

3rd North Sea Meeting on Brain Asymmetries



Ghent

October 5-6 2012

Thank you for attending the 3rd North Sea Meeting on Brain Asymmetries.

You can find the scientific program below, including first authors and titles of all presentations, followed by the full abstracts (page 6). From page 28 on, you can find some practical and tourist information (maps, where we meet for dinners etc.).

Scientific program

Thursday, October 4

6.45 pm Arrival at Ibis Cathedral hotel

Friday, October 5

9.00 am Welcome

Session 1

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9.00 am Kenneth Hugdahl (University of Bergen, Norway)
Hemispheric asymmetry in the auditory modality: Thirty years of dichotic listening research

9.20 am René Westerhausen (University of Bergen, Norway)
Crowd-sourcing laterality research: Results of a three-month dichotic listening study using a mobile device application

9.40 am Marco Hirnstein (University of Bergen, Norway)
The little difference is very little indeed – A large scale study on sex differences in dichotic listening

10.00 am Susanne Passow (Max Planck Institute for Human Development, Berlin, Germany; University of Bergen, Norway)
The Development of Attentional Control of Auditory Perception from Middle to Late Childhood and Comparisons to Healthy Aging

10.20 am Break

Session 2

- 10.50 am Karsten Specht (University of Bergen, Norway)
Differential lateralisation of syllables with short and long voice-onset times within the primary auditory cortex.
- 11.10 am Michal Lavidor (Bar Ilan University, Israel; University of Hull, UK)
Enhancing lexical ambiguity resolution by brain polarization of the right posterior superior temporal sulcus
- 11.30 am Alan Beaton (Swansea University, UK)
All men dream: but not equally
- 12.00 pm Lunch break

Poster session

1. Nicole Thomas (Flinders University, Australia)
Central fixations with rightward deviations: Saccadic eye movements on the landmark task
2. Helene Hjelmervik (University of Bergen, Norway)
Variations of the glutamate levels in inferior frontal gyrus across the menstrual cycle
3. Sebastian Ocklenburg (Ruhr-University of Bochum, Germany)
Variation in the schizophrenia-related cholecystokinin A receptor gene CCKAR modulates functional hemispheric asymmetries
4. Philippe Pinel (INSERM U992; CEA, DSV/I2BM, NeuroSpin Center; Univ Paris-Sud; Collège de France, France)
Genetic and environmental contributions to left and right parietal activations during calculation
5. Leif Oltedal (University of Bergen, Norway)
A dichoptic analog to the bergen dichotic listening paradigm: A pilot study.
6. Rachel Sumner (Brunel University, UK)
The Prospective Relation between Hemispheric Lateralisation and CD4⁺ T-cells in Human Immunodeficiency Virus Type 1 (HIV-1)

Session 3

- 2.00 pm Kristiina Kompus (University of Bergen, Norway)
Auditory verbal hallucinations in a non-clinical population
- 2.20 pm Christine Mohr (Institut de Psychologie, Lausanne, Switzerland)
Hemispheric asymmetry along the psychosis dimension: watch out for drug use!
- 2.40 pm Alexander Rapp (University of Tuebingen, Germany)

3.00 pm *Lateralisation of figurative language in schizophrenia: fMRI results*
Gina Grimshaw (Victoria University of Wellington, New Zealand)
Cognitive Correlates of Frontal EEG Asymmetries

3.20 pm Break

Session 4

3.50 pm Nicole Thomas (Flinders University, Australia)
Eye Movements in Attractiveness and Emotionality

4.10 pm Victoria Bourne (Royal Holloway University of London, UK)
Understanding Sex Differences in Emotion Lateralisation

5.00 pm Louise Roberts (Swansea University, UK)
Identification of emotion in eyes from the Ekman faces test.

6.30 pm Gastronomic walk through Ghent

Saturday, October 6

Session 1

9.30 am Natalie Uomini (University of Liverpool, UK)
Introduction to the evolution of laterality

9.40 am Tim Crow (SANE POWIC, University Department of Psychiatry, Warneford Hospital, Oxford, UK)
The Epigenetic Origin of the Cerebral Torque in Modern Homo sapiens.

10.00 am Chris McManus (University College London)
What do Genome-Wide Association Studies tell us about the genetics of handedness?

10.20 am Ton GG Groothuis (University of Groningen, NL)
Health care hypothesis better predicts variation in percentages of left-handers than the fighting hypothesis.

10.40 am Break

Session 2

11.10 am Francois Leroy (INSERM U992; Neurospin, France)
Is the asymmetry of the superior temporal sulcus specifically human?

11.30 am Nele Zickert (University of Groningen, NL)
Is there an advantage of lateralization in human (dual) task performance?

- 11.50 am Qing Cai (Ghent University, Belgium; East China Normal University, China; INSERM, France)
Laterality of visuospatial attention and language production: Evidence for complementarity
- 12.10 pm Gabriela Fernández (Paris Descartes University, France)
Complementary hemispheric strategies in preparatory attention: The modulation of events probability and task difficulty

12.30 pm Lunch break

Session 3

- 1.40 pm Guy Vingerhoets (Ghent University, Belgium)
Effect of handedness and language dominance on the cerebral lateralization of praxis
- 2.00 pm David Carey (Bangor University, UK)
Manual asymmetries in visually-guided aiming
- 2.20 pm Mike Nicholls (Flinders University, Australia)
An investigation of asymmetries in spatial attention and wheelchair navigation
- 2.40 pm Lynn Wright (Abertay University, Scotland)
Lateral preference and personality influence behaviour towards a manual task

3.00 pm Break

Session 4

- 3.30 pm Janet Hsiao (University of Hong Kong)
Asymmetries in the recognition of visual stimuli as a result of expertise
- 3.50 pm Cristina Izura (Swansea University, UK)
Hemispheric asymmetries in the naming and recognition of words with different Orthographic Uniqueness Points
- 4.10 pm Ark Verma (Ghent University, Belgium)
Symmetry Detection in Typically and Atypically Lateralized Individuals: A Visual Half-field Study
- 4.30 pm Lise Van der Haegen (Ghent University, Belgium)
Central visual word recognition requires interhemispheric communication

Abstracts

Friday, Session 1

Hemispheric asymmetry in the auditory modality: Thirty years of dichotic listening research

*Kenneth Hugdahl
University of Bergen, Norway*

In my presentation I will give a historic overview of our research over the last 30 years. A frequently used method for investigation of auditory laterality is dichotic listening to repeated presentations of pairs of CV-syllables. We have shown that the typical right ear advantage (REA) effect is a very robust indicator of a left hemisphere speech perception effect, replicated in numerous laboratories and clinics all over the world. The REA is accompanied by increased neuronal activation in the left peri-Sylvian region, shown by both fMRI and PET techniques. In this respect the REA represents a bottom-up, perceptual effect, driven by the neuronal wiring of the auditory pathways. Speech perception is however, also dependent on allocation of cognitive resources, like focusing of attention to the acoustic source, as in the well-known cocktail-party phenomenon. We have simulated this situation in the laboratory by instructing the subjects and patients to selective focus attention on only the right or left ear stimulus of the dichotic pair, thus adding a top-down cognitive modulator of a bottom-up driven perceptual effect. With the “forced-attention” dichotic paradigm we have probed the interaction between perceptual laterality and cognitive processes in a range of clinical groups, revealing commonalities in cognitive impairment across diagnostic categories.

Crowd-sourcing laterality research: Results of a three-month dichotic listening study using a mobile device application

*René Westerhausen, Josef J. Bless, Kristiina Kompus, Magne Gudmundsen, and Kenneth Hugdahl
University of Bergen, Norway*

At the last Northsea meeting on Laterality in Gregynog 2011 we presented the newly developed iDichotic application (App); an implementation of consonant-vowel dichotic listening test for iPhone/iPod devices. Since the results of an initial validity and reliability study looked promising, we published in December 2011 the App for free download, together with the option to anonymously send the results to us. During the first three months, the App was downloaded 340 times, and 169 (49.7%) datasets were received. Removing double submissions, as well as data from participants that were not right-handed, low-performing, or had hearing problems, 109 datasets (40 females, mean age: 32.1 ± 11.49 years) remained. The statistical analysis revealed a mean laterality index of 10.57% (s.d.= 28.7%, a right-ear advantage) which is well in the range of laterality indices revealed with a standard laboratory version of the test. A two-factorial analysis of variance revealed a main effect of ear ($F(1,107)=8.35$, $p=.004$, $\eta^2=.14$), i.e. a

right-ear advantage, as well as an interaction of ear and sex ($F(1,107)=4.99$, $p=.028$, $\eta^2=.08$) indicating that the right-ear advantage was significantly larger in male than in female participants. In summary, the App-based data collection replicates results typically found in dichotic-listening experiments, supporting the notion that mobile devices might serve as a platform for testing larger samples. In this, the present results also open up the possibility to use Apps for longitudinal and training studies.

The little difference is very little indeed – A large scale study on sex differences in dichotic listening

*Marco Hirnstein, Rene Westerhausen, & Kenneth Hugdahl
University of Bergen, Norway*

The idea that men have a functionally more asymmetrical brain organization than women is widespread and women's superiority in certain verbal tasks is typically attributed to their more bilateral brain organization. However, there is little empirical support for a sex difference in lateralization. For example, meta-analyses on language lateralization suggest that sex only accounts for 0.05% (Voyer, 2011) to 2% of the variance (Sommer et al., 2004, 2008). Over the years we have collected dichotic listening data from a large sample of participants, who all completed the same consonant-vowel (CV) syllable task. We report behavioral results from 1782 (828 females, 125 non-right-handers) as well as behavioral *and* functional imaging (fMRI) data from an additional 104 participants (49 females). These datasets provided a comprehensive test whether there is a sex difference in functional language lateralization. The behavioral and functional imaging data showed the typical right ear advantage and left hemispheric activity in language areas, respectively. Overall, there was a small bias towards stronger asymmetry in men. However, sex only accounted for <1% (N=1782 dataset) and 4% (N=104 dataset) of variance. Thus, one might question whether sex differences in functional brain lateralization really are as meaningful as it is often believed.

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The Development of Attentional Control of Auditory Perception from Middle to Late Childhood and Comparisons to Healthy Aging

Susanne Passow^{a,b}, Maïke Müller^c, René Westerhausen^{b,d}, Kenneth Hugdahl^{b,d,e}, Isabell Wartenburger^f, Hauke R. Heekeren^{a,g}, Ulman Lindenberger^a, Shu-Chen Li^{a,h}*

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Daily conversational situations confront listeners with a wealth of competing auditory inputs; the listeners, thus, need to selectively focus on relevant information, particularly when the perceptual saliency of the competing irrelevant auditory inputs is high. We used an intensity and attention modulated dichotic listening paradigm to study age-related differences in such selective attention mechanism between younger children aged 7-8 years and older children aged 11-12 years. The children were instructed to either attend to the right or left ear and perceptual saliency was manipulated by decreasing the loudness of either the left- or right-ear stimulus. The results showed that older children were able to focus on auditory inputs from either ear, overcoming the effects of perceptual saliency, while younger children showed deficits in the high demand situation. Direct comparisons with data from a recently published study of younger adults aged 23-35 years and older adults aged 65-76 (Passow et al., 2012; *Psychology and Aging*) suggest that although younger children and older adults show similar levels of performance, different factors were involved. The younger children's performance was characterized by selective difficulties in attentional control, whereas older adults' performance deficits additionally reflect an exaggerated reliance on perceptual saliency. We conclude that auditory attention deficits in healthy aging cannot be reduced to a simple reversal of childhood improvements.

Friday, Session 2

Differential lateralisation of syllables with short and long voice-onset times within the primary auditory cortex

Karsten Specht
University of Bergen, Norway

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Speech lateralisation is often explored with behavioural task like dichotic listening (DL), where two syllables are presented to the participants at the same time, one to the left ear and one to the right ear. Participants have the task to report that syllable they have heard best or most clearly. The overall result is that participants report predominantly more syllables that were presented to the right ear, thus called the right ear advantage (REA). However, it has also been shown that different pairings of the syllables are modulating the strength of the REA. One modulating factor is thereby the voice-onset time (VOT), which is the time between the release sound of an unvoiced consonant and the onset of the voice. Taking the different VOTs into account, it has been shown that the strongest REA is observed when a syllable with a long VOT is presented to the right and a syllable with a short VOT to the left ear and the weakest or even a left-ear advantage for the reversed combination.

In order to examine this effect in more detail, participants were explored with fMRI within a 7T MR scanner. During the fMRI experiment, participants were passively listening to mono-aurally presented consonant-vowel syllables with different VOTs. In order to focus only onto the differential VOT effects, the syllables were spoken by four different male and four different female voices, and the dental consonants /d/ and /t/ as well as the bilabial consonants /b/ and /p/ were paired either with the vowel /a/ or /o/.

The analysis was performed as 2x2 ANOVA with the factor VOT (long/short) and the factor place of articulation (dental/labial). The preliminary results indicate a main effect for the factor place of articulation, bilaterally in the auditory cortex, and a significant interaction within the left primary auditory cortex. Follow-up test demonstrated that the strongest effect were caused by the syllables with dental consonants, and that the overall strongest activation were detected for syllables with dental consonants and long voice-onset times within the left auditory cortex.

The results are not only explaining the observed behavioural effect, seen in dichotic listening tasks, but are also supporting current models on differential sensitivity of the left and right auditory cortex, with an assumed higher temporal resolution of the left auditory cortex, relevant for identifying spectrally complex signals like unvoiced consonants. Therefore, these results are important for understanding the differential functions of the left and right auditory cortex for speech-perception processes.

Enhancing lexical ambiguity resolution by brain polarization of the right posterior superior temporal sulcus

Michal Lavidor

Bar Ilan University, Israel and the University of Hull, UK

Previous studies have reported a hemispheric asymmetry in processing dominant (e.g. paper) and subordinate (e.g., farmer) associations of ambiguous words (pen). Here we applied sham and anodal Transcranial Direct Current Stimulation (tDCS) over Wernicke's area and its right homologue to test whether we can modulate the selective hemispheric expertise in processing lexical ambiguity. Ambiguous prime words were presented followed by target words that could be associated to the dominant or subordinate meaning of the prime in a semantic relatedness task. Anodal stimulation of the right Wernicke's area significantly decreased RTs to subordinate but not dominant associations compared to sham stimulation. There was also a complementary trend of faster responses to dominant associations following anodal stimulation of Wernicke's area. The results support brain asymmetry in processing lexical ambiguity and show that tDCS can enhance complex language processing even in a sample of highly literate individuals.

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All men dream: but not equally

Alan Beaton

Swansea University, UK

Since the famous report by Humphrey and Zangwill (1951) of cessation of dreaming following parieto-occipital damage, there has been considerable debate as to whether dreaming is a unilaterally mediated activity, and if so by which of the cerebral hemispheres, or is dependent upon the interaction of both hemispheres (Greenberg and Farah, 1986). The finding that four acallosal participants recalled fewer dreams than controls (Lassonde et al., 1993) supports the view that dreaming is bilaterally mediated and raises the question as to whether, as has been suggested for visual imagery which has been argued to

relate to dreaming, participants of different handedness may show differences in dream recall. Results of a fairly large scale study which support this conjecture will be reported.

Friday, Poster session

Central fixations with rightward deviations: Saccadic eye movements on the landmark task

Nicole Thomas

School of Psychology, Flinders University, Australia

Neurologically normal individuals show an attentional bias toward the left side, which results from right hemisphere activation during visuospatial tasks. The strength of this bias is influenced by various factors, such as line length, vertical elevation and presentation time. What remains unknown is how participants gather information via saccadic eye movements during task performance and how this relates to responses. Eye movements were recorded while participants performed the landmark task. Fixations and saccades were both analysed to gain a complete understanding of eye movement patterns. Fixations tended to focus on the centre of the line, with few left-right differences. Saccades were examined by creating histograms illustrating all x-coordinates which were examined over the course of each trial. Interestingly, mean eye position varied with participant response, with an overall tendency to look to the right of centre. Results are consistent with prior research, which has primarily looked at fixations and demonstrate the necessity of examining saccades as well as fixations in order to see how eye movement patterns relate to pseudoneglect.

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Variations of the glutamate levels in inferior frontal gyrus across the menstrual cycle

Helene Hjelmervik (1), Markus Hausmann (4), Berge Osnes (1), Cecilie Byholt Endresen (1), Kenneth Hugdahl (1,2), René Westerhausen (1,2), Karsten Specht (1,3)

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3 Department of Clinical Engineering, Haukeland University Hospital, Bergen, Norway

4 Department of Psychology, Durham University, Durham, United Kingdom

Introduction

Gonadal hormones have been suggested to modulate interhemispheric inhibition, and it has been demonstrated, within the inferior frontal gyrus (IFG, Broca), a reduction of left hemispheric inhibition on the right hemisphere during the high estradiol follicular phase. Also, a drop in glutamate levels within the anterior cingulate cortex (ACC) from the follicular to the luteal phase has been found. As interhemispheric inhibition is thought to rely on callosal glutamatergic and GABAergic fibers, the current study aims to investigate whether glutamate levels within the IFG will change across the cycle. In particular, it was hypothesized that, due to less interhemispheric inhibition of the right IFG by the left, the glutamate level within the right IFG will rise in the follicular phase compared to the menstrual and luteal phase and also compared to men.

Methods

Fifteen male and fourteen female subjects were tested three times within a month period, whereby the women were tested in their menstrual, follicular, and luteal phase. MRS data acquisition was done using a 3T MR scanner. In vivo short echo ^1H -spectra from the left (Brocas area) and right inferior frontal gyrus were obtained by using a single-voxel point-resolved spectroscopy (PRESS) sequence (voxel size $20 \times 20 \times 20 \text{ mm}^3$, time repetition/time echo [TE] = 1500/35 ms, 128 averages). Here, we report the ratio of the combined signal of glutamate and glutamine to creatine (Glx/Cre)

Results

First, an ANOVA with sex, phase, and side was conducted and revealed a main effect of side ($F(1,27)=5.05;p=0.03$; $\eta^2=0.16$), but no further main effects or interaction effects were detected. However, in order to test the specific hypothesis for the right IFG, ANOVAs with sex and phase were conducted for each side separately. While there was no significant effects for the left side, the ANOVA for the right side resulted in a sex \times phase interaction ($F(2, 54)=3.41;p=0.04;\eta^2=0.11$). Post hoc testing with Fishers LSD revealed a difference in the follicular phase compared to menstrual ($p=0.01$, $d=0.58$), luteal phase ($p=0.054$, $d=0.48$), and men ($p=0.01$, $d=0.96$)

Conclusion

The results show overall higher levels of glutamate in the right IFG compared to the left. Furthermore, the GLX/Cre levels within the right IFG are stable for men, whereas they fluctuate across the menstrual cycle in women (increase in the follicular phase and decrease in the luteal phase). Although only partly supported by the here presented results, it can be speculated that the increased levels of GLX/Cre during follicular phase indicates reduced interhemispheric inhibition of the right hemisphere.

Variation in the schizophrenia-related cholecystokinin-A receptor gene *CCKAR* modulates language lateralization

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[†]*Department of Human Genetics, Ruhr-University of Bochum, Germany*

Schizophrenia is a severe psychiatric disorder that is likely to be caused by a combination of environmental and genetic factors. Several studies have shown that schizophrenia is associated with atypical handedness and language lateralization. For example, schizophrenic patients typically have a higher prevalence of non-right-handedness than healthy controls. Moreover, it has been shown that especially those patients who frequently experience auditory hallucinations show reduced left-hemispheric language dominance, while young and stable patients that do not experience hallucinations sometimes do not show such a reduction. However, the molecular mechanisms underlying these functional changes are still poorly understood. Therefore, the present study was aimed at investigating whether variation in schizophrenia-related genes modulates individual lateralization patterns. To this end, we genotyped 16 single nucleotide polymorphisms (SNPs) in different candidate genes that have previously been linked to schizophrenia on a meta-analysis level in a sample of 444 genetically unrelated healthy participants and examined the association of these polymorphisms with handedness, footedness and language lateralization. We found a significant association of the cholecystokinin-A receptor (*CCKAR*) gene variation rs1800857 (IVS1-5T>C) and language lateralization assessed using the dichotic listening

task. Individuals carrying the schizophrenia risk allele C of this polymorphism showed a marked reduction of the typical left-hemispheric dominance for language processing. Since CCKAR is involved in dopamine release in the central nervous system, these findings suggest that genetic variation in this receptor may modulate language lateralization due to its impact on dopaminergic pathways.

Genetic and environmental contributions to left and right parietal activations during calculation

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Neuroimaging studies of human adults have long demonstrated that performing an arithmetical task repeatedly activates a frontoparietal network. Such a skill requires a preverbal sense of numerosity that is present early in life, later refined and extended by the learning of mathematics at school. Interestingly, recent results suggest that the left and right parietal lobes play different roles according to these two numerical knowledges. On one hand, a recent study of newborns evidenced that the preverbal sensitivity to numerosity is supported by a right intraparietal region. On the other hand, several neuroimaging studies showed that training and acquisition of symbols alter more specifically the left intraparietal cortex. In this context, we aimed to test in the mature brain whether the left activation, the right activation or the functional asymmetry of the parietal sites depend either of genetic or either of environmental determinants.

We investigated fMRI data from a group of 19 MZ (monozygotic) and 13 DZ (dizygotic) adult twin pairs, scanned during a mental calculation task. Heritability was first investigated by comparing the respective MZ and DZ correlations. Then, the genetic and environmental contribution was estimated more tightly by fitting a ACE model classically used in twin study.

We found that the bilateral posterior superior parietal lobules and the right intraparietal sulcus were associated to a significant genetic contribution. An additional region of the left inferior parietal cortex, whose deactivation correlates with a behavioral calculation score, also presented higher similarity between MZ than between DZ twins, pointed out a plausible physiological basis for the observable inheritance of maths score. Finally, the main impact of the environment shared by twins was found in the lateralization of activation within the intraparietal sulcus. Our results fit with previous neuroimaging results and enlighten how genetic and education are articulated within one functional network in the adult brain.

A dichoptic analog to the bergen dichotic listening paradigm: A pilot study.

Leif Olteidal, René Westerhausen and Kenneth Hugdahl

University of Bergen, Norway.

Hemispheric asymmetries can be studied both using tasks based on auditory and visual stimulation techniques. In the auditory domain, dichotic listening paradigms are frequently used for the assessment of brain asymmetry; and the typically observed right ear advantage is taken as indicator of the left-hemispheric dominance for language processing. Comparably, in the visual domain, the right-visual field

advantage as revealed with various verbal visual half-field (VHF) paradigms, has been taken to reflect leftward hemispheric asymmetry. The aim of the present study was to compare behavioral asymmetries as assessed with auditory and visual tasks in the same participants. To this end, a visual analog to the Bergen dichotic listening test (a consonant-vowel dichotic listening paradigm) was developed: Pairs of consonant-vowel syllables (e.g. ba – ga) were presented simultaneously (one in each VHF; 80 ms duration; visual angle $\sim 2^\circ$) and masked at offset. The distance from the two syllables to the center of the screen was systematically varied, in order to control for a potential bias caused by reading direction. In both tasks, three attention conditions were used (non-forced, forced right and forced left attention) and presented in a pseudo-randomized order and indicated by a visual symbol at the center of a computer screen. Ten healthy volunteers (all male, right-handed) were tested with both tasks. As expected, the dichotic listening task revealed a significant right-ear advantage in the non-forced condition ($36.7 \pm 9.3\%$ versus $51.0 \pm 10.2\%$; $P = 0.03$; for left and right ear, respectively). In contrast, the corresponding results for the visual analog were opposite; $71.1 \pm 10.5\%$ versus $24.1 \pm 11.3\%$; $P < 0.001$; for left and right VHF, respectively. Thus, for the visual analog, an advantage of the left VHF was observed. The results may suggest that hemispheric dominance in these dichotic tests could be dependent on the sensory modality.

The Prospective Relation between Hemispheric Lateralisation and CD4⁺ T-cells in Human Immunodeficiency Virus Type 1 (HIV-1)

Rachel Sumner, Alex Nowicky, Andrew Parton, Carolien Wylock, Renata Cserjesi, Benjamin Fischler, Patrick Lacor & Yori Gidron

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Objectives: Modulation of the immune system has been proposed to be influenced by hemispheric lateralisation (HL), the stable tendency to relatively utilise one hemisphere or its functions over another. To date, only one study has examined the effects of HL on the progression of Human Immunodeficiency Virus (HIV). However, that study included a small sample with very little third variable control. The present study tested whether HL predicted CD4 levels, statistically controlling for confounders.

Methods: Employing two neuropsychological assessments of HL, 68 HIV-1⁺ patients were followed prospectively. Numerous exclusion criteria and confounder assessments were employed (e.g., age, sex, mode of contraction, medication) to provide a more rigorous and controlled analysis.

Results: The present work partly corroborated the theory of asymmetrical influence on HIV immunity by HL and identified a moderator: HAART medication. The main analyses revealed a statistically significant relationship between HL and follow-up CD4+ levels, yet this was moderated by HAART. Among HAART-naïve patients, left-HL predicted better immunity, while no such relationship was seen in HAART-treated patients, independent of confounders. Ethnicity was also implicated as a potential moderator. Further observations were made between HL and HIV-relevant behaviours. Left HL was related to higher number of sexual partners in Europeans. A near-significant relationship was observed between left HL and longer periods between HIV clinic attendances in Africans.

Conclusions: The present study adds new information concerning a moderating factor of the HL-immunity relationship in HIV. As expected, left-HL predicted higher CD4+ counts, but only in HAART-

naïve patients. The added methodological and statistical control employed extend the validity of the HL-immunity relationship. Indications for future research are provided.

Friday, Session 3

Auditory verbal hallucinations in a non-clinical population

Kristiina Kompus
University of Bergen, Norway

Auditory verbal hallucinations are one of the most important diagnostic signs of schizophrenia. They can, however, occur independently of any acute psychiatric disorder. Non-clinical auditory hallucinations offer a unique opportunity to examine the neural correlates of "hearing voices" in the absence of possible confounds from psychotic symptoms or psychoactive medication. Previous research has suggested that auditory verbal hallucinations may be associated with aberrant lateralization of language processing networks. We conducted a functional magnetic resonance imaging study on a group of non-clinical hallucinators and non-hallucinators. We examined the lateralization of the language networks, and the functionality of attentional control using a consonant-vowel dichotic listening task with intensity modulation. In this presentation, preliminary findings are presented and discussed in the context of hemispheric asymmetry.

Hemispheric asymmetry along the psychosis dimension: watch out for drug use!

Christine Mohr & Daniela Herzig
Faculté des sciences sociales et politiques, Institut de Psychologie, Bâtiment Anthropole, Lausanne, CH

Reduced hemispheric asymmetry is thought to be a behavioural and anatomical marker along the psychosis dimension, whether study populations concern patients suffering from psychotic illness or schizotypal individuals from the general, healthy population. Yet, inconsistent reports from behavioural half-field studies in these populations question the sensitivity of reduced hemispheric asymmetry to psychotic (-like) symptoms. An explanation for these inconsistencies may be a higher than average illicit and licit drug use along the psychosis dimension. In a series of studies, we assessed lateralized lexical decisions in both patients with a first episode of psychosis and individuals from the general population with relatively elevated self-reported schizotypy. Additionally, we accounted for individuals' drug use (e.g. nicotine, cannabis, alcohol or unspecified substance use severity). From our study results, we infer that drug use may be a more promising predictor of hemispheric asymmetry than individuals' psychotic (patient populations) or psychotic-like (healthy populations) symptoms. These observations question the notion that hemispheric asymmetry could be a behavioural marker of the psychosis dimension, and suggests that elevated drug use might be better suited in explaining the previously reported link between reduced hemispheric asymmetry and psychotic (-like) symptoms.

Lateralisation of figurative language in schizophrenia: fMRI results

Alexander Rapp

Department of Psychiatry & Psychotherapy, University of Tuebingen

Several lines of evidence indicate that language lateralization is altered (reduced) in schizophrenia, a finding that may play an important role for the pathophysiology of the disease (e.g. Crow, 1997). More specifically, a number of functional imaging studies found reduced language lateralisation indices/increased right hemisphere contribution in schizophrenia compared to healthy control subjects. However, the right cerebral hemisphere plays some role for language comprehension even in healthy individuals. Traditionally, especially the comprehension of nonliteral, “figurative” expressions like metaphors, proverbs, metonymy and irony are ascribed to the right cerebral hemisphere.

In the first part of the presentation the evidence for this assumption is reviewed. Approx. 40 fMRI studies and an even higher number of brain lesion studies investigated the comprehension of nonliteral expressions. A coordinate-based meta-analysis of the imaging data makes clear that the right hemisphere contribution for nonliteral expressions is somewhat larger, but overall the left hemisphere plays the larger role.

One question is what happens in schizophrenia. It has been suggested that “right hemisphere language functions” may be reversely shifted to the left hemisphere. Data from three own functional magnetic resonance imaging studies in schizophrenia are presented (on metaphor, n=12 patients; on metonymy n=15 patients; on irony n=15 patients). Data indicate reduced rather than reversed lateralisation for nonliteral language in schizophrenia, although several limitations are to be recommended.

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Cognitive Correlates of Frontal EEG Asymmetries

Gina Grimshaw

Victoria University of Wellington, New Zealand

We have known for decades that asymmetries of the prefrontal cortex predict vulnerability to depression. Whereas most people have greater left than right frontal activity at rest (as measured by EEG), vulnerable people have greater right than left frontal activity. However, we have only just started to explore the cognitive mechanisms that are reflected in that asymmetry, and to understand how those same processes might play a role in the generation of depression. I will describe research in our lab using behavioural, ERP, and psychophysiological methods to identify the cognitive processes that are associated with frontal asymmetry. Our findings point to a key role for the left prefrontal cortex in controlling disengagement from negative information.

Friday, Session 4

Eye Movements in Attractiveness and Emotionality

*Nicole A. Thomas & Sophie J. Wignall
School of Psychology, Flinders University*

The left cheek is judged as more emotionally expressive than the right and is more often presented when conveying emotion. When judging attractiveness, however, the right side of female faces is preferred. Attractiveness research has primarily used chimeric or composite faces, which does not provide information on how attractiveness is judged for real faces. The current research employed eye tracking to examine fixation patterns and scan paths when evaluating attractiveness and emotionality in real faces. Overall, fixations were longer and more numerous on the lower left hemiface, particularly when evaluating emotion. When rating attractiveness, more fixations were made to the right mouth. In contrast, more fixations on the left mouth occurred when appraising emotionality. When examining happy and sad faces separately, more fixations were made to the upper left, relative to the upper right and lower left quadrants, for sad expressions. Fixations were more numerous on the right eye and mouth for happy expressions and on the left eye for sad faces. Examination of the four quadrants of the face suggests the left side of the face is inspected more, regardless of what type of judgments participants are making. However, when considering specific areas of the face, fixation patterns identify subtle differences that support the valence hypothesis. Although the right side of the face was not examined more frequently overall when judging attractiveness, the right side of the mouth was evaluated more closely than the left.

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Understanding Sex Differences in Emotion Lateralisation

*Victoria Bourne
Royal Holloway, University of London*

For most people the processing of emotional facial expressions is lateralised to the right hemisphere of the brain; however there is variability in this lateralisation which has been widely examined using the chimeric faces test, a behavioural measure of lateralisation for the processing of facial emotion. One of the most researched sources of variability in strength of lateralisation is sex differences. Typically males are more strongly lateralised than females, although not all research has replicated this finding. In this talk a range of studies will be discussed that attempt to broaden our understanding of sex differences in lateralisation, including consideration of psychological gender identity (i.e., masculinity and femininity) and prenatal testosterone exposure, as measured by the 2D:4D finger length ratio. Additionally, data will be presented considering whether there may be sex differences, not just in strength of lateralisation, but also in intra-individual variability in lateralisation across the six basic emotions. Whilst the evidence for sex differences in lateralisation appear to be quite robust, it is clear that a simple and universal binary

distinction is not possible and that a range of factors need to be considered to understand the observed sex differences.

Identification of emotion in eyes from the Ekman faces test

*Louise Roberts & Alan Beaton
Swansea University*

Previous research has shown that complex emotion can be identified from the eyes alone (Baron-Cohen et al., 1997b). The present study looked at the effects of sex and empathy on accuracy of identification of emotion in isolated eyes taken from the six basic emotions included in the Ekman 60 faces test (Ekman & Friesen, 1969); these are anger, disgust, fear, happy, sad and surprise. There were two experiments: in the first participants completed an empathy questionnaire (Baron-Cohen et al., 2001), followed by a computer-based task in which they were presented with isolated emotional eyes and had to identify which of the six emotions was being portrayed. In the second experiment, rather than identifying the emotion participants were asked to rate the intensity of emotion on a five point Likert scale. The results showed a significant effect of type of emotion in both accuracy and intensity ratings but no significant effect of sex or empathy on either accuracy or intensity rating. In terms of intensity there was a significant difference between positive versus negative emotions as well as between high versus low arousal emotions. Both accuracy and intensity ratings differed significantly as between the 10 different items (individuals) of the Ekman faces test.

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Saturday, Session 1

Introduction to the evolution of laterality

*Natalie Uomini
"Lucy to Language" Research Group, University of Liverpool*

In order to understand how and when laterality evolved, it is useful to look for clues from prehistory. I will present a brief overview of prehistoric evidence for laterality in human ancestors. Two types of laterality can be ascertained from the fossil and archaeological records: hand preference and brain asymmetry. These will be discussed in relation to the problem of studying laterality at the individual vs. group levels.

The Epigenetic Origin of the Cerebral Torque in Modern Homo sapiens

Tim J Crow, SJ Leask, TH Priddle

SANE POWIC, University Department of Psychiatry, Warneford Hospital, Oxford, OX3 7JX, U.K.

The French neurologist Pierre Gratiolet concluded that in Man the gyri of the left frontal lobe develop before those on the right, while in the occipital lobe those on the right develop before those on the left. His contemporary Paul Broca speculated that the asymmetry that confers the faculty of language defines Homo sapiens as a species.

The key to the genetic basis of this development lies in the sex chromosome aneuploidies. Turner (X0) syndrome individuals acquire words at a normal rate but have deficits in spatial ability and relative anatomical deficits in the right posterior quadrant. Klinefelter (XXY), like XXX and XYY syndrome, individuals are delayed in the acquisition of words and have losses of frontal asymmetry. The conclusion to be drawn is that the determinant of asymmetry is located on both the X and the Y chromosomes (Crow, 1995, 1998).

A hominin-specific stratum (the "X- transposed region") on the Y was created by a duplication from the X long arm now dated at 6MYA, ie close to the hominin great ape separation (Sargent et al., 1996; Schwartz et al., 1998). Two genes have been eliminated from the Y block leaving one gene pair (Protocadherin11XY – PCDH11XY) expressed from both X and Y chromosomes to account for the survival of the transposed block in modern hominins. PCDH11XY codes for two molecules expressed on the cell surface that interact with each other to control the relative growth of axonal processes.

Thus Protocadherin11Y is present on the Y in all modern human males and no other mammals. Protocadherin11X is present and subject to conservative selection in all mammals; in the hominin lineage it has been subject to "accelerated evolution". Relative to the sequences in the great apes there have been 18 coding changes in the Y sequence and crucially 5 changes in the X sequence including two to reactive cysteines in the ectodomain (Williams, Close, Giouze, & Crow, 2006).

Across populations the sequences of PCDH11X and Y are stable. The process of meiotic suppression of unpaired chromosomes (MSUC) is the origin of an imprint on the paternal X chromosome identified with X chromosome inactivation in females. It carries a species-specific epigenetic message to the embryo, perhaps at a time when gene expression is suppressed.

Epigenetic variation can be detected through variation in the age of parent at the time of birth of the child. Thus the children of mothers aged less than 20 years at the time of birth are more left-handed, and the children of fathers aged less than 20 are more likely to be right handed than would otherwise be expected.

In conclusion there are strong grounds for considering the Protocadherin11XY gene-pair the primary determinant of cerebral asymmetry and the identifier of the specific mate recognition system in Man. Through variable pairing of X and Y chromosomes in male meiosis it is associated with variation that is epigenetic and species-specific. (Crow, 2012)

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What do Genome-Wide Association Studies tell us about the genetics of handedness?

Chris McManus, University College London

Angus Davison, University of Nottingham

John Armour, University of Nottingham

Handedness runs in families, and models such as the DC model of McManus and the RS model of Annett do a good job of predicting patterns within families, within twins, and between handedness and language dominance. All these models have two alleles at a single genetic locus. If it is true that a single gene underpins handedness then in the age of Genome-Wide Association Studies (GWASs), it should be straightforward to find that gene.

In this paper we will review the existing GWASs, and present the results of our own analysis of the association of handedness and a very large number of SNPs in the large Twin Research Unit dataset. Our conclusions are simple: no SNPs show a statistically significant association with handedness, despite a 99% power to detect a single locus should it exist. Other GWASs, as well as a meta-analysis of GWASs, force the same conclusion.

Does that mean that there is no gene for handedness? Hardly, as all the classical studies find evidence of genetic effects with good heritability. What it probably means is that handedness is determined by many loci, each with a small effect. We show that a multi-locus version of the DC model makes predictions for families and twins which are effectively indistinguishable from a single-locus model. The key difference is that there is no power to detect the multiple loci in a GWAS.

Handedness is not alone in not finding effects in a GWAS – there are growing discussions of what have been called the ‘missing heritability’ for height, for intelligence, and for a host of other ‘complex conditions’, such as schizophrenia. We will show the parallels with these conditions, and in particular with the condition of primary ciliary dyskinesia, in which the heart is on the right side rather than the left, and suggest that handedness works in similar ways, multiple loci having large effects within individuals but low frequencies in the population.

Health care hypothesis better predicts variation in percentages of left-handers than the fighting hypothesis.

Ton GG Groothuis (1), Sara M. Schaafsma (3), Reint H. Geuze (2), Gert Stulp (1)

(1) Behavioural Biology, Centre for behaviour and Neuroscience, University of Groningen, NL

(2) Clinical and Developmental Neuropsychology, University of Groningen, NL

In past and present human societies right- and left-handers have coexisted with left-handers being always in the minority. Left-handedness is substantially heritable and has been associated with fitness costs. Its continuous presence in the population therefore indicates that benefits are associated with left-handedness also. It has been proposed that left-handers have an advantage during fights and are subject to negative frequency dependent selection. This fighting hypothesis is supported by two sort of evidences: First, an increased percentage of left-

handers in interactive sports. In a recent large meta analyses we substantiated this. However, we will argue that frequency dependent selection might not be the best explanation for these results

Second, a cross-cultural study showed that aggressive societies hold increased frequencies of left-handers. However, measurements of handedness in the population with highest recorded left-handedness and homicide were either based on film material not intended for laterality research or on indirect measures only. Therefore, we measured direction and strength of handedness in one of these pre-industrial societies in a more direct and detailed way. We found extreme low levels of left-handedness in this nonindustrial society, even in the generation that would still be exposed to tribal wars. This undermines the fighting hypothesis.

Since this Eipo population suffered from low quality health care and left handedness has been related to health problems, we hypothesised that its low frequency of left handedness is due to low survival of diseased people. Or, more generally, variation in health care among human populations may explain variation in left-handedness. Using a comparative approach in 12 Western populations, we examined whether public expenditure on health care is a better explanatory factor for the variation among societies in proportions of left-handedness. Public expenditure on health care was a significant explanatory factor of variation in left-handedness and this variable explained significantly better handedness variation than the number of homicides. This suggests that the persistence of left-handedness is at least partly the by-product of pathology on which selection pressures can not act upon.

Saturday, Session 2

Is the asymmetry of the superior temporal sulcus specifically human?

*Francois Leroy, S. Bogaert, Q. Cai, H. Simmonet, W. Hopkins, G. Dehaene-Lambertz
INSERM U992, Neurospin, 91191 Gif sur Yvette, France*

Lateralization of the linguistic brain network may result from strong architectural constrains which have favored language development in our species. We focused on the superior temporal sulcus (STS) which plays a key role in the linguistic network in both human adults and infants and whose asymmetry has recently been reported early in life. First, we measured the depth along the sulcus in two populations of human adults, one left-lateralized and the other one right-lateralized for language. The right STS was deeper than its left counterpart in both populations as in infant brains. Besides, the asymmetry was larger in left-lateralized subjects. Then, we applied the same methodology to a group of chimpanzees. No asymmetry was found at the location homologue to the human asymmetrical region. Thus, the STS asymmetry in both immature and mature human brains seems to lack in our close cousin in the primate lineage. These results suggest that the STS asymmetry could be a robust human landmark related to language and that its location should be further explored as a target for a genetic evolutionary pressure.

Is there an advantage of lateralization in human (dual) task performance?

*Nele Zickert (1), Tess Beking(1), Reint Geuze (2), Ton Groothuis(1)
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(2) Clinical and Developmental Neuropsychology, University of Groningen, NL*

Although it has now been established that lateralization of brain and behaviour is a fundamental property of the organization of behaviour in the animal kingdom, its Darwinian function remains elusive. One of the evolutionary advantages of brain lateralization could be that it enhances cognitive and task performance, both in single and dual tasks. Some evidence for the former comes from non-human and human studies showing that stronger lateralization improves performance in single tasks but the literature is not entirely consistent. Dual-task performance might profit even more from a lateralized brain that allows for parallel processing of distinct tasks when allocated to different hemispheres, reducing interference. A few animal studies found support for this but the few studies on humans did not, perhaps because interference between the tasks was not substantial.

We will report results from our study in which human subjects performed a (supposedly left hemispheric) language task and a (supposedly right hemispheric) visual-spatial task, both as single tasks and as a dual task. In each single task we measured the actual strength of hemispheric dominance independently from performance by using functional Transcranial Doppler (fTCD) monitoring of blood flow velocity. We classified the subjects according to their pattern and strength of lateralization to test our main hypotheses that I) strength of lateralization has a positive effect on performance in both single and dual tasks and II) two functions lateralized in a contralateral fashion will result in better dual task performance compared to an ipsilateral pattern.

We successfully increased interference levels in the dual task condition. We could show a positive effect of the strength of lateralization on task performance in the single and dual task condition in our new study, underpinning evidence found in animal studies for human subjects. Moreover, our data give support to the hypothesis that a contralateral pattern of lateralization is of advantage for task performance.

Laterality of visuospatial attention and language production: Evidence for complementarity

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c INSERM, Cognitive Neuroimaging Unit, 91191 Gif sur Yvette, France

Language production and spatial attention are the most salient lateralized cerebral functions and their complementary specialization has been observed in the majority of the population. To investigate whether the complementary specialization has a causal origin (the lateralization of one function causes the opposite lateralization of the other) or is rather a statistical phenomenon (different functions lateralize independently of each other), we determined the lateralization for spatial attention in a group of individuals with known atypical right hemispheric (RH) lateralization for speech production, based on a previous large-scale screening of left-handers. We show that all 13 participants with RH language dominance have left-hemispheric (LH) dominance for spatial attention, and all but one of 16 participants with LH language dominance are RH dominant for spatial attention. Activity was observed in the dorsal fronto-parietal pathway of attention, including the inferior parietal sulcus (IPS) and superior parietal lobule (SPL), the frontal eye-movement field (FEF) and the inferior frontal sulcus/gyrus (IFS/IFG), and

these regions functionally co-lateralized in the dominant hemisphere for attention, independently of the side of lateralization. Our results clearly support the *Causal hypothesis* about the complementary specialization, and we speculate that it derives from a longstanding evolutionary origin. We also suggest that the conclusions about lateralization based on an unselected sample of the population and laterality assessment using coarse fTCD should be interpreted with more caution.

Complementary hemispheric strategies in preparatory attention: The modulation of events probability and task difficulty

Laura Gabriela Fernández & Eric Siéroff

EA 4468, Neuropsychologie du vieillissement, Paris Descartes University, France

A crucial component in attentional control is the ability to prepare to the occurrence of an upcoming stimulus. Preparatory attention (PA) to an impending target-stimulus improves its subsequent processing. LaBerge, Auclair, and Siéroff (2000) developed the Attentional Preparatory Test (APT), which measures the ability of subjects to modulate (enhance) PA to a target location when the probability of a distractor occurrence varies in several blocks. In the APT, the distractors occur in the preparatory phase before the target presentation, and are never simultaneous with the target. Response times increase as a function of the distractor probability, showing a competition between PA to the target and to the distractor. We investigated the role of each hemisphere in PA, using a lateralized version of the APT, the LAPT, in which targets appeared peripherally in the right (RVF) or left (LVF) visual fields. Several experiments were conducted, varying the instructions (explicit or not about the proportion of trials with a distractor), the task (detection, localization), and the difficulty of the target/distractor discrimination (easy, hard). We found that PA is modulated differently in the right (RH) and the left hemisphere (LH), depending on task configuration. In the RVF/LH, PA is modulated by the exact probability of distractor events (frequency matching?), specifically when this probability is explicit. Also, the LH seems to play a crucial role when the target and the distractor are hard to discriminate, possibly showing a role in the selection aspect of attention. In the LVF/RH, PA is less dependent on the distractor probability, and may depend on the exact delay at which the target is expected (maximizing?), but only when the discrimination between the target and the distractor is easy. Most importantly, in all these experiments, the difference between LH and RH in the modulation of PA is independent of the response hand, thus may occur at the perceptual level of processing.

Saturday, Session 3

Effect of handedness and language dominance on the cerebral lateralization of praxis

Guy Vingerhoets

Department of Experimental Psychology, Ghent University, Belgium

Praxis refers to the ability to perform learned movements, such as the use of tools or making symbolic gestures. Many neuroimaging and patient studies have documented a left hemispheric dominance for praxis in most individuals, with activation/lesions of the left frontal and posterior parietal areas being most involved with performance/disruption of praxis skills. We aimed to investigate the effect of hand preference and language dominance on the lateralization of cerebral activation during tool pantomiming, a classical task for the evaluation of learned gestures. Volunteers were instructed to pantomime the use of tools with their dominant, non-dominant, or with both hands while undergoing functional magnetic resonance imaging (fMRI). In a first study we compared the activation patterns of 14 left and 14 right handed participants matched for strength of hand preference. Both groups showed a left hemispheric lateralization in the expected regions regardless of which hand(s) performed the task. Left handers showed a significantly reduced overall lateralization (based on the lateralization-index of the 10% most active voxels), that was mainly due to a diminished asymmetry over the posterior parietal cortex. In a second study the same paradigm was performed by 10 volunteers with atypical language dominance and their activation patterns during tool pantomiming were compared with those of 10 participants with typical language dominance that were matched for handedness with the atypical group. Language dominance was determined by a word fluency paradigm during fMRI. All typical language dominant volunteers also revealed left hemisphere changes during tool use pantomiming in prefrontal, premotor, and posterior parietal regions. All atypical language dominant participants displayed right hemisphere engagement for tool use. Co-lateralization of the language and praxis networks was observed on group and individual level, regardless of the participant's handedness. Activation maps of the word generation and tool use pantomiming contrasts displayed overlap in five cortical regions whose lateralization indices showed significant within-task as well as cross-task correlations. We conclude that handedness only influences the strength (not the side) of the lateralization, whereas language dominance and praxis dominance appear closely related, suggesting a functional and topographic link between language and praxis.

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Manual asymmetries in visually-guided aiming

David Carey

School of Psychology, Bangor University

Hand differences in movement control include a paradoxical left hand advantage for reaction time in visually-guided aiming movements. These are typically linked to a left hemisphere advantage for either visuospatial processing, attention, localisation or “premotor processing”. Manipulations in my lab have found that it is remarkably difficult to attenuate or exacerbate these RT advantages even with increasing spatial demands of the task. This task will focus on our recent efforts to revisit these effects, which include utilising two-dimensional target arrays, hemispace, and separating input and output relayed processes.

An investigation of asymmetries in spatial attention and wheelchair navigation

Mike Nicholls

School of Psychology, Flinders University

While right parietal damage can result in left hemineglect, the general population shows a subtle neglect of the right hemispace. This bias, known as pseudoneglect, may cause people to collide with objects on the right more than the left when walking. This study explored the mechanisms that give rise to pseudoneglect and asymmetrical navigation. In Experiment 1, participants navigated manual and electric wheelchairs through a narrow doorway. More rightward collisions were observed for the electric, but not the manual wheelchair. Experiment 2 replicated the effect by showing a rightward deviation for an electric wheelchair, which increased for wider doorways. Experiment 3 demonstrated that the rightward deviation was not affected by the hand used to control the joystick. Experiment 4 established that the rightward deviation is not the result of task-related vestibular input by requiring participants to drive the wheelchair away from them using a remote control. To demonstrate that the bias is related to an asymmetry on behalf of the operator, and not the chair, Experiment 5 dissociated the participant’s left and right from the wheelchairs left and right by asking participants to operate the wheelchair at a distance and drive it towards them. The rightward bias disappeared, demonstrating that the bias stems from the operator. Finally, in Experiment 6, the rightward bias was replicated using an electric scooter, which is steered using handle-bars. Over attention to the left side of space and inattention to the right, caused by pseudoneglect, provides the best explanation of the rightward deviation. The rightward deviation could impact the operation of many human-machine interfaces, such as cars and ships.

Lateral preference and personality influence behaviour towards a manual task

Lynn Wright & Scott Hardie

Evolutionary & Biological Approaches to Behaviour Research Group, Abertay University, Dundee, Scotland

Differences in task behaviour between left- and right-handers and left- and right-eared individuals have been reported (e.g. Wright, Hardie & Rodway, 2004; Jackson, 2008) with left-handers taking longer to begin a task and right-eared individuals having a more disinhibited approach. Personality measurements are also important when examining approach behaviour. Jackson (2008) reported those with higher neuroticism levels and a right-ear preference react faster to tasks. The current study investigated the effects of lateral preference and personality on behaviour towards a manual sorting task. 85 participants completed laterality and personality scales and a card sorting task. Left-handers took longer to begin the task than right-handers but there was no difference between left- and right-eared individuals. Strength of hand preference was found to influence behaviour towards the task with strong left-handers taking longer to begin. Finally it was found that neuroticism interacted with hand- and ear-preference to influence task approach, however, extraversion did not influence task approach. We concluded that hand preference, and more specifically a strong left-hand preference is a good predictor of initiation time on a manual task and that neuroticism is a stronger predictor than ear-preference when predicting manual task initiation time.

Saturday, Session 4

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Asymmetries in the recognition of visual stimuli as a result of expertise

Janet Hsiao

Department of Psychology, University of Hong Kong

In this talk, I will present recent findings from my lab to support the argument that hemispheric asymmetry in the recognition of different types of visual stimuli can be accounted for by differences in task requirements. I will start with presenting some behavioral data in the perception of faces and Chinese characters, which suggest that asymmetry in the perception of visual stimuli (i.e., the left side bias effect) reflects expertise in recognition at the categorical level. I will then present a computational model of visual stimulus recognition that implements a theory of hemispheric asymmetry in perception, i.e., differential spatial frequency processing in the two hemispheres, and demonstrate how various hemispheric asymmetry effects in the recognition of faces, Chinese characters, and words in alphabetic languages can be accounted for by visual and task characteristics of the recognition tasks alone, without assuming influences from linguist properties of the languages.

Hemispheric asymmetries in the naming and recognition of words with different Orthographic Uniqueness Points

*Cristina Izura and Victoria Wright
Department of Psychology, Singleton Park, Swansea*

The orthographic uniqueness point (OUP) of a printed word is the letter position at which the word becomes unique and distinguishable from all other words in the mental lexicon. For example, the OUP of *acrylic* is 4 because upon reading the letter *y*, *acrylic* is the only possible remaining match in the English language. The present study explored the effects of OUP when participants identified and named words displayed in the right and left visual field. Results showed a main effect of visual field (i.e., faster recognition and naming of words presented in the right visual field) and an interaction between visual field and OUP. Thus, words presented in the left visual field and with an OUP on the 4th letter were recognised and named faster than words presented in the left visual field with an OUP in the 7th letter. However, words displayed in the right visual field with an OUP in the last letter were recognised and named faster than words with an OUP in the middle of the word. Findings suggest that while the LH was sensitive to the relative position of the OUP within a word the RH was sensitive to the absolute position of the OUP within a word supporting the idea that both hemispheres recognised words in qualitatively different ways. Results will be discussed in light of current models of hemispheric word processing.

Symmetry Detection in Typically and Atypically Lateralized Individuals: A Visual Half-field Study

*Ark Verma, Lise Van der Haegen & Marc Brysbaert
Department of Experimental Psychology, Ghent University, Belgium*

Visuospatial functions are typically lateralized to the right cerebral hemisphere, giving rise to a left visual field advantage in visual half-field tasks. In a first study we investigated whether this is also true for symmetry detection off fixation. Twenty right-handed participants with left hemisphere speech dominance took part in a visual half-field experiment requiring them to judge the symmetry of 2-dimensional figures made by joining rectangles in symmetrical or asymmetrical ways. As expected, a significant left visual field advantage was observed for the symmetrical figures. In a second study, we examined the laterality of symmetry detection for a group of participants with known right hemisphere dominance for speech production. A group of 15 left handed individuals with right speech dominance was compared to a group of 15 left handed individuals with left speech dominance (speech dominance had been identified with fMRI in an earlier study; Van der Haegen et al, 2011). While the typically lateralized individuals elicited the previously found left visual half-field advantage for symmetry, the atypically lateralized individuals showed a reversed pattern, i.e. a right visual half-field advantage. These findings suggest that language and visuospatial functions are lateralized in opposite hemispheres of the brain, as predicted by the complementarity view of lateralization.

Central visual word recognition requires interhemispheric communication

Lise Van der Haegen¹, Qing Cai^{1,2}, Michael Stevens¹, Marc Brysbaert¹

¹Department of Experimental Psychology, Ghent University, Belgium.

²INSERM, Cognitive Neuroimaging Unit, 91191 Gif sur Yvette, France

The split fovea theory states that letters of foveally presented words (i.e. within the central 3 visual degrees) are initially split and sent to the contralateral visual cortex. As such, letters presented in the left (LVF)/right (RVF) visual field are initially projected to the right (RH)/left (LH) hemisphere respectively. The present study tested the consequences of a foveal split for word reading in left- and right-handers with typical left or atypical right speech dominance. First, their speech lateralization was measured by a silent word generation task in a functional Magnetic Resonance Imaging study. All participants then named three-, four-, and six-letter words in isolation, while fixating at all possible letter positions. In addition, they were asked to read texts in silence. An eye tracking device monitored their eyes binocularly in both behavioral tasks. Results showed that left speech dominants named the words fastest while fixating at the word beginning (i.e. when most letters fall in RVF/LH), while the optimal viewing position of the right dominants was situated more towards the word end (i.e. with most letters in LVF/RH). Reading behavior also interacted with speech lateralization in the reading test: The eyes of the left-dominant group landed more at the word beginning and less at the word end relative to the initial fixation positions of the right-dominant group. These findings clearly demonstrate that interhemispheric communication is not only needed in central visual word recognition, but that reading behavior is also optimized in function of speech lateralization.

Practical information

The conference

The meeting will take place in the monastery **Het Pand** (Address: Onderbergen 1, 9000 Ghent, **no 1** on the map below).

If you arrive at **Brussels Airport**, you can either

(1) take a taxi (about 90 EUR)

(2) take a train to Gent Sint Pieters station (Timetable: <http://www.belgianrail.be/en/Default.aspx> from Brussel-Nationaal-Luchthaven to Gent-Sint-Pieters, 14 EUR; If you travel in group, you can buy a Rail pass for 76 EUR, valid for 10 single journeys in Belgium).

From **Gent Sint Pieters station**, you can

(1) take a taxi (about 8 EUR)

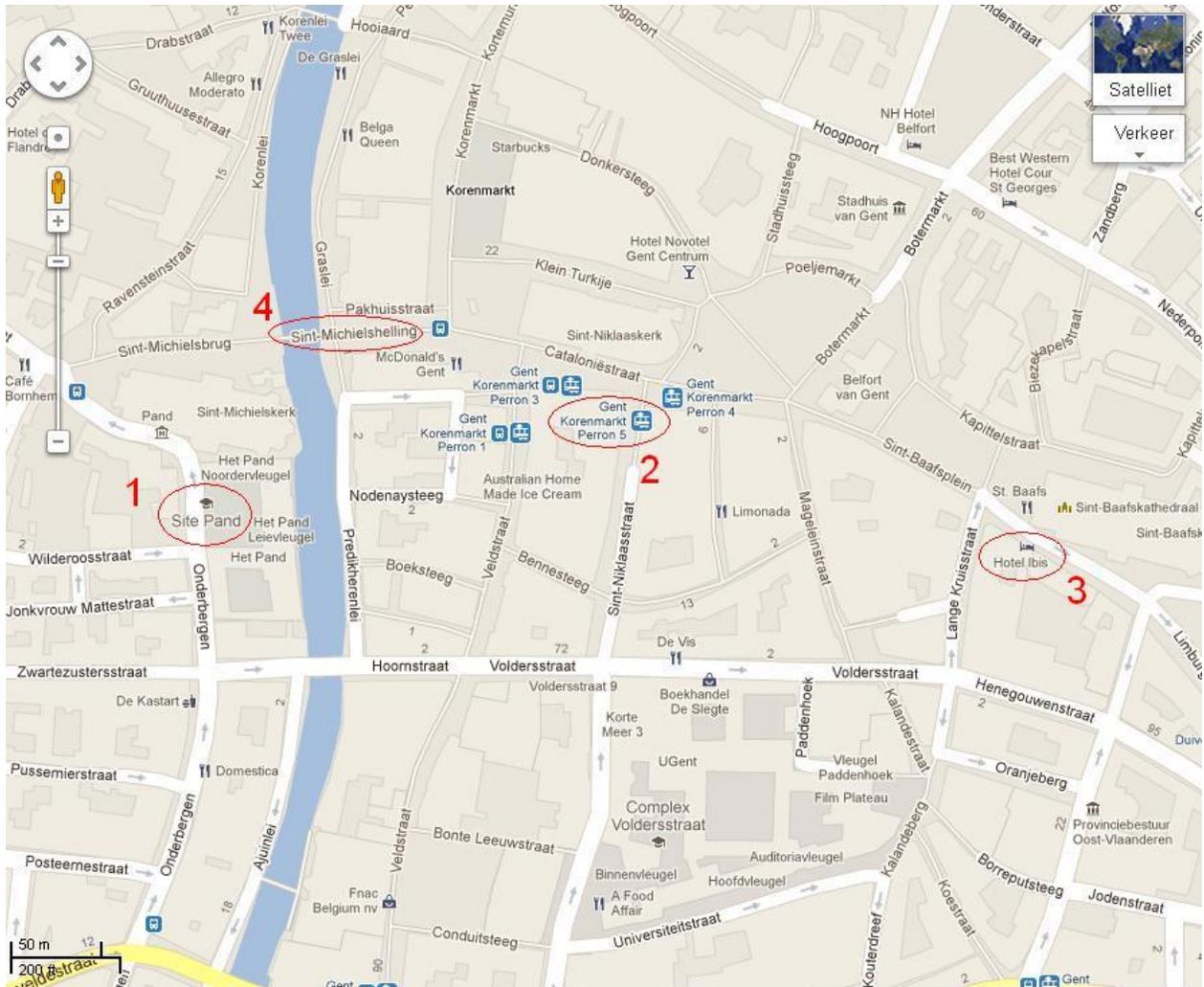
(2) take Tram 1 (<http://www.delijn.be/en/index.htm> ; Direction: Evergem or Wondelgem, 2 EUR on the tram, 1.20 EUR purchased in advance at the station) to Korenmarkt (**no 2** on the map). Both the meeting place Het Pand and the hotel IBIS Cathedral (Limburgstraat 2 near the Sint-Baafs Cathedral, **no 3** on the map) we recommended are within walking distance.

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On **Thursday October 4**, we can meet at the Ibis cathedral hotel at **6.45pm** for dinner, or you can go directly to the restaurant Aba-Jour (address: Oudburg 20, Gent) at 7pm.

On **Friday October 5**, we will meet at **6.15 pm** at the Sint-Michielsbrug (**no 4** on the map) to go for a 'gastronomic walk through Ghent'.

On **Saturday October 6**, we can again meet at the Ibis cathedral hotel at **6.45 pm** for a Spanish tapas meal, or you can go directly to the restaurant Casa de las tapas (address: Corduaniersstraat 41, Gent) at 7pm.



Some tourist information

Ghent

You can find a lot of information on <http://www.visitgent.be/> or go to the tourist office at the Oude Vismijn (Old fish market), Sint-Veerleplein 5. If you cannot choose, some recommendations are Het Gravensteen (Castle of the counts – an impressive fortress in the city centre), Sint-Baafskathedraal (St.-Bavo's Cathedral, with the Adoration of the Mystic Lamb, the famous painting of the Van Eyck brothers), St. Pieters Abbey, Bourgoyen-Ossemeersen (if you want to see many species of birds rather than buildings) etc.

Bruges

The easiest way to go to Bruges, famous because of its historical buildings and lace, is by train. It takes about 30 minutes from Ghent Sint Pieters station; Return tickets cost EUR 7.20 if you travel in the weekend, or EUR 12.40 on Monday-Friday. You can find more detailed tourist information on <http://www.brugge.be/internet/en/toerisme/index.htm>

Antwerp

If you want to visit Antwerp, known for its diamonds, fashion and Flemish artists such as Rubens and van Dyck, you take a train from Ghent Sint Pieters station to Antwerpen Centraal. It takes about 1 hour and costs 10 EUR (return tickets in weekend) or 18 EUR (Monday-Friday). More information on <http://www.visitantwerpen.be/bze.net?id=1470>

Brussels

Finally, if you want to visit the capital city Brussels, take a train to Brussel Centraal (in the direction of Eupen or Genk, about 35 minutes, 9.40 EUR return tickets in the weekend, 17 EUR Monday-Friday). Tourist information can be found on http://visitbrussels.be/bitc/front/home/display/ct/BE_en/section/visiteur.do

Notes

