Project Report

No 4

2013

Thinking in Time
Cognition, Communication and Learning (CCL)
- a multidisciplinary research environment at Lund University
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1. Introduction
Communication, cognition and learning are key to the human condition. It is of fundamental importance to better understand children’s and adults’ ability to acquire skills of language and communication in order to potentially help them realise their full potential. This was the starting point of CCL.

CCL began with a group of scholars in Lund from different disciplines, (Psychology, Cognitive Science, Speech pathology, Linguistics and Experimental Medicine) with a shared belief that our respective research areas were important to issues of learning problems, and with a shared vision of a research environment that would approach these problems from new angles and encourage and facilitate research and communication across academic barriers.

In outlining the goals of CCL in the original application, we chose to focus on the role of timing in cognitive function. Timing is here to be understood broadly and includes processes with durations and precision ranging from milliseconds, as in precision movements, to seconds as in conveying information by pausing in conversation.

The focus on timing was motivated by two considerations. Firstly, it was felt that this was neglected aspect of much of cognitive science and psychology and one where expertise present in Lund could uniquely contribute in new ways. Secondly, and most importantly, we had a vision of a unified science of cognitive function. Timing can be defined on all levels of analysis, from timing of neural responses to timing of phonemes or intonation in speech. Insight into various aspects of timing could serve as a tool that would help us to bridge the conceptual gaps between many different branches of science and the humanities.

The empirical work on this topic is conducted in about 25 different research projects, usually involving 2-5 people, many of them with participants from two or more departments. The research has been focussed around a set of five “core themes”. These are akin to “research programmes” in the sense of the philosopher of science Imre Lakatos, that is, hypotheses or theoretical ideas that are too general to be tested directly, but that can guide or inspire research and also generate more specific and testable research ideas. These core themes represented clusters of notions and approaches to the issues at stake where the collaborations within CCL would give rise to fruitful interactions and novel approaches. Significant advances have been made in all the projects proposed in the original application.

The five core themes are:
1. Internal simulation of perception and action is a fundamental mechanism for cognitive function
2. Acquisition of concepts and language is strongly related to other cognitive processes.
3. Modelling and quantifying semantic development in children is a rich resource for diagnosis and intervention.
4. The temporal coordination of speech, gaze and gestures plays an important role for language processing, interpersonal communication, and learning.
5. The cerebellum is critically involved in temporal aspects of motor and cognitive functions.

This report contains updated information on the activities, progress and future plans for the current 26 research projects within the CCL environment. An indication of how each project relates to the above core themes are given as well.

Lund in June, 2013
## 2. CCL Projects and research teams

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<th>Project name</th>
<th>Research team</th>
<th>Time frame</th>
<th>Comment (change from last report)</th>
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<tbody>
<tr>
<td>1</td>
<td>Peter Gärdenfors</td>
<td>Semantic development of adjectives</td>
<td>Rasmus Bäåth, Simone Löhndorf, Carita Paradis, Marianne Gullberg, Kristina Hansson</td>
<td>2009-2014</td>
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<tr>
<td>2</td>
<td>Sverker Sikström</td>
<td>Quantitative Semantics</td>
<td>Rasmus Bäåth, Peter Gärdenfors</td>
<td>2012-</td>
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<tr>
<td>3</td>
<td>Peter Gärdenfors</td>
<td>Modeling semantics with the aid of conceptual spaces</td>
<td>Magnus Lindgren, Rasmus Bäåth, Simone Löhndorf, Carita Paradis</td>
<td>2008-2016</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Peter Gärdenfors</td>
<td>Play, learning and artefacts</td>
<td>Agneta Gulz, Åsa Harvard</td>
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<td>5</td>
<td>Mikael Johansson</td>
<td>Temporal dynamics of memory-system interactions : Effects of prior knowledge on learning and remembering</td>
<td>Susanna Bernstrup, Robin Hellerstedt</td>
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<td>6</td>
<td>Victoria Johansson</td>
<td>Temporal aspects of (written) language production</td>
<td>Birgitta Sahlén, Lena Askér-Arnason, Emily Grenner</td>
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<tr>
<td>7</td>
<td>Victoria Johansson</td>
<td>Narrative and lexical intervention for children and adolescents with typical and atypical language development</td>
<td>Birgitta Sahlén, Joost van de Weijer, Victoria Åkerlund</td>
<td>Completed 2012</td>
<td>Project completed.</td>
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<td>8</td>
<td>Jana Holsanova</td>
<td>Eye movements and mental imagery</td>
<td>Roger Johansson, Kenneth Holmqvist</td>
<td>2009-2014</td>
<td>New project name (formerly The existence and use of mental images)</td>
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<td>9</td>
<td>Agneta Gulz</td>
<td>Narratives and the impact of timing of gestures and speech on an addressee</td>
<td>Marianne Gullberg, Magnus Haake, Kristina Hansson, Birgitta Sahlén, Betty Tärning</td>
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<td>10</td>
<td>Marianne Gullberg</td>
<td>Multilingual Processing</td>
<td>Annika Andersson, Susan Sayehli, Damon Tutunjian</td>
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<td>11</td>
<td>Magnus Lindgren</td>
<td>Semantic memory processes in learning. Studies on children’s early word learning and category learning in adults</td>
<td>Kristina Borgström, Marianne Gullberg, Peter Gärdenfors, Mikael Johansson</td>
<td>2014-</td>
<td>Project nr 13 in last Project report nr 3, is now reported within the current Project nr 11</td>
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<td>12</td>
<td>Magnus Lindgren</td>
<td>Social influences on event perception</td>
<td>Ingar Brinck, Andreas Falck</td>
<td>2010-2014</td>
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<tr>
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<td>Name</td>
<td>Project Title</td>
<td>Authors</td>
<td>Years</td>
<td>Description</td>
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<td>14</td>
<td>Karolina Löwgren</td>
<td>Cerebellum, timing and language impairment in children</td>
<td>Germund Hesslow, Birgitta Sahlén, Magnus Lindgren, Rasmus Bååth, Joost van de Weijer</td>
<td>2010-2014</td>
<td>New project (formerly Cerebellar contributions to speech production and speech perception) New project leader (formerly Germund Hesslow)</td>
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<td>15</td>
<td>Susanne Schötz</td>
<td>Speaking in Time: analysis of temporal aspects in speech and communication</td>
<td>Johan Frid</td>
<td>2013-2014</td>
<td>New project (a follow-up of the now completed project Functional data analysis of speech movements)</td>
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<td>16</td>
<td>Kristina Hansson</td>
<td>Digitalized TROG-2 in Swedish -The influence of speech rate and voice quality on sentence comprehension</td>
<td>Birgitta Sahlén, Marianne Gullberg, Magnus Haake, Agneta Gulz, Viveka Lyberg-Åhlander, Jonas Brännström</td>
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<td>17</td>
<td>Kristina Hansson</td>
<td>Assessment of semantic linguistic maturity in children’s narratives: An application of latent semantic analysis</td>
<td>Rasmus Bååth, Simone Löhdorf, Birgitta Sahlén, Sverker Sikström</td>
<td>2009-2014</td>
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<tr>
<td>18</td>
<td>Birgitta Sahlén</td>
<td>Phonological intervention for children with hearing impairment (HI) with hearing aid or cochlear implant</td>
<td>Susanne Schötz, Magnus Lindgren, Marianne Ors, Cecilia von Mentzer, Inger Uhlén, Björn Lyxell</td>
<td>2009-2014</td>
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<td>19</td>
<td>Germund Hesslow</td>
<td>Simulated feedback control of learning</td>
<td>Ricardo Zucca, Anders Rasmussen, Fredrik Johansson</td>
<td>2010-2014</td>
<td>Moderated project name (formerly Feedback of control of learning)</td>
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<td>20</td>
<td>Germund Hesslow</td>
<td>Learning of timing in the cerebellum</td>
<td>Fredrik Johansson, Dan-Anders Jirenhed, Anders Rasmussen, Ricardo Zucca</td>
<td>2010-2014</td>
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<td>21</td>
<td>Magnus Johnsson</td>
<td>Cognitive architecture/Internal simulation</td>
<td>Christian Balkenius, Peter Gärdenfors, Germund Hesslow, Stefan Winberg</td>
<td>2009-2013</td>
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<td>22</td>
<td>Jana Holsanova</td>
<td>Interplay between language and pictures in communication</td>
<td>Richard Andersson, Kenneth Holmqvist</td>
<td>2009-2013</td>
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<td>23</td>
<td>Magnus Lindgren</td>
<td>Localization of verbs in the brain</td>
<td>Peter Gärdenfors</td>
<td>2012</td>
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<td>24</td>
<td>Germund Hesslow</td>
<td>Learning associations of simulated stimuli</td>
<td>Karolina Löwgren, Henk-Jan Boele</td>
<td>2012-2015</td>
<td>New project</td>
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<td>26</td>
<td>Agneta Gulz</td>
<td>Exploring and supporting metacognitive capabilities in 3-5 year olds by means of a digital learning-game</td>
<td>Magnus Haake, Birgitta Sahlén, Richard Andersson, Magnus Lindgren, Peter Gärdenfors</td>
<td>2013-2014</td>
<td>New project</td>
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</tr>
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</table>
3. Project reports

Project 1. Semantic development of adjectives

Project leader: Peter Gärdenfors

Project members: Simone Löhndorf, Peter Gärdenfors, Carita Paradis, Kristina Hansson, Marianne Gullberg, Rasmus Bååth

Time frame: The project started in July 2009 and is expected to last until mid-spring 2014.

Aim of project/main objective/main hypothesis:
The use of adjectives is scarce, i.e. children talk about different objects and phenomena, but they don’t describe or specify them further. With increasing age, the knowledge of word meanings goes beyond the most concrete sense and words are used in different senses in a variety of contexts. Furthermore concrete words are used metaphorically to express abstract meanings, and vice versa, abstract may - by way of reification - be used to denote concrete meanings. But when does this happen? And what kind of abstract meanings do emerge first and in what contexts? Knowledge about when and in what ways the meanings of adjectives extend over time to become more abstract can give us more general insight into conceptual development and deviations from typical development.

The goal of the first subproject, mainly conducted by Simone Löhndorf in her Ph.D. work, is to study the semantic development of adjectives in children and adolescents. In particular the degree of abstract uses of adjectives will be investigated, i.e. the trajectory from concrete language use to the use of more abstract language and metaphors and metonymies in later language development. The nature of the noun and the salience of the aspect of the meaning of the noun that is modified by the adjective is important for the interpretation of adjectives. The adjective–noun combination is examined as a whole, as well as in its parts. A well-known problem with adjectives is that they are not possible to study in isolation; one has to take the noun into account. A multiple factor analysis will be carried out, identifying the abstractness of the nouns and what kind of information the adjectives target in the noun. The focus is on word sense from the perspective of cognitive semantics, where lexical meanings are considered to be dynamic and sensitive to contextual demands, rather than fixed and stable.

The second new subproject studies the semantic development of adjectives in preschool children by investigating their understanding of antonyms such as hot-cold, tall-short and rich-poor. According to a hypothesis formulated by Peter Gärdenfors, children do not learn words in isolation, but words in the same domain are learned at about the same period of development. This hypothesis is currently tested by two master students in logopedics under the supervision of Kristina Hansson. Three- and five-year-old children are asked to generate antonyms of adjectives to investigate whether a particular semantic domain is established in their vocabulary. A goal is to determine the developmental order of the semantics domain and the typical age they are established.

How does this project contribute to an “added value” in the CCL environment? The research on semantics requires competences from linguistics, cognitive science and logopedics. Both subprojects are results of cooperation within CCL.

Why is this project interesting? The development of the semantics of adjectives has hardly been studied. By analyzing data on adjective comprehension and production from children of different ages, we can learn a lot about semantic development. Our hope is that these results can
generate diagnostic tests for aberrations in semantic development.

**How does this project relate to the CCL Core Ideas?** The study in this project is performed within the framework of Cognitive Linguistics, which is based on the CCL core theme that *language learning is strongly dependent on other cognitive processes.* The quantitative nature of the corpus approach also makes possible the *modelling and quantifying semantic development in children.*

**Is the project cross-disciplinary and if it is, which disciplines are involved?** The project is interdisciplinary in the sense that the project members represent different academic fields, namely cognitive science, linguistics and logopedics. Furthermore, since the framework of cognitive linguistics is based on the assumption that language acquisition depends on a number of more basic cognitive processes, there is a strong link to the field of psychology.

**Progress since last report:** In the first subproject, over 8000 adjective–noun combinations have been manually coded with regard to different semantic aspects. The coding scheme has also been expanded to encompass the FUNCTION of the adjective. The (statistical) analysis of the material is about to begin. The theoretical background part of Löhndorf’s thesis is in progress.

The second subproject is new and has arisen as a consequence of the theoretical work within project 3 (Modeling semantics with the aid of conceptual spaces). The methodology for the testing of antonym pairs in preschool children has been developed, a set of antonyms pairs have been tested in a pilot experiment and the full data set is currently being collected by two master students in logopedics.

**Problems in the project:** The corpus for the first subproject is not balanced with regard to text distribution between age groups, gender and topic. There are strong reasons to address this problem, both to get more reliable results in the current study, as well as for the usability of the corpus for future studies. To correct this imbalance, further funding has been applied for, in order to complement the corpus with more digitalized material.

**Plans for the next semester and in the long term (incl. equipment needed):**
For the first subproject:
- complete the coding
- statistical analysis of the material
- digitalize and code texts in order to address the imbalance of the corpus
- write background chapters
- analysis, discussion, getting the thesis together before end of spring term 2014

For the second subproject, the first goal is to analyze the data from the experiment with the preschool children. This will result in a master thesis and hopefully this can be extended to a journal article. In a slightly longer perspective, we want to develop the methods of antonym elicitations to a test for semantic development in children.

**Potential applications (diagnostic tools, methods for other research areas, for society):**
The fairly large Swedish text corpus that has been generated in the first subproject will have great potential for other researchers. It is possible to perform a large number of linguistic analyses on the texts in order to find out more about language development, how children structure their texts, etc. Since the teachers grades are available, research could also be conducted on which criteria teachers use to set different grades. If the experimental, psycholinguistic study, provides us clues about how concrete and abstract concepts are processed in the brain at different ages, the results could provide guidelines about what linguistic material it is reasonable to expect children at different ages to understand and use.
For the second subproject the ambition is to develop a diagnostic tool for semantic development. Since there are comparatively few such tests, it could become a valuable addition.

**Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted)**

**Conferences, workshops, lectures, invited talks:**
Participation in EMCL 6, Empirical Methods in Cognitive Linguistics, in Cleveland, Ohio, August 2012 (https://sites.google.com/site/emcl6case/)

S. Löhndorf: Poster presentation at the Association for Research and Applying Metaphor (RaAM) conference, Almagro, May 4-7, 2011
Project 2. Quantitative Semantics

Project leader: Sverker Sikström

Project members: Sverker Sikström, Peter Gärdenfors, Rasmus Bååth

Time frame: The project started 2012-01-01. It is an ongoing project with no specific endpoint.

Aim of project/main objective/main hypothesis:

How does this project contribute to an “added value” in the CCL environment?

Why is this project interesting? The project is interesting because little research has previously been done to quantify semantics.

How does this project relate to the CCL Core Ideas? The project is clearly related to cognition, language and communication, and therefore clearly related to the core themes of CCL.

Is the project cross-disciplinary and if it is, which disciplines are involved? Yes the project is cross disciplinary, including themes from psychology, computational linguistics, philosophy, social psychology, economics, sociology, and linguistics.

Plans for the next semester and in the long term (incl. equipment needed): A book on Quantitative Semantics for Cambridge University press is planned. A webpage to where researchers can make statistical tests related to quantitative semantics is planned. A webpage for studying changes in semantic representation using Google Ngram is planned.

Potential applications (diagnostic tools, methods for other research areas, for society): The project aims at developing methods for statistical test on semantics and quantification of semantics. Quantitative semantics has in the project been used to for diagnosing aphasic patients (Roll, M, Mårtensson F., Sikström S., Apt P., Arnling-Bååth, R., Horne M. (2011). Atypical Associations to Abstract Words in Broca’s Aphasia, Cortex, 48, 1068-1072.), and for discriminating between children with or without specific linguistic impairment (SLI)

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):
Gustafsson, M., Lindholm, T. Sikström, S. (submitted to European Journal of Social Psychology). Selection Bias as Reflected by Choice of Words – The Evaluations of I and We Differ between Communication Contexts, but They are always Worse".
Conferences, workshops, lectures, invited talks:

Please describe collaborations within CCL (name of researchers, research question):
Birgitta Sahlén and Kristina Hansson, quantifying semantic content of children's narrative to study and measure semantic maturity and specific language impairments. Rasmus Bååth, Mikael Roll, Frida Mårtensson studying semantic associations in aphasic patients.

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): Susanne Vejdemo, SU, changes of semantic constructs over time; Erik Willander, UU, Measuring the meaning of holy concepts; Danilo Garcia, Semantic aspect of happiness, Oscar Kjell, Semantics and harmony; Hossein Asgharian, predicting volatility of stock prices from semantics, Marie Gustafsson, SU, Torun Lindholm, UU, Social psychology and evaluations of social groups.
Project 3. Modeling semantics with the aid of conceptual spaces

*Project leader:* Peter Gärdenfors

**Project members:** Peter Gärdenfors, Magnus Lindgren, Rasmus Bååth, Simone Löhndorf, Carita Paradis

**Time frame:** 2008-2016

**Aim of project/main objective/main hypothesis:** The project is long-term theoretical work together with Massimo Warglien, University of Venice, and Mathijs Westera, University of Amsterdam, Joost Zwarts and some other semanticists. The overall purpose is to develop a socio-cognitive theory of semantics. The theory will be based on Gärdenfors's conceptual spaces, but will also include elements from communication games and theories of intersubjectivity. One aim is to show that there is continuity in the semantics of verbal and non-verbal communication. One of the main goals of the model is to provide a cognitive grounding of word classes. In Peter Gärdenfors's earlier work it has been proposed that adjectives map onto regions of single semantic domains (color, shape, size, loudness...) and that nouns in general map onto bundles of regions domains together with information about how the regions are correlated. The analysis has been extended to verbs and recently to prepositions. The verb semantics is based on a model of events consisting of two vectors – one action vector and one result vector. The basic hypothesis is that a verb denotes one of the vectors in an event.

**How does this project contribute to an “added value” in the CCL environment?** The research on semantics requires competences from cognitive science, linguistics, psychology and logopedics. This project has already spawned several new subprojects within CCL, for example the second subproject of project 1 and project 24.

**Why is this project interesting?** We believe that our work on verbs and prepositions, in addition to earlier work on nouns and adjectives, will show that conceptual space approach to semantics is viable and can generate new insights into meaning-creating processes. It will provide a bridge between research on the formation of different kinds of concepts and semantics for natural languages. As shown in project 1, it may also have application for diagnostic tests.

**How does the project relate to the CCL Core Ideas?** This project falls within the framework of cognitive linguistics, which is based on the CCL core theme that *language learning is strongly dependent on other cognitive processes.* But there are also connections to the *modelling and quantifying semantic development in children* and that *internal simulation of perception and action is a fundamental mechanism for cognitive function.*

**Is the project cross-disciplinary and if it is, which disciplines are involved?** The project is interdisciplinary in the sense that the project members represent different academic fields, namely cognitive science, linguistics and logopedics. Furthermore, since the framework of cognitive linguistics is based on the assumption that language acquisition depends on a number of more basic cognitive processes, there is a strong link to the field of psychology.

**Progress since last report:** Peter has finished a book with the title *Geometry of Meaning: Semantics Based on Conceptual Spaces* that is a milestone in the project. During the fall the theory was extended to prepositions with the aid of expertize from Joost Zwarts, Utrecht. Several articles related to the project have been written (see below).

**Problems in the project:** N/A
Plans for the next semester and in the long term (incl. equipment needed): The model will be applied to new problem areas. In particular the semantics of combinations of words will be investigated, for example noun-verb, noun-adjective and verb-preposition combinations. There are also possibilities for applying the model in robotic communication systems (we are part of an application for an EU project on this).

Potential applications (diagnostic tools, methods for other research areas, for society): The model can become a useful tool for analyzing the development of communication in children. It will also have application in the Internet technologies behind creating the Semantic Web.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Conferences, workshops, lectures, invited talks

Please describe collaborations within CCL (name of researchers, research question):
Actual: Marianne Gullberg. Potential: The simulation group on robot communication.

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question):
Project 4. Play, learning and artefacts

Project leader: Peter Gärdenfors

Project members: Åsa Harvard, Peter Gärdenfors, Agneta Gulz

Time frame: The project started in July 2009 and is expected to last until 2015.

Aim of project/main objective/main hypothesis: Within the context of children’s peer learning in play, the project investigates the design of learning activities and artifacts. In the present study, we study how children age 7-9 engage in mathematical play/games during after school care. The objective is to furnish a knowledge basis for design of learning artifacts intended for use in the peer group, outside of class.

The research questions are:
- What are the learning opportunities provided by children’s peer groups to their members?
- How can learning activities/artifacts be designed with focus on learning in the peer group?

More specifically, we study how children play card games involving visual search for mathematical patterns, and how children collaborate and communicate as part of gaming and problem-solving.

How does this project contribute to an “added value” in the CCL environment? The added value of the present project is the application perspective, where themes from basic research in other CCL projects are placed into the setting of education inside and outside the classroom, and used to understand interaction in real-life settings.

Why is this project interesting? This project addresses issues of motivation and social relevance of learning. Learning activities and artifacts that manage to embed and create value around school-relevant topics in a peer context could offer important learning opportunities to children that have difficulties in relating to classroom activities. The project uses methods from design research to approach issues that are normally approached through experimental studies, which potentially can open for new angles and fields of application.

How does this project relate to the CCL Core Ideas? “The temporal coordination of speech, gaze and gestures plays an important role for language comprehension and interpersonal communication.” This CCL core theme is closely related to this project, where the role of children’s peer groups for learning and meaning-making is investigated. The tight alignment (in language, gesture and references) between children that participate in the same peer groups facilitates learning and cultural transmission between children and favors development of shared peer cultures.

Is the project cross-disciplinary and if it is, which disciplines are involved? The project combines a theoretical framework from cognitive science (situated, distributed cognition, imitation, low-level alignment, communication) with methods and issues from interaction design and mathematics education research.

Progress since last report: We have established contacts with Malmö University College, and researchers involved in mathematics education research. Åsa Harvard Maare has been collecting data during field studies at a Malmö school/after school care during February and March 2013.
Problems in the project: Earlier problems in setting up collaboration with a school have been resolved. At present, the main problem is to harmonize research methods from interaction design (qualitative, design based) with the more quantitative “scientific” paradigm of both LUCC and CCL.

Plans for the next semester and in the long term (incl. equipment needed): During next semester the data from the field studies will be analysed, and if the need arises some smaller follow-up sessions with children playing math games will be arranged. Åsa Harvard will spend the year 2014 writing her dissertation on a full-time basis provided that this can be arranged with Malmö University College, CCL and Lund University.

Potential applications (diagnostic tools, methods for other research areas, for society): Development of clinical applications, teaching materials, games and toys.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Conferences, workshops, lectures, invited talks:
Åsa Harvard has presented her research at Lärandedagarna i Lund, June 2012. Peter Gärdenfors has given, and continues to give, a large number of lectures to various school auditoria since the publication of his book Lusten att förstå in 2010.

Please describe collaborations within CCL (name of researchers, research question): Many other CCL projects contribute with basic research in areas of relevance for our project: speech and language development in children, how toddlers associate images and verbal labels, cognitive changes as a consequence of expertise. This project can, on the other hand, be of benefit to the CCL project portfolio through its focus on applying knowledge and using it as a basis for design. Designing “toy applications” with a connection to basic research issues also has a potential in communicating research to a broader audience (as demonstrators, exhibition objects...). The study around math games has been done in collaboration with Agneta Gulz.

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question):
Actual: Malmö University, School of Art and Communication. A design-oriented research environment with focus on interaction design.
Potential: The Mobile Learning group at DSV, Stockholm University (professor Robert Ramberg is a secondary supervisor of this project already). This research group shares many of the concerns and methods in our project, and also has well-established connection to the research group Didaktik Design at Lärarhögskolan, Stockholm. Our project would benefit from a research environment where many similar projects have been carried out, with a broad experience of relevant research methods.
Project 5. Temporal dynamics of memory-system interactions: Effects of prior knowledge on learning and remembering

Project leader: Mikael Johansson

Project members and the percentage (within this project) they are financed by CCL:
Susanna Bernstrup, Robin Hellerstedt*, Mikael Johansson

*new member

Time frame: 2009-

Aim of project/main objective/main hypothesis: The objective of this project is to advance understanding of how semantic memory (language, general knowledge) affects learning of new information, and influences encoding and retrieval of episodic memories (personal past experiences). We combine behavioral measures and electrophysiological measures of brain activity (EEG/ERP) to investigate the neurocognitive basis of such memory-system interactions, with a particular emphasis on their temporal dynamics.

Prior knowledge often has a beneficial effect on encoding and later remembering, but can also have detrimental effects. Memory errors may occur when pre-established, salient memory representations interfere during the retrieval of related information (causing retrieval-induced forgetting), and when verbalizing ones experiences has negative consequences for later remembering due to the level of perceptual expertise exceeding the level of verbal expertise (verbal overshadowing).

In the present project, we examine the extent to which different levels of expertise and vocabulary within a particular domain (e.g., color, face, voice identification) influence attention, and promote encoding and retrieval of domain-related information. By comparing novice and expert participants, and examining participant at different time points during learning, we can observe when different levels of knowledge may both cause and protect against memory errors.

Study A (Exp. 1–n). Verbal overshadowing in face recognition memory.
Questions addressed in this line of experiments include the following: What are the effects of verbalization on face recognition memory? Does verbalization induce variations in confidence? What are the memory consequences of orienting towards global and local processing? Is verbal overshadowing associated with a memory switch cost, when switching between different processing orientations (verbalization versus no verbalization, global versus local processing)?

Study B (Exp. 1–n). Electrophysiological correlates of verbal overshadowing in recognition memory for faces.
Questions addressed in this line of experiments include the following:
What are the effects of verbal overshadowing on ERP old/new effects recorded in the ensuing memory test (putative correlates of implicit memory, familiarity, and recollection)? Does verbal overshadowing induce a change in the way items are processed at later study opportunities? Is verbal overshadowing associated with a change in retrieval orientation?

Study C (Exp. 1–n). Electrophysiological correlates of voice memory and auditory expertise.
Questions addressed in this line of experiments include the following:
Are auditory experts (e.g. musicians, phoneticians, speech therapists) better at recognizing voices than novices? Does auditory expertise lower the susceptibility to detrimental effects of verbal overshadowing? Do EEG/ERPs reflect differences in voice encoding as a function of the
participants level of expertise? Are EEG/ERPs sensitive to voice repetition, with or without conscious recognition?

Study D (Exp. 1–n). Electrophysiological correlates of retrieval competition, interference control, and inhibition.
Questions addressed in this line of experiments include the following: How do we handle interference from related but currently irrelevant memories during selective memory retrieval? Can the use of EEG/ERP research techniques disentangle competing accounts of retrieval-induced forgetting (i.e., inhibitory control account vs. associative blocking)? How and when does semantic memory influence the encoding of episodic memories?

How does this project contribute to an “added value” in the CCL environment? The project has great potential to inform and be informed by several of the CCL projects. For example, retrieval competition and interference control would be interesting to examine from a bilingual and/or second language learning perspective. There is also a clear interaction between the present project and project 25, which represents collaboration that would not have happened without the CCL environment.

Why is this project interesting? By developing a deeper understanding of the neurocognitive basis of memory-system interactions, and mechanisms underlying both beneficial and detrimental effects of prior knowledge on encoding and remembering, the present research project will inform theories of memory and cognitive control.

How does the project relate to the CCL Core Ideas? The questions addressed in the project are of relevance to CCL Core Ideas 1 and 2. For example, the concept retrieval orientation refers to the idea that we are able to facilitate remembering by activating sensory regions prior to retrieval of particular episodic detail (CCL Core Idea 1). Central to the project is the notion that learning depends on the co-activation of prior knowledge and memory of past events (CCL Core Idea 2).

Is the project cross-disciplinary and if it is, which disciplines are involved? This project is based on theories and research methods from cognitive psychology, neuroscience and linguistics.

Progress since last report: Data collection and data analysis for experiment 2-3 (Study A) is completed. Data collection and data analysis for experiment 1 (Study B) is completed. Recording of auditory material (Study C) completed. Piloting (Study C) completed. Manuscripts are in progress, reporting data from Study A and B.

One project member, doctoral student Susanna Bernstrup, has been on sick leave large parts of 2012, which have had the unfortunate consequence that Studies A-C have progressed little since the last report. However, a new member has joined the project, Robin Hellerstedt, who is working on Study D. This research is concerned with fundamental aspects of memory-system interactions and contributes to the project as a whole. Data from the first experiment were recently published in a peer-reviewed journal and the following experiments are progressing according to plans.

Problems in the project: Editing material for Study B has been difficult, and the current choice should be considered tentative until piloting is completed. See also response to the previous point (6).

Plans, for the next semester and long term: Data collection, data analysis (Exp. 2-n, Study B); editing of recorded auditory material, writing of technical report (Study C). Data collection, data analysis (Exp. 2-n, Study C).
A manuscript describing the results of Study D-Exp. 2 is currently in preparation and will soon be submitted to an international peer-reviewed journal.
Study D-Exp. 3: data analysis.
Study D-Exp. 4: data collection.

**Potential applications (diagnostic tools, methods for other research areas, for society):**
The present research will be of potential value in more applied settings, such as in forensic contexts, where independent and objective measures of memory content (e.g. ERP correlates of voice recognition) would be of great importance.

**Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):**


**Conferences, workshops, lectures, invited talks:**


**Collaborations within CCL:**
Susanne Schötz, Department of Linguistics and Phonetics (Collaboration regarding voice identification parameters and construction of auditory stimulus material).
Peter Gärdenfors, Cognitive Science (PG’s conceptual space theory may be used to derive predictions about the effects of verbal overshadowing and development of verbal expertise).
Roger Johansson, Department of Linguistics and Phonetics, Lund University (Collaboration regarding face recognition memory and consequences of global versus local processing).
Sverker Sikström, Department of Psychology, Lund University (Collaboration regarding computational models of retrieval-induced forgetting).

Collaborations outside of CCL:
Mats Dahl, Department of Psychology, Lund University (Collaboration regarding forensic applications of voice identification and recognition).
Georg Stenberg, Kristianstad University (Collaboration regarding semantic-episodic memory interactions and cognitive control).
CogComLab: Ingar Brinck, Department of Philosophy, Lund University (Collaboration regarding embodied cognition and retrieval orientations).
Axel Mecklinger & Timm Rosburg, Department of Psychology, Saarland University (Collaboration regarding ERP correlates of retrieval orientation).
Project 6. Temporal aspects of (written) language production
Project leader: Victoria Johansson

Project members: Victoria Johansson, Birgitta Sahlén, Emily Grenner, Lena Asker-Árnason

Time frame: This project serves as an umbrella for other projects related to the study of how temporal structures in (written) language production can be related to cognitive aspects. At the moment none of the participants in this project is financed by CCL, but the ideas are carried out e.g. in Johansson’s VR-project Expert writing – divine inspiration or hard work, and in the Wengelin project Gaze behavior during writing. Further, the idea of using pauses as a way of investigating cognitive burden will be used in the just started Wallenberg-financed project Öka skrivlusten! Keystroke logging and peer observation – tools for text creation in children’s writing.

Aim of project/main objective/main hypothesis: Alamargot and Chanquoy (2001) summarize the underlying assumption behind the analysis of pause duration during text writing in on-line studies by saying that longer pause durations indicate that the ongoing processes are more complex. The most widespread interpretation of pauses is that they occur because of competition for limited processing capacity (proposed e.g. by Just and Carpenter, 1992). Another reason for pausing is that the execution of a motor skill like typing (i.e. a low-level process) competes with high-level processes like planning and revision (e.g. Pashler, 1993; McCutchen, 1994). A third suggestion is that pauses occur because the outcome of the processing of one task conflicts with the processing required for another task (proposed by Navon and Miller, 1987). This project aims at describing and analyzing the location and function of pauses and editings in text writing, and thereby identifying such (linguistic) contexts and text types that prove to be difficult.

How does this project contribute to an “added value” in the CCL environment? This project focuses on cognitive aspects during language production, i.e., what makes it difficult or easy to produce language. It aims to study that by looking at pauses (i.e. with the assumption that pauses and hesitations indicate where it is more effortful to produce language). To fully study this phenomenon many disciplines are needed. Computational linguistics in order to program (in this case keystroke logging programs, but it can also be tools for e.g. analyzing speech), psychologists to contribute with knowledge of working memory, linguists for performing the linguistic analysis, and speech language therapists for contributing with the view of the non-typical language user. Further, cognitive scientists can contribute with knowledge on e.g. eye movements and multimodal analyses of the on-going processes. In projects related to this topic, all these disciplines are represented with important contributions.

Why is this project interesting? Pause analyses can give valuable insights into e.g. what linguistic structures and text types, which are difficult to produce. By comparing the real-time writing processes (e.g. provided from keystroke logging) from writers with different skills and abilities, we will know more about the development of writing. We will also know more about the processes behind texts of different types, which will help in developing aids and guidelines for improving writing. Finally, a closer analysis of writing in real time will add to the fundamental knowledge of how human language is produced.

How does this project relate to the CCL Core Ideas? The project connects to core theme 4.

Is the project cross-disciplinary and if it is, which disciplines are involved? The project involves linguists and speech-linguist therapists. However, the ideas in this project are also explored in related projects (e.g. Johansson’s VR-project Expert writing – divine inspiration or hard work, and Åsa Wengelin’s VR-project Gaze behavior during writing), which engages scientists from cognitive science and psychology.
**Progress since last report:** The systematic investigation of foremost the location and duration of pauses during writing has led to several outcomes:

One connected part of this project is the development of a new version of the keystroke logging program ScriptLog, which makes it possible to record and analyze the pause behavior during writing. This new ScriptLog version has been developed by Johan Frid within the project Gaze behavior during writing (see conference presentation Frid et al 2012).

The methodology of investigating the pauses duration and syntactic location has been used for analyzing written data from expository texts from writers from five different age groups: 10-year-olds, 13-year-olds, 15-year-olds, 17-year-olds and adult university students. All texts were collected in a lab environment using the keystroke program ScriptLog (Strömqvist & Karlsson 2002). The program makes it possible to study for instance revisions and pauses in the text. In total, we coded 120 texts, and coded all pauses (n≈12000) longer than 2 seconds. All pauses were coded according to syntactic position.

A general result was that there were no differences in the proportion pausing time of total writing time between the different age groups. However, preliminary results show differences between the age groups regarding how high proportion of the total pausing time that were found in clause boundary. $F(4,20) = 6,539, p < 0.002$. The age groups with highest proportion pause time in clause boundary were the 13-year-olds and 15-year-olds, and the groups with the least were on the one hand the 10-year-olds and on the other the two oldest age groups: 17-year-olds and adults. This can be related to other findings: the 10-year-olds had a higher proportion than any other group within words, while the 17-year-olds paused more in the middle of phrases, and adults more in connection with editing. The analysis of the pause contexts shows interesting developmental patterns. The 10-year-olds seem to be occupied with spelling and with finding keys (indicated by more word-internal pauses). The 13-year-olds and 15-year-olds pause comparably little everywhere, except in clause boundaries, which – together with analyses that show that they edit to a very little extent and have relatively short writing times – indicate that they can be characterized as very 'linear writers'. The 17-year-olds are more occupied with expanding their phrases. And the adults edit on a more global text level than any other group. This is described in several conference presentations (Johansson et al 2012; Gustafson et al 2013; Johansson et al 2013).

The methodology has further been using in investigating the written language by hearing impaired children (see Grenner 2012; and conference presentation by Asker-Árnason et al 2012). These studies do not find the same developmental patterns as is found in the above described of expository texts written by children with no hearing impairment above. This is why it will be interesting to further investigate this in the just started project Öka skrivlusten! Keystroke logging and peer observation – tools for text creation in children’s writing (Birgitta Sahlén, Emily Grenner, Victoria Johansson, Lena Asker-Árnason, Viktoria Åkerlund, Joost van de Weijer), financed by Stiftelsen Marcus och Amalia Wallenbergs Minnesfond 2013-2015.

A final outcome of investigating pauses during writing is found in Palviainen & Johansson 2013 (conference presentation), where the same “pausing profile” is found in how pauses are distributed during narrative writing when L1- and L2-writers of Swedish are compared – the only difference is that the L2-writers pause for longer time. This gives valuable insights in how genre competence and genre knowledge is kept between languages.

**Problems in the project:** This project is at the moment an umbrella project for research that the different project members carry out in other projects. It will be difficult to systematically report any progress solely connected to this project. My suggestion is that other projects investigating this topic will be loosely associated with CCL, and that this project stops.

**Plans for the next semester and in the long term (incl. equipment needed):**
**Potential applications (diagnostic tools, methods for other research areas, for society):**

The project has given important input and worked as a pilot for the analyses of a new project, “Öka skrivlusten!”

A systematic comparison between language production in speech and writing will be useful for any kind of linguistic analyses. A systematic description of what pauses in writing can reveal will in the end make it possible to use keystroke logging as a diagnostic tool – to identify areas (grammatical, structural, semantic, etc.) where the writer at a certain point may be susceptible for improvement.

**Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):**

- Grenner, E. (2012) Pause patterns in written narratives and working memory capacity in 11-12 year-old children with hearing impairment and CI or HA. [master thesis in logopedics]

**Conferences, workshops, lectures, invited talks:**

**Conferences**


**Popular presentations**


**Please describe collaborations within CCL (name of researchers, research question):**

Several researchers in CCL have participated in the Theme related to this project. Those are for instance: Victoria Johansson, Birgitta Sahlén, Jana Holsanova, Maria Graziano, Roger Johansson, Richard Andersson, Marianne Gullberg, Susanne Schötz, Johan Frid, Olof Sandgren, Kristina Hansson. Other participants have been Emily Grenner and Andreas Lind.

**Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question):**

Collaboration with Åsa Palviainen, professor in Swedish language at Jyväskylä University. One research question is: “Do writers pause the same when writing in L1 and L2?”
Project 7. Narrative and lexical intervention for children with typical development.
Project leader: Victoria Johansson

Project members: Victoria Johansson, Birgitta Sahlén, Viktoria Åkerlund, Joost van de Weijer

Time frame: Project was finished in 2012 (as was stated in previous CCL-report)

Aim of project/main objective/main hypothesis: The aim of this study was to investigate what aspects of the narrative ability can be enhanced by language intervention.

How does this project contribute to an “added value” in the CCL environment? In this project speech-language therapists contributed with their knowledge of intervention and training children, while the linguist contributed with knowledge about keystroke logging methodology and linguistic analyses.

Why is this project interesting? This study sheds lights on what parameters we can expect to affect during a intervention training procedure of writing – especially for narratives. This is important to know to develop training programs for writing, specific for special groups, and for specific text types.

How does this project relate to the CCL Core Ideas? The project connects to core theme 2, 3, and 4.

Is the project cross-disciplinary and if it is, which disciplines are involved? The project involves linguists and speech-language therapists.

Progress since last report: Project is finished; final article is being written. This is a summary of the results:

- With the purpose of eventually increasing our knowledge on how to improve the story-telling skills of language impaired children, we designed an ABA-inspired intervention study that hopefully would improve the narrative skills for children with typical linguistic development.
- Five 11-year-old children participated in the study. They were divided into 2 dyads, and one single participant (due to participant drop-out). The comparative data consists of 40 written narratives (8 texts/child), from 3 baseline tests (A), 3 tests during the intervention period (B), 1 post test (A) after three weeks, and 1 follow up-test (approx. after 3 months). The intervention period consisted of in total 12 meetings with a speech language therapist. Each meeting followed a training procedure (based on Åkerlund & Sahlén 2010), practising oral narrative, lexical knowledge, written narrative, and narrative meta-knowledge. Peer observation in the dyads comprised an essential part of the procedure.
- We analysed: 1) length measures, i.e. number of words, clauses and t-units; 2) measures of syntactic complexity, i.e., clauses per t-unit; 3) lexical measures, i.e. lexical diversity and density; and 4) story-grammar (modified from Stein & Glenn 1979).
- The findings showed an increased text length, a significant increase in story grammar points and a strong tendency of increased lexical diversity. Last but not least, the children in each dyad followed each other’s development of story grammar.

Problems in the project: N/A

Plans for the next semester and in the long term (incl. equipment needed): N/A
Potential applications (diagnostic tools, methods for other research areas, for society):
The project has given important input and worked as a pilot for a new project, “Öka skrivlusten!” – see below.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Conferences, workshops, lectures, invited talks:

Please describe collaborations within CCL (name of researchers, research question):
The project has resulted in two new grants:
- Wibel 2011-2012: Skriftliga redogörelser. Intervention för universitetssuderande med och utan hörselskada. (Viktoria Åkerlund, Victoria Johansson, Birgitta Sahlen, Lena Asker-Árnason, Joost van de Weijer). This project, connected to CCL used keystroke logging and peer observation in an intervention study with the purpose to improve the argumentative writing for university students with and without hearing impairment. The grant holder was Viktoria Åkerlund. The project is finished and is now being written up.
- Stiftelsen Marcus och Amalia Wallenbergs Minnesfond 2013-2015: Öka skrivlusten! Keystroke logging and peer observation – tools for text creation in children's writing. (Birgitta Sahlen, Emily Grenner, Victoria Johansson, Lena Asker-Árnason, Viktoria Åkerlund, Joost van de Weijer). This is a 3-year-old project, starting 2013, with the aim of implementing and evaluating a model for training writing for school children with typical linguistic development and for children with linguistic development on different conditions. In the project we use keystroke logging and peer observation. This project, and the connected projects further benefit from the development of the keystroke logging program ScriptLog, developed by researchers connected to CCL (although not financed by CCL) – Åsa Wengelin, Victoria Johansson, Johan Frid, Roger Johansson & Mikael Johansson, financed by VR-grants (“Reading during writing” (Wengelin), “Gaze behaviour during writing” (Wengelin), “Expert writing – divine inspiration or hard work” (V. Johansson)), and The Crafoord Foundation (“Ögonrörelser under skrivande – programmeringshjälp” (Wengelin)).

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): The project, “Öka skrivlusten!” cooperates with Martine Braaksma (and team), from University of Amsterdam, Netherlands.
Project 8. Eye movements and mental imagery  
*Project leader: Jana Holsanova*

**Project members:** Jana Holsanova, Roger Johansson, Kenneth Holmqvist

**Time frame:** 2009–2014

**Aim of the project:** Theoretical objective: to examine mental image representations, their role in human cognition, in which situations they are used and how they interact with the oculomotor system. Methodological objective: to develop methods where eye-tracking is used to study these questions. Specific questions that we will focus on in this project are: 1) the role for eye movements during mental imagery, i.e., are eye movements functionally connected with image formation and inspection during internal simulations; 2) how are such eye movements related to *individual differences* in visuospatial capabilities and working memory; 3) can eye movements to ‘nothing’ facilitate *memory retrieval*; 4) can this methodology be developed to investigate when and how we use mental imagery over time in *different kinds of tasks*, e.g., problem solving tasks, writing tasks and tasks of decision making and reasoning (cf. ‘thinking in time’); 5) what is the nature of *spatial reference frames* used during mental imagery.

**How does this project contribute to an “added value” in the CCL environment?** This project is to a large degree based upon Roger Johansson's doctoral thesis, which is funded by the CCL environment. Therefore, this project would not exist without CCL. Apart from this, collaborations with CCL-members Mikael Johansson and Germund Hesslow have contributed a lot to this project in respect to theories of memory retrieval and internal simulations. This would not have happened without the CCL environment.

**Why is this project interesting?** Due to the private nature of mental imagery, this phenomenon has for a long time been very hard to study. However, our way of using eye-tracking techniques provides a novel way to trace the “mind's eye” in *space* and over *time*. Knowledge of mental image representations in the brain has very important implications for general cognitive models of our mind and internal simulation, as well as for domain specific models of working memory and long-term memory. Results of how we use mental imagery are fundamental for applied research on learning, design, creative thinking, problem solving, mental practice, physical therapy and psychological treatment.

**How does this project relate to the CCL Core Ideas?** This project is directly linked to the core theme: *Internal simulation of perception and action is a fundamental mechanism for cognitive function.*

**Is this project cross-disciplinary and if it is, which disciplines are involved?** This project consists of people from Cognitive science and the Humanities laboratory. Cognitive science is per definition cross-disciplinary and this project primarily combines cognitive psychology, neuroscience and linguistics.

**Progress since last report:** Results from study 1, concerning *the role for eye movements during mental imagery*, were published in a larger article in a high-impact international journal (Journal of Experimental Psychology: Human Perception and Performance). Study 3, concerning *eye movements to nothing and memory retrieval* (in co-operation with Mikael Johansson), was finalized. This study investigated specific eye movement manipulations during memory retrieval in detail. Results have been presented as talks in three international conferences (VSS 2011, SWAET 2011, TeaP 2012) and a larger article has recently been submitted to a top international journal. *Simulation theory and modeling* is a topic that we have started to discuss with project 23 (cognitive architecture/internal simulation), in co-operation with Magnus Johnsson and Germund Hesslow. But this co-operation has not taken off yet. Another related co-operation has
started with Kerstin Gidlöf, Annika Wallin and Philip Pärnamets where we use our “looking at nothing” method to investigate decision-making.

**Method and tool development**

Roger and Kenneth have been involved in developing a novel method for comparing eye movement sequences over time, which is more suited for mental imagery studies than established methods of today. Two papers have been published about this method in international journals (*Behavior Research Methods, Journal of Eye Movement Research*).

**Problems in the project:** The analyses for the latest study were very time consuming and due to the rich material it was somewhat difficult to select what we wanted to include (and not include) in the very tight manuscript that was recently submitted. Also, time pressure from other commitments has been tough on all project members and has led to delays in respect to submissions and analyses.

**Plans for the next semester and in the long run:** We have recently submitted a grant proposal (VR) to fund three new studies of mental imagery and internal simulation where we aim to study the nature of *spatial reference frames* used when we recall scenes from memory. More specifically, this project will systematically investigate how eye movements respond to viewpoint changes grounded in either environment, body or mind during a mental imagery task of scene recollection. This will be operationalized in three groups of experiments where we actively manipulate: (1) orientation and location of frames in the external environment, (2) eye, head and body position of the observer herself, and (3) orientation and rotation of the internal simulation (the mental image itself). Spatial reference frames concern one of the most elementary and universal questions in models of internal simulation and mental imagery and has been proven to be very important for mental practice in sports, psychological treatment, physical therapy, as well as for learning and design. But surprisingly, researchers in the cognitive sciences have to date not even begun to investigate this fundamental issue. Roger will defend his doctoral thesis on 2014-09-26. The faculty opponent will be professor Michael Spivey (University of California at Merced).

**Long term plans**

Conduct a series of experiments to investigate the link between mental imagery and spatial reference frames, as well as continue with the avenue where we target problem solving. Elaborate our cooperation with 23 (Cognitive architecture/internal simulation). Also, we plan to initiate a new direction where we investigate mental imagery for populations with visual disabilities. We have also collaboration with project 25 (Eye movements and Memory).

**Potential applications:** It has been shown that people have preferences to either think visually, spatially or in words. It is, however, not known what implications different formats of thinking actually have for information processing. Results from this project can be used to develop new methods for educational sciences, design and creative thinking in order to adapt to different preferences and abilities. Results about the causality between eye movements, mental imagery and memory can be used to develop explicit mnemonic strategies to enhance learning and memory. Direct applications also reside in the fields of mental practice, physical therapy and psychological treatment. For example, it has been demonstrated that mental practice of visuospatial and motor skills can enhance performance in sports, in medical training, in physical therapy of relearning locomotor skills, in psychological treatment of post-traumatic stress disorder (PTS), schizophrenia, depression and bipolar disorder, and for people with visual disabilities. To date, these disciplines rely on subjective reports and there is a surge for more valid objective measures that are capable of identifying how we use internal simulations, as well as better tools to instruct how such simulations should be used. This could in the long run lead
to improved methods in order to evaluate and improve strategies/training/therapy in such applied avenues.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Peer reviewed journal papers

Peer reviewed papers in conference proceedings

Edited volumes

Book chapters

Conferences, workshops, lectures, invited talks:

**Media & popular presentations**


**Collaboration within CCL:** Gerry Hesslow, Magnus Johnsson (simulation theory, computational models, robotics), Mikael Johansson (working memory & memory retrieval), Åsa Wengelin, Viktoria Johansson (writing, problem-solving & eye-tracking methodology).

**Collaboration outside of CCL:** Thomas Barkowsky, Christian Freksa, Holger Schultheis (SFB/TR 8 Spatial cognition, Bremen university), Sven Bertel (Weimar, Germany), Mark Torrance (Nottingham Trent University, UK), Daniel Richardson (University College London), Georg Jahn (Universiy of Greifswald), Agnes Scholtz (Chemnitz University of Technology), Fred Mast, Corinna Matarelli (Institut für Psychologie der Universität Bern), Dragana Micic, Howard Ehrlichman (Queens College and the Graduate Center of the City University of New York), Maryam Fourtassi (Centre de recherché en neuroscience de Lyon).

**Membership:** Jana Holsanova has been elected the Vice Chair (2011-2013) / Chair Elect (2013-2015) for the Visual Communication Division by the International Communication Association. She is also the Chairman of the Swedish Braille Authority (Punktskriftsnämnden), Swedish Agency for Accessible Media (MTM).
Project 9. Narratives and the Impact of Timing of Gestures and speech on an Addressee

*Project leader: Agneta Gulz*

*Project members:*
Magnus Haake, Dept. of Design Sciences, Lund Univ.
Marianne Gullberg, Centre for Languages and Literature, Humanities Lab, Lund Univ.
Betty Tärning, Cognitive Science, Lund Univ.
Birgitta Sahlén, Dept. of Logopedics, Phoniatrics & Audiology, Lund Univ.
Kristina Hansson, Dept. of Logopedics, Phoniatrics & Audiology, Lund Univ.

*Time frame:* Starting 2011. Project arisen from CCL seminars and discussions on timing/synchronization, narratives and understanding in combination with work on the Digitalized Trog2 project. In a first phase planned to run 2011 and 2012.

*Aim of project:* The aim is to shed light on the effects of the semantic-pragmatic and temporal co-ordination of speech and gestures on an addressee, specifically shifts of the temporal alignment. Although the tight semantic-pragmatic and temporal link between speech and gesture is well established, it remains unknown how the fine-grained temporal synchronization influences the addressee, and how important the precise alignment of speech and gestures is to the listener. We ask the following:

1. *When* (at what time interval of displacement) does temporal misalignment affect comprehension of a narrative, and what are those effects? Are combinations of speech and different types of gestures differentially affected (representational vs. beats)?

2. Does temporal misalignment between speech and gesture cause semantic integration difficulties in processing as detectable in electrophysiological measurements such as the N400?

3. *When (at what time interval of displacement)* does temporal misalignment affect emotional experiences such as irritation?

4. Are there individual and group differences in sensitivity for temporal misalignment?

To address these questions, the project will use virtual character techniques to enable fine-grained manipulation of parameters. We are developing a digital character on the basis of motion capture data of natural speech and gesture. This will allow us to displace gesture relative to speech in a controlled fashion. Gestures will be displaced to occur both before and after the relevant elements in speech. The project is a potential starting point for a digital platform to study several other interaction and communication phenomena.

*Why is this project interesting:* Temporal alignment of speech and gestures is a pervasive naturally occurring production phenomenon, and is in this sense a fundamental communicative phenomenon. The project seeks to contribute to the understanding of this phenomenon from the perspective of the addressee. Despite a large literature on how listeners' process gesture information, no study has addressed the four specific questions posed above. An obvious reason is that systematic and controlled displacements of gestures in relation to speech using human beings or video recordings are not feasible. The methodology using virtual characters is crucial to the enterprise.

In the long term the project can contribute to a potentially powerful platform/infrastructure unmatched by any other Swedish university. Concerning technology and methodology, the new VHIL centre at Stanford would serve as a source of inspiration and exchange.
Progress since last report: In June and October two rounds of MoCap recordings of 2 + 3 human narrators were conducted in preparation for the final recording, done in November. A main challenge during the process has been to simultaneously obtain MoCap data, sound data and facial expression data of the technical quality required. In between the MoCap system was upgraded (very positive) and project members participated in two workshops on the novel system and on MoCap data in gesture research. The November recording appears to have the quality required, and we are about to select one narrative (of four) to be more thoroughly processed, including an Elan coding, in order for the modelling of the development of the virtual character / virtual human to start out.

Problems in the project: The balancing of this project and the Digitalized Trog2-project remains. The basis of this problem is, however positive: two interesting and promising projects. We are taking actions in terms of writing grant applications. Three applications have been completed and one is newly started. We are grateful for the CCL-environment’s support in this.

Fall 2011 has involved several time consuming technology-related preparations: i) the complex recording required (see above) with coordination and tuning of several pieces of technology in addition to the MoCap system as such, ii) work on the set-up of the MoCap room, iii) decisions, ordering and installation of a new computer and 3D-modelling software. (Some of this, it should be noted, relates to heightened ambitions in the modelling of Virtual Gessie). On the human side an injured shoulder (Magnus H) made all computer based work practically impossible during the two months (August and September), that were scheduled for more focused work. The circumstances of the coming semester, however, look good both in terms of technology (and health conditions).


Potential applications (diagnostic tools, methods for other research areas, for society): The most interesting potential is to provide a platform for addressing questions on cognition, communication, interaction and learning. The primary strength lies in allowing precise and controlled manipulation of variables that cannot be obtained with humans or video recordings. Some of the current CCL-projects/issues could potentially benefit from this.

Collaborations within CCL. Present: Centre for Languages and Literature, Div. of Cognitive Science, Dept. of Design Sciences, Dept, of Logopedics, Phoniatrics & Audiology. Potential: See above under potential applications.

Collaborations outside of CCL, actual and potential: In collaboration with M. Lindvall, child and youth psychiatry, LU, Haake and Gulz designed a project and a grant application regarding digital characters as a resource for training and diagnosis for children with Asperger’s syndrome. Potentials: Gullberg has an extensive network on gesture in general and on man-machine interaction with a focus on gesture in particular (Leverhulme network) and Gulz and Haake will make use of their network within the virtual character community (among the potential collaborators are J. Bailenson and C. Nass at Stanford). Within the Humanities lab: collaborations with Maria Graziano, post-doc researcher.
What general research problem would you like to attack in five years from now? Hot topics? How could CCL anticipate research on these questions? In relation to the specific project: explore the role of communicative variables regarding gestures and speech for humans’ understanding of language, perhaps with a focus on children with various language disorders, for instance hearing impairments, SLI and Asperger’s syndrome. In relation to the potential infrastructure: address selected CCL-domains, for example, second language fluency with respect to gestures and speech (production vs. comprehension); digital character support for the development of narrative competencies (explore/compare therapeutic strategies for support). CCL could anticipate the overall potential of this kind of research platform plus specific (hot) questions that the platform can be used to address.
Project 10. Multilingual processing

*Project leader: Marianne Gullberg*

**Project members:** Marianne Gullberg, Annika Andersson, Susan Sayehli, Damon Tutunjian

**Time frame:**
- The sub-project *Swedish word order processing in second language learners and native speakers: A psycholinguistic and neurocognitive perspective (SWOP)* is financed by Vetenskapsrådet 2011-2013 (running 2012-2014).
- The sub-project *Argument processing in Swedish as an L2* runs 2012-2013, financed by funding to Gullberg for a postdoctoral researcher.
- New funding (Knut and Alice Wallenberg Foundation) will continue to finance the broad theme.

**Aim of project/main objective/main hypothesis:** This project explores the acquisition and processing of language when another language is already in place as in adult second language (L2) or bilingual language use. The crosslinguistic differences in the lexical, morphosyntactic, prosodic and gestural means of expression raises important challenges for bilingual processing. This project asks the following general questions: How do the representations of a new language develop and then co-exist with the representations of other languages in the mind and brain of an (adult) individual? What role does the language input play? How do co-existing language systems influence each other? We currently explore the following domains:

(a) *Swedish word order processing in second language learners and native speakers: A psycholinguistic and neurocognitive perspective (SWOP)* (Gullberg, Andersson, Sayehli). In this VR-funded project we examine how adult L2 users understand Swedish word orders that they themselves do not use correctly. We compare how native Swedish speakers, adult German and English learners of Swedish process word orders using ERP and behavioral measures of comprehension and production. The aim is to shed new light on 1) the interaction between the first language (± similar to the target language) and general bilingual effects in learning and processing, and 2) the relationship between production and comprehension in learning and bilingualism.

(b) *Argument processing in Swedish as an L2 (APS)* (Gullberg & Tutunjian). This project investigates how L2 speakers process (implicit) arguments in the L2. The literature suggests that L2 speakers may arrive at similar end products as native speakers but that their online syntactic processing may nevertheless differ. We address this question by examining how native English speakers and Swedish learners of English process different passive constructions using self-paced reading.

**How does this project contribute to an “added value” in the CCL environment?** The project contributes an important focus on adult learners and adult online language processing missing elsewhere in the CCL. It also combines fundamental (psycho-)linguistic and acquisition work with neurocognitive approaches to language learning.

**Why is this project interesting?** Although bilingualism is prevalent in the world, the processes of L2 acquisition and the properties of (online) bilingual language processing remain surprisingly understudied. Both domains are of fundamental relevance to models of production and comprehension in psycholinguistics, to models of language development, theories of language change, and to models of cognitive processing and its neurological underpinnings. Of particular relevance to CCL are the temporal aspects of online use of multilingual knowledge and representations.
How does this project relate to the CCL Core Ideas? The project is directly related to core theme No 2.

Is the project cross-disciplinary and if it is, which disciplines are involved?
Linguistics, psychology, cognitive science, neuroscience

Progress since last report: SWOP sub-project: Data collection is almost complete. We have collected behavioural and ERP-data from native speakers of Swedish, German learners of Swedish, and English learners of Swedish. Behavioural data and ERP-data are being treated in preparation for analysis.
ASP-sub-project: Self-paced reading data, background language questionnaire data, objective proficiency measures, and working memory data from native English speakers and Swedish learners of English have been gathered, analysed, and presented at the biggest sentence processing conference in the world, CUNY. Currently, a follow-up study of Spanish learners of English is being conducted.

Problems in the project: Participant recruitment is always tricky in studies of second language learners. It has proven particularly challenging to recruit English learners of Swedish. Much work has gone into personal recruitment in university classes predominantly at the engineering faculty to avoid students of language, at Malmö University, in expat community clubs, international student groups, etc. We are also faced with challenges in finding monolingual native speakers of other languages than Swedish, which requires fieldwork and data collection abroad (e.g. York).

Plans for the next semester and in the long term (incl. equipment needed): In the SWOP sub-project, data analysis will be the focus to have results ready for conference deadlines for the big processing and L2/bilingual conferences in 2014. Potential follow-up data collection and writing up will be the focus during 2014 and potential follow-up data collection. In the APS sub-project, a follow-up study on Spanish learners of English is under way during the summer, and analysis and writing up of a paper will be the focus during the autumn semester.

Potential applications (diagnostic tools, methods for other research areas, for society):
The SWOP project has good potential to lay the foundation for continued work on the acquisition of word order, and possibly for the development of tools to improve both learning and teaching. At this point, however, both sub-projects primarily focus on ground research.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Edited volume:

Peer reviewed journal articles:


**Peer reviewed book chapters:**


**Peer reviewed conference paper:**

• Tutunjian, D. & Gullberg, M. (2013). L1/L2 differences in processing verbal vs. adjectival short passive constructions. 26th annual CUNY conference on human sentence processing, 218. CUNY. [http://artsandsciences.sc.edu/cuny2013/sites/default/files/final%20proceedings_0.pdf](http://artsandsciences.sc.edu/cuny2013/sites/default/files/final%20proceedings_0.pdf)

**Dissertations:**


**Conferences, workshops, lectures, invited talks:**

**Conferences:**


Invited talks:


Plenaries:


Please describe collaborations within CCL (name of researchers, research question):
Magnus Lindgren, neurocognitive aspects on language processing

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question):
Christine Dimroth, Osnabrück Universität, Germany, L2 acquisition, word order, information structure
Carrie Jackson, Pennsylvania State University, USA, second language/bilingual sentence processing
Christina Karns, University of Oregon, USA, EEG analyzing methods
Leah Roberts, University of York, second language/bilingual sentence processing
Lisa D Sander, University of Massachusetts, USA, sentence processing in mono- and bilingual children, ERP

Project leader: Magnus Lindgren

Study 1: Shape or detail? An electrophysiological investigation of object recognition processes related to language development in 20-month-olds
Study 2: Effects of item variability and spacing on category learning: (Un)desirable difficulties?
Study 3: A longitudinal follow-up of study 1 at 24 months.

An affiliated project ERP correlates of non-verbal declarative memory in small children is also reported under this heading as Study 4 and 5.

Project members: Kristina Borgström, Magnus Lindgren, Mikael Johansson, Peter Gärdenfors, Marianne Gullberg.

Time frame:
Study 1 – will be submitted in fall 2013
Study 2 – submitted in February 2013, under review
Study 3 – will continue during 2013-14.
Study 4 – completed
Study 5 - data collection continues during spring 2013.

Aim of project/main objective/main hypothesis: The overall objective is to understand the basic neural mechanisms underlying the ability to rapidly learn novel words for novel concepts. Studies 1 and 3 aim to investigate the growth of the earliest lexicon, between 1½ and 2 years, in a longitudinal ERP design for measuring online word learning. Study 2 tests the effect of different conditions in a learning phase on memory for object categories and their novel labels. Specifically, it tests the possible interaction between distributed learning and item variability during learning on later memory performance.

How does this project contribute to an “added value” in the CCL environment?
The research focus of studies 1 and 3, which combines ideas about the development of object recognition and language, is a direct consequence of the collaboration between the project members.

Why is this project interesting? The cognitive mechanisms underlying the rapid vocabulary growth that takes place between 1½ and 2 years are still not completely understood. Study 1 and 3 allow us to measure the development that occurs at a neural level and see how it correlates with other measures of children's language and general cognitive development. Although the benefit of distributed learning in episodic memory tasks is well established, few have studied its effect on inductive semantic learning. Study 2 has provided new data that are relevant for the theories of why distributed presentation improves learning, and also how category learning is affected by item variability depending on whether learning has occurred in a distributed or non-distributed fashion.

How does this project relate to the CCL Core Ideas? The project is fundamentally linked to core themes 2 and 3:

- **Language learning is strongly dependent on other cognitive processes.**
- **Modelling and quantifying semantic development in children is a rich resource for diagnosis and intervention.**
Studies 1 and 3 investigate the link between language learning and the development of object recognition, and look at the neural mechanisms involved in object word learning. Study 3 links the process of object word learning to factors known to affect general memory processes.

Progress since last report:

- **Study 1**: Data collection and analysis completed. A preliminary manuscript exists but has not yet been submitted. We are waiting to submit until analysis of study 3 is complete.
- **Study 2**: Data collection and analysis completed. Manuscript submitted in February 2013 and is under review.
- **Study 3**: Data collection has been completed, analysis partly completed. Analysis will continue during 2013, and submission is planned for 2014.
- **Study 4**: Manuscript published (see below)
- **Study 5**: An extension of Study 4, with another age range and retention conditions. Data collection ongoing, will be completed during spring 2013. Thereafter analysis and write-up.

Problems in the project: No problems at the moment. The time plan presented in previous project reports has been delayed due to parental leave.

Plans for the next semester and in the long term (incl. equipment needed): Continued EEG analysis and article write-up. The equipment needed is available: computer software (Net Station, Matlab, SPSS).

Potential applications (diagnostic tools, methods for other research areas, for society):

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

- Borgström, K., Johansson, M., & Lindgren, M. *Effects of item variability and spacing on category learning: (Un)desirable difficulties?* Submitted 2013

Conferences, workshops, lectures, invited talks:


Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): Mikael Heimann, Mary Rudner, Emelie Nordqvist, all at Linköping University
Project 12. Social influences on event perception

Project leader: Magnus Lindgren

Project members: Andreas Falck, Magnus Lindgren, Ingar Brinck

Time frame: 2010-2014

Aim of project/main objective/main hypothesis: The main aim of the project is to deconstruct the idea of an automatic perspective taking or "perspective contagion" in terms of other perceptual mechanisms. A main hypothesis is that the apparent automatic means of which adults and infants address what other people have seen or not, can be expressed as a function of social attention and predictive structures based on our sensitivity to goal-directed action (event segmentation). Most work has been focused on the role of other agent’s perceived interest in objects, which may act as a modulator of an observers own interest and thus processing of the same objects. A minor part of the project so far has been devoted to the influence of perceived eye contact on visual attention.

How does this project contribute to an “added value” in the CCL environment? It addresses the temporal properties of actions, especially those which convey meaning in terms of interest and other object- or circumstance-related attitudes.

Why is this project interesting? If infants and adults appreciation of other’s apparent beliefs can be explained in terms of nonconceptual and non-metarepresentational abilities, it would change the conceptual ground for the field of social cognition and Theory-of-Mind. We could easier explain why infants seem to have abilities, which before was thought reliant on language and complex reasoning.

How does this project relate to the CCL Core Ideas? It relates to temporal coordination in interpersonal coordination.

Is the project cross-disciplinary and if it is, which disciplines are involved? Andreas Falck and Magnus Lindgren are from the field of psychology while Ingar Brink is in philosophy.

Progress since last report: Two theoretical and one empirical manuscript have been produced.

Problems in the project: Some time have been devoted into trying to replicate the results by Kovács et.al (2010, Science 330(6012): 1830-1834), which so far has not succeeded. Because of this part of the project has been refocused on likely confounds intrinsic to Kovacs paradigm, which has yielded two critical papers from a theoretical position.

Plans for the next semester and in the long term (incl. equipment needed): Because of the problem mentioned in pt 7, we are refocusing the empirical route to address other aspects of our how we process events and objects being attended by others. A focus being currently elaborated is the “common ground” created whenever sentient organisms interact, and specifically when and how we represent the other person in such interactions. A working hypothesis is that the other is not represented when not needed, that is, not unless we are prompted to reflect on the other or when the interaction "breaks down".

Potential applications (diagnostic tools, methods for other research areas, for society): Diagnostic tools for ASD and related cognitive disorders, teaching applications. The current paradigm may show useful for research on mentalising, event perception, communicative behavior and perhaps also in/outgroup mechanisms within the field of social cognition.
Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):
Two abstracts accepted for a special issue in Frontiers in Cognitive Science, “Social signals and intention recognition in action understanding”.

Conferences, workshops, lectures, invited talks:
Presentation of data from a study on eye contact and visual attention at SweCog fall conference 2012.

Please describe collaborations within CCL (name of researchers, research question):
None at the moment.

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): A collaboration with Elia Psouni at the psychology department regarding ecological validity in verbal false-belief tasks.
Project 13. Gaze behavior and request-response strategies in interaction between children/adolescents with hearing impairment and normally hearing peers

Project leader: Birgitta Sahlén

Project members
Olof Sandgren, PhD student, Birgitta Sahlén, Principal Investigator, Prof. Speech/Language Pathology, Kristina Hansson, Ass.prof. Speech/Language Pathology, Richard Andersson, Humanities Laboratory, Marianne Gullberg, Prof. Psycholinguistics, Joost van de Weijer, Methodologist, Jonas Brännström, senior lecturer, Speech/Language Pathology

Time frame: The project started the spring 2009. Planned date for Olof Sandgren's dissertation October, 18, 2013.

Aim of project/main objective/main hypothesis: Analysis of gaze behavior in interaction between children/adolescents (10-15 yrs.) with mild to moderate hearing impairment and normally hearing peers. Relate gaze behavior to underlying cognitive and linguistic functions and request-response strategies in a structured referential communication task and in a semi-structured conversational setting.

How does this project contribute to an 'added value' in the CCL environment? The project has made the development of new methods necessary. The registration of eye-movements in child conversations is rare and challenging. This has forced researchers from several disciplines to closely work together to make methods reliable and valid and also introduced new populations (children with functional language handicaps) to researchers mainly working within the area of typical language development in adults.

Why is this project interesting? Studies of simultaneous monitoring of gaze behavior in both interlocutors in conversation are sparse. Such studies can provide important real time data on the ongoing co-creation of understanding. Our method provides a way of studying the temporal link between verbal and nonverbal contributions during conversation. Differences between dyads of normally hearing children and dyads where one partner has a hearing impairment can tell us about the integration of information from different modalities. With our design a dialogic as well as an individual perspective can be taken. In combination with analysis of the dynamics in dialogue (as measured by e.g. requests, responses, breakdowns, and pause time) the use of eye tracking in conversation provides important data on the gaze mediated correlates of these linguistic events. In children/adolescents with hearing impairment, the use of visual cues, e.g. monitoring of facial expressions, is normally considered to be of great importance for successful interaction. Important clinical and pedagogical implications for hearing impaired in a speaking environment will be gained. Further theoretical gains include increased knowledge of the temporal processes in the on-line creation of meaning in conversation, as well as the integration of information from different modalities.

How does this project relate to the CCL core themes? This project is directly related to the core themes The temporal coordination of speech, gaze and gestures plays an important role for language comprehension and interpersonal communication and Language learning is strongly dependent on other cognitive processes.

Is the project cross-disciplinary and if it is, which disciplines are involved? Yes. The disciplines involved are: Cognitive science, Linguistics, Speech pathology, and Audiology
**Progress since last report:** Substantial methodological progress through the inclusion of powerful statistical methods; survival analysis and proportional hazards Cox regression to investigate the influence of cognition and language on gaze behavior. Paper 2 has been accepted for publication. Paper 3 is revised and currently pending. Paper 4 to be submitted during April 2013. An analysis of data from another conversational genre (conversations about a film) between the children with HI and their peers, has been made by student Elicia Volt (audiologist) within the framework of a summer scholarship.

**Problems in the project:** Few since last report.

**Plans for the next semester and in the long term (incl. equipment needed):** Revision of Paper 3 and submission of Paper 4. Olof Sandgren is finalizing his thesis during the summer 2013. Long term goals include additional data collection with easier to calibrate eye tracking equipment. Recruitment of post-docs within CCL is currently being made in order to continue this line of research.

**Potential applications (diagnostic tools, methods for other research areas, for society):**
Gaze can reflect linguistic planning, and thus inform us on the properties of language processing. For clinical populations (e.g. hearing impaired, language impairment, neuropsychiatric disorders) this information can be used in language/communicative intervention. Highlighting good examples (for parents, other clinicians, teachers) can have therapeutic effects.

Our findings can also be applied in the development of human-machine interaction systems. Currently, very few of these applications take non-verbal information into account. Improved algorithms must include all modalities used in human-human interaction, i.e. speech, gaze, and gestures.

**Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):**

**Conferences, workshops, lectures, invited talks:**
Since last report:
**Invited talks:**

**Collaborations within CCL (name of researchers, research questions):** A mutually beneficial collaboration with Marianne Gullberg, Maria Graziano (linguistics), Agneta Gulz and Magnus Haake (cognitive science) is taking place within theme groups Multimodal language processing and Multimodal comprehension. The research questions focus temporal aspects of gaze, gestures and verbal exchanges of participants engaged in natural language tasks. Collaboration with Richard Andersson (cognitive science) and Jonas Brännström (audiology) on listener’s gaze behaviour when talkers speak in different noise conditions.
Within a new RJ financed project Kristina Hansson and colleagues will study cognitive, linguistic and interactional abilities of 5-6 year old children with profound hearing impairment and cochlear implant. Analysis of younger children of a different clinical population will add power to our findings.

Collaborations outside of CCL (researchers, organization, research questions):
Already formally established collaborations with Björn Lyxell's group (Malin Wass, Cecilia von Mentzer), at the Linnaeus environment HEAD at Linköping University on cognitive development and effects of intervention in children with cochlear implants.
Project 14. Cerebellum, timing and language impairment in children

Karolina Löwgren

Project members: Karolina Löwgren, Germund Hesslow, Birgitta Sahlén, Magnus Lindgren, Rasmus Bååth, Joost van de Weijer

Time frame: 2010-2014

Aim of project/main objective/main hypothesis: To explore cerebellar function and timing in children with speech and language impairments.

How does this project contribute to an “added value” in the CCL environment? The project arose because of the merging within CCL of physiological work on timing functions of the cerebellum and current ideas of a cerebellar timing deficit in specific language impairment. The project could not have been started without the competences of the cerebellum group concerning eyeblink conditioning and the logopedics group on specific language impairment.

Why is this project interesting? Several investigators in the field of speech and language impairments believe that defective timing is an important part of the impairment, in at least some patients. Because of the role of the cerebellum in timing between perception and motor control the hypothesis is that there will be an association between cerebellar function and speech and language skills where exact timing is needed, for example in rhythm production, rhythm perception, speech prosody and articulatory control. The project has theoretical interest because it may contribute to understanding dynamic aspects of speech and language and mechanisms behind speech and language impairments. It may thus also have clinical implications for the diagnosis and treatment of children with speech/language impairments.

How does this project relate to the CCL Core Ideas? The project explores cerebellar timing function in language production and language perception as a cognitive function and thus contributes to the core theme that the cerebellum is critically involved in temporal aspects of motor and cognitive functions.

Is the project cross-disciplinary and if it is, which disciplines are involved? The project is a collaboration between members from different research areas: Speech and language pathology, neurophysiology, neuropsychology, audiology and cognitive science.

Progress since last report: Eyeblink conditioning, rhythmic finger tapping and prism adaptation have been performed to test cerebellar function on school aged children and adults with typical language. The children with typical language have also been tested on speech, language and hearing tests, non-verbal intelligence and other tasks to eventually be able to compare with children with speech and language impairments that are soon to be tested. A first manuscript on tests of cerebellar function in relation to age in children and adults is in progress and two other manuscripts are planned to include different timing aspects in language or of cerebellar function from the already collected data.

Problems in the project: N/A

Plans for the next semester and in the long term (incl. equipment needed): The plans for the next semester is to continue to work with data analysis of the already collected data sample, finish the three manuscripts that are in progress and to start to test children with speech and language impairments. The same test battery (eyeblink conditioning, finger tapping, prism adaptation, speech, language and hearing tests, non-verbal intelligence etc), as for the children with typical language development, will be used to test the children with speech and language impairments.
impairments. In addition, the variance of the articulatory movements (articulograph measurements) could also be performed in this group.

In the first paper we will investigate tests of cerebellar function in relation to each other and to age in children and adults with typical language development. The second paper is planned to investigate temporal resolution of the hearing system and rhythm production in relation to language production and language perception. In the third paper the plan is to match and compare children with speech and language impairments to children with typical language development regarding measures of variability in cerebellar test performance. The fourth paper is planned to look more closely into finger tapping in children, for example in relation to non-verbal intelligence (that has been studied in adults in other research groups).

**Potential applications (diagnostic tools, methods for other research areas, for society):** We believe it is a realistic hope that the results of this project will help us to develop diagnostic tools that will enable us to classify and diagnose speech and language disorders in a way that better fits the underlying causes and possible therapeutic interventions.

**Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):**

Conferences, workshops, lectures, invited talks: The project has been presented at several occasions. For example at seminars or conferences arranged by the Medical Faculty in Lund, the CCL environment, the Linnaeus research centre HEAD at Linköping University, at Humanist- och teologdagarna, at national meetings on hearing research etc.


**Please describe collaborations within CCL (name of researchers, research question):** The project is a collaboration between Germund Hesslow, Birgitta Sahlén, Magnus Lindgren and PhD student Karolina Löwgren. Collaborations outside this group involve the articulograph project by Anders Löfqvist, Susanne Schötz and Johan Frid and the PhD project of Rasmus Bååth that considers rhythmic actions.

**Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question):** In collaboration with the conditioning group at the Erasmus University in Rotterdam we have developed the human eyeblink conditioning setup that is one of the methods used to measure the cerebellar function in this project.

Guy Madison at Umeå University contributes to the project with a computerized test for rhythmic finger tapping.

Auditory temporal resolution and speech sound production studies is done in collaboration with Jonas Brännström, Clinical Sciences in Lund, and Jan Grenner, Department of Audiology in Lund, who also has developed an auditory test equipment which is used in the project.
Project 15. Speaking in Time: analysis of temporal aspects in speech and communication

*Project leader: Susanne Schötz*

(This project was inspired by and can be seen as a stand-alone follow-up project to the now completed project *Functional data analysis of speech movements*).

**Project members:** Susanne Schötz, Johan Frid. In addition several of our CCL colleagues and also some external researchers are participating in various ways in studies related to their areas of research.

**Time frame:** 2013-2014

**Aim of project/main objective/main hypothesis:** The main objective of the project is to examine the temporal aspects of speech using a phonetic as well as a multi-disciplinary approach. By running a number of studies related to existing projects within or associated to CCL, by sharing data and methods, our aim is to increase our knowledge about the temporal variation in speech. The following studies are currently starting or in progress:

- **Temporal coordination in crossmodal production:** This project/study aims to investigate the fine-grained temporal coordination between speech, manual gestures and gaze in language production in order to improve our understanding of how crossmodal information coordination is achieved, how it develops, and, ultimately, its role in face-to-face interaction.

- **Timing in regional variation:** This set of studies uses the materials from other existing projects, namely the external projects VOKART, ESST and FuPro to study timing in Swedish dialects. How does the prosody of Estonian Swedish compare to other Swedish dialects? What are the articulatory and acoustic timing differences of vowels (e.g. duration and diphthongisation) in different regional varieties of Swedish? What are the temporal differences between East Middle and South Swedish tonal prosody?

- **Prosody in second language acquisition:** Will pronunciation training using phonetic tools for a short period of time (7 weeks) improve the pronunciation (intonation) of the target second language for a test group of high school students compared to a control group that will not receive the extra training? If so, in what way and to what extent? What would be the most important components in a special easy to use training program or tool that can be used in high schools to improve the pronunciation in second language learning?

- **Temporal aspects of animal vocalisations and human–animal communication:** In this study we look at the temporal aspects of cat vocalisations (duration, repetition frequency, quantity in complex vocalisation types) and human–animal communication (e.g. articulatory and acoustic differences between human-directed and pet-directed speech).

**How does this project contribute to an “added value” in the CCL environment?**

- Builds on and replaces the CCL project Functional data analysis of speech movements
- Has led to collaborations within and outside CCL, e.g.
- New findings in the prosodic timing of an nearly extinct and surprisingly understudied regional variety of Swedish – Estonian Swedish – made it possible to start the completion of the Swedish Prosody Model by including Estonian Swedish compound intonation and contributed to an external project Grant for studying Estonian Swedish further
- Pilot studies of vocalisations in the domestic cat with the first acoustic-phonetic analyses of cat vocalisations with new collaborations and follow up studies in planning or start up phase
- Functional data analysis is now being used in other projects (now being connected to CCL)
- Has triggered multi-disciplinary research questions and ideas for new projects

**Why is this project interesting?** It is a well-known fact that there is an enormous amount of variation in how a language is pronounced. This variation is complex and multi-dimensional, and can be both linguistic and non-linguistic. The numerous types of variation in speech, such as regional, social, sex, age, and speaking style are difficult to investigate systematically, as it requires large sets of data. By recycling data from other studies and projects, and by focusing on a few specific research questions concerning temporal variation, we want to increase our knowledge of variation in speech, especially of timing and of crossmodal temporal coordination.

**How does this project relate to the CCL Core Ideas?** Most of the studies in this project relate to the CCL core theme *The temporal coordination of speech, gaze and gestures plays an important role for language comprehension and interpersonal communication.*

**Is the project cross-disciplinary and if it is, which disciplines are involved?**

It is cross-disciplinary in the sense that it brings together disciplines that normally do not collaborate in this way, including phonetics, general linguistics, speech therapy, zoology, ethology, musicology, and cognitive science.

**Progress since last report:** Design and preparation of the project/study of prosody in language acquisition, which will start in February 2013. Our main research question is: When learning a foreign language, how do we develop (improve?) our pronunciation of prosody? Susanne Schötz and Elisabeth Zetterholm (Linnéuniversitetet, Växjö) will serve as “house researchers” at St Petri school in Malmö, a collaboration with Forskningsnätet Skåne. Additional participants in this project are Victoria Johansson, Susan Sahyeli, and Joost van de Weijer. Pilot recordings of simultaneous articulatory, acoustic and manual gesture data have been carried out and evaluated with focus on optimising the equipment, method and execution to prepare for the projects/study temporal coordination in crossmodal production.

- Pilot study of South Swedish diphthongisation of /u:/ in order to prepare for a larger analysis of diphthongisations in Malmö, Gothenburgh and Stockholm Swedish (Johan Frid, Anders Löfqvist, Susanne Schötz)

Acoustic analysis of compound word accentuation in Estonian Swedish and also a very first acoustic comparison of compound word accentuation of Estonian Swedish and other Swedish dialects. (Eva Liina Asu, Tartu University and Susanne Schötz)

Acoustic pilot study of cat vocalisations (Fonetik 2012), combined with initial tests of different equipment, set-ups and techniques for recording high quality audio and video of communicative situations involving small pets (cats). This led to a Cat vocalisation project application submitted to Wallenberg 2012 (Susanne Schötz, Robert Eklund, LiU)

Pilot recording of articulatory movements during singing (related to the planned study/project Singer’s comfort with Frans Mossberg and Viveka Lyberg-Åhlander)

**Problems in the project:**

We are struggling to invite and include other disciplines in our project studies. So far it has been rather difficult to combine phonetic aspects of timing with other research areas in a multi-disciplinary environment like CCL. However, we are increasing our efforts, and have now found common denominators with musicology (Frans Mossberg), zoology (Gustav Peters, Bonn) and speech therapy (Viveka Lyberg-Åhlander).
Plans for the next semester and in the long term (incl. equipment needed):
Initial analyses of articulatory timing of vowels in three regional varieties of Swedish (together with the VOKART project).
Conduct the study of prosody in second language acquisition (together with students and teachers at St Petri High School in Malmö)
Continue to record Estonian Swedish dialects and start analysis of timing in intonation
Further explore Functional Data Analysis (FDA) as a method for speech analysis and resynthesis. FDA makes it possible to reduce the statistical analysis of a set of speech parameter contours in time, like f0, formants, intensity, on their own or together. This will build on our acquired experience of using FDA for speech movements.
Continue our efforts to find cross-fertilisations and new collaborations within and outside CCL using the Speaking In Time theme group as a platform.

Potential applications (diagnostic tools, methods for other research areas, for society):
Tools for pronunciation training in second language learning with focus on prosody
Public database of Estonian Swedish dialectal speech samples at the Aiboland Museum, Haapsalu, Estonia
Completion of the SweDia 2000 dialect project by including Estonian Swedish dialects

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Conferences, workshops, lectures, invited talks:
- Fonetik 2012, Department of Philosophy, Linguistics and Theory of Science, University of Gothenburg
- Nordic Prosody XI, Tartu, Estonia
- Linguistics seminar, Lund University: Purrs and Miaows: Two phonetic studies of cat vocalisations. 22 November 2012
- Invited lecture about our research in CCL and Humlab, St Petri High School in Malmö, 21 January 2013: Voices, curves and models: doing research on language and pronunciation.

Please describe collaborations within CCL (name of researchers, research question):
- Temporal coordination in crossmodal production (Marianne Gullberg).
- L2 learning of articulatory movements (Marianne Gullberg) (Potential)
- Language production (Speaking & Writing) in Time (Victoria Johansson, Roger Johansson, Åsa Wengelin) (Potential)
- Cat vocalisations and cat cognition (Rasmus Bååth) (Potential)

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question):
- Exotic vowels in Swedish – an articulographic study of palatal vowels [VOKART] (VR 2011-2013)
- Funktions- och produktionsbaserad modellering av svensk prosodi [FuPro] (VR 2010-2013)
- Haskins Laboratories, New Haven, CT, USA
- Estonian Swedish Language Structure [ESST] (VR 2013-2016) (Eva Liina Asu, Tartu University, and Henrik Rosenkvist and Maja Andréasson, University of Göteborg)
- PETCOM: Human – Pet Communication (Robert Eklund, LiU, and John Ohala, Berkeley)
- CATVOC: Recording Techniques for Domestic Animals (Technical Acoustics/LTH)
- Singer’s Comfort (Viveka Lyberg-Åhlander, Jonas Brunskog, Frans Mossberg, Lund University)
- Prosodic Timing in Speech and Gestures (Marianne Gullberg, Maria Graziano, Gilbert Ambrazaitis, David House, KTH, Ineke Mennen, Bangor)
Project 16. Digitalized TROG-2 in Swedish – The Influence of Speech Rate on Sentence Comprehension

*Project leader: Kristina Hansson*

**Project members:**
Birgitta Sahlén, Department of Logopedics, Phoniatrics & Audiology, Lund University
Agneta Gulz, Cognitive Science, Lund University (CCL financed)
Magnus Haake, Department of Design Sciences, Lund University (CCL financed)
Kristina Hansson, Department of Logopedics, Phoniatrics & Audiology, Lund University (CCL financed)
Viveka Lyberg-Åhlander, Department of Logopedics, Phoniatrics & Audiology, Lund University
Jonas Brännström, Department of Logopedics, Phoniatrics & Audiology, Lund University
Marianne Gullberg, Centre for Languages and Literature, Lund University

**Time frame:** The project started in fall 2009. It is now more or less finished and will take the form of a post-doc project focusing on teacher’s voice quality and children’s comprehension and cognition in different listening contexts (noise). Project start planned to May 1st 2013. It merges with project 9 "Narratives and the Impact of Timing of Gestures and speech on an Addressee" and the theme group “Multimodal comprehension”.

**Aim of project/main objective/main hypothesis:** The aim of the project is to create a Swedish version of the digitalized TROG-2 (Bishop, 2003) and to use this to investigate the influence of speech rate and voice quality on sentence comprehension in typical and clinical (children with or at risk for language impairment) populations. A further aim is to explore the role of working memory capacity in processing speech under different speech rate and voice quality conditions.

**How does this project contribute to an “added value” in the CCL environment?** It contributes to added value by using tools and competence in one area (cognitive science, linguistics) to meet the needs in another (logopedics), and, reversely, to provide data and research questions from one area (logopedics) to apply to the tools and competences in the other (cognitive science, linguistics), so that they can be further developed.

**Why is this project interesting?** Research on children with specific language impairment (SLI) shows that they tend to be slower than controls on both verbal and nonverbal tasks, evidenced as longer reaction times. "The generalized slowing” hypothesis (Kail, 1994) maintains that those children are slower than peers with typical language development at each step of a given task. Usually language comprehension tests are presented by the individual speech-language pathologist in real time. We know nothing about how individual variation in how the test is presented, in speech rate, voice quality and in other aspects of speech behaviour influence the child’s performance. Exploring how speech rate and voice quality influences sentence comprehension in children, and how the effect of these factors interacts with working memory capacity and executive function will thus have important clinical implications for both assessment of and intervention for language impairment. A digitalized version of TROG-2 with different speech rates will offer a more strictly standardized assessment instrument to (Swedish) speech-language pathologists.

**How does this project relate to the CCL Core Ideas?** This project relates to two of the core themes: first with “Language learning is strongly dependent on other cognitive processes” in that we take into account cognitive skills like working memory and executive functions for the influence to speaker factors for comprehension”. To some extent it also relates to “The temporal coordination of speech, gaze and gestures plays in important role for language comprehension and interpersonal communication”, since it highlights comprehension and how the speaker’s behavior influences.
Is the project cross-disciplinary and if it is, which disciplines are involved? The disciplines involved are: cognitive science, logopedics, linguistics and design sciences.

Progress since last report: A group of students in speech-language pathology made a master's thesis during spring 2012, where they investigated the importance of voice quality (based on earlier findings that voice quality of teachers influence language comprehension of children) under normal speech rate. 85 children 8-9 years old performed TROG-2 with either a normal or a dysphonic voice reading the test items. The results indicate more self-corrections in children who received TROG-2 with a dysphonic voice, larger effects in more grammatically complex test items and that cognitive function was more important for language comprehension in the group who listened to the dysphonic voice.

Problems in the project: None.

Plans for the next semester and in the long term (incl. equipment needed): To have two papers published, one about TROG-2 and speech rate and one about TROG-2 and voice quality. Thereafter the project will be finished and the methods and results will form the basis for a post-doc project.

Potential applications (diagnostic tools, methods for other research areas, for society): We will propose to the editor of TROG-2 to offer the Swedish digitalized version of the test in the different speeds and with reference data from children aged 5-6.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):


Lyberg-Ahlander, V., Haake, M., Schöttz, S. Hanson, K., Gulz, A, Sahlén B. Teachers’ voice quality and childrens language comprehension (ms to be submitted)

Conferences, workshops, lectures, invited talks:


Lyberg-Åhlander, V., Haake, M., Brännström, J., Schöttz, S., Hansson, K., & Sahlén, Fördrag vid Pufendorf-institutet , mars 2013

Please describe collaborations within CCL (name of researchers, research question):
The group working with working memory and language comprehension under different timing conditions (Magnus Lindgren or Mikael Johansson). This work is also useful for the group working with gestures and virtual agents (Marianne Gullberg and Agneta Gulz). Collaboration with post-doc project starting spring 2013 'Multimodal communication'.

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question):
Speech-language pathologists working with children with language impairments. Audiology: Jonas Brännström, LU; Environmental technology (room acoustics) Robert Ljung, Örebro University; Psychology: Sverker Sikström, LU (similar project on children with ADHD).

Project leader: Kristina Hansson

Project members:
Birgitta Sahlén, Department of Logopedics, Phoniatrics & Audiology, Lund University
Sverker Sikström, Department of Psychology, Lund University
Rasmus Arning Bååth, Cognitive Science, Lund University (CCL financed)
Simone Löhndorf, Centre for Languages and Literature, Lund University (CCL financed)
Kristina Hansson, Department of Logopedics, Phoniatrics & Audiology, Lund University (CCL financed)

Time frame: The project started the fall 2009 and we plan to finish in 2014.

Aim of project/main objective/main hypothesis: The purpose of this project is to apply Latent Semantic Analysis (LSA) to quantify the semantic content in narratives from children with typical and impaired language development in order to evaluate if it can be used as a tool to assess the development of semantic representations and if it can be used to identify children with language impairment.

How does this project contribute to an “added value” in the CCL environment? It contributes added value to CCL by being a collaboration between several of the academic disciplines involved (cognitive science, psychology, linguistics and logopedics). It combines the need for assessment tools for semantic skills within logopedics (and linguistics) and the need for data to work with to develop the use of LSA (cognitive science and psychology).

Why is this project interesting? Most studies of typical and impaired language development focus on form (phonology, grammar) and in studies on content there is a bias towards studying lexical skills on a word-by-word basis in experimental studies. Arguably the inclusion of multidimensional semantic features may yield a more accurate description of linguistic maturity in data on the text level. So far, no assessment instrument exists that can capture this aspect of language skills. This collaboration is not likely to have occurred if it had not been for CCL.

How does this project relate to the CCL Core Ideas? The project is directly related to the core theme “Modelling and quantifying semantic development in children is a rich resource for diagnosis and intervention”.

Is the project cross-disciplinary and if it is, which disciplines are involved? The disciplines involved are: Cognitive science, linguistics, logopedics and psychology

Progress since last report: Our manuscript has still not been accepted and we have submitted a further revised version recently. We have also analysed another type of data from some of the children included in the first and second study, word flow data (“Say as many animals as you can come up with”). The purpose was to compare the results of LSA analysis (using the variables coherence and variability) with results from traditional analysis of this kind of data, and to compare children with language impairment with controls. We found some association between the LSA-variables and the traditional variables, and a tendency for children with language impairment to have lower variability than controls. Even if the results are tentative, they further strengthen our view that this kind of analysis has something important to contribute, but it needs refinement.

Problems in the project: None.
Plans for the next semester and in the long term (incl. equipment needed): We have made an analysis of LSA prediction of language impairment and will finalize writing and submit a manuscript on this topic. Possibly we will also look more into the analysis of word flow data from children with and without language impairment.

Potential applications (diagnostic tools, methods for other research areas, for society): Use of LSA for assessment of semantic maturity in research focusing on linguistic and/or cognitive skills/problems in different groups of language learners/users. Possibly also the use of LSA as a diagnostic tool for identifying children with language impairment.


Conferences, workshops, lectures, invited talks:

Please describe collaborations within CCL (name of researchers, research question): Possible collaboration with Peter Gärdenfors in word on the development of adjectives (Peter Gärdenfors.) in children with typical development and children with hearing impairment and also with a post-doc project on action verbs (Peter Gärdenfors).

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): Researchers in the area of hearing impairment from HEAD, (Ulrika Löqvist) Linköping and language impairment from KI (Nelli Kalnak). NK is already collaborating with us on narratives and word flow data.
Project 18. Phonological intervention for children with hearing impairment (HI) with hearing aid (HA) or cochlear implant (CI)

Project leader: Birgitta Sahlén

Project members:
Birgitta Sahlén, speech pathology
Magnus Lindgren, neuropsychology
Susanne Schötz, linguistics
Marianne Ors, neurophysiology
Cecilia von Mentzer (doctoral student financed by FAS, speech pathology
Inger Uhlén, Karolinska Institutet, Sweden, audiology
Björn Lyxell, Linköping University, Sweden, cognitive psychology

Time frame: 2009-2014

Aim of project/main objective/main hypothesis: To study feasibility and effectiveness of a computer-based intervention program for children with hearing impairment (HI). The program (Graphogame) was originally developed by prof Heikki Lyytinen, Univ of Jyväskylää for children with dyslexia. It has been translated and adapted to Swedish by Schötz/Sahlén. Our hypothesis is that by strengthening the correspondence between phonemes - graphemes, children with HI will develop their phonological skills.

How does this project contribute to an 'added value' in the CCL environment? By being a multicenter study, incorporating researchers at Linköping university and Karolinska Institutet. It combines the need for more knowledge about cognitive development in children with HI and the development of intervention tools for children with language development under adverse circumstances.

Why is this project interesting? Very few intervention studies are reported for children with HI. Ten years of research in the area of paediatric cochlear implants by Sahlén's (Lund) and Lyxell’s groups (Linköping university) point in the same direction: Phonology is particularly vulnerable in children with HI and in children with CI to a greater extent than in children with HA. This may explain why early, fairly good, reading skills in this group seem to plateau when the children reach their teens. Children with CI seem to rely more on visual/orthographic strategies in reading, which may lead to ‘resilient’ reading later on when switching flexibly between phonological and orthographic strategies is required.

How does this project relate to the CCL core themes? The project is related to core theme 2 Language learning is strongly dependent on other cognitive processes

Is the project cross-disciplinary and if it is, which disciplines are involved? Yes. It involves cognitive psychology, neuropsychology, linguistics, speech pathology, audiology, neurophysiology

Progress since last report: Doctoral student Cecilia von Mentzer had her 60% seminar in December, 2012. Three manuscripts are still in progress, the two first papers on effects of training on phonology and on effects of training on reading and working memory are under revision. A third paper on changes in ERPs (MMN’s) during intervention is still under preparation.

Problems in the project: The project is a joint venture between three universities (Karolinska, Linköping, Lund), the geographic distance has been a challenge and also the fact that most researchers do not have financial support and therefore limited time for the project.
Plans for the next semester and in the long term (incl. equipment needed): 2-year follow-up testings of children will start fall 2013. A joint stay for the research group in Croatia (Brac) will take place again in May 2013 in order to finalize revisions of papers. ERP-data (N400) will be analyzed.

Potential applications (diagnostic tools, methods for other research areas, for society): Graphogame is an evidenced-based intervention tool for children with dyslexia. We have so far strong indications for the effectiveness for children with CI. The Grapho-game could also be a useful tool in SLI intervention and in the future to boost literacy development in less developed countries. Applications for mobile phones are considered.

Publications with status change since last report


Conferences, workshops, lectures, invited talks: Several posters and lectures have been presented by Cecilia von Mentzer. BS is constantly reporting results from the study in her lectures in the speech pathology and audiology programs, LU, at all levels and in meetings with parent organizations and SPSM. Results are also reported at the national network meetings for researchers in the area of paediatric cochlear implants. Birgitta Sahlén presented results as invited speaker at the ONICI, Antwerpen, 2012

Collaborations within CCL: No, except from CCL researchers directly involved in the project.

Collaborations outside of CCL
The project is a multicenter study, why we have collaboration with researchers in HEAD (Linneaus center, Linköping), i.e., Björn Lyxell’s group and with Karolinska Institutet (Inger Uhléns group).
Project 19. Simulated feedback control of learning

Project leader: Germund Hesslow

Project members: Riccardo Zucca, Anders Rasmussen, Fredrik Johansson, Germund Hesslow

Time frame: 2010-2014

Aim of project/main objective/main hypothesis: To understand feedback control of learning in the context of classical conditioning in the cerebellum. We will try to replace a neural circuit with a computer simulation in a functioning cerebellum.

How does this project contribute to an “added value” in the CCL environment?

Why is this project interesting? The project will elucidate mechanisms underlying learned timing, particularly feedback control of such learning. The project also implements a method for integrating a simulation of neural circuit in a functioning brain.

How does this project relate to the CCL Core Ideas? It directly addresses timing mechanisms and it employs simulation techniques for doing so.

Is the project cross-disciplinary and if it is, which disciplines are involved? The project utilizes techniques from AI and modeling and integrates them with neurophysiology.

Progress since last report: The technique and the software have been completed. Some data has been collected but not sufficient for publication.

Problems in the project: Data collection slow because the project is technically difficult and for lack of man-power. Riccardo Zucca has gone back to Barcelona and there is no one else who has been able to pursue it.

Plans for the next semester and in the long term (incl. equipment needed): Riccardo Zucca will visit Lund in the spring of 2013 in order to finish data collection.

Potential applications (diagnostic tools, methods for other research areas, for society): N/A

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted): N/A

Conferences, workshops, lectures, invited talks: Abstract presented at Society for Neuroscience meeting 2012

Please describe collaborations within CCL (name of researchers, research question): N/A

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): This is a direct collaboration between the neurophysiologists in Lund and the Pompeu Fabra University in Barcelona.
Project 20. Learning of timing in the cerebellum

Project leader: Germund Hesslow

Project members: Fredrik Johansson, Dan-Anders Jirenhed, Anders Rasmussen, Germund Hesslow, Riccardo Zucca

Time frame: 2010-2014

Aim of project/main objective/main hypothesis: To investigate the temporal control of cerebellar behavior in general and eyelid conditioned responses in particular.

How does this project contribute to an “added value” in the CCL environment? The project merges skills and ideas from artificial intelligence with basic neuroscience. It would not have occurred without CCL and collaboration with research group in Barcelona to which Riccardo Zucca belongs.

Why is this project interesting? The cerebellum is hypothesized to be important in achieving precise temporal control of many behaviors and an outstanding question for decades has been how the production of cerebellar conditioned responses is controlled. We have discovered a cellular response in the cerebellum that drives the behavior and we have in our reach an understanding of the cellular bases of the clock mechanism.

How does the project relate to the CCL Core Ideas? It directly addresses timing mechanisms of the cerebellum

Is the project cross-disciplinary and if it is, which disciplines are involved? No

Progress since last report: We have succeeded in obtaining conditioned responses in Purkinje cell using direct parallel fibre stimulation. This demonstrates that the clock mechanism is located in cells in the cerebellar cortex. We are about to publish these results and we have begun experiments to determine which of the cortical cells that are involved.

Problems in the project: There are no problems except that data collection is slow because the project is technically difficult.

Plans for the next semester and in the long term (incl. equipment needed): The immediate plan is to use pharmacological techniques to determine which cells are involved. Specifically, we intend to use GABA-blockers and drugs, which interfere with cannabinoids.

Potential applications (diagnostic tools, methods for other research areas, for society): No direct applications, but we expect to learn things about the functions of cannabinoids in the brain.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Conferences, workshops, lectures, invited talks:

Abstract presented at Society for Neuroscience meeting 2012

Please describe collaborations within CCL (name of researchers, research question): None
Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): We have initiated collaboration with Prof Peter Zygmunt in Lund who is an expert on cannabinoid pharmacology.
Project 21. Cognitive architecture/Internal simulation

Project leader: Magnus Johnsson

Project members: Magnus Johnsson, Christian Balkenius, Rasmus Bååth, Peter Gärdenfors, Germund Hesslow, Stefan Winberg

Time frame: The project started in 2009 and is expected to last until the end of 2013.

Aim of project/main objective/main hypothesis: To develop a bio-inspired self-organizing cognitive architecture which with increasing degree of detail and scale can help to increase the understanding of internal simulation. The modeling is done primarily at system level, which means that we can pursue an overall structural similarity between models and the systems in the brain that are modeled. For individual systems a functional similarity is sought due to computational limitations, e.g. a Self-Organizing Map (SOM) can be used to approximate a cortical area.

Why is this project interesting? The project is interesting because we expect it to increase understanding of internal simulation, anticipation, cross-sensory integration, memory, etc. Furthermore, it is expected to enable a better understanding of how more complete cognitive systems can function and evolve over time, since we aim at a complete self-organizing cognitive architecture, and how a cognitive architecture can be integrated with physical robots. The cognitive architecture can be used to study various cognitive abnormalities such as autism.

How does this project relate to the CCL Core Ideas? This project relates to the CCL core theme that says that internal simulation of perception and action is a fundamental mechanism for cognitive function. The project aims at models and architectures capable of internal simulations.

Is the project cross-disciplinary and if it is, which disciplines are involved? The project is interdisciplinary in the sense that the project members represent different academic fields, namely cognitive science, computer science and neuroscience.

Progress since last report: The project has started to investigate how to implement the understanding of intentions and how internal simulation of perceptions and actions could be a part of that.

Plans for the next semester and in the long term (incl. equipment needed): Continued investigations about how to implement the understanding of intentions and how internal simulation of perceptions and actions could be a part of that.

Potential applications (diagnostic tools, methods for other research areas, for society): Some examples of potential applications:

- Improved models of memory (neuropsychology)
- Models/cognitive architectures can potentially be used for simulation/diagnoses of cognitive abnormalities (eg autism)
- Developed neural networks and other algorithms has wide potential applications, eg machine learning, data mining, medical diagnosis, robotics
Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):


Conferences, workshops, lectures, invited talks:

Participation in the conference *Biologically Inspired Cognitive Architectures 2012*, Palermo, Italy.
Project 22: Interplay between language and pictures in communication

*Project leader: Jana Holsanova*

**Project members:** Jana Holsanova, Richard Andersson, Kenneth Holmqvist

**Time frame:** 2009–2013

**Aim of project:** The overriding goal is to investigate how speakers integrate language and pictures in communication. Do pictures contribute to a better common ground and to a “meeting of minds”? Do they activate concepts, do they make production and/or perception easier? Can partners better predict/simulate the others mind? Can we bridge the psycholinguistic tradition (visual world paradigm) and the conversation analysis tradition? The goal of the project is to both broaden the current psycholinguistic discussion (integrating neglected areas from conversational analysis) and to expand on the experimental evidence in favor of more naturalistic set-ups.

Another goal is to analyze the interplay between visual information retrieval and content structuring of language production flow. While there is a growing body of psycholinguistic experimental research on mappings between language and vision on a word and sentence level, there are almost no studies on how speakers perceive, conceptualize and spontaneously describe complex visual scenes on higher levels of discourse. We investigate the dynamic process of scene inspection, the process of scene description and cognitive processes underlying both. What do we attend to visually when we describe something verbally? How do we construct meaningful units of a scene during the scene discovery?

**How does this project contribute to an ‘added value’ in the CCL environment?** The project both contributes and benefits from the cooperation within CCL.

**Why is this project interesting?** The sensory modalities have typically been lacking the psycholinguistic language models. However, this has started to change in later years (e.g. "coordinated interplay account (CIA)" (Knoeferle &. Crocker, 2006), but these models are strictly focused on resolving referential expressions with visual counterparts in the world. We believe there could be other effects that have been neglected with this view. For example, unreferenced visual objects may still contribute to the "common ground" of interlocutors, provide ideas for conversational topics, constrain non-(explicitly-)referential expressions, and more. This would help broaden the current psycholinguistic research and help avoid a research tradition stuck with overly narrow mechanistic interpretations on the role of vision and language.

**How does this project relate to the CCL Core Ideas?** This project is directly linked to the core theme 4: The temporal coordination of speech, gaze and gestures plays an important role for language comprehension and interpersonal communication.

**Is this project cross-disciplinary and if it is, which disciplines are involved?** This project consists of people from Cognitive science and the Humanities laboratory. Cognitive science is per definition cross-disciplinary and this project primarily combines cognitive psychology, neuroscience and linguistics.

**Progress since last report:**
- Richard Andersson has finished and defended his PhD thesis "Language and Vision. Using visual information in real-world language situations" on April 20th 2012. The faculty opponent was prof. Zenzi Griffin.
- Research results have been presented at SemDial conference (Los Angeles) and ECEM (Marseille).
Richard Andersson has spent three months at the Max Planck Institute for Psycholinguistics in Nijmegen, the Netherlands (2012-05 -- 2012-08).
A conference paper resulting from this stay has been accepted:
A journal article based on the research in Nijmegen is under way.
Jana Holsanova has completed a special issue as guest editor of Visual communication journal (Sage), written an introduction to the volume and a joint article with Mårten Boeriis.
Jana Holsanova has been invited to write a chapter for the Routledge Handbook of Multimodal Analysis (completed in December 2012).
Jana Holsanova has been invited to write a chapter for the Handbook of Visual communication, Mouton - De Gruyter (completed in February 2013). Both chapter will be published during summer 2013.
Jana Holsanova contributed to the teaching book “Språket, människan och världen” that will be published at Studentlitteratur publishing house, Lund in summer 2013.
Richard Andersson, Jana Holsanova and Roger Johansson participated at the CCL conference in March 2013 and performed a demonstration of the eye tracking equipment and gave a number of popular presentations on the project topic for broad audiences.
Richard Andersson submitted an abstract to ECEM conference in Lund.

Problems in the project: The work with eye tracking and natural language processing in complex visual environments is connected to problems with the laborious transcriptions and laborious qualitative analyses of the conversational data and eye tracking data.

Plans for the next semester and in the long run: Future collaboration with other language–interested researchers within CCL in order to establish a firm understanding and integration of eye tracking in their research. Vision should be a part of all language models attempting to explain natural language processing.

Also, we plan a new project on the multimodal integration of spoken language and vision, in particular on the use of audio description of visual scenes for visually impaired audiences. Jana Holsanova has got a start-up grant for the project “Syntolkning och multimodalitet” from Philosophy department and the plan is to write a full research proposal.

Potential applications The results of our research can help to create models of gaze in natural conversation settings. The application areas are speech therapy, language processing in computers, HCI and augmentative and alternative communication (AAC). The challenge for the future is to develop and test multimodal language models for real conversations.

Publications with status change since last report:
Books

Peer reviewed journal articles


### Peer reviewed papers in conference proceedings


### Edited volumes


### Book chapters


### Conference papers


### Teaching materials


### Popular science articles/ presentations


Collaborations within CCL, actual and potential:
Peter Gärdenfors (meetings of the mind), Kristina Hansson (conversational analysis), a close collaboration with Olof Sandgren (conversation analysis, alignment).

Collaborations outside of CCL, actual and potential:
Herb Clark (Stanford), Susan Goldin-Meadow (Chicago), Odette Scharenborg (Radboud University) and the EU network Investigating Speech Perception in Realistic Environments (INSPIRE).

Membership
Jana Holsanova has been elected the Vice Chair (2011-2013) /Chair Elect (2013-2015) for the Visual Communication Division by the International Communication Association. She is also the Chairman of the Swedish Braille Authority (Punktskriftsnämnden), Swedish Agency for Accessible Media (MTM).
**Project 23. Localization of verbs in the brain**

*Project leader: Magnus Lindgren*

**Project members:** Magnus Lindgren, Peter Gärdensfors, Tor Endestad, Janne von Koss Torkildsen,

**Time frame:** The project started in 2011 and is expected to last until 2016.

**Aim of project/main objective/main hypothesis:**
Previous work by, among others, Pulvermüller and his group has shown that sensorimotor areas play a crucial role in the representation of motion-related verbs. These findings have been extended to some other verbs by Kemmerer et al. A general division of verbs into manner verbs and result verbs has been proposed in linguistics. This division is supported by the semantic analysis in terms of conceptual spaces that has been developed by Gärdensfors.

The aim of the project is to directly investigate the contrast between the neural correlates of verbs denoting actions (manner) and verbs denoting consequences of actions (results). In our first fMRI experiment, we used a paradigm where each trial consisted of a triangular array of three verbs, one at the top and two at the bottom. The participant's task was to decide, using a response button, which of the two bottom verbs was more similar in meaning (part 1) or more different in meaning (part 2) compared to the top verb. For each trial, the three verbs came from the same semantic class (either manner, result motion or result property), and the verb that differed the most from the others in meaning was only moderately different from the other two.

Preliminary results indicate that the contrast between result versus action verbs show significantly more activation in left Supplementary Motor Area, Inferior Frontal Gyrus insula, left Parietal Lobule (hP3)) and Calcarine and Lingual Gyrus bilaterally. The reversed contrast of action versus result did not show any significant activations.

**How does this project contribute to an “added value” in the CCL environment?** The project is a result of cooperation within CCL that then has been extended to international collaboration. It relates closely to several of the other CCL projects.

**Why is this project interesting?** The contrast between manner and results verbs, which is in focus of much linguistic research has not been previously studied by brain imaging methods. If our experiments show clear results, this will have far-reaching implications for future studies of the brain activations of verb processing.

**How does this project relate to the CCL Core Ideas?** The study is based on the CCL core idea that *acquisition of concepts and language is strongly related to other cognitive processes and to that internal simulation of perception and action is a fundamental mechanism for cognitive function.*

**Is the project cross-disciplinary and if it is, which disciplines are involved?** The research on semantics requires competences from linguistics, cognitive science and neuropsychology.

**Plans for the next semester and in the long term (incl. equipment needed):** First of all, the data from the first experiment must be analyzed and written up. We then plan to design further experiments based on semantically motivated division of verb classes.
Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted)
Project 24: Learning associations of simulated stimuli

Project leader: Germund Hesslow

Project members: Germund Hesslow, Karolina Löwgren, Henk-Jan Boele

Time frame: The project started in August 2012 and is expected to last until 2015.

Aim of project/main objective/main hypothesis: There are many instances where simulated or imagined stimuli seem to be able to function in a way that resembles real stimuli. Imagining or recalling tragic episodes can elicit anxiety, imagining physical exercise can elicit cardiovascular adaptations. The purpose of the present project is to use the eyeblink conditioning technique employed in other projects but use an imagined corneal stimulus as the unconditioned stimulus instead of an air puff. The first step is to determine if this is possible at all. Later, we will want to investigate details of this learning such as the extent to which it resembles standard conditioning.

How does this project contribute to an “added value” in the CCL environment? The project merges two core themes; simulation, the role of the cerebellum in learned timing.

Why is this project interesting? This project explores the power of internal simulation in learning. It will be relevant to understanding learning mechanisms. It may also have practical clinical applications in improving techniques for rehabilitating stroke patients because it represents a novel approach to relearning motor skills. There is also a possible application to athletic training where the value of simulated training has long been recognized.

How does this project relate to the CCL Core Ideas? The project merges two core themes; simulation, the role of the cerebellum in learned timing.

Is the project cross-disciplinary and if it is, which disciplines are involved? The project combines ideas and competences from neurophysiology, psychological learning theory and cognitive science of internal simulation.

Progress since last report: The project is new and has not been reported before.

Problems in the project: The main problem is man power. There are also problems of experimental design. The timing of the imagined air puff (the unconditioned stimulus) is difficult to control.

Plans for the next semester and in the long term (incl. equipment needed): Data will be collected by Karolina Löwgren and by students. Because this is subsidiary to Karolina Löwgrens PhD project, it will have lower priority than her other project.

Potential applications (diagnostic tools, methods for other research areas, for society): Development of training techniques in stroke rehabilitation and sports.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Please describe collaborations within CCL (name of researchers, research question): Germund Hesslow from the Dept of experimental medicine and Karolina Löwgren from speech therapy department.

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): The project uses equipment developed in
collaboration with the research group led by Chris de Zeeuw in Rotterdam. The study design will also be developed in collaboration with Hen-Jan Boele from Rotterdam.
Project 25. The relationship between eye-movements and memory

Project leader: Mikael Johansson

Project members: Mikael Johansson, Roger Johansson, Richard Dewhurst

Time frame: 2012-

Aim of project/main objective/main hypothesis: The theoretical objective of this project is to examine the role of eye movements during memory encoding and retrieval. The methodological objective is to develop an experimental paradigm where eye-tracking is used to study these questions and to combine this method with EEG/ERP measures of brain activity. Specific questions that we will focus on in this project revolve around: 1) how and when the oculomotor system is engaged during memory formation and retrieval; 2) how eye-movements may affect memory performance and phenomenology; 3) to what extent eye-movements may assist mnemonic control mechanisms, for example, in selecting target memories at the expense of competing memories, and in the specification of the cues used to query memory; and 4) can eye movements be used as a behavioural correlate of memory even if overt reports are withheld or incorrect (i.e., memories without conscious awareness)?

How does this project contribute to an “added value” in the CCL environment? This project started as collaboration between Mikael Johansson and project 8 (eye movements and mental imagery) but has now developed into a separate project with novel research questions. This project is a direct consequence of collaborations within the CCL environment and would not have happened without it.

Why is this project interesting? Experience from everyday life constantly reminds us that our memories often are a subject of distortion. We frequently retrieve inaccurate information and sometimes completely misremember properties of past events. This may lead to annoying and embarrassing situations, such as, where we forget conversations we have previously been involved in and people we have bumped into. However, distorted memories can also have more serious consequences, for example, in situations where an eyewitness is to identify the perpetrator of a crime or testify about details of a crime scene. Consequently, developing sensitive and reliable methods to investigate memory retrieval are an important undertaking with a large potential for practical applications. The advantage of investigating these aspects by means of eye-movement measures is twofold. First, the sensitivity of eye-movement measures has been demonstrated in previous studies of both explicit and implicit memories. Second, eye-tracking constitutes an unobtrusive method that can be recorded together with other techniques, such as verbal protocols and EEG/ERP to further disambiguate the data. In addition to the abovementioned potential practical applications, the project will provide valuable information about the role of eye-movements in memory formation and retrieval. While past research suggests that eye-movements may mirror retrieval from memory, it is currently a hot topic of debate if and how eye-movements play a causal role in influencing memory retrieval.

How does the project relate to the CCL Core Ideas? This project is primarily linked to the core theme: Internal simulation of perception and action is a fundamental mechanism for cognitive function. This idea is elementary for underlying theories of ‘cortical reinstatement’ and ‘encoding specificity’. Future studies within this project are also related to the core theme: Language learning is strongly dependent on other cognitive processes.

Is the project cross-disciplinary and if it is, which disciplines are involved? This project consists of people from Psychology and Cognitive science. Cognitive science is per definition cross-disciplinary and this project depends on theories from cognitive psychology, neuroscience and linguistics.
Progress since last report: No previous report.

Problems in the project: None so far.

Plans, for the next semester and long term: We are currently recruiting a two-year full-time researcher at a post-doctoral level to the project. The opening was published online April 3 and the last day of applying is May 31. Also, Roger Johansson is organizing a symposium on eye movements during memory retrieval at this year’s European Conference on Eye Movements (ECEM). Top international researchers that have conducted contemporary research on eye movements during memory retrieval will take part in this symposium.

Potential applications (diagnostic tools, methods for other research areas, for society): Besides informing current theories of memory, the present results may have implications for mnemonic strategies and could potentially assist populations with retrieval impairments. The present research will also be of potential value in more applied settings, such as in forensic contexts, where independent and objective measures of memory content are of great importance.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):

Peer reviewed journal papers

Peer reviewed papers in conference proceedings

Conferences, workshops, lectures, invited talks:
• Johansson, R. (2013). Eye movements to “nothing” have an active role during visuospatial memory retrieval. The 55th Conference of Experimental Psychologists (TeaP 2013), University of Vienna, Austria, March 24, 2013.
• Johansson R., & Johansson M. (2012). The relationship between eye movements and memory. Presentation during the visit of the Scientific Advisory Board to the CCL research environment, 10-11 April 2012.
Media & popular presentations


Collaborations within CCL: Germund Hesslow, Magnus Johnsson (simulation theory, computational models, robotics) Jana Holsanova (mental imagery, spatial cognition, visual communication).

Collaborations outside of CCL: Daniel Richardson (University College London), Georg Jahn (Universität of Greifswald), Agnes Scholtz (Chemnitz University of Technology), Fred Mast, Corinna Matarelli (Institut für Psychologie der Universität Bern), Dragana Micic, Howard Ehrlichman (Queens College and the Graduate Center of the City University of New York), Maryam Fourtassi (Centre de recherché en neuroscience de Lyon), Anthony Wagner (Stanford University).
Project 26. Exploring and supporting metacognitive capabilities in 3-5 year olds by means of a digital learning-game

Project leader: Agneta Gulz

Project members
Magnus Haake, Department of Design Sciences, Lund University
Agneta Gulz, Cognitive Science, Lund University
Birgitta Sahlén, Department of Logopedics, Phoniatrics & Audiology, Lund University
Richard Andersson, The Humanities Lab / Cognitive Science, Lund University
Magnus Lindgren, Department of Psychology, Lund University
Peter Gärdenfors, Cognitive Science, Lund University

Time frame: The project started 2013 as an independent line of research related to one of the major digital platforms in the Educational Technology Group at LU/LiU. The initial inspiration for the project can be traced to Josef Perner’s CCL guest lectures in May 2012. Its foreseen duration in a first phase is 2013 and 2014.

Aim of project/main objective/main hypothesis: The project’s overall focus is on the development of metacognition in 3-5 year old children, and it has three different strands. Strand one explores: (i) whether playful linguistic training involving active production of mental verbs influences the development of a theory of mind (ToM) in Swedish 3-5 year olds, as has been shown in Italian and American 3-5 year olds, (ii) if and how the potential effects differ between children with a weak and strong initial ToM. Strand two explores: (i) to what extent 3-5 year olds keep their focus on a digital social character – their digital adept – in a digital learning game when presented with distracting visual stimuli; (ii) if their ability/inclination to keep their focus relates to their development level of ToM; (iii) if their ability/inclination to keep their focus relates to their development level regarding executive control, and (iv) whether a well-developed ToM in this case can “compensate” for less developed executive control functions and vice versa with respect to their ability/inclination to keep their focus on the digital social character. This second strand involves eye-tracking methodology. Strand three, finally, explores the relation between: (i) children’s developmental level of ToM, where abilities to think about other’s minds are probed, and (ii) children’s developmental level as to their abilities to think and reason about their own learning and problem solving, that is to think about their own mind, in particular as a learning mind. Both (i) and (ii) in strand three regard metacognitive capabilities. The main objective is to connect the two. All three strands – to various degrees – exploit a research instrument in the form of a digital learning game, in which the child acts as teacher and instructs and guides a digital tutee or protégée.

How does this project contribute to an “added value” in the CCL environment? The project has emerged thanks to the CCL environment. The studies involved could not have been designed and cannot be carried through without the combination of different experts with their respective knowledge and skills, which the CCL environment contains.

Why is this project interesting? The area of “human development of a theory of mind” is arguably at the very core of cognition, communication and learning. Although research on children’s mentalizing abilities has become a large and fast-growing area of research within cognitive developmental psychology, there are many open questions. We hope to contribute to the answering of some of them. In addition, with strand 3 we aim at contributing to a novel research front in the gap between encompassing research fields that both focus on development of metacognitive capabilities but that are rarely brought together ((i) ToM-capabilities in children, targeting thinking about other’s minds and (ii) children’s thinking about themselves as learners and problem solvers and about cognitive control strategies and the like). Alongside with the basic research motives for the project, there are application-oriented motives. The combined results from strand 1 and 2 will be used for the design of digital play-and-learn games.
for pre-schoolers that can support the development of ToM and socio-cognitive abilities. It is also well established that children who fail in school often have weakly developed meta-cognitive abilities, whereas the successful children are strong in this respect. Increased knowledge on the development of these capabilities, including the conception of oneself as a learner, is therefore of importance. If we at an early stage can identify and support children who are weak or slow in this development we may positively influence their chances of future learning inside and outside of the school context.

How does this project relate to the CCL Core Ideas? This project does not in any direct way relate to the CCL core themes – yet it is arguably at the core of cognition, communication and learning (see above).

Is the project cross-disciplinary and if it is, which disciplines are involved? The disciplines involved are: cognitive science, learning science, psychology, logopedics, linguistics, design science and interaction design.

Progress since last report: The project started January 2013. Two studies are scheduled for spring-summer 2013, targeting strand one and strand two respectively. Around 60 3-5 year olds will participate in the two studies, conducted by two cognitive science master students: Anton Axelsson and Mette Clausen-Bruun.

Problems in the project:

Plans for the next semester and in the long term (incl. equipment needed): To guide and carry out the two studies mentioned above and hopefully work on publications in relation to their results. Work on grant applications.

Potential applications (diagnostic tools, methods for other research areas, for society): A central research instrument in the project is a digital play-and-learn-game for pre-schoolers where the child takes the role as teacher and shows a digital protégée how to solve tasks. The combined results from strand 1 and 2 will be used for further development of this play-and-learn game into a version, that together with teacher materials, can be used to support the development of ToM and socio-cognitive abilities. For society in broad the project has the following potential value. It is well established that children who fail in school often have weakly developed meta-cognitive abilities, whereas successful children are strong in this respect. Increased knowledge on the development of these capabilities, including the conception of one self as a learner, is therefore of importance. If we at an early stage can identify and support children who are weak or slow in this development we may positively influence their chances of future learning inside and outside of the school context.

Publications with status change since last report (indicate peer reviewed article, book, book chapter, conference paper, and status: published, in press, accepted, submitted):


Conferences, workshops, lectures, invited talks:

Please describe collaborations within CCL (name of researchers, research question):
The project is newly started, but with potential connections to projects and researchers working on child development in various respects.

Please describe collaborations with researchers or research teams outside of CCL (name of researchers, organization, research question): The project is related to a collaborative project run together with Dan Schwarz and Kristen Pilner Blair, School of Education, Stanford University. We plan cross-cultural investigations on how pre-schoolers understand so called Teachable-Agent based educational games and why, and on how they may profit from them; investigations that involve developmental issues from cognitive science.