formation of the ability to detect and recognize images in different parts of the perceptual field. For this purpose, images with strengthened features (brightness, contrast, and color saturation) were selected which ensured effective image discrimination and aroused interest and emotional reactions in children. The suddenness of image presentation was essential for attracting children's attention to it. Attention activation was also achieved by a change in the probability of image and perceptual task presentation, a way of imparting signal meaning to a stimulus, feedback introduction, in the course of visual search, etc. The essence of the method was as follows. In accordance with a preliminary instruction, a child fixed the centre of display screen. Along horizontal, vertical, and diagonal lines of different distances from the centre images were presented in a sudden and quasi-random order with dosed exposure time. When an image appeared in the visual field, a child had to press the key as soon as possible, fix his/her eyes on it, and recognize its shape and color. The feedback principle was realized in the course of training. If recognition was correct, a green circle flashed (f = 1 Hz) in the left lower square of the screen, while in the opposite case a red circle appeared. A child "had to share" his/her attention between the target image and the feedback signalling. Numerical data (reaction time and a number of recognition errors) were automatically recorded in the PC memory. It was shown that if it was necessary to shared (switched) attention in order to selectively perceive the target image, children with sensory disorders and attention deficit made much more recognition errors than normal children of the same age. Their reaction time was more than twice as much as this parameter in normal children, this being related to the lack of cognitive motivation for visual materials, an impairment of sensoriperceptual process, and an underdevelopment of visual attention. After a special remedial course of perceptual training, a marked decrease both in the reaction time and in the number of recognition errors was revealed. Our study grounds the necessity of special courses of perceptual training for children with attention and perception disorders largely based on computer methods which enhance children's cognitive motivation. The computer method verified in our work may be effectively used both in diagnostic studies and as remedial technique improving children's visual attention and perception.

Poster F

Representation of object motion at 4.5 months of age: a study of spatio-temporal parameters when an object is occluded

O. Kochukhova, K. Rosander, C. von Hofsten
Department of psychology, Uppsala university, Sweden

This study investigated the ability to predict the reappearance of an object after occlusion. Such ability combines perception of object motion with knowledge of how objects move in space and time. It was hypothesized that preserving the representation of object motion over occlusion is both a function of occlusion duration and occluder width. In addition it probably depends on tracking the object during sufficient time before occlusion. All these parameters were systematically varied in the present experiment. We hypothesized that duration of occlusion was a more crucial determinant of predictive occluder tracking than occluder width. The experiment was designed as a live situation where the moving object was a happy face of 8 deg. visual angle. Infants tracked the object smoothly and made a saccade over the occluder situated at the center of the objects trajectory. The time difference between the arrival of the saccade and object reappearance was calculated for the different conditions. Eye movements were measured with EOG, and head+ object movements with a Proreflex system, (Qualisys).

Poster G

The efficiency of computer methods in treatment of strabismus and amblyopia

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Child Ophthalmological Sanatorium, Moscow

Purpose. In 1990 we began to introduce computer methods in treatment of strabismus and amblyopia. We used various interactive software that either imitated certain traditional clinical procedures or allowed accomplish some new procedures that were practically impossible without the means of moderncomputer graphics. Over the following 12 years, we accumulated large amount of data concerning the efficiency of different computer methods in different cases. It seems important to analyze the results obtained in order to optimize further employment of computer techniques in treatment of binocular disorders.
Methods. To evaluate the contribution of the computer methods to the positive effect of treatment we analyzed the results obtained in all our patients with strabismus and/or amblyopia that were treated over the period of the last 15 years. The data obtained in 1988 (i. e. without computer techniques) and in 2002 (i. e. during the 12th year of the computer technique employment) were compared in more detail. The total number of the patients with binocular disorders was 238 in 1988 and 228 in 2002.
Results. According to the same criteria, the amount of successfully treated patients constituted 55% in 1988 and 90% in 2002 indicating undoubted positive contribution of computer methods. Different software appeared to be more effective in different cases. For many children, the treatment became fascinating but not tiresome. Adequate employment of computer methods allowed to shorten the duration of treatment and to restore or to develop all the binocular capabilities in most patients.
Conclusion: Computer methods could make treatment of strabismus and amblyopia much more rapid and successful.

Poster H

Assessment protocol in children with multiple visual impairments

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Introduction. More and more children suspected of having multiple visual problems are referred to our centre for assessment and guidance. It concerns children with a possible combination of visual sensory impairment, visuomotor impairment, visual perceptual impairment, often accompanied by retardation, infantile encephalopathy and epilepsy. There are limitations in visual functioning that cannot be fully explained by the visual sensory impairment. Our regular assessment protocol is not adequate for these children and needs to be adapted in order to objectify and specify the visual disabilities.
Purpose. To develop a more appropriate protocol for multidisciplinary assessment in children with multiple visual impairments in order to improve guidance and support of these children.
Method. 10 children will be assessed in the period January till July 2003. They should meet the following criteria: age 3 _ to 12 years old; visual acuity between 0.1 and 0.6; mental age of at least 3 _ years; cooperative. The assessment takes place according to a fixed protocol and involves: extensive hetero-anamnesis (medical, neurological, ophthalmological, developmental, visual functioning); ophthalmologic examination; orthoptic examination; psychological assessment; motor assessment. Detailed information about this protocol will be presented. The assessment takes about seven hours, divided in two days. All data are processed in a database programme. We judge which parts of the protocol will give the most relevant information. In this way we want to develop an effective and efficient protocol for clinical practice, indicating which children need additional visual assessment.
Results. Preliminary results will be presented.

Poster I

Developing a polyfocal VEP perimeter for infants

Erik Gustavsson, Anders Sjöström
Children´s Eye Clinic, Göteborg University, Sweden

Purpose. To develop a perimetry method for infants, needed in different conditions including: following of treatment with Vigabatrin (Sabrilex), perinatal asfyxia, intracranial haemorrhage and CP syndrome. The method is based on VEP (Visual Evoked Potential) to enable examinations from a very young age, without the need for neither premedication nor active cooperation.
Method. White light emitting diodes, LEDs, are used to stimulate the retina from different positions in the visual field. A total of nine separate sources of light are used, one mounted at the desired fixation point (0°), and two more at 30° and 60° in each of the four diagonal meridia. ERG from both eyes and three-channel VEP are recorded simultaneously. The visual field is then evaluated by comparing the responses elicited by the different monocular stimuli. The ERG from the covered eye must be isoelectrical to ensure that only one eye is stimulated.
Results. VEP and ERG recordings are possible up to 90° away from the fixation point. Peripheral VEP responses shows longer latencies and somewhat different waveforms compared to foveal VEP. We have been able to examine a few children with known visual field defects, also reflected on the VEPs as attenuated or missing responses.
Conclusion. Polyfocal VEP seems to give information about the function of the visual system in a large part of the visual field. Further study of patients with known visual field defects is needed to determine how well lesions are detected. Children and infants tolerate the examination well, but further development is needed to decrease examination time.

Poster J

The perception of others' actions in 9-month-old infants

Hauf, Petra; Prinz, Wolfgang; Aschersleben, Gisa
Max-Planck-Institute for Psychological Research, Munich, Germany

The present study investigated the early development of the cognitive mechanisms underlying action perception and action production in infancy. In more detail, we analyzed the question if the perception of others' actions is influenced by the active performance of these actions and vice versa. 9-month-olds were randomly assigned to one of two experimental groups. (a) In the "*other-condition"* the infant first watched a video clip with two adults playing with a toy. Subsequently, the infant could either play with the same toy or a new one. (b) In the "*self-condition"* the infant first played with a toy and, then, saw simultaneously two video clips with two adults playing with either the same or a new toy. The results revealed an interesting interaction: In the *"other-condition"* infants played longer with the new toy, which they had not seen in the video clip before (novelty preference). However, in the *"self-condition"* there was a significant preference for the video clip with two adults playing with the same toy the infants had played before. At least in 9-month-olds the perception of other persons' actions is clearly influenced by the active performance of these actions. These results will be discussed in the framework of different assumptions on how the perception of other persons' actions might interact with the active performance of own actions.

Poster K

Visual masking in children with dyslexia

O.V.Levashov,O.B.Inshakova,I.Gordeeva,A.Gordeev
Moscow State Pedagogical Univ.,Moscow, Russia

We measured the accuracy of visual recognition in children with dyslexia (D) (25 subjects) and good readers (15 Ss) aged 7-8 . Stimuli were letter-like signs (size 2 deg of arc). Time of exposition was 50-100 ms. Visual mask (VM) presented immediately after St and was 2 type – static and dynamic. Static VM was vertical grid or concentric circles which occupied a most part of computer screen. Dynamic VM was produced by moving the static VM along the screen (circles expanded from centre to periphery of visual field). In normal Ss both static and dynamic VM decreased the accuracy of recognition in equal degree, but in Ss with D static VM was more effective than dynamic VM – 41% and 29% of errors respectively.

In accord with our model of visual system (O.Levashov et.al., Perception, 1999,v.28,p.74) we can consider a visual cortex as a parallel neurocomputer with specific inter- and intrahemispheric interaction between subsystems, in particular – between magno- (M) and parvocellular (P) channels. Right (R) hemisphere (H) in R-handed has a dominant P-channel and performs a lot of processing of real visual scene images. In contrast left (L) H has a dominant M-channel and processes schematic images like letters and words. In normal reading a rapid achromatic M-channel inhibits slow P-channel and facilitate word recognition by means of erasing the old traces in iconic memory.

It is known that a lot of dyslexics are left-handers or hidden left-handers and can have abnormal profile of inerhemispheric asymmetry. In this case a reversal of interaction between M and P-channel can occur - P-channel can become dominant in LH. As a result a weak M-channel cannot provide a good visual processing in reading and dyslexia can occur. In our experiments moving VM could stimulate M-channel and facilitated letter recognition.

Poster L

Deficit of visual recognition and tracking in children with dyslexia

M.Rusetskaya, O.Levashov, O.Inshakova,
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We investigated a visual recognition of letters and line drawings in 100 children of aged 7-10. A control group consisted of 43 subjects with good reading, and experimental group consisted of 57 Ss with dyslexia (D) (reading disability in children with normal intelligence and hearing).
Stimuli were rows of 4 letters – A,O,Y,E or P,X,T,M or rows of 4 line images of well known fruits. St were exposed on a computer monitor as horizontal rows with length of 8 deg. The exposition was 500 ms. The order of items in rows was varied. The task of Ss was to recognize all the items in row and to name its orally. We measured the latency of answer, order of reported items and errors. 10,5% of Ss with D showed a deficit of visual recognition (errors) in comparison with 2,3% in control Ss.
We found also that 22,3% of Ss with D (and only 9,3% of control Ss) showed a reversal of naming in reporting items in row– they made it from the right to the left. These data confirm our previous results which was obtained by another method (O.Levashov et..al.,Perception,2002,v.31,p.176).

Session VI: Diagnostic electrophysiology

9-10.15
Saturday June 14

Moderators: Colin Barber & Maria Kraemer

Steady-state VEP and behavioural measures of visual acuity and contrast sensitivity in children with down syndrome

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Purpose. Children with Down syndrome (DS) show reduced visual acuity (VA) and contrast sensitivity (CS) when tested using behavioural testing techniques. This study aimed to determine whether reduced VA and CS could be also be detected in VEP recordings from the first stages of the response pathway.
Methods. The VA subject group contained 36 children with DS and 32 controls, the CS (VEP) subject group consisted of 23 children with DS and 33 controls, and the behavioural CS group contained 42 children with DS and 25 controls* all aged 3mos. to 14 yrs. VA and CS were measured using both steady-state, swept VEP (Norcia and Tyler, 1985) and appropriate behavioural tests.
Results. Data was analysed using ANCOVA, with age as the covariate. The children with DS had significantly lower VA than the control group, for both behavioural and VEP tests. Analysis also showed that the children with DS had lower CS than the controls for the VEP measure. The difference in behavioural CS was not significant.
Conclusion. The reduced VA and CS VEP thresholds observed in the DS group support the idea of an underlying sensory deficit in the DS visual system. The difference between the DS and control group (for both VA and CS measures) becomes more pronounced with age, suggesting developmental deficit in the DS visual system.

Direction-selective and orientation-selective vep's in infants

Dee Birtles1, Oliver Braddick2, John Wattam-Bell1, Janette Atkinson1
1Visual Development Unit, University College London2; Dept of Experimental Psychology, University of Oxford

Purpose. During the first 3 months, infants develop VEP responses that are signatures of cortical orientation selectivity and direction selectivity (Braddick et al, 1986; Wattam-Bell, 1991). This study compared these directly in the same infants, to investigate whether the later appearance of direction selectivity was intrinsic, or a function of the spatio-temporal characteristics of the stimuli used.
Methods. Steady-state orientation reversal (OR) VEPs and direction reversal (DR) VEPs were tested in infants aged 4-18 weeks. DR-VEPs were elicited both with random-pixel patterns and with gratings spatially similar to those for OR-VEPs, at velocities of 5.5 and 11 deg/sec, and reversal rates of 2 and 4 reversals/sec.
Results. Infants throughout the age range showed significant responses to orientation reversal. Almost all infants of 10 weeks and over showed significant responses to direction reversal, but the majority under 10 weeks did not, either for random-dot or grating stimuli, and at both velocities and reversal rates. However, DR-VEP responses appeared about 2 weeks earlier on average at the lower reversal rate.
Conclusions. Responses indicating cortical direction selectivity emerge at a later age than those indicating orientation selectivity, over a range of stimulus conditions. We conclude that sensitivity to directional motion is a separate, later developing aspect of cortical processing than is pattern sensitivity. Within each system, there is a developmental improvement in temporal response. The comparison of directional and orientation-selective systems will be discussed in relation to the differential development and vulnerability of the dorsal and ventral cortical streams.

Supported by Medical Research Council Programme Grant G7908507

Visual evoked potential in premature children and small-for-gestational age children

Maria Kraemer, Ann Hellström, Anders Sjöström
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Infants, born prematurely with or without intrauterine growth retardation (IUGR), are more vulnerable in postnatal life and different cerebral devastating catastrophes may occur, which may leave sequels later in life. The sequels can range from serious functional loss to more subtle findings in cognitive function for example and visual function may or may not be affected. We wanted to study the visual function in premature children to see whether we could separate the prematurity problem from the IUGR problem.
Methods. We have studied forty-five premature children, at the age of 10 months of corrected age, both appropriate-for-gestational age (AGA) and small-for-gestational age (SGA) with visual evoked potential.
Results. The overall group of premature children had somewhat longer latencies (N1, P1) compared to controls although the premature group was heterogeneous. When dividing the premature children into two groups; AGA and SGA , the SGA group showed the tendency to contain the children with most delayed latencies compared to both controls and the AGA group. The AGA group on the other hand was difficult to separate from controls Conclusion: The children who are SGA (presumably IUGR) showed delayed visual evoked potential to a greater extent than the premature children without IUGR. It seems that visual function in premature children depend more on whether the child is SGA (presumably IUGR) than to prematurity itself.

Diagnosing congenital nystagmus in infancy

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1 Univ. Eye Clinic, 2 Institute of Clinical Neurophysiology, Ljubljana, Slovenia

Introduction and purpose. Congenital nystagmus presents at birth or soon after and may be a manifestation of various developmental or acquired ocular or central nervous system abnormalities. It is pertinent to classify it as sensory defect nystagmus in ocular or visual pathway disease, neurological nystagmus in identified neurological problems and idiopathic nystagmus by the exclusion of any disorder. Eye movement recordings assist in the diagnosis, but usually the nystagmus waveform can not differentiate the eventual underlying abnormality. Besides thorough clinical ophthalmological and neurological with neuroradiological examination electrophysiology is crucial especially in infancy and apparently normal eyes.
Methods. We analyzed 35 randomly chosen infants referred as congenital nystagmus in their first months of life (mean age 6,6 months) and followed between their 1- 6 years. Our interest in the study was the sensitivity of simultaneous ERG and VEP recording (skin electrodes, alert children, no pupil dilation) in identifying or excluding retinal or postretinal dysfunction in infants with congenital nystagmus and its correlation with the clinical outcome.
Results. Out of 35 infants 20 were classified as having sensory defect nystagmus (10 Leber's congenital amaurosis, 1 achromatopsia, 1 retinal dystrophy, 2 ocular albinism, 6 optic nerve hypoplasia, 10 infants neurological (various developmental and structural brain defects, 1 intraventricular haemorrhage, 1 myelinization defect) and 5 infants idiopathic congenital nystagmus. The analysis results showed that clinically the underlying disorder could be presumed in up to 80% of the infants with congenital nystagmus already in their first months of life. Clinical and electrophysiologic results correlated well and together fullfilled the diagnosis in cases of not obvious sensory defect, like retinal dystrophy and achromatopsia as well as albinism, mild optic nerve hypoplasia and in the cases of suspected neurological nystagmus with not yet manifested central nervous system abnormalities. However, follow-up was necessary especially to determine the severity of the defect, like in optic nerve hypoplasia, progression of the central nervous system disorder and to better discriminate idiopathic nystagmus.
Conclusion. It is important to recognize early any disorder of the visual pathway not only for nystagmus classification itself, but also for eventual therapeutic, genetic and habilitaiton needs.

Session VII: Miscellaneous

10.45-12.00
Saturday June 14

Moderator: Anders Sjöström

Visual development compared to neonatal MRI in very premature infants

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Purpose. Significant prematurity is associated with poor visual and cognitive outcome, particularly in infants with periventricular leukomalacia (PVL). However, we have found normal onset of visual cortical function in very low birth weight (VLBW) premature infants with normal ultrasound images and neurological examination, but cortical responses delayed or absent in VLBW infants with abnormalities on ultrasound. Here we study visual development up to 6 years in a large cohort (N=43) of very premature infants at risk of perinatal insults, divided by neonatal MRI into those with (a) cystic PVL; (b) other abnormalities; (c) apparently normal MRI.
Methods. We used two indicators of visual cortical function: (i) orientation reversal VEP (ii) fixation shifts with a competing central target, plus a standardized battery (ABCDEFV) for functional visual development between birth and 4 years, and a set of new tests of attention and executive frontal function (1-5 years).
Results. Group (a) showed high failure rates on core vision tests (strabismus, acuity, refractive errors, eye movements, fields), onset of cortical function and later visuocognitive tests. Failure rates were lower in group (b), and lower still in group (c), who almost all show normal core vision tests in the first year. However, many of this group show delays on visual cortical tests (OR-VEP and fixation shifts) and executive function tests, which may be sensitive prognostic indicators of later, more subtle learning problems at school (e.g. ADHD, dyslexia).
Conclusions. Failures on early vision tests correlate well with neonatal MRI, and serve as early indicators of later problems. Children without major damage show relatively normal development on early core vision tests but may show more subtle deficits on later visuocognitive, attentional and frontal tests. Models of abnormal subcortical-cortical interactions and 'dorsal (motion/ action) stream vulnerability' will be considered in the light of these results.

References: http://www.psychol.ucl.ac.uk/vdu/publications.html
Supported by Medical Research Council Programme Grant G7908507

The visual impact of bifocals on children with Down's syndrome

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Purpose. Studies show that a significant number of children with Down's syndrome have an accommodative deficit; an average 2.90D at 16.6cm 1, 2, 3, 4. A bifocal study was conducted to assess the benefit of optical correction for the deficit.
Methods. Thirty-four children with Down's syndrome were paired to form two groups, matched for age, cognitive ability, school type, refractive error type, and habitual spectacle wear. One group was then chosen at random to wear bifocal glasses (treatment group) and the other to wear normal single vision correction, if appropriate (control group). The study took place in primary schools across South and West Wales over a 5-month period. Each child was seen for a near visual assessment on 4 occasions.
Results. Comparison of the mean distance lens response between the two groups showed a significant improvement in focusing for those children wearing bifocals (Independent Samples t-test, $t = 2.04$, $p = 0.001$). Further comparison of the mean response of the bifocal group through the near addition and distance portion of their lenses showed a significant improvement through the near addition (Paired t-test, $t = 2.16$, $p = 0.000$). Analysis of mean near visual acuity showed no significant difference between the two groups (Mann-Whitney U, $Z = -0.51$, $p = 0.613$).
Conclusions. Children with Down's syndrome who under focus and are prescribed bifocals show significant improvement in near focusing through both their near addition and distance lens compared to controls. However, improved focusing did not result in a significant improvement in near acuity.

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Developmental changes of far vs. near visual acuity in children and the concept of emmetropization

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Purpose. The concept of emmetropization implies a gradual developmental change of the average clinical refraction in children from the initial hyperopia of about +3.5D at birth to emmetropia. It has been shown that this process is most rapid in infants but, on average, it appears to be extended up to 11 years of age (Ehrlich et al., 1997 Optometry and Vision Science 74 822-843; Pointer, 2001 Ophthal. Physiol. Opt. 21 361-367). The purpose of our study was to analyse developmental changes of far and near visual acuity (FVA and NVA) at preschool and school again view of such change of clinical refraction.
Methods. The histograms of the ratios FVA/NVA were built for the age intervals of 1-2 years using the data obtained in the course of the accurate measurements of uncorrected FVA and NVA at observation distances 0.5 m and 5.0 m in about 1000 children aged 5-17 yr.
Results. In the group of the youngest children studied (aged 5-6 yr), FVA/NVA histogram appeared to be slightly asymmetric indicating that, on average, NVA was somewhat better than FVA. However, in about two year the situation became the reverse of that. Further age-dependent transformations of FVA/NVA histograms exhibited more significant improvement of FVA with age in comparison with NVA up to 14 yr. These findings seem to be inconsistent with the concept of emmetropization predicting the opposite interrelation.
Conclusions. The data on FVA/NVA changes with age evidence that other developmental factors than clinical refraction dominate in determining the ratio of visual acuity values at far and near distances.

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Vision induced temporal asynchrony in early language development

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Purpose. This paper features temporal asynchrony in language development. The non-linear approach proposed unites developmental cognitive neuroscience and dynamic systems theory. We start from the assumption that maturational factors and experience play complementary roles in forming specialized systems which display different degrees of experience-dependent modification and operate at different time scales. We shall follow the time course of individual systems up to the age of three and try to locate their neurobiological correlates. The framework used allows for the spotting of vision-induced delays and of system-specific growth curves each of them depending on the interplay of the given neural infrastructure and the input (and therapy) provided.
Methods. We will present longitudinal case studies of sighted and visually impaired children. The data were transcribed according to the guidelines of CHILDES (Child Language Data Exchange System) (MacWhinney 2001) and coded for communicative attempts employing the INCA-A Coding Scheme (Ninio et al 1994). We will provide analyses of general linguistic capacities (MLU, morphosyntax, lexicon) and of pragmatic development.
Results. Sighted subjects in our study had their highpoint in general linguistic and pragmatic development at the age of 25 /28 months. The same holds true for lexical and morphosyntactic organization. We observed an interesting developmental asynchrony in our sighted versus visually impaired subjects illustrating how lopsided development can become.
Conclusions. By finding out more about language development and its interaction with the brain and the environment, we hope to find solutions for therapy of infants at risk for disturbances in their language developments.

Session VIII: Visual perception

13.30-14.45
Saturday June 14

Moderators: Oliver Braddick & Ruxandra Sireteanu

Saliency and context play a role in infants' texture segmentation

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Purpose. To investigate whether infants can orient reliably towards the most salient and the least salient object in a visual scene, using texture-defined stimuli.
Method: Infants between 2 and 12 months and children from 1 year to 4 years of age were tested in a forced-choice preferential looking procedure, with stimuli presented on two textured fields. One field showed a target stimulus (a more salient or a less salient texture patch consisting of black dots on a white background) and the other a uniform texture stimulus.
Results. Older children showed a positive preference for all target stimuli. All subjects showed a preference for the most salient target stimulus, when paired with a background of small dots. Infants under one year of age did not show any preference for the least aliment stimulus, when paired with a background of large dots, but they weakly preferred it, when paired with a background of small dots. Infants also did not show a preference for the most salient stimulus, when this was paired with a background of large dots.
Conclusion: These results show that the background stimulus plays a crucial role in infants' ability to segment a target stimulus, suggesting a prominent role of the visual context in infants' scene segmentation.

Maturation of the sensitivity for first- and second-order motion during the development of normal and strabismic children

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Purpose. Moving images can contain at least two types of spatio-temporal patterns, labelled as first-order and second-order. The first- and second-order stimuli are respectively types of simple and complex stimuli. The first-order motion (Fourier or linear) is defined by spatiotemporal luminance variations in the retinal image while second-order motion (non-Fourier or non–linear) is defined by variations in stimulus properties such as contrast, texture, or depth (Chubb & Sperling, 1988 ; Cavanagh & Mather, 1989). Psychophysical and physiological evidence from computational modeling suggests the existence of multiple processing channels for the different types of motion cues (Clifford & Vaina, 1998,1999). Measures of contrast threshold in the elderly showed a larger threshold increase in older subjects for the perception of second-order stimuli than for the perception of first-order stimuli (Habak & Faubert, 2000). Two studies have dealt with the development of simple and complex motion sensitivity. Atkinson et al (1993) reported that infants (8 to 20 weeks) are sensitive to first and second order stimuli with a preference for the first-order. They did not show any variation of the sensitivity between 8 and 20 weeks of life. The purpose of this study is to show that if there are two different pathways underlying perception of first and second order motion then the maturation for the complex motion might be delayed with respect to the simple
Methods. Stimuli were generated with Vpixx" software and were based on those introduced by Ledgeway and Smith (1994). The children were recruited with their parents agreement at "Bébé Vision" unit of Jules Courmont Hospital. Observers underwent complete eye exams (visual resolution, monocular optokinetic nystagmus, orthoptic and ophthalmologic exams). 161 children (between 8 months and 7 years) participated in the experiments: 73 devoid of ocular problems, 48 with a strabismus, and 40 pre-terms (without ocular and neurological trouble). The infants were tested using a forced-choice preferential looking procedure . Contrast threshold was measured for the two types of stimuli. The threshold was set at the minimum contrast necessary (as defined by a 75% correct threshold criterion) to evoke a preferential looking behaviour.
Results. The log thresholds for motion varied linearly as a function of the log age in the control population and showed the same profile of maturation for the two stimuli. The contrast threshold for the second order motion was 10 times higher (1log unit) with all groups of infants. Large inter-individual differences were observed. Analysis of the premature group did not show significant variation from the control group when corrected for gestational age. Strabismic children have a delayed maturation for the second order process only.
Conclusion: Our psychophysical investigation has underlined differences in first and second order motion systems implying the existence of two different mechanisms for their perception. The development of premature children (without pathology) is similar to the normal development. Investigation of the strabismic group confirms a disorder in complex motion perception.

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Cues for spatial location in virtual and real environments

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Purpose. previous studies into the encoding of spatial location have suggested that young children differ from adults in their processing of visual cues, having difficulty conjoining landmark and geometric information (Hermer & Spelke, 1996). To develop ways of studying this question in normally and atypically developing children, we have used two tests of encoding spatial location in real and virtual environments.
Methods. (i) adult subjects were tested for location memory in a real or computer-simulated rectangular room, whose orientation was disambiguated only by one blue wall, with or without (a) physical disorientation and (b) a shadowing task for verbal interference. (ii) real and virtual spatial memory tasks with hidden objects assessed children's ability to encode multiple locations in medium/large scale environments from a shifted viewpoint.
Results. (i) verbal shadowing did not prevent adults using the coloured wall cue as previously reported, but performance showed effects of physical disorientation, subjects' overall sense of orientation, and individual strategies. (ii) The real and virtual environments provided a sensitive test of children's location encoding. Children with Williams' syndrome demonstrated view-invariant encoding in the real but not the virtual environment, still at a level below normally developing children.
Conclusions. A virtual environment can successfully simulate the task of recalling a location relative to room geometry and landmarks. The large scale task is effective in assessing view-invariant ability to use location, but may require a real environment to induce adequate viewpoint information in children. These methods offer means for investigating the development of visuospatial cognition.

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Visual size information specifying a graspable object for infants

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Purpose. Visual objects elicit compulsive reaching and grasping from infants from 4-5 months onwards, suggesting a visuomotor module controlling this behaviour. This study explored the developing use of visual size information to elicit different responses to objects that could be grasped with one hand, both hands, or not at all.
Methods. Lightweight rectangular objects, ranging from 1.6 cm to 47 cm wide, were revealed by a rising shutter within reaching distance of infants aged 22 - 44 weeks. Behaviour was videotaped and coded for: occurrence and latency of reach, unimanual vs bimanual reach, formation of grasp and its position on the object. The kinetics of each reach were recorded using an ELITE infrared camera system, to allow analysis of acceleration-deceleration components in the reaching trajectory.
Results. Data were compared for infants aged under vs over 30 weeks. In both age groups, occurrence of reaches decreased with increasing object size, and the larger objects were more likely to elicit a touch with the open hand onto the object's surface, while smaller objects elicited a closing grasp around its edges or corners. The proportion of bimanual reaches increased with object size for the older but not the younger group.
Conclusions. As young as 22-30 weeks, there are distinct visuo-motor categories of small "objects" for grasping and larger "surfaces" for exploration. The reach-grasp module is selectively triggered by visual size information as soon as it emerges functionally, but this size information is coupled to selection of a bimanual response only after 30 weeks.

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