

# Learning & Perception

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## Dubrovnik Conference on Cognitive Science

DuCog 2009

# LANGUAGE AND THE BRAIN

in the framework of the newly formed **Central European Cognitive Science Association**  
(CECOG)

Invited talks

**Jacques Mehler, Franck Ramus, István Winkler**

DUBROVNIK, 22–24 MAY 2009

Centre for Advanced Academic Studies (CAAS) Dubrovnik  
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Budapest University of Technology and Economics (BME)



## PROGRAMME

### Friday, May 22

- 10:00–11:00 Registration for early birds
- 15:00–16:00 Registration and welcome drink
- 16:00–17:30 **Poster session 1:** Early language development
- 17:30–18:00 *Coffee break*
- 18:00–18:30 **Opening session:** Welcome words by Melita Kovacevic,  
Vice-rector for Science and Technology, Zagreb University
- Founding event of the **Central European Cognitive Science Association:**  
Talk by Csaba Pléh, Budapest University of Technology and Economics,  
Budapest, Hungary

### Saturday, May 23

- 8:30–9:00 *Coffee*
- 9:00–10:30 **Poster session 2:** Language and the brain
- 10:30–11:00 *Coffee break*
- 11:00–12:00 **Tutorial I:** Franck Ramus: Genes, brain and language
- 13:30–16:30 **Poster sessions 3 and 4:** Brain, cognition, disorders
- 16:30–17:00 *Coffee break*
- 17:00–18:00 **Tutorial II:** Jacques Mehler: Why cognitive development deserves  
precocious study

### Sunday, May 24

- 8:30–9:00 *Coffee*
- 9:00–10:30 **Poster session 5:** Metaphor and related issues
- 10:30–11:00 *Coffee break*
- 11:00–12:00 **Tutorial III:** István Winkler: Maintaining the acoustic internet:  
How auditory processes support verbal communication

## POSTER SESSIONS

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### Poster session 1: Friday, May 22, 16:00–17:30

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#### EARLY LANGUAGE DEVELOPMENT

Chaired by *István Winkler*

#### **Lexical and morphological data from Croatian Child Frequency Dictionary: A developmental perspective**

*Gordana Hrzica, Jelena Kuvac Kraljevic, Jan Snajder*

#### **Infants' use of word frequency to identify function word candidates**

*Jean-Rémy Hochmann, Jacques Mehler*

#### **Structure learning under 'noisy' conditions in infancy: Adjacent repetitions vs. non-adjacent repetitions**

*Ágnes Melinda Kovács, Jacques Mehler*

#### **Statistical computation and rule-learning in 12- and 18-month-olds: Evidence for two distinct mechanisms**

*Erika Marchetto, Luca L. Bonatti*

#### **Optical topography study in neonates: Is memory for speech already present at birth?**

*Silvia Benavides Varela, David Maximiliano Gómez, Ricardo Augusto Hoffmann Bion, Francesco Macagno, Jacques Mehler*

#### **Why do 12-month-olds point? Desire to learn vs. desire to share interest**

*Tibor Tauzin, Ágnes M. Kovács, Gergely Csibra, György Gergely*

#### **Can 10-month-old infants use quantifiers?**

*Ernő Téglás, Luca L. Bonatti*

#### **The development of emotion-regulation and representational abilities in post-institutionalized adopted children**

*Anna Bátki*

#### **Cognitive and emotional maturation occurred in parallel with reorganization of associative prefrontal cortex circuitry**

*Martina Zeba, Zdravko Petanjek*

#### **The comparative study of concept understanding by blind and sighted children. Implications for the process of second language acquisition**

*Katarzyna Jaworska-Biskup*

#### **Phonological and semantic processing in children with developmental dyslexia – Evidence from event-related potentials**

*Katarzyna Jednoróg, Artur Marchewka, Paweł Tacikowski, Anna Grabowska*

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**Poster session 2: Saturday, May 23, 9:00–10:30**

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**LANGUAGE AND THE BRAIN**Chaired by *Csaba Pléh***Click detection and stream segmentation***David M. Gomez, Ricardo H. Bion, Jacques Mehler***Factors influencing speed of lexical decision and word naming task for Slovenian words***Lea Mencinger***Semantic coalitions and animacy violations elicit different brain responses***Jakub Szewczyk, Herbert Schriefers***Anaphoric resolution processes by intermediate second language learners of English during text comprehension***Yasunori Morishima, Sayaka Sato***Event-related potentials during contextual integration of unimodal and multimodal semantic information in adults***Nevena Padovan***Effects of TMS on different stages of motor and non-motor verb processing in the primary motor cortex***Liuba Papeo, Raffaella Ida Rumiati***Eye tracking study of IAPS: The look can fool you!***Sanja Budimir, Marijan Palmovica***The processing of agreement patterns in Croatian***Marijan Palmović, Ranko Matasović***Electrophysiological evidence for first and second language sentence processing: Thematic roles in Croatian***Gordana Dobravac***Monolingualism, bilingualism and working memory***Beáta Grabovac***Sadness and happiness in speech***Eszter Szabó***The comparative study of concept understanding by blind and sighted children. Implications for the process of second language acquisition***Katarzyna Jaworska-Biskup***Phonological and semantic processing in children with developmental dyslexia – Evidence from event-related potentials***Katarzyna Jednoróg, Artur Marchewka, Paweł Tacikowski, Anna Grabowska***A case study of Hungarian***Daniel Vasarhelyi*

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**Poster session 3: Saturday, May 23, 13:30–15:00**

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**BRAIN AND COGNITION**Chaired by *Jacques Mehler***Lateralized executive functions in memory retrieval***Mónika Albu, Mihály Racsmány***Influence of input modalities on working memory retrieval speed in children***Jelena Kuvac Kraljevic, Gordana Dobravac***Positive verbal feedback effect on procedural learning***Péter Hári, Ferenc Kemény***Phonological neighborhood density and word retrieval – An ERP study***Lucija Katalenić, Blanka Treselj, Marijan Palmović, Klara Bilic-Mestric***The role of transparency in probabilistic category learning***Ferenc Kemény, Ágnes Lukács***Investigating the role of competition in retrieval induced forgetting through reaction-time analysis***Attila Keresztes***Set size and serial position effects in auditory event-related potentials during Sternberg memory experiment***Magdalena Krbot***Connectionist framework for recognition and generation of biological motion patterns and their transitions***Emilian Lalev***Structural correlates of true and false recognition. A voxel based morphometry study***Artur Marchewka, Katarzyna Jednoróg, Anna Nowicka, André Brechmann, Anna Grabowska***The World Color Study visualization***Kristína Rebrová***Visual perception in context: An eyetracking study to analyse the influence of emotions on viewing behaviour in free-viewing tasks***Teresa Hloucal, Jürgen Kriz, Timo Sackmann***Cognitive evoked potentials of voluntary movements***Ana Branka Šefer***The interplay of memory and attention***Ivan I. Vankov*

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**Poster session 4: Saturday, May 23, 15:30-17:00**

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**COGNITIVE CHALLENGES AND DISORDERS**Chaired by *Franck Ramus***How does knowledge affect memory distortion? Empirical studies on the basis of print advertisement***Magdalena Romanowska***Language of irrational decision making in the brain***Jakub Traczyk, Agata Sobków***Cognitive and neural correlates of normal aging in task-setting: Interactive effects of practice, conflict and task complexity***Antonino Vallesi, Anthony R. McIntosh, Donald T. Stuss***Vocabulary as a mediator variable between old age and theory of mind performances***Zlata Alina***Source monitoring in high functioning autism: Component processes and individual variations***Barbara Batta, Miklós Györi, Zsuzsanna Kata Pohl***Motor learning in Williams syndrome and in typically developing children and adults***Andrea Berencsi, Ilona Kovács***Dissociating structural abnormalities and epigenetic factors in WS individuals***Patricia Gerván and Ilona Kovács***Sleep architecture and EEG spectra in adolescents and young adults with Williams Syndrome***Ferenc Gombos, Patricia Gerván, Róbert Bódizs, Ilona Kovács***Executive prospective memory and obsessive-compulsive disorder (OCD)***Gyula Demeter, Mihály Racsmány, Katalin Csigó, András Harsányi, Attila Németh*

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**Poster session 5: Sunday, May 24, 9:00-10:30**

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**METAPHOR PROCESSING AND COMPUTATIONAL LINGUISTICS**Chaired by *Melita Kovacevic***A model of learning verb argument frames in Hungarian***András Serény, Eszter Simon, Anna Babarczy***A corpus-based analysis of abstract language use***Anna Babarczy, Ildikó Bencze, István Fekete, Eszter Simon***Places, people, institutions: Processing metonymic and polysemic expressions***Ildikó Bencze***Electronic name address as individual identity***Leila Sadeghi Esfehani***Auditory mental simulation during linguistic processing: Specific sounds affect the understanding of concrete and abstract sentences***István Fekete***Effector-specific motor simulation in idiom processing***Galina Gradinarova, Armina Janyan***Universal data categorizator architecture***L'udovít Malinovský***Scientific and everyday metaphors of psychology***Bálint Forgács***Political metaphor as a mythologem***Ignacy Nasalski***Experience and opinion in forming of politician's image***Andrzej Falkowski, Ma<sup>3</sup>gorzata Michalak*

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## Abstracts – Tutorials

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### *Tutorial I*

#### **Genes, brain and language**

*Franck Ramus*

Laboratoire de Sciences Cognitives et Psycholinguistique  
Ecole Normale Supérieure

Since the beginning of the cognitive revolution, it has been hypothesised that the human faculty to acquire a language is “innate”, that is, part of our species’ biological makeup, and, therefore, encoded in some way in our genetic program (Chomsky, 1959). Over the years, a wide variety of arguments have been advanced in support of this view: the universality of some properties of human languages (Chomsky, 1957), the “poverty of the stimulus” available for language acquisition (Chomsky, 1965), the spontaneous emergence of languages (Bickerton, 1984; Goldin-Meadow & Mylander, 1998), biological adaptations such as that of the vocal tract (Lenneberg, 1967), the existence of inherited disorders that may specifically affect language (Gopnik & Crago, 1991), the heritability of language abilities and disorders (Stromswold, 2001), the adaptiveness of language as a communication system (Pinker & Bloom, 1990), and the plausibility of a gradual evolution of the language faculty (Jackendoff, 1999). Although the evidence gathered in the last decades in favour of a biological basis of language looks convincing to many scientists, until recently genetic evidence has remained relatively indirect, in the sense that it has not addressed the fundamental questions: if there is a genetic basis for language, then what exactly is there in the human genome that is different from other species, and that gives us language? How does it build a brain that can learn a human language?

There is no easy way to obtain a direct answer to this fascinating question. Genetic differences between species are only beginning to be systematically searched, and the many differences that are found are not straightforwardly identifiable as associated with language (Fisher & Marcus, 2006). However, part of the answer will likely come from addressing a related but different question: what human genetic variations are associated with variations in the ability to learn a language? Indeed, most genetic methods rely on detecting correlations between variations in the genotype and variations in the phenotype. The capacity to acquire spoken language is usually treated as a universal characteristic of our species. Nevertheless, like many other traits, the language abilities that are observed in the human population vary along a normal distribution. Cases in the lower end of the distribution (“disorders”) are typically the most informative, as they may highlight causal relationships between genes, brain, and cognition, that are often not readily apparent in normal development. Indeed, disorders of language acquisition have so far provided almost all the available data on language genetics. Furthermore, developmental language disorders are diverse, affecting different aspects of language, therefore promising to illuminate putative genetic influences on particular components of language (phonology, morphology, syntax, articulation, etc.). Accordingly, we will review the genetic data gathered on the various types of language-related disorders (specific language impairment, speech sound disorder, developmental dyslexia, etc.) and reflect on what they teach us about the genetic basis of language.

#### **References:**

- Bickerton, D. (1984). The language bioprogram hypothesis. *Behavioral and Brain Sciences*, 7, 173–221. Chomsky, N. (1957). *Syntactic Structures*. The Hague: Mouton.

- Chomsky, N. (1959). A Review of B. F. Skinner's Verbal Behavior. *Language*, 35, 26–58.
- Chomsky, N. (1965). *Aspects of the Theory of Syntax*. Cambridge, MA: MIT Press.
- Fisher, S. E., Marcus, G. F. (2006). The eloquent ape: Genes, brains and the evolution of language. *Nature Reviews Genetics*, 7(1), 9–20.
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- Gopnik, M., Crago, M. B. (1991). Familial aggregation of a developmental language disorder. *Cognition*, 39(1), 1–50.
- Jackendoff, R. (1999). Possible stages in the evolution of the language capacity. *Trends Cogn. Sci.*, 3(7), 272–279.
- Lenneberg, E. H. (1967). *Biological Foundations of Language*. New York: Wiley.
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***Tutorial II***

***Tutorial III*****Maintaining the acoustic internet:  
How auditory processes support verbal communication***István Winkler*Institute for Psychology, Hungarian Academy of Sciences;  
Institute of Psychology, University of Szeged

In any communication network, exchanging messages between participants requires seamless operation of a number of low-level functions. On top of the physical layer of connections (such as those implemented in today's computer networks by cables, transmitting and receiving devices, modems, hubs, switches, network adapters, etc.), protocols common to some or all participants of the network enable them to 1) detect when an incoming message is relevant to them, 2) identify the source of the message, 3) understand what type of message arrived, 4) determine whether the sender of the message or some other participant of the network requires a communicative response, and, if yes 5) form a response that is adequate with respect to the incoming message as well as adhering to the protocols of the network, such that the intended recipients of the outgoing message are able to process it in a similar way (points 1-5). Although animals and humans have been communicating for millions of years, these aspects of communication have been taken for granted until the need for artificial communication networks arose. For example, when discussing an issue with someone, we are typically unaware of how the voice of the conversation partner is selected from all other concurrent sounds, how we know that the partner addressed us (as opposed to some other communication-capable entity present; e.g., a dog), how we determine that the partner's message is verbal (as opposed to e.g., a shriek or a grunt), whether and when to reply or interject, how we convey to the partner that his/her message has been received, how we can signal understanding, compliance, agreement, etc. Some of these functions require no or negligible effort and even when effort is needed, we don't know exactly what functions are helped by it (e.g., with high levels of noise in the environment, following someone's speech requires focused attention, but is transparent to us how this helps to extract the desired stream of sounds from the background). Typically, our efforts appear to us as being directed towards understanding the semantic content of incoming messages and to convey to others what we mean. Just as a typical internet user opens an e-mail with a few clicks or keystrokes, types his own message and sends it to the recipient without being, or indeed needing to be aware of how the text is encoded into some format that can be transferred through the network, how it will find the recipient's computer, and how will this computer recognize that the incoming information has been intended for it and that this information contains a text message that can be displayed on the screen as a series of letters.

The talk will address some of the human auditory functions underlying verbal communication both as they appear in adults. We shall also ask: Which of these abilities humans are we born with? The latter issue is of special relevance. We know that we have to learn to speak. To bootstrap such learning, some communication-supporting processes must be already functional at birth. Understanding how communication develops in children and being able to pinpoint some of the possible problems arising during the development of communication requires knowledge about how communication can function before language starts to dominate it and obscures much of what lies under.

We shall first discuss the separation and selection of sound sources. This problem has been termed "Auditory Scene Analysis" in the literature. What cues and what kind of processes are involved in finding out which part of the incoming mixture of sound have been emitted by a single sound source, how we can detect that a new sound source appeared, etc. Of special importance is the balance between the need for stability (i.e., maintaining some durable internal representation describing the current configuration of sound sources in the environment) and the need to adapt to the normally ever-changing environment,

which requires flexibility in interpreting the cues that help us to solve the scene analysis problem. We will then take a look at what kind of internal object representations may exist in the auditory modality. Because we strongly believe that perception is oriented towards the future (as opposed to describing the present), in discussing these issues, we shall look for the role of predictions in auditory perception.

We will then shortly assess what has been learned by neuroscience regarding the long-standing debate of whether speech is processed by dedicated neural networks as opposed to general auditory ones.

Finally, we shall focus on auditory processes allowing new-born babies to segregate sound sources and to follow both the melodic contour and dynamic (rhythmic) aspects of sound sequences. We shall argue that, together with detection of gaze direction and communicative gestures, these abilities enable babies to assess how and when to respond to auditory (including verbal) communication directed to them and thus form a crucial prerequisite of learning to speak.

**Suggested reading:**

- Bregman, A. S. (1990). *Auditory Scene Analysis: The Perceptual Organization of Sound*. Cambridge, MA: MIT Press.
- Denham, S. L., Winkler, I. (2006). The role of predictive models in the formation of auditory streams. *Journal of Neurophysiology*, *100*, 154–170.
- Scott, S. K., Wise, R. J. S. (2004). The functional neuroanatomy of prelexical processing in speech perception. *Cognition*, *92*, 13–45.
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## Abstracts – Posters

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### Lateralized executive functions in memory retrieval

*Mónika Albu<sup>1</sup>, Mihály Racsmány<sup>2</sup>*

<sup>1</sup>Hungarian Academy of Sciences - Budapest University of Technology and Economics Research Group in Cognitive Science, Budapest, Hungary

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The main purpose of this lesion study was to examine the role of the two hemispheres in the different executive and memory processes. Our study was designed to contrast two existent hypotheses about the role of the two hemispheres in episodic retrieval processes. Classical neuropsychological studies provide evidence for material-specificity. The so-called “systematic-heuristic” hypothesis states that the left prefrontal cortex (PFC) is more involved in systematic retrieval, while the right PFC is more active in heuristic retrieval. The “production-monitoring” hypothesis proposes that the left PFC is primarily involved in semantically guided production of information, while the right PFC is more active during monitoring processes. Involving frontal and temporal lobe patients with left or right-sided lesions, we used 10 different verbal and visual recall and recognition tasks loading different processes of production and monitoring, including analytical and heuristic processes. The results support the conclusion that the “production- monitoring” hypothesis is more appropriate in explaining the effect of frontal lobe lesion on memory performances, while the heuristic-systematic hypothesis is more suited to explain the effect of temporal lobe lesions in episodic memory.

**Keywords:** systematic–heuristic hypothesis, production-monitoring hypothesis, executive functions, lateralization

### Vocabulary as a mediator variable between old age and theory of mind performances

*Zlata Alina*

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The few studies that focused on theory of mind in old age obtained contradictory results, although the same subcomponent of theory of mind was measured (the capacity to understand the protagonist’s intentions), with versions of the same instrument (Strange Stories Task). One possible explanation lies in the characteristics of the samples used, in particular the varying vocabulary levels of the participants. As such, we hypothesised that vocabulary moderates the relationship between age and theory of mind performance in verbal tasks. Seventy-seven young participants ( $m = 19.37$  years), 52 with low and 26 with high vocabulary scores, and 81 old participants ( $m = 67.37$  years), 31 with low and 50 with high vocabulary scores, completed the Mill Hill Vocabulary Scale and the Strange Stories Task. The older participants achieved significantly lower scores than did younger participants on the verbal theory of mind task, with no differences on the control task. When vocabulary was considered, however, the effect of age on theory of mind performance was smaller in those older participants who had a good vocabulary. Thus, we can say that our hypothesis was confirmed: vocabulary compensates for the theory of mind decline in old age.

**Keywords:** theory of mind, vocabulary, old age, decline, compensation

### **A corpus-based analysis of abstract language use**

*Anna Babarczy, Ildikó Bencze, István Fekete, Eszter Simon*

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According to Cognitive Linguistics, the representation of abstract concepts in the mind/brain is grounded in the representation of concrete knowledge, which in turn is grounded in our bodily experience of the world. Cognitive Theory of Metaphor (CTM) claims that to comprehend and to produce abstract language, we use “conceptual metaphors” (e.g., time is money, more is up, politics is war, etc.) which are conceptual source-target domain relations stored in our minds. The present study is a corpus-based analysis of the concrete-abstract (metaphoric) language use. Twelve widespread conceptual metaphors were selected from Lakoff and Johnson (1980) and the metaphor index in Kövecses (2002) so that mapping would be present from a concrete (source) domain to an abstract (target) domain. Taking the Embodiment hypothesis as a starting point of our analysis, we supposed that a metaphoric sentence should include both source and target domain expressions. To test this assumption we tried three different methods, each of them having as underlying principle an association experiment. The results show that the identification of metaphorical expressions by means of computer-based analysis is not so efficient as would be expected by CTM, and there exist some metaphoric types that do not strengthen the Embodiment hypothesis.

**Keywords:** cognitive linguistics, embodiment hypothesis, conceptual metaphors, corpus-based

This research was funded by EU FP6 Grant No. 28714.

### **The development of emotion-regulation and representational abilities in post-institutionalized adopted children**

*Anna Bátki*

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In order to examine the effects of early deprivation on emotional and cognitive development, I assessed and compared emotion-regulative and representational abilities in 3 groups of 4–6 year old children ( $n = 30$  in each group). Children in the first group had been adopted from institutional care after the age of 6 months. The second group consisted of children adopted within 6 weeks after birth, and the third group consisted of children raised by their biological parents. Emotion regulation was assessed in a pretend play context using the MacArthur Story-Stem Battery. Representational abilities were also assessed in the emotionally charged pretend play context and also by using false belief tasks and an action pantomime task. Results support the hypotheses that (i) early institutional care results in less developed capacities for emotion regulation: children spending their early months in institutions are less able to use pretend play for emotion-regulative purposes. Furthermore, (ii) while their representational abilities seem intact in the false belief and action pantomime tasks, these abilities are less effectively employed in emotionally charged situations. Results also indicate that (iii) the emotion-regulative abilities of children adopted as infants also show some developmental delays when compared to those of children raised in birth-families.

**Keywords:** early deprivation, adoption, emotion-regulation, social cognition, representational development

This research was supported by a grant from the International Psychoanalytical Association and a Semmelweis University doctoral scholarship.

**Source monitoring in high functioning autism: Component processes and individual variations**

*Barbara Batta<sup>1,2</sup>, Miklós Györi<sup>1,2</sup>, Zsuzsanna Kata Pohl<sup>1</sup>*

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Numerous studies have emphasized the connections between source monitoring, executive functions and episodic memory processes. Our research focuses on systematic and heuristic metamemory processes in source monitoring judgement, especially on the patterns of source judgement failures in autism, which seem to be very heterogeneous on the basis of available evidence. This poster reports preliminary findings from a sample of high functioning young adults with autism (N = 10). Our tool for examining competing monitoring processes in memory retrieval was an advanced perceptual source monitoring test, in which we used two conditions: “conventional” and “violated conventional”. Our hypothesis was that in this arrangement competing monitoring processes emerge in source judgement. In the conventional condition, heuristic monitoring processes help to find the correct response, while in the violated conventional condition, by contrast, systematic processes confound heuristic monitoring processes, so specific efforts have to be made to inhibit the conventional responses. Preliminary findings are surprisingly heterogeneous, indicating strongly individual patterns of information processing behind source monitoring judgement in autism. This may mirror a compound mechanism of retrieval control processes, where impairments of the component processes may show considerable variability across individuals with autism.

**Keywords:** autism, source monitoring, heuristic and systematic monitoring functions, retrieval, metamemory processes

This research has been funded by the Hungarian Scientific Research Fund (OTKA, grant nr. 61615); the 7th Frame Programme of the European Commission (HANDS project, grant nr. 224216), and a Bolyai scholarship of the Hungarian Academy of Sciences to the second author.

**Optical topography study in neonates:  
Is memory for speech already present at birth?**

*Silvia Benavides Varela, David Maximiliano Gómez, Ricardo Augusto Hoffmann Bion,  
Francesco Macagno, Jacques Mehler*

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Extraordinary abilities to process linguistic stimuli are present soon after birth. Besides their perceptual capacities, little is known about babies’ abilities to actually encode the information that they are receiving. What information coming from the speech stimuli can be represented and stored in the immature brain of the neonate? In this work we explore traces of memory in newborns using optical topography (OT). We presented forty 1–4 day-old healthy babies with a single word repeated for approximately 6 minutes. After 2 minutes of silence, the second phase (test) began; the same word was presented for around 3 minutes to half of the babies, while the other half heard a novel word. When comparing the two groups we obtained significant differences in the changes to their oxyhemoglobin levels. Babies who listened to a novel word in the test phase showed a greater response than those who heard the same word before and after the pause ( $p < 0.05$ ). Our results show that even few days after birth babies are able to register and hold onto a word over a brief delay. Experiments in progress try to determine the nature of

the word-information that continues to be represented over the 2 minute interval between familiarization and test.

**Keywords:** memory, optical topography, language acquisition, newborns

This work was supported by a program grant from MICYT (Ministerio de Ciencia y Tecnología), CONICIT (Consejo Nacional para Investigaciones Científicas y Tecnológicas) of Costa Rica and also by the J.S. McDonnell Foundation.

### **Places, people, institutions: Processing metonymic and polysemic expressions**

*Ildikó Bencze*

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Some recent linguistic studies classify the place-institution and place-people traditional metonymic relationships with the group of systematic polysemy. Psycholinguistic experiments studying comprehension of the place-institution conventional metonymy type have found that literal and figurative interpretations are computed in equal time. According to a theoretical hypothesis, the ‘institution’ sense of words like school, zoo, theatre, cinema, etc. is thought to be part of the semantic representation of these lexemes as much as the ‘place, building’ sense is; that is, this type is said to be really polysemic. The ‘people’ meaning, in contrast, is believed not to be part of the inherent semantic structure of the words referred to, but the processor is thought to construct this sense, i.e., this type is said to be metonymic. Experiments using the self-paced moving window procedure confirm this assumption. Eighteen critical words were tested, each of them occurring in the three senses mentioned above. Sentences were randomized and were mixed with 54 semantically ill-formed filler sentences. Participants had to decide whether sentences were semantically meaningful or not, and their decision time was measured. The results show that expressions with the ‘people’ sense took longer to process than those with the ‘place’ and ‘institution’ senses.

**Keywords:** metonymy, systematic polysemy, on-line construction, self-paced reading

### **Motor learning in Williams syndrome and in typically developing children and adults**

*Andrea Berencsi, Ilona Kovács*

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Budapest, Hungary; aberencsi@cogsci.bme.hu

Williams syndrome (WS) is a developmental disorder with a genetic origin, whose motor aspects are not currently well understood. The present study compares motor learning of WS young adults with that of six age groups of typically developing children and adults. The participants practiced a finger tapping task consisting of a four-element sequence for five consecutive days. Motor performance was monitored both in terms of accuracy and speed using a combined measure of ‘Performance Rate’ (PR). We found that initial PR in typically developing individuals increases with age, with similar learning curves across the six age groups. Furthermore, there was little or no transfer to the contralateral side for a new sequence, indicating the involvement of M1 (primary motor cortex) in learning. In WS, both the initial PR and the rate of learning were markedly decreased. These results will be discussed with reference to other aspects of Williams syndrome such as perceptual learning and sleep.

**Keywords:** Williams syndrome, motor learning, finger tapping, developmental genetics

### Eye tracking study of IAPS: The look can fool you!

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The International Affective Picture System (IAPS) consists of emotional pictures divided in three categories; valence, arousal and dominance. This base has been used for different electrophysiological research of emotional processes, but with no consistent results. One possible explanation for this may be the difference in perceiving pictures. In order to detect what subjects really look at in the presented pictures, an eye-tracking experiment with 12 emotional pictures divided into three categories by valence was conducted. Areas of interest were defined for each picture in order to capture generalizations about how the participants direct their gaze. Two generalizations of the results are considered. One concerns participants and their “strategies” of how to deal with emotionally packed material. The other concerns the features of the pictures: is their gaze different depending on what the picture presents (animals, objects, people, landscapes, etc.)?

**Keywords:** IAPS, eye-tracking, emotions, ERP, valence

### Executive prospective memory and obsessive-compulsive disorder (OCD)

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Disorder of the executive system is generally thought to be the main underlying cognitive factor of symptoms in OCD. In our view, besides the executive deficit, the prospective memory is also impaired in OCD, in the sense of overactivation. Prospective memory is defined as the ability to formulate, retain and carry out intentions, plans and promises at the appropriate time or in the appropriate context. We explored in two experiments whether prospective memory task performance is impaired in a properly diagnosed clinical sample of OCD patients. We adapted the experimental paradigm developed by Burgess et al. (2001), who demonstrated that different cortical areas are implicated in the maintenance and realization of an intention. According to our results, the OCD group performed significantly slower on this event based prospective memory tasks than the matched healthy control group. A further aim of our study was to find different performance patterns related to the two major subgroups of OCD patients. The so-called compulsive subgroup performed significantly slower on the expectation condition relative to the baseline condition, while the obsessive subgroup produced impaired performance on the execution of the prospective task. We suggest that the overactivity of the prospective memory system could be a major factor in OCD cognitive phenotype.

**Keywords:** executive functions, prospective memory, obsessive-compulsive disorder

**Electrophysiological evidence for first and second language sentence processing:  
Thematic roles in Croatian**

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One of the crucial things in understanding the meaning of a sentence is the assignment of thematic roles within the sentence. It is interesting that various cues that lead us to comprehend a sentence have different strength hierarchies across languages. Learning a second language that has a different cue hierarchy than that of the native one can lead to difficulty in thematic role assignment, especially at the beginning level. Presenting Croatian sentences with different cue configurations (animacy, word order, case marking), the effect of cue strength on thematic role assignment was investigated in adult native speakers of Croatian and adult English native speakers learning Croatian as a second language. The participants were asked to respond to visually-presented Croatian sentences viewed on a computer screen word by word. All sentences were short three-word sentences consisting of a simple noun-verb-noun structure (e.g. Pas gleda loptu. – The dog is watching a ball.). Participants were asked to state who was the doer of the action by pressing a button. Reaction time and accuracy of responses were monitored, and on-going electro-encephalographic (EEG) activity was recorded to provide information about changes in participants' brain activity during task performance in order to assess the online processes involved in language processing.

**Keywords:** sentence processing, first language, second language, thematic roles, event-related potentials

**Experience and opinion in forming of politician's image**

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Later-received information can influence memories of experiences related to the particular event. The results of the backward framing study evidence the feasibility of transforming memories of a certain experience under the influence of politician image evaluation. The study participants (N = 232) have been given a description of a Polish popular politician, or another fictional political figure, then all the participants evaluated each aspect of the candidate's image: programme, personality, physical appearance. One week later the study participants read a positive or negative opinion of the earlier evaluated politician and were asked to recall their earlier evaluations of the presented politicians. Results show that the recalled information can be related to an experience which in reality has never occurred. Such an approach towards the construction of reality perception provides a tool for the development of fictional political images.

**Keywords:** image, backward framing, memory, advertisement

**Auditory mental simulation during linguistic processing: Specific sounds affect the understanding of concrete and abstract sentences**

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Is there a difference between the understanding of concrete (Don't ring that bell) and abstract (Her name rings a bell) sentences describing sounds? Previous reports have, for example, demonstrated that the comprehension of sentences describing auditory motion in a specific direction is affected by concurrently viewing a stimulus that depicts motion in the same or opposite direction (Kaschak et al., 2006). The present study reports on an experiment that extends our understanding of the relation between the processing of specific sounds and linguistic stimuli. The results show that visual sentence processing can also be affected by the concurrent processing of specific sounds (e.g. musical instruments and animal sounds). Participants made sensibility judgements on concrete and abstract sentences that encoded sounds. They were assigned to either of four groups at random: (1) congruent sounds, (2) incongruent sounds, (3) unrelated sounds, (4) no sound. The groups were defined as to what kind of sounds the subjects heard during the critical sentences. The data show that sentences were processed faster in the congruent condition as opposed to the incongruent condition. Second, congruent sounds facilitated processing relative to the no-sound condition. The results are discussed in the framework of simulational semantics (Bergen, 2007).

**Keywords:** sentence processing, sounds, auditory imagery, mental simulation, concrete and abstract language

**Scientific and everyday metaphors of psychology**

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The scientific reduction of psychology's different schools utilizes various key concepts which can be viewed as conceptual-metaphoric mappings of certain sets of plausible concepts (e.g., REFLEX, COGNITION) onto a variety of human functioning (e.g., BEHAVIOR, PERCEPTION). These abstract psychological concepts are the target domains of metaphorical mappings, which ground them into source domains of sensorimotor experiences. Based on these mappings we can create a metaphorical cortical map, and hence identify the neural dispositions of the different schools of psychology, revealing their differences. Hypothesis: psychological concepts can be arranged in a neural connotation-map. Method: in a pilot study participants had to judge 105 psychological concepts by conceptual dichotomies, corresponding to three neural dimensions of the brain (limbic-cortical, hemispheres, anterior-posterior), in a forced choice test. Results: psychological concepts were arranged in a conceptual space in a way that their location had neural relevance – complex concepts appeared in the brain areas where they were located by neuroscience. This might reflect that phenomenological dimensions, created by certain neural networks, appear in language as the source domains of the metaphors of psychological concepts. As various epistemological schools of psychology prefer different key concepts, they can be arranged in a metaphorical map of the brain.

**Keywords:** metaphor, neuroscience, concepts, psychology, cognitive, epistemology

## Dissociating structural abnormalities and epigenetic factors in WS individuals

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Williams syndrome (WS) is a neurodevelopmental disorder with surprisingly large neurobehavioral differences among WS individuals. In order to understand the role of genes controlling neurodevelopment, individual variations in the amount of genetic deletion, cortical structural abnormalities, and epigenetic factors have to be taken into account. Structural abnormalities in the brains of WS individuals include a relatively large loss of occipital gray matter volume. Employing a behavioral contour integration paradigm (CI) designed to test occipital visual function, we found that WS individuals performed much more poorly than IQ and age matched Down syndrome individuals. This is in general agreement with the structural findings. Among the many epigenetic factors affecting neurodevelopment, the micro-pattern of sleep is known to affect performance improvement in CI. In order to be able to compare individual WS perceptual learning data to typically developing (TD) data, we obtained TD learning curves in several age groups between 7 to 22 years of age. These TD data form a Developmental-Learning Surface (DLS) providing us with a unique and novel way of matching patient and control data: we attempted to predict whether a certain individual had severe occipital volumetric loss, severe sleep disturbance, or both.

**Keywords:** contour integration, visual development, perceptual learning, plasticity, Williams syndrome

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## Sleep architecture and EEG spectra in adolescents and young adults with Williams Syndrome

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Background: Children with Williams syndrome (WS) have been reported to have specific sleep problems, difficulties in initiating sleep, fragmented sleep with long wakeful periods, as well as periodic limb movements during sleep. Questionnaire data and wrist actigraphy supports the continuity of these problems into adolescence and adulthood, but no studies have examined sleep architecture by polysomnography in adolescents and adults with WS. Methods: Eight adolescents and young adults with WS and 8 age and sex matched healthy controls underwent polysomnography. We examined sleep macrostructure and specific EEG frequency bands at different scalp locations by using a mixed-radix FFT algorithm. Results: We found fragmented sleep, decreased sleep duration, increased NREM (mostly stages 3–4) and decreased REM duration in WS subjects. Frequency spectrum analysis showed decreased slow spindle (11–12.75 Hz) activity in all EEG channels, accompanied by decreased alpha activity over the right posterior temporal region in WS subjects. In the 8–16 Hz frequency domain a remarkably different pattern of spectral peaks characterizing sleep spindles was also observed. Discussion: Sleep disruption, increased slow-wave sleep, decreased REM sleep and specificities in the spectral fingerprints of NREM sleep EEG are characteristic features of sleep in adolescents and adults with WS.

**Keywords:** polysomnography, sleep patterns, sleep spindles, Williams syndrome, adolescents and young adults

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### Click detection and stream segmentation

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After familiarization with an artificial speech stream – composed of words defined by transitional probabilities – the usual tests do not inform us of the time course of the segmentation process. In order to study this time course, 28 Italian adults performed a click detection task while hearing an 8-minute long artificial speech stream composed of four statistically-defined words. Crucially, clicks were inserted both at the boundaries of some words and between the syllables of other words, allowing us to compare the reaction times (RTs) associated with both click locations. We hypothesized that RTs would be longer for clicks located within words than for clicks located between words. We computed RTs in time-windows of one minute in duration. Differences between average RTs for both click locations became increasingly large during the first four minutes of exposure, and reached significance at the third minute. We also observed an abrupt rise in the number of participants who responded faster to between-words clicks than to within-words clicks at the third minute (24 out of 28 participants). Our findings show that it is possible to study parsing in an online fashion.

**Keywords:** speech perception, click detection, speech segmentation, transition probabilities, statistical learning

### Monolingualism, bilingualism and working memory

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The goal of this research was to map the possible differences in the cognitive functioning of mono- and bilinguals. We wanted to examine the possibility of statistically significant relations between working memory capacity and language knowledge. Bialystok and colleagues proposed that bilinguals might have different cognitive functioning from monolinguals and that they might have a better developed and more efficient central executive functioning. Based on their results, the hypothesis of our research was that bilinguals have more developed executive control and also that they are better in verbal working memory functioning. Ten monolingual and ten bilingual adults speaking Hungarian and Serbian were studied. The tests used were the following: Digit Span Test (forward and backward), Letter Fluency Test, Nonword repetition Test, Readig Span test, 7+/- Test. The bilinguals did the forward Digit Span and Nonword repetition tasks in both of their languages. The results showed no significant differences in verbal working memory capacity or executive control functioning between the tested groups. This challenges the proposal that bilinguals would have an overall working memory superiority over monolinguals.

**Keywords:** working memory, central executive, bilingualism, monolingualism

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### **Effector-specific motor simulation in idiom processing**

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The theory of embodied/grounded cognition would entail that understanding verbal input describing actions and performing these actions should be closely linked through a common neural circuit activated during both processes. The present experiment is aimed at finding support for effector-specific motor simulation in the processing of idiomatic phrases. Idioms are a special case in that, although they might include verbs standing for actions with a specific body effector, the overall non-literal meaning of the idiom does not refer to such an action. Motor simulation in processing idioms would either be due to automatic activation of the idiom's literal interpretation or suggest the possibility that understanding abstract linguistic meaning could be embodied. Participants were asked to read literal and idiomatic expressions containing verbs for actions with different effectors and to match the meaning of verbs in phrases with verbs individually presented after the phrases. Analysis of the RT showed no effect of phrase type. However, it did show an effect of effector matching, i.e., RTs in response to a shared effector between the two verbs were slower than RTs to the non-shared/different effectors. The results are interpreted in terms of the so-called motor interference effect and simulation-based theories.

**Keywords:** embodiment, simulation, idiom processing, behavioral experiments, reaction time

### **Positive verbal feedback effect on procedural learning**

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Recent studies have shown that the striate is involved in emotional and motivational functions in addition to procedural motor learning. Procedural learning is described as incidental acquisition of complex information without verbal access to the information acquired. Informational feedback on achievement has an effect on tasks involving attention and concentration. In the case of positive verbal feedback the rewarding effect must be separated from the informational one. The acceptance of verbal reward is associated with the activation of the striate. The current research hypothesized that verbal rewards would have a positive effect on procedural learning task, which is caused by striatal activation, but mere data feedback would have no positive effect on procedural learning. The experimental design consists of 3 groups: the control group received no feedback in procedural learning task, the informational feedback group received data about their achievement, while the reward group received positive verbal feedback along with achievement data. The reward group significantly differed from the control and the informational groups in performance, but the control and informational groups did not differ. These results show that explicit positive verbal reward has a positive effect on a procedural learning task, but that explicit information feedback has no effect on procedural learning.

**Keywords:** striate, procedural learning, positive verbal feedback, informational achievement feedback

**Visual perception in context: An eyetracking study to analyse the influence of emotions on viewing behaviour in free-viewing tasks**

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Objective: Saliency-based theories assume that stimulus features (luminance, edges, texture) shape the hierarchy of perception. Predictions about human viewing behaviour are possible so that highly salient objects or regions of a picture will be perceived first (e.g., Itti et al. 2001). Not much attention has been paid to top-down factors such as emotions, motivation and other cognitive functions. The present study analyses the influence of a top-down factor (emotions) on visual perception in free-viewing tasks. We assume that even in artificial contexts such as viewing neutral pictures in an experiment, top-down factors, such as emotion, might influence the length of fixation and the velocity of saccades. Approaches to visual perception and perception in general should focus more on the individual cognitive aspects of this process. Method: In an eyetracking study 100 participants looked at neutral and emotionally relevant pictures without any task. After seeing five emotionally relevant pictures (crime, murder), which were taken from the IAPS (Lang, Bradley, Cuthbert, 2005), participants were shown one neutral picture (forest, grass) taken from studies of Peters et al. (2005) and Einhäuser et al. (2003). Results: It is expected that there will be significant differences in viewing behaviour concerning the neutral pictures depending on the emotional condition of the participants.

**Keywords:** saliency, eye movements, top-down factors, visual perception

**Infants' use of word frequency to identify function word candidates**

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Knowledge of function words (such as determiners and prepositions) is beneficial both for vocabulary and syntax acquisition. Before using them, however, infants need to identify them. To do so they can rely on language-specific phonological cues and universal distributional cues. One such cue comes from the observation that the most frequent words are function words. While these cues have long been recognized, it is unclear whether infants can actually use them. Here, we investigate whether such cues influence the way 17-month-old infants associate words and objects. In several experiments, we first exposed infants to a novel language, implementing frequency and/or phonological cues. We then presented them with two-word sentences together with a visual object, and asked which of the two words would be better associated with the object, reasoning that content-word candidates should be easier to associate to objects than function-word candidates. The two syllables differed in frequency, phonological properties, or both. Using an Eye-Tracker, we found that frequent syllables were less strongly associated with the object than infrequent ones, regardless of their phonological properties. Phonological cues alone did not elicit a similar effect. Hence, infants may start identifying function words based on their distributional properties, especially their high frequency.

**Keywords:** language acquisition, function words, word learning, word frequency, eye-tracker

**Lexical and morphological data from Croatian Child Frequency Dictionary:  
A developmental perspective**

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The Croatian corpus of child language consists of recordings of spontaneous speech of three monolingual children, taken from 1;5 to 2;8, approximately twice a month. Recordings were transcribed using the CLAN program, according to the CHAT rules and are available on-line in the CHILDES database (<http://childes.psy.cmu.edu/data/Slavic/>). As a second part of data processing, the complete corpus was morphologically tagged using a morphological lexicon developed specifically for Croatian child language, and then post-edited. The tagged corpus was used as a base for compiling the first Croatian Child Frequency Dictionary. The data from the corpus were lemmatized and then analyzed with regards to the specificity of the child language corpora, preserving in particular the time-developmental component. The Croatian Child Frequency Dictionary allows for the analysis of the most frequent lemmas in all three sub-corpora, according to frequency, alphabetic ordering, time of appearance, and part-of-speech. Also, it preserves morphological encoding of types and number of types and tokens. It therefore incorporates a larger amount of information than traditional corpora of written language, enabling users to extract relevant information on child language development, such as type/token ratio, lexical diversity, morphological diversity, etc.

**Keywords:** Croatian corpus of child language, Croatian Child Frequency Dictionary, CHILDES, lemmatization, tagging of corpus

**The comparative study of concept understanding by blind and sighted children.  
Implications for the process of second language acquisition**

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The aim of this study is to explore the issue of concept understanding by blind children. The main goal was to determine whether sight is an essential sense in language comprehension or whether the ability to comprehend language may depend on other mechanisms. In the case of the blind, one should recall sensory compensation and analogical reasoning as primary cognitive strategies. It was also of interest to pinpoint the implications of the peculiar language understanding of blind children for the process of foreign language acquisition. Participants were sighted and congenitally blind children. The results show many differences in the understanding of concepts between sighted and blind subjects such as egocentric-based responses, gaps in knowledge, or incorrect understanding of concepts, a high number of metaphors, stereotypic speech and analogical comparisons on the part of blind children. Sighted children, in contrast, preferred vision-based responses. The spotted data translates into the manner of second language acquisition and conditions the choice of the methods of teaching.

**Keywords:** blindness, conceptual development, conceptual awareness, sensory compensation

**Phonological and semantic processing in children with developmental dyslexia –  
Evidence from event-related potentials**

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We used ERPs to examine whether the brain response (N400 component) in dyslexic children is modulated by phonological or semantic priming similarly to age-matched controls. ERPs were recorded while children listened to word lists, in which we manipulated semantic and phonological expectations and congruency of the terminal word. In dyslexics, we found a dissociation of priming effects depending on whether semantically or phonologically loaded primes were used. We observed an enhancement of N400 amplitude (greater negativity) to semantically incongruent words; however this effect was reduced and delayed compared to controls. Direct comparison between the two studied groups revealed that they differed only for semantically incongruent words. In the phonological priming task, instead of an enhancement of the N400 amplitude found in controls, dyslexics displayed a reduction of the N400 in the incongruent as compared to the congruent condition. This time, the studied groups differed in both phonologically congruent and incongruent conditions. Results suggest that, when faced with phonological priming, dyslexics have problems with both matching for similarities (integration into context) and lexical decision (incongruency detection). In the case of semantic priming, integration of semantic context seems relatively intact in dyslexics, while they show difficulties with detection of shift from one semantic category to another.

**Keywords:** developmental dyslexia, ERP, semantic priming, phonological priming, N400

**Phonological Neighborhood Density and Word Retrieval – An ERP study**

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During the process of word retrieval, words are elicited from the mental lexicon. According to the Cohort Model, word recognition occurs when only one candidate in the cohort of possible words remains. Words are recognized via successive reductions in the number of possible word candidates as each phoneme is perceived. Each word has a particular number of neighbors, whereas a word can have dense or sparse neighborhood density (ND) depending on the number of words that sound similar to a target word. Words with dense neighborhoods are defined less accurately than words with sparse neighborhoods. Our study aimed to investigate the influence of neighborhood density in the process of spoken word and non-word retrieval, using the ERP technique following the N400 effect, and using an auditory lexical decision task. Words were presented to the participants in groups of 20 bisyllabic words and pseudo-words, with the initial trigram being controlled for neighborhood density (dense vs. sparse). The Cohort Model makes different predictions than models based purely on frequency regarding the amplitude of N400, therefore, the results will be interpreted in terms of psychological reality of the model.

**Keywords:** neighborhood density, ERP, N400, lexical decision task, cohort model

### **The role of transparency in probabilistic category learning**

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Implicit Learning is usually defined as incidental learning of complex information without the ability to explicitly recall the acquired content. One approach suggests that implicit learning is a domain general, robust learning mechanism that is independent of the nature of the learned information and relies on pure statistics (Saffran et al., 1996). Another proposes that implicit learning is domain-specific: there are mechanisms specialised for learning linguistic patterns, and there are mechanisms for other domains like geometric forms (Marcus et al., 1999). These theories differ in their claims about the effect of the nature of the presented stimuli (i.e., the category members) on learning, but both of them agree that there should be no difference in learning within a category due to the link between the category itself and its members. Our study compared two almost identical clones of a classical implicit learning task, the Weather Prediction task. In one of the conditions, the link between category members and category membership was arbitrary, while in the other condition the link was non-arbitrary and transparent. Our results show that transparency helps learning: the same probabilistic associations are significantly easier to learn when the category members have a transparent connection to the category.

**Keywords:** probabilistic category learning, transparency, domain general, robust learning, implicit learning

### **Investigating the role of competition in retrieval induced forgetting through reaction-time analysis**

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Retrieval of information from memory can lead to forgetting of related information. This finding, called retrieval induced forgetting, is held to be the result of interference resolution. It is not clear, however, whether interference resolution involves facilitatory processes only or inhibitory processes too. One common approach to this question is to investigate the role of interference that to-be-recalled memories have to overcome during retrieval practice in the Retrieval Practice Paradigm. Experiments designed for this purpose have not yet analysed the relation of a variable that directly mirrors the amount of interference to the forgetting of a competing memory. In a novel retrieval practice design, recall reaction times were measured in the retrieval practice phase, where each to-be-recalled item had only one competing memory. The effect of interference on the forgetting of the competing memory could thus be measured on an item by item basis. We found below baseline recall of competing memories. More importantly, we have found that interference measured through recall RTs affected the probability of later recall of the competing memory. Based on our results we discuss possible new directions for understanding the background and the long-term effects of interference resolution in memory recall.

**Keywords:** memory, inhibition, interference

**Structure learning under ‘noisy’ conditions in infancy:  
Adjacent repetitions vs. non-adjacent repetitions**

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A fundamental task in language learning is to extract adjacent and distant dependency relations. Previous studies suggest that infants learn repetition-based regularities when exposed to speech-stimuli conforming to one pattern (Marcus et al., 1999). However, infants are naturally exposed to a ‘noisy’ signal that contains multiple regularities. In three eye-tracker experiments we explored whether infants can extract structures from ‘noisy’ input where different patterns were present, and whether they can integrate them into differential eye-movements. Seven-month-olds were familiarized simultaneously with adjacent and non-adjacent repetitions; they generalized the adjacent repetitions. However, they also generalized the non-adjacent repetitions when these were contrasted with random patterns. When exposed to non-identical adjacent repetitions and identical non-adjacent repetitions, infants generalized the adjacent regularity. The results show that preverbal infants possess powerful abilities to extract regularities from ‘noisy’ input. They manage to find the more salient structure and presumably, for efficient learning, consider other evidence to be noise.

**Keywords:** regularity learning, repetition-based structures, eye tracking, infants

**Set size and serial position effects in auditory event-related potentials  
during Sternberg memory experiment**

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The main purpose of this study was to determine how the difference in set size and serial position affect auditory event-related potentials (ERP) and related reaction time. Subjects were healthy adults with no auditory impairments. The Sternberg experiment is usually associated with visual ERP, so we chose auditory ERP for comparison. During the Sternberg experiment, sets of two (set2) or four (set4) digits were acoustically presented to participants. After the last item in the set, the probe digit was presented. Participants had to indicate whether the probe did (positive probe) or did not belong (negative probe) to the presented set by pressing appropriate buttons. Event-related potentials were recorded using a 32 channel EEG device. We assumed that the increase of the set size would elicit an increase in the reaction time; the reaction time for the negative probe would be greater than for the positive probe and the reaction time would increase with the serial position. We also assumed that latencies of the event-related potentials would increase with increased set size and serial position and also would be greater for the negative probe in comparison with the positive probe. Preliminary results support our assumptions.

**Keywords:** Sternberg memory experiment, auditory event-related potentials, set size, serial position, reaction time, N500

**Influence of input modalities on working memory retrieval speed in children***Jelena Kuvac Kraljevic, Gordana Dobravac*

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The important role of working memory in the functioning of various cognitive abilities explains the continuous research interest in this area. However, research has mostly focused on working memory capacity and less on retrieval speed. The goal of this study was twofold: To investigate the influence of different input modalities on working memory retrieval speed, and to investigate the correlation between retrieval speed and other working memory aspects (e.g., capacity, coordination of information). To achieve these goals, reaction time data were collected using the Sternberg paradigm with different perceptual sources (auditory and visual) and different codes (verbal and nonverbal). Data related to working memory capacity were obtained by administering well-known tests such as: digit span, word list recall, non-word list recall, and listening recall. The participants were typically developing school children with an age range from seven to eleven. The broader aim of this study was to provide data about capacity, speed and functioning of all four working memory components in monolingual Croatian speaking children by testing them using two different but complementary methods.

**Keywords:** working memory, processing speed and capacity, school-age children

**Connectionist framework for recognition and generation of biological motion patterns and their transitions***Emilian Lalev*

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Biological Motion perception is the ability to perceive Gestalts of moving human or animal figures from two-dimensional projections of their joints. These projections are called point-light displays and are very salient stimuli. Biological Motion carries rich information about the perceived object: it works for identification of life in the surrounding, revealing the structure of the observed body and allowing the identity of the living being to be classified. Biological Motion also contains information about the particular type of action being performed, such as walking, running or dancing. Finally, perception of Biological Motion can even help define qualitative characteristics of the actor such as gender, weight, and mood. A neural network system for processing Biological Motion was developed. Separate parts of the system can classify motions, recover 3D structure from 2D projections, predict next states, and generate motion with realistic animated transitions between them. Results from the work of this system, trained with human motion capture data, show the presence of perceptual skills similar to those of people, including versatility and noise tolerance. The system can be used as a cognitive model for human Biological Motion perception. There are also possible applications in the fields of artificial vision and computer animation.

**Keywords:** biological motion, neural networks, perception, cognitive model

### Universal data categorizator architecture

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Organization of data in mind is associative, based on semantics and context, and its development is driven by biological evolution. Computers use various methods of data organization, from tree-like structures to relational databases, but they mainly reflect the functional needs of the system. The user is the one who has to adapt, which makes finding a relevant resource complicated. I propose a three-level modular architecture for a universal categorizator capable of learning how users organize data based on content semantics, in order to later access it more easily. It roughly parallels the three stages of information processing in the human brain: external conditions are first recorded by receptors and transferred to unimodal primary and secondary cortices, where domain specific sensory input is analysed and results from all domains are finally integrated in the polymodal cortex. Similarly, in my architecture, data is first divided by proper reading procedure into modal channels (textual, visual, sound...) which are next processed by channel specific feature extracting modules. Finally all features are collected and the categorizator module is employed. Data is assigned to known semantic categories and immediate feedback from the user is used for learning. The architecture specifies interfaces between levels and is extensible by adding new modules.

**Keywords:** categorization, data organization, feature extraction, semantic categories, biological plausibility, data processing, system architecture

### Statistical computation and rule-learning in 12- and 18-month-olds: Evidence for two distinct mechanisms

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Acquiring language requires the child to find words and to master the morphological rules governing word structure. In these studies we investigated whether infants recruit different mechanisms, one to extract statistically defined speech sequences, the other one to generalize word-internal rules. Crucially, we hypothesized that different mechanisms would require different signal properties. Infants at 12 and 18 months were tested with a modified head-turn procedure. They were familiarized with artificial speech streams containing nonsense words. Then, they were tested with sequences statistically present in the stream, but spanning the word boundaries, and with sequences which never occurred in the stream, but which were structurally similar to words. When exposed to a segmented stream, both 12- and 18-month-olds generalized word-internal rules to novel sequences. When exposed to a continuous stream, however, 18-month-olds but not 12-month-olds extracted statistically defined sequences and failed to generalize. These results suggest that two distinct mechanisms, activated by different signal properties (i.e., the presence or the absence of the pauses), are recruited to find words and to process word-internal structure. This developmental difference suggests that the two mechanisms have different time courses, and that the generalization mechanism may be effective before infants can fine-tune it to statistical relations occurring in speech.

**Keywords:** infant language processing; artificial grammar learning; statistical computation; rule-learning.

**Structural correlates of true and false recognition. A voxel based morphometry study**

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The issue concerning the neuronal basis of true and false recognition is still a subject of extensive debate. In the present study, voxel based morphometry (VBM) was used to examine structural brain correlates of these processes. We decided to use emotional stimuli because emotional content facilitates both true and false recognition. Behavioral measures, i.e., true and false recognition rates, were used as covariants in VBM analyses. VBM results indicated that the true recognition rate correlated positively with grey-matter (GM) density in bilateral amygdala, anterior cingulate and middle temporal gyrus, i.e., brain regions involved in the memory of emotional material, as revealed by fMRI results. False recognition rate correlated negatively with GM density in prefrontal areas (BA47 and BA9), supporting the role of the prefrontal cortex in monitoring retrieval and limiting false recognition rates. Thus our VBM findings (i) point to the brain structures critical for correct and false emotional memory and (ii) disclose structural differences between the neural bases of these two types of memory.

**Keywords:** memory, magnetic resonance imaging, emotion, VBM, grey-matter density

**Factors influencing speed of lexical decision and word naming task for Slovenian words**

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In psychology and cognitive neuroscience words are frequently used as stimuli, which participants have to process in different conditions while speed of processing or accuracy is being assessed. Words, however, differ in many properties that can affect the cognitive processing and behavioral performance in addition to or beyond the experimental task manipulation. Word length, morphological structure, frequency, type, semantic characteristics, associative links and other factors can affect the speed and quality of word processing. To enable informed selection of words in experimental designs and to gain better understanding of the Slovenian language, we plan to collect data on the speed of lexical decision and word reading for a large sample of Slovenian words. This will enable us to both gain relevant empirical information on these words as well as test hypotheses regarding the influence of a set of word properties on their processing speed. We will specifically look at contributions of word length, frequency, number of orthographic neighbours, type and concrete/abstract judgements. We present the initial results at the conference.

**Keywords:** lexical decision, reading aloud, word length, word frequency, orthographic neighbours, word type, concreteness

**Anaphoric resolution processes by intermediate second language learners of English during text comprehension**

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This study is concerned with anaphoric resolution processes involving bridging description (BD) and direct anaphora (DA) in second language (L2) reading. Anaphoric resolution is generally considered to be a necessary bridging process that is performed during reading. We hypothesized that intermediate L2 learners with limited control over their target language would require greater cognitive resources to resolve the BD during reading than the DA because the DA uses the same head noun as its antecedent and merely requires a matching process for resolution whereas the BD does not share the same head noun as its antecedents and requires an inference process for resolution. To test this hypothesis, a series of experiments were conducted. Sentence reading times and the reaction times for antecedent priming showed that the DA took less time, i.e., less cognitive load, to process the bridge than the BD when the antecedent and anaphora were placed close together. However, when distanced by an intervening sentence, the BD was not processed as an anaphora. We conclude that in L2 reading unlike L1, making a bridging inference for anaphoric resolution requires a substantial amount of cognitive resources especially for bridging descriptions and may not even be achieved during reading.

**Keywords:** second language, text comprehension, anaphoric resolution, bridging inferences, cognitive load

**Political metaphor as a mythologem**

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In 2004 I published a book “Die politische Metapher im Arabischen. Untersuchungen zu Semiotik und Symbolik der politischen Sprache am Beispiel Ägyptens” in which I demonstrated, using the Arabic language as an example, that the political metaphor is a special sort of metaphor different from its poetic counterpart, let alone “dead metaphor”, not only due to its collective character (contrary to rather individualized poetic images), but first and foremost because of its narrative potential. A political metaphor is a cognitive phenomenon that is unconsciously perceived, I will argue, as a narration in posse. The dominant types of political metaphors and the major metaphorical topoi, as they appear scattered in a variety of texts and in the course of time, are recognized by the addressees as a polyphonic structure making up a supra-individual political hypertext that reflects the mythologized socio-political reality. To sum up: a symbolic and semiotic analysis of political texts reveals not only cognitive and semantic but also close textual relations between metaphors appearing in them. These metaphors can and ought to be seen as mythologems, i.e., constitutive elements of a political myth.

**Keywords:** political metaphor, language and politics, political myth, narration, Egypt, Arabic

### **Event-related potentials during contextual integration of unimodal and multimodal semantic information in adults**

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The ability to make a meaningful interpretation from continuously incoming information is particularly essential for language comprehension, which requires integration of many types of information, from morphosyntactic and lexical to visual and social. Besides managing information from different sources, successful interpretation of ongoing message relies on drawing inferences i.e. integrating information that is not explicitly stated. However, spatiotemporal dynamics of postlexical semantic/contextual processing still remains a controversial issue that distinguishes different psycholinguistic comprehension models. The crucial difference between those models is whether they consider semantic/contextual integration as serial and, possibly, modular or as parallel and interactive process. The main goal of this study is to observe event-related potentials (ERP) in Croatian adults evoked while establishing coherence between unimodal and multimodal semantic information. Two scenarios, unimodal (verbal pair = 2 sentences) and multimodal (visual – verbal pair = picture-sentence), represent ERP stimuli. The general assumption was that ERP responses, namely N400 effect, will be similar in amplitude and latency in unimodal and multimodal scenarios, suggesting that all available information is immediately integrated into a global context.

**Keywords:** language comprehension, multimodal semantic integration, event-related potentials, adults, Croatian language

### **The processing of agreement patterns in Croatian**

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Croatian is a language with agreement in the categories of person, case, gender, and number. The verb agrees with its subject in person, and adjectives and pronouns agree with the head nouns in gender, number, and case within the NP. Although person agreement is treated as parallel to gender and number agreement in current linguistic theory, and case agreement is sometimes treated as exceptional, there are strong theoretical and typological reasons against such a view: first, treating person agreement in the same manner as case/gender/number agreement obscures the referential status of personal affixes in Head Marking languages, and secondly, person agreement is much more common cross-linguistically. This paper presents the results of a neurolinguistic (ERP) experiment which aimed to show the differences in processing errors in person agreement, on the one hand, and errors in case/gender agreement on the other hand. While case and gender agreement errors elicited LAN and P600 effects, person agreement errors elicited strong late negativity on the left anterior electrodes. The obtained differences suggest that these three agreement patterns are processed by two different cognitive strategies – one for person and another for case/gender agreement.

**Keywords:** agreement, person, gender, case, Croatian, ERP

### **Effects of TMS on different stages of motor and non-motor verb processing in the primary motor cortex**

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Evidence for activations in the primary motor cortex (M1) during action language processing, suggests that words' conceptual representations are not symbolic, but embodied in sensorimotor brain areas. We investigate (i) whether M1 automatically activates even when participants perform a task that barely requires explicitly retrieving words' motor information; (ii) which stage (lexical, semantic or post-conceptual) of word recognition activates M1. With transcranial magnetic stimulation (TMS) delivered to M1 at different delays (170, 350, 500 ms), we elicited motor-evoked potentials in hand-muscles and measured M1-activity while participants judged whether a verb was action-related (semantic task) or counted the number of its syllables (syllabic task). Reaction times and accuracy were collected to assess whether TMS-interference with M1 affected linguistic performance. M1-activity did not change during lexical-semantic processing (170 and 350 ms). At 500 ms, it increased during the semantic, and decreased during the syllabic task on action verbs, whereas linguistic performance remained unaffected by TMS. Contrary to the embodied hypothesis, lexical-semantic processing of action verbs does not automatically and causally involve M1. M1 would rather maintain post-conceptual processes that follow the retrieval of motor information, its activity being strategically modulated (facilitated or inhibited), in a top-down manner, by the specific demand of the task.

**Keywords:** embodied cognition, motor cortex, action language, motor simulation, lexical-semantic access, imagery

### **A stochastic optimality theoretic account for the variation in Hungarian object agreement**

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Phenomenon: Hungarian object agreement shows some variation even within a single idiolect in certain cases. In addition to the syntactic agreement rule, the following factors influence the agreement: word order, locality, information structure, semantic factors (e.g.: thematic roles), morphological factors (the similarity of the two competing agreement morphemes), analogical effects (the existence of the unaccusative variant of the transitive verb). Hypothesis: The phenomenon can be best modelled by letting morphological, syntactic, semantic and information structural constraints interact, instead of separating them to different modules. Goals: The goals are (1) to explore the wide variety of effects that influence the phenomenon, and (2) to present a stochastic optimality theoretic analysis which handles probabilistic effects as an inherent property of natural languages. Methods: The analysis is based on the Maximum Entropy model of stochastic OT. The Stochastic Graduate Algorithm was used to determine the weights of the different factors on the basis of training data obtained from 10 informants. Given the weights, the probabilities of the candidates can be determined and compared with the test values. Results: (1) The analogical effect which is ignored in traditional syntactic theories is the most relevant one. (2) The phenomenon provides example for the so-called cumulativity effects which standard OT cannot account for.

**Keywords:** idiolectal variation, object agreement, stochastic optimality theory, maximum entropy model, analogy, cumulativity

### **The World Color Study visualization**

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The World Color Survey (WCS) was initiated in the late 1970s to test the hypotheses advanced by Berlin and Kay (1969) regarding the existence of universal constraints on cross-language color naming and of a partially fixed evolutionary progression according to which languages gain color terms over time. Data from WCS consist of results of color naming experiments from 110 different languages with no written forms from non-industrialized cultures. In this experiment subjects were asked to provide the simplest and most general names for 330 color chips and also to choose the best examples of submitted colors on a color palette. This visualization projects each language's vocabulary on a special grid (WCS color grid) with a mapping of color categories, best example responses, and reliability of answers (percentage of agreement of participants on certain name for given input). The most interesting form of the visualization displays results in a fuzzy set style and can be considered an intuitively comprehensible proof for some of Berlin and Kay's original theses. This project also includes a slightly modified version of the color naming experiment in the Slovak language.

**Keywords:** the World Color Survey, categorization, color naming, basic color terms, data visualization

### **How does knowledge affect memory distortion? Empirical studies on the basis of print advertisement**

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The theoretical foundations for the research are network models of memory and processes of categorization. It is the category remaining in relation with other categories that creates an extensive network in which the knowledge of the world is stored, including that from the mass-media. Borders between particular categories change depending on the context. Recent research has shown that print advertisements constitute categories. The aim of current research is to show the role of the product knowledge, understood as the internal context, in memorizing and distorting particular elements of an advertisement. Participants were presented with pairs of advertisements from the same or different categories: brand claims concerned physical attributes of both advertisements in a pair or physical attributes of one advertisement and functional attributes of the other. Advertisements of high and low involvement products were used. Participants differed in their product knowledge. The memory of brand name and brand claims was checked by two memory tests. The results reveal that the better the product knowledge, the greater the amount of recalled information, including the distorted one as well. There are more recognition distortions when advertisements belong to the same category and when it is a low involvement product.

**Keywords:** knowledge, internal context, categorization, memory distortion, advertisement

### **Electronic name address as individual identity**

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The purpose of the present study is to examine the essence and implication of real name, the relationship between electronic name address and individual identity as well as the individual and social value of the nomination phenomenon. To do so, a questionnaire was designed which consisted of 10 questions, each giving a choice of four possible responses. Results were obtained from 222 respondents from which 13 themes of virtual nomination were extracted and analyzed using descriptive statistics. Presumably, a person by choosing unconsciously every theme of nomination refers to his/her standpoint regarding his/her Self and signifies partially his individual identity. The result of the study showed that in the virtual world, given that an individual has the option to choose a name, it is possible to delineate an individual's psychological profile. Furthermore, our results showed that the discourse system of the real name is a referential one where the virtual name has a signifying system through which one can draw the facets of the individual's mind. Thus, the individuals' personality, to some extent, can influence his/her choice of virtual name. Thus, there are some differences in the utility of real and virtual names in the real worlds, in that, virtual names entail individual and social identity of the internet users.

**Keywords:** electronic name address, virtual name, real name, individual identity, referential system, signifying system, nomination

### **Cognitive evoked potentials of voluntary movements**

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In order to demonstrate the influence of experimental conditions in which a voluntary movement is conducted on activation of different brain structures, we developed four groups of experiments. The conducted movement was pressing a joystick button with the right or left-hand thumb. Selected experiments were: spontaneous button-pressing, pressing the button after sound stimuli, pressing the button after target sound stimuli. There was also an experiment where a participant only counted target sound stimuli, which elicited cognitive, but not motor activity. Participants were 10 healthy young male adults. We recorded movement related evoked potentials using a 32 channel EEG device. Reaction times were also recorded. Obtained results showed the complexity of a seemingly simple movement. A long preparation phase occurred prior to spontaneous voluntary movement. In experiments with stimulus presentation there was a prominent positive activity in the parietal region which represented a cognitive component of evoked potentials. A latency of this component was extended in the experiment where participants responded to target stimuli. As expected, the choice reaction time was longer than the simple reaction time. Results clearly showed that apparently equal movements were accompanied by different cerebral dynamics.

**Keywords:** spontaneous and elicited movement, movement related evoked potentials (MREP), simple and choice reaction time, cognitive evoked potential

### A model of learning verb argument frames in Hungarian

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One of the key questions in first language acquisition research is the mechanism of learning verb argument frames. In languages such as Hungarian, where argument roles are primarily identified by morphological marking, the learner's task essentially involves establishing the mapping between the semantic roles associated with a predicate's meaning and the morphological cases marking those roles. The task is far from simple since there is no one-to-one mapping between semantic roles and morphological cases. One way of shedding some light on the learning process is to build a computational model of argument frame acquisition, where learning parameters are adjusted until the output of the model matches empirical data of child language. Our paper presents such a model. Our results show that data frequency and the size of the input corpus are highly important factors. The performance of the system is best when a small number of highly frequent subcategorization frames need to be learnt. This result is consistent with the psycholinguistic finding that child language tends to be characterized by a U-shaped learning curve, where the adult-like use of a relatively small number of construction types is followed by a decline in accuracy as the breadth of the child's knowledge expands.

**Keywords:** child language, computational modelling, argument frames, U-shaped learning

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### Sadness and happiness in speech

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It is well documented that emotions modify the human voice, and the speech style. Autobiographical recall and music were used in this study to induce sad and happy emotional states. The basic issue was whether the same phenomena exist in Hungarian speech samples as in others, and whether we can also make substantive statements about longer speech periods. Participants told happy, neutral and sad stories about themselves, and half minute periods of each story were analysed phonetically with the PRAAT program. We studied how speech parameters like duration of silent pauses, ratio of the pauses to the whole speech, articulation rate, fundamental frequency and its variability, intensity and its variability are modified by emotions. Results show that emotions have measurable effects on speech. A tendency-level difference was found between sad, neutral and happy emotional states. Calculating with the parameters one at time the following significant differences were found: in sad emotional states, as compared to happy ones, the intensity and rate of articulation decreased, and the duration of pauses and their relation to the whole speech extended. Compared with the neutral state there was only one significant difference: happy speech was louder.

**Keywords:** vocal communication, emotion, speech acoustic, PRAAT, mood induction

### Semantic coilations and animacy violations elicit differenct brain responses

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Many linguistic and psycholinguistics theories treat animacy as a special “grammaticalized” semantic feature because animacy is involved in grammatical distinctions in many languages. The present experiment employs the ERP technique to examine whether animacy information has a special status in syntactically canonical and unambiguous sentences. Participants were presented with 120 short stories in Polish. They were constructed in such a way that for half of them an animate direct-object-noun in the story’s final sentence is highly expected, and for the other half an inanimate noun would be most natural. The critical noun occurred in (1) a congruent condition – semantically congruent with the preceding context (tested by a cloze test); or (2) a semantic violation condition – introducing a semantic violation while still being congruent with respect to the animacy/inanimacy expectation induced by the story; or (3) an animacy violation condition – introducing a semantic violation which in addition violates the animacy/inanimacy expectation induced by the story. The critical nouns in both the semantic violation condition and in the animacy violation condition (conditions 2 and 3) elicited an N400 effect relative to the congruent condition. In addition, violations of animacy expectation elicited a P600 effect relative to the semantic violation and congruent conditions.

**Keywords:** language perception, animacy, ERP, N400, P600

### Why do 12-month-olds point? Desire to learn vs. desire to share interest

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Infants start to point systematically to objects or events around their first birthday. Recently it was proposed that infants point to novel sights for adults because they wish adults to share their appreciation of the sight (Liszkowski et al., 2004). In the current study, we tested a new hypothesis, derived from the theory of Natural Pedagogy (Csibra and Gergely, in press), according to which infants’ pointing gesture acts as a question. Thus, infants’ motivation for pointing to new objects may go well beyond attention-sharing, and may be accompanied by an expectation that adults would transmit relevant information about the referred object. In two experiments, an adult reacted to 12-month-olds’ pointing by exhibiting ‘teaching’ or ‘sharing’ behavior. In response, infants pointed more frequently across trials in the teaching condition than in the sharing condition. This suggests that the teaching feedback matched more infants’ expectations towards adults than merely sharing their attention did. Such a result is consistent with the idea that not just the comprehension but also the production of early communicative signals is tuned to assist infants’ learning from others, and supports the theory of Natural Pedagogy.

**Keywords:** social cognition, infants, sharing, teaching, natural pedagogy

### Can 10-month-old infants use quantifiers?

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Understanding the logical structure of a scene is traditionally thought to emerge relatively late in development. However, recent studies on probabilistic reasoning (Teglas et al., 2007) suggest early representations of possible future outcomes. Here we test directly whether infants can “navigate” in the list of possible outcomes by means of quantifiers such as “all” and “some”. In a violation of expectation paradigm we presented 3D-animations: a colorful object exhibiting well-defined agency cues entered the stage displaying a searching behavior. This agent could check all the possible locations or some of the possible locations. Thus by manipulating the total number of possible locations in the different phases of the experiment and the locations visited by the agent we could introduce conflicting logical representations. After familiarization where the agent visited all possible locations two conditions were presented. In the logically incongruent condition the agent visited some, but not all possible locations. In the congruent condition the logical representation of the scene was identical to that of the familiarization. The longer looking time after the logically incongruent conditions suggests that infants code the scene in terms of possible outcomes and rely on abstract logical operators such as the “some” and “all” quantifiers.

**Keywords:** infant cognition, logic, quantifiers, numeric representations

### Language of irrational decision making in the brain

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The framing effect (Kahneman and Tversky, 1981) is a psychological phenomenon that concerns risky decision making. In particular, the framing effect depicts how people make different (irrational) decisions depending on whether the presented situation is framed in context of either gains or losses. When possible outcomes are framed as gains, people prefer certain options. On the contrary, when the situation is framed as a loss, people make risky decisions, choosing uncertain options. McElroy and Seta (2004) claim that hemispheric brain activation (by finger tapping procedure or dichotic listening) causes attenuation of the framing effect. On activating right hemisphere (holistic), the effect occurs, while on activating left hemisphere (analytic), the effect is not observed. Gallagher and Dagenbach (2007) tried to manipulate noise frequency in the classical framing effect scenarios. They assumed that the left hemisphere processes relative high-frequency information (semantic content) and the right hemisphere processes relative low-frequency information (prosody). As in earlier studies the framing effect occurred but only in case of activating the right hemisphere. These results are being investigated with other stimuli. The brain imaging equipment (EEG) is concerned in further research.

**Keywords:** brain, language, rationality, framing effect, hemispheric lateralization

**Cognitive and neural correlates of normal aging in task-setting:  
Interactive effects of practice, conflict and task complexity**

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The aim of this study was to investigate the cognitive and neural effects of healthy aging on task-setting. Task setting is an executive function important to acquiring novel, complex, and weak rules, especially when contrasting with prepotent stimulus-response associations. Simple and complex go/nogo tasks were used with 2 vs. 8 colored letters as go stimuli, respectively. In both tasks, nogo stimuli produced either strong (same letter, different color) or weak (colored numbers) conflict with go stimuli. Fourteen young and 14 elderly subjects performed the tasks while scanned with functional magnetic resonance imaging (fMRI). fMRI data were analyzed with a multivariate Partial Least Square analysis. A fronto-parietal network, including lateral prefrontal and parietal regions and pre-SMA, was over-recruited by elderly subjects under three specific conditions: (i) nogo stimuli producing strong conflict (ii) during the learning phase (iii) of the complex task. These neural effects were accompanied by learning-related improvements in task performance. These findings have two implications. First, functional over-recruitment in aging represents an inefficient use of neural resources supporting task-setting. Second, learning is crucial, even within a single experimental session, in dramatically reducing age-differences during the performance of demanding cognitive tasks, both at the neural and at the behavioral level.

**Keywords:** learning, Stroop-like effect, aging, neural over-recruitment, go/nogo

**The interplay of memory and attention**

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Several eye-tracking studies have shown that people look at empty places where requested information has been previously presented. It remains unclear, however, whether and how these memory-induced attentional shifts are related to memory performance, and whether they can interfere with other cognitive tasks. We conducted two experiments in order to investigate these issues. In both studies, the trials consisted of four objects displayed in a 2×2 grid, followed by a word which appeared in one of the grid cells. The task in the first experiment was simply to answer whether the word denoted any of the previously presented objects. An analysis of reaction times revealed that people responded significantly faster when the word was at the same position as the object it denoted. The second experiment involved a spatial judgment task: participants had to answer whether the word denoted any of the objects by pressing a button spatially congruent to the position of the word. An analysis of reaction times and error rates revealed that the relative position of the object to be recalled induced a robust Simon effect, although it was irrelevant to the task and the relevant spatial information was directly available. Both results were explained with the attentional shifts induced by memory retrieval and were related to contemporary theoretical and empirical findings.

**Keywords:** memory, attention, space, Simon effect

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### A case study of Hungarian

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If there is any consensus about the notion of case, it is likely something about marking dependent nouns according to their kind of dependency. This would seem misleading for languages like Hungarian where case marking can be found on other words, too. Another problematic aspect of case marking is the type of dependency that it accounts for. One has to choose between semantic dependency and a dependency more syntactic in nature. Finally, the way case marking is expressed can be strictly morphological, or may allow other forms of case marking. I introduce a notion of case that is

- semantically based
- morphologically expressed

I use an event-based semantics where every word of a sentence contributes to the meaning of it by narrowing the set of events and by predicating something about some individual bearing a thematic role of the event or about a generalized quantifier. I will show that every word in a sentence can be aligned into a (semantic) hierarchy where the higher a word is in this hierarchy, the more able it is to carry a morphological marker which expresses its thematic role.

**Keywords:** morphology, case, semantics, Hungarian

### Cognitive and emotional maturation occurred in parallel with reorganization of associative prefrontal cortex circuitry

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Psychological findings about protracted cognitive and emotional development through adolescence have recently been supported by extensive data on functional brain development, suggesting a highly extended period of synaptic pruning. The aim of this study was to examine dendritic spine density on layer IIIc pyramidal neurons in dorsolateral prefrontal cortex, through different developmental stages: early prenatal (0–3 months), infancy (4–18 months), childhood (2–8 years), adolescence (9–18 years), early adulthood (19–30 years), adulthood (31–65 years) and aging (66+ years). We used available data obtained from 32 participants from the Zagreb Neuroembryological Collection. We found massive dendritic spine overproduction during childhood and adolescence, but also during early adulthood. Dendritic spine density in adulthood was highest in the most distal segments of apical oblique dendrites, that showed also largest and most protracted overproduction compared to proximal oblique and basal dendrites. Distal dendrites are known to be predominantly innervated by intracortical and associative cortico-cortical fibers. The protracted maturation of layer IIIc pyramids, as key elements of circuitry involved in processing higher cognitive functions, might represent a biological basis for protracted cognitive development. In future studies, a larger number of analyzed subjects should be considered, whereas obtained morphological data should be correlated with psychological findings about different development stages.

**Keywords:** development, pyramidal neurons, prefrontal cortex

**AUTHOR INDEX**

- Albu, Mónika  
 Alina, Zlati  
 Babarczy, Anna  
 Bátki, Anna  
 Batta, Barbara  
 Benavides Varela, Silvia  
 Bencze, Ildikó  
 Berencsi, Andrea  
 Bilic-Mestric, Klara  
 Bódizs, Róbert  
 Bonatti, Luca L.  
 Brechmann, André  
 Budimir, Sanja  
 Csibra, Gergely  
 Csigó, Katalin  
 Demeter, Gyula  
 Dobravac, Gordana  
 Esfehiani, Leila Sadeghi  
 Falkowski, Andrzej  
 Fekete, István  
 Ferenc, Kemény  
 Forgács, Bálint  
 Gergely, György  
 Gerván, Patrícia  
 Gombos, Ferenc  
 Gómez, David Maximiliano  
 Grabovac, Beáta  
 Grabowska, Anna  
 Gradinarova, Galina  
 Győri, Miklós  
 Hári, Péter  
 Harsányi, András  
 Hloucal, Teresa  
 Hochmann, Jean-Rémy  
 Hoffmann Bion, Ricardo Augusto  
 Hrzica, Gordana  
 Janyan, Armina  
 Jaworska-Biskup, Katarzyna  
 Jednoróg, Katarzyna  
 Katalenić, Lucija  
 Keresztes, Attila  
 Kovács, Ágnes Melinda  
 Kovács, Ilona  
 Kraljevic, Jelena Kuvac  
 Krbot, Magdalena  
 Kriz, Jürgen  
 Lalev, Emilian  
 Lukács, Ágnes  
 Macagno, Francesco  
 Malinovský, L'udovít  
 Marchetto, Erika  
 Marchewka, Artur  
 Matasović, Ranko  
 McIntosh, Anthony R.  
 Mehler, Jacques  
 Mencinger, Lea  
 Michalak, Małgorzata  
 Morishima, Yasunori  
 Nasalski, Ignacy  
 Németh, Attila  
 Nowicka, Anna  
 Padovan, Nevena  
 Palmović, Marijan  
 Papeo, Liuba  
 Petanjek, Zdravko  
 Pohl Zsuzsanna, Kata  
 Racsmány, Mihály  
 Rebrová, Kristína  
 Romanowska, Magdalena  
 Rumiat, Raffaella Ida  
 Sackmann, Timo  
 Sato, Sayaka  
 Schriefers, Herbert  
 Šefer, Ana Branka  
 Serény, András  
 Simon, Eszter  
 Snajder, Jan  
 Sobków, Agata  
 Stuss, Donald T.  
 Szabó, Eszter  
 Szewczyk, Jakub  
 Tacikowski, Paweł  
 Tauzin, Tibor  
 Téglás, Ernő  
 Traczyk, Jakub  
 Treselj, Blanka  
 Vallesi, Antonino  
 Vankov, Ivan I.  
 Vasarhelyi, Daniel  
 Zeba, Martina