The Structure of Cognitive Motion: From Analysis to Synthesis

CITEC, Bielefeld University
6–11 September 2010
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organizing committee

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orga cell phone: 0151–58548226
Welcome to CITEC!

The 2010 Inaugural Summer School on The Structure of Cognitive Motion is an exciting opportunity for graduate students from around the globe to learn about and discuss the latest research at the intersection of motion and cognition. The summer school will include workshops on practical, experimental and theoretical topics, plenary lectures by leading researchers, as well as discussion groups, evening lectures and much more. Details of all activities can be found in this brochure.

The Center of Excellence Cognitive Interaction Technology (CITEC) was founded at Bielefeld University as part of the Excellence Initiative of the German Federal Government and the state governments.

CITEC researchers envision a future with interactive tools that can be operated easily and intuitively, ranging from everyday objects to advanced humanoid robots. The technology of the future should adapt itself to human users, rather than forcing humans to adjust to the often cumbersome operation of the current equipment. Just as every human being automatically adapts his speech and actions to the addressee in order to be understood, technological systems should adjust their behavior to suit the needs of the operator.

In order to interact naturally with humans and to flexibly adapt to changing conditions, a system needs to be endowed with the corresponding cognitive abilities. Consequently, the study of the fundamental architectural principles of cognitive interaction – be it between humans or human–machine interaction – is the necessary pioneering work.

We believe that this dual goal of combining basic research with technological application in order to advance our understanding of cognition itself can only be realized through intense interdisciplinary cooperations. Ideally, this should involve drawing on the expertise of researchers from different backgrounds and cultures. We hope the CITEC Summer School Series will have a key role to play in fostering these cooperative ventures, and hence the school is intended to enable communication and collaboration between young researchers from all over the world. On behalf of the organizing committee, we welcome you to Bielefeld and hope you have a productive and exciting stay!
travel and accommodation information

student accommodation (ZiF)

From Bielefeld's main station you can either take a taxi to the ZiF (address: Wellenberg 1; approx. 10 Euro) or take the underground tram line 4 (destination "Universität" or "Lohmannshof"). To reach the tram station, you have to leave Bielefeld Main Station using the main exit (the side with the McDonalds restaurant) and go straight ahead for approx. 60 meters until you reach the entrance to the underground tram station on the left (marked by a big blue “U” sign). Once you have descended to the intermediary level and purchased your ticket to university at one of the automatic selling machines you can further descend to Platform 2, where tram Route 4 departs towards university (this tram has red labels). Leave the tram at “Universität” (fifth station from main station/"Hauptbahnhof"). Go up the stairs and straight on through the glass tunnel. At its end, you will see the university’s main building. Turn left into the avenue with benches on the left and the main building on the right. Go straight on until you see a red building in front of you and some stairs on your right side. Go up the stairs and straight on up the hill past the signpost with “ZiF” on it. Follow the signpost. ZiF is on a small hill, so you have to walk uphill the rest of the way. Cross the next street und keep on going up the hill. (There is another signpost). After a little while, there is an bigger street. Cross the street carefully and you will see a “ZiF” sign on your right. Beyond this sign, go upstairs and enter the main building. Someone from our organizers committee will be waiting for you. Walking the way from tram station to ZiF will take 10 to 15 minutes. In case you get lost, call this number: 0151-58548226
travel and accommodation information

speakers accommodation (Morgenbreede)

From Bielefeld's main station you can either take a taxi to the ZiF (address: Wellenberg 1; approx. 10 Euro) or take the underground tram line 4 (destination "Universität" or "Lohmannshof"). To reach the tram station, you have to leave Bielefeld Main Station using the main exit (the side with the McDonalds restaurant) and go straight ahead for approx. 60 meters until you reach the entrance to the underground tram station on the left (marked by a big blue “U” sign). Once you have descended to the intermediary level and purchased your ticket to university at one of the automatic selling machines you can further descend to Platform 2, where tram Route 4 departs towards university (this tram has red labels). Leave the tram at “Universität” (fifth station from main station/"Hauptbahnhof"). Go up the stairs and straight on through the glass tunnel. At its end, you will see the university’s main building.

Turn left into the avenue with benches on the left and the main building on the right. Go straight on until you see a red building in front of you and some stairs on your right side. Go up the stairs and straight on up the hill past the signpost with “ZiF” on it. Walk up the little hill till you arrive at the small street Morgenbreede. Turn left and cross the parking area. You accommodation is in the building with the colored windows: Morgenbreede 8. Insert your personal PIN code in the electronic postbox to get your room key.

In case of problems call our CITEC cell phone: 0151-58548226
## Schedule CITEC Summer School - *The Structure of Cognitive Motion: From Analysis to Synthesis*

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday, 6th</th>
<th>Tuesday, 7th</th>
<th>Wednesday, 8th</th>
<th>Thursday, 9th</th>
<th>Friday, 10th</th>
<th>Saturday</th>
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<tbody>
<tr>
<td>8:00 -</td>
<td>Breakfast</td>
<td>Breakfast in Main building, Cafete, opening at 8:00 a.m.</td>
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<td>8:45</td>
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<td>Welcome by CITEC Speakers</td>
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<tr>
<td>9:00 - 10:30</td>
<td>Plenary Lectures in H 16</td>
<td>Stefan Schaal</td>
<td>David Wolpert</td>
<td>Bettina Bläsin</td>
<td>Hanspeter Mallot</td>
<td>Anatol Stefanowitsch</td>
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<tr>
<td>11:00 - 12:30</td>
<td>Discussion Groups in Q2-101</td>
<td>Stefan Schaal &amp; Moderator: Charmayne Hughes</td>
<td>David Wolpert &amp; Moderator: Barbara Hammer</td>
<td>David Rosenbaum &amp; Moderator: Bettina Bläsin</td>
<td>Hanspeter Mallot &amp; Moderator: Nicole Carey</td>
<td>Anatol Stefanowitsch &amp; Moderator: Monica Gonzalez-Marquez</td>
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<td>12:30</td>
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<td>Lunch time at Westend</td>
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<tr>
<td>2:00 - 4:00</td>
<td>Stream 1 Bio-inspired Robot Vision</td>
<td>Module 1</td>
<td>Module 3</td>
<td>Afternoon program: a) Ropes course, or b) Zoo Oderdissen</td>
<td>Module 5</td>
<td>Lab Demonstration</td>
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<td></td>
<td>Stream 2 Complex Human Movement</td>
<td>Module 1</td>
<td>Module 3</td>
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<td>Module 5</td>
<td>Module 7</td>
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<td></td>
<td>Stream 3 Language &amp; Space</td>
<td>Module 1</td>
<td>Module 3</td>
<td></td>
<td>Module 5</td>
<td>Module 7</td>
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<td></td>
<td>Stream 4 From Perception to Behavior</td>
<td>Module 1</td>
<td>Module 3</td>
<td></td>
<td>Module 5</td>
<td>Module 7</td>
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<tr>
<td>30 min. open</td>
<td>Tea &amp; coffee break</td>
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<td>Tea &amp; coffee break</td>
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## Schedule

<table>
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<tr>
<th>Time</th>
<th>Stream 1</th>
<th>Stream 2</th>
<th>Stream 3</th>
<th>Stream 4</th>
<th>Evening Program</th>
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</thead>
<tbody>
<tr>
<td>4:30 - 6:30</td>
<td>Bio-inspired Robot Vision</td>
<td>Complex Human Movement</td>
<td>Language &amp; Space</td>
<td>From Perception to Behavior</td>
<td>7 p.m.</td>
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<tr>
<td>8 p.m.</td>
<td>Evening Program</td>
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# Afternoon Schedule: Module Details

## Stream 1 - Bio-inspired Robot Vision
- Modules 5 & 6: Neurocognitive and Neurophysiological Measures of (Inter)Action – Andrea Finke, Hendrik Koesling & Dirk Koester – Q0–116 eye-tracking labor
- Module 7: Lab Demonstration

## Stream 2 - Complex Human Movement - Neurocognition and Neuroinformatics in Action
- Module 1: Data Acquisition and Analysis with VICON – Christoph Schütz & Christian Seigelke
- Module 2: Measuring of Cognitive Motor Representations – Heiko Lex & Iris Güldenpenning –
- Module 3: Anticipation and Motor Control – Christian Seigelke & Charmayne Hughes – Biomechanics lab W01–182
- Module 4 & 5: Eye-tracking and Attention – Kai Essig, Elena Carbone & Rebecca Förster – Q1–101
- Module 6: Neurocognition Workshop – Thomas Schack, Bettina Bläsing, Christoph Schütz & Heiko Lex – Biomechanics lab W01–182
- Module 7: Cognitive Control in Manual Action – Bettina Bläsing & Robert Haschke –

## Stream 3 - Language & Space
- Modules 5–8: Language and Space – Marcus Kracht & Christian Wurm – Q0–119

## Stream 4 - From Perception to Behavior
- Modules 1–4: Perceiving Multimodal Saliency – Anna-Lisa Vollmer & Lars Schillingmann – N5–113, iCub lab
- Module 5: Multiagent Systems – Building Braitenberg Vehicles in Breve – Hana Boukriha & Nhunh Nguyen – V0–133
- Module 6 & 7: Multiagent Systems – Implementing the Mars Explorer Experiment in Breve – Hana Boukriha & Nhunh Nguyen – V0–133
- Module 8: Multiagent Systems – Tournament of the Multiagent Teams – Hana Boukriha & Nhunh Nguyen – V0–133
stream and module abstracts

Stream 1: Bio-inspired Robot Vision

This stream will focus on the melding of biology and engineering, exploring the ways in which vision influences decisions about motion and path-planning. We will investigate the biological behaviours which have inspired a new generation of computer programs and autonomous robots, following the research process from data gathering through to control system implementation.

Modules 1 & 2: Biologically-inspired Robot Vision,
Monday 2.00 – 4.00 p.m. & Monday 4.30 – 6.30 p.m.
We will begin by exploring the methods insects use to navigate, through behavioural experiments and electrophysiological investigations. Along the way, the participants will get to analyse insect flights, reconstruct motion from the point of view of an insect, and present that motion to an insect in an electrophysiological replay experiment. Afterwords, there will be a brief introduction into the use of biologically-inspired navigation techniques in robotic homing. Finally, as part of the lead-in to Tuesday's module, there will be an opportunity to see the recorded flights converted into commands for a multi-degree-of-freedom robot.

Modules 3 & 4: Biomimetic visual robot navigation,
Tuesday 2.00 – 4.00 p.m. & Tuesday 4.30 – 6.30 p.m.
Based on experimental data, algorithms for visual navigation of autonomous robots can be developed. This approach yields robust and computationally simple solutions for technical applications as well as refined hypotheses to be tested in behavioral experiments. This course will give a brief overview over the research on biologically inspired, vision-based robot-navigation done at the Bielefeld Group of Computer Engineering. The course contains a theoretical introduction, lab tours demonstrating current research, and a hands-on-session (navigation experiments with a robot simulation). For the hands-on-session, no programming skills are required.
**stream and module abstracts**

**Modules 5 & 6: Neurocognitive and neurophysiological measures of (inter)action, Thursday 2.00 – 4.00 p.m. & Thursday 4.30 – 6.30 p.m.**

In this module students will learn how the simultaneous recording and analysis of EEG and eye-movement data can be used to create novel user interfaces. We will start by discussing the relevant aspects of neurophysiology in human interaction, e.g., motor imagery. Methodologically, students will have the opportunity to experiment "hands-on" with EEG wiring, eye-tracker setup, data collection and signal processing. Feeding cortical signals and gaze points into a brain-eye-computer interface, students can then experience a novel way of controlling computer games driven by their mind and attention. – This research may contribute to the understanding of action control in humans and robotic systems.

**Stream 2: Complex Human Movement – Neurocognition and Neuroinformatics in Action**

This stream provides insight into recent experiments to reveal representations of human motor knowledge ranging from motion analysis with high-speed motion-tracking systems, EEG and eyetracking studies to analysis of cognitive structures. The stream contains interwoven modules on formal modelling of motion patterns as well as their implementation on two-handed robot systems.

**Module 1: Data Acquisition and Analysis with VICON, Monday 2.00 – 4.00 p.m.**

In this course, participants are introduced to the basic principles of motion capture. In a hands-on experience, one of the participants will be equipped with a set of retroreflective markers and his/her movements will be recorded with an optical motion capture system (VICON). Participants will then be lead through the necessary steps of data post-processing, including labelling and cleaning of the recorded trajectories. At the end of the course, the reconstructed full-body movement will be fitted to a three-dimensional skeletal actor.
stream and module abstracts

Module 2: Measuring of Cognitive Motor representations, Monday 4.30 – 6.30 p.m.
This session will focus on the nature and role of long-term memory in movement performance. First, a theoretical framework, the cognitive architecture of complex movements, will be proposed. The students will be familiarized with the development and definition of so called Basic Action Concepts, i.e. the cognitive representation units of complex movements. Second, the Structure Dimension Analysis–Motorics (SDA–M), which is a experimental tool to investigate memory structures, will be provided to all PhD–students directly in the memory lab. Besides theoretical basics, it is planned to have practical experiences with that tool during this session.

Module 3: Anticipation and Motor Control, Tuesday 2.00 – 4.00 p.m.
One fundamental topic in the field of motor control is the planning of movements. People plan and execute their actions in an anticipatory manner, that is, they are able to represent future posture states. Hereby, motor planning is influenced by the perception of the environment and the intention of the actor. This module provides insights into the aim of identifying phenomena that can be considered selection criteria influencing movement planning by using experimental methods (e.g. motion tracking) while focusing on manual action and object manipulation.

Module 4 & 5: Eye-tracking and Attention, Tuesday 4.30 – 6.30 p.m. & Thursday 2.00 – 4.00 p.m.
The course will give a general introduction to the field of eye tracking with respect to applications regarding attention, perception and motion. We will address the following topics: Why do we make eye movements? What is eye tracking? We will also focus on: different eye tracking systems, methods for analyzing recorded eye movements, examples with still images from sports science and examples with dynamic scenes from speed-stacking, and eye tracking combined with other techniques (and hardware systems (e.g., body tracking, fMRI, EEG).
stream and module abstracts

Module 6: Simulation in Complex Movements Using Neural Networks, Thursday 4.30 – 6.30 p.m.
In this practical, hands-on course, students will implement recurrent neural networks (RNN) using matlab. A special class of RNN, called Echo State Networks, will be introduced and facilitated for motor pattern learning and sequence prediction. Echo State Networks are easy to implement and fast to train, giving a positive experience to RNN approaches. A basic understanding of linear algebra, programming fundamentals and some experience with scripting languages is recommended.

Module 7: Cognitive Control in Manual Action, Friday 2.00 – 4.00 p.m.
Hand movement during grasping and object manipulation is influenced by many factors, such as size, shape and weight of the object, but also by concepts of the object, its purpose, affordances and features, and the intended actions. As an adaptation to this variety, basic grasp types can be distinguished, such as power and precision grasps, representing concept formation on the level of manual action. In this session we will investigate grasping from a point of view that integrates biomechanics and cognition, by analysing interactions between hand movement (measured via data glove and motion capture), object representations and action planning.

Module 8: Manual Action and Intelligence for Robots, Friday 4.30 – 6.30 p.m.
This session focuses on the transfer of the acquired motor concepts to a real robot system. Based on psychologically motivated concepts for representation of grasping motions we propose a strategy for grasp realization suited for a real robot comprising two anthropomorphic hands. Participants shall implement and test this grasping strategy using a virtual simulation environment. This includes finding suitable hand postures. Successful implementations subsequently will be evaluated on the real robot system.
Stream and module abstracts

Stream 3: Interaction, Language and Space

In this stream we will scrutinize how humans refer to space in verbal and non-verbal interaction, and how these insights can be used for building cognitive interaction technology. One part of this stream examines the role of 'space' as a communicational resource in human/human and human/robot interaction. To investigate how the participants' spatial behavior dynamically shapes and re-shapes interaction, we take as an example the scenario of a robot museum guide, using the NAO-robot. The module suggests an interdisciplinary research loop encompassing a) fine-grained analysis of video data from human–human–interaction (Conversation Analysis), b) modeling/implementation in a cognitive architecture, and c) evaluation of the system in human–robot–interaction in an authentic museum. The second part will take a more theoretical stance: we will look at the way natural languages encode information about space and motion. We will use mathematical / physical properties of space-time, as well as the nature of human cognition of space and motion, to gain important insights in how natural languages encode spatial information, and how humans use natural language to reason about it.

Modules 1–4: Interaction in Space – From Human–Human to Human–Robot–Interaction, Monday 2.00 – 4.00 p.m., Monday 4.30 – 6.30 p.m., Tuesday 2.00 – 4.00 pm & Tuesday 4.30 – 6.30 p.m.

Three modules of this stream examine the role of 'space' as a communicational resource in human/human and human/robot interaction. To investigate how the participants' spatial behavior dynamically shapes and re-shapes interaction, we take as an example the scenario of a robot museum guide, using the NAO-robot. The modules suggest an interdisciplinary research loop encompassing (1) fine-grained analysis of video data from human–human–interaction (Conversation Analysis), (2) modeling/implementation in a robotic architecture, and (3) evaluation of the system in human–robot–interaction in an authentic museum.
stream and module abstracts

Modules 5-8: Language and Space, Thursday 2.00 – 4.00, Thursday 4.30 – 6.30 p.m., Friday 2.00 – 4.00 p.m. & Friday 4.30 – 6.30 p.m.

We look at the way languages encode information about space and motion. We shall explore the subject from several directions: one is the nature of space-time, seen from a physical and mathematical point of view; another is the nature of human cognition of space and motion; and a third one is the nature of language itself and how it likes to package spatial information both syntactically and morphologically.

One of the most basic categories of meanings are things, time and place. While there has been ample research on the first two, the research into the semantics of space has begun with considerable delay. Fortunately, the theory of space, be it physical space or abstract mathematical space, is well understood. This means that unlike with propositional attitudes we have precise models by which we can interpret linguistic expressions and test our theories as well as develop new ones. This is becoming increasingly important since many dialogue settings require rather sophisticated techniques for handling spatial expressions and keeping track of individuals and things and their locations in time.

(1) In the first module we shall briefly identify the key areas in which linguistic theory can help to deepen our understanding of the semantics of spatial expressions and also what it cannot do. After that we shall illustrate the mathematical tools we need to model space (topology and metric spaces).

(2) In the second module we shall identify the variety of types of expressions that deal with space and motion. It will turn out for example that constituents tend to qualify just one aspect of location and change (eg, the change of shape, or the change of location, or the speed of motion) while complex motion patterns must typically be inferred from the description (the only exception is lexical items).
stream and module abstracts

(3) In the third module we shall look at events: what are they and how are they be used to talk about change? Again, we shall see that humans have special habits in the way they perceive and talk about events, as has been argued in cognitive linguistics (and found in experiments). For example, complex motion patterns tend to be broken into well-defined sequences of motion events. This division is quite uniform, though its expression in languages does vary to some extent.

(4) We shall provide a full blown semantics of spatial expressions, bottom up and compositional. It will be shown that there is a match between the morphological structure and the semantic types. The complex nature of spatial expressions is mainly due to the rather complex patterns they are used to describe.

Stream 4: From Perception to Behavior
This stream consists of two parts. On the one hand we will focus on robot perception. With the help of practical exercises we will get insights into methods, which enable robots to react to specific events in tutoring situations. On the other hand hands on excersises dealing with multiagent systems convey methods to model systems which perceive their environment, generate, and coordinate actions.

Modules 1-4: Perceiving Multimodal Saliency, Monday 2.00 – 4.00 p.m., Monday 4.30 – 6.30 p.m. Or Tuesday 4.30 – 6.30 p.m.
In human robot interaction robots are required to perceive the communicative means of their human interaction partners. Here we will focus on tutoring situations in which a human tutor demonstrates actions. Specifically we will use methods to detect salient events both in the visual and the acoustic modality. In this module we will use these modalities to analyse and detect events in the tutor's behavior such as trying to grab the learner's attention.
stream and module abstracts

Modules 5-8: Multiagent systems
Thursday 2.00 – 4.00 p.m., Thursday 4.30 – 6.30 p.m., Friday 2.00 – 4.00 p.m. & Friday 4.30 – 6.30 p.m.
Module 5: Building Braithenber Vehicles in breve, Module 6 and 7: Implementing the Mars Explorer Experiment in breve, and Module 8: Tournament of the multiagent teams

Multiagent systems seem to be a natural metaphor for understanding and building a wide range of what we might crudely call artificial social systems. The field of multiagent system deals with two following problems:
Building agents capable of independent autonomous actions, in order to successfully carry out the tasks delegated to them.
Building agents that are capable of interacting with other agents in order to successfully carry out the tasks delegated to them, particularly when the other agent can not be assumed to share the same interests or goals.

Using a 3D Computer Graphics framework, agents based on simple reactive systems will be implemented. The agents are situated in a virtual world in which they interact with the environment as well as with each other. We start with implementing single agent behaviors and extend them to competitive and cooperative multiagent behaviors. At the end a tournament between the multiagent teams will take place.

Objectives:
1. Acquiring practical experiences in the field of multiagent systems by implementing theoretical multiagent concepts.
2. Developing and enhancing agent architectures to cope with environments growing in their complexity.
Dr. Bettina Bläsing
Responsible Investigator Research Area:
Motion Intelligence
CITEC – Cognitive Interaction Technology

Talk:

Action within our grasp – how we manually understand the world and what to do with it

The human hand is one of the most complex extremities that we find in nature. Many tasks require our hands to operate in a coordinated fashion to successfully interact with our environment. Thus, the way in which we act manually is directly influenced by how actions are represented in the brain. Especially when we grasp, manipulate and interact with an object, the movements of the hand have to be accurately adapted to the object’s characteristics such as size, shape, weight and texture, as well as to the task we intend to perform. Studies show that hand postures during grasping are in fact controlled actively, depending on the conceptual properties of task and object. Additional to object and task representations, the representation of the body, especially the hands, is an important factor influencing and influenced by the way we manually interact with the world.

References:
The organization and usage of spatial memory in humans
The presentation will be divided in two parts. In the the first part, I will discuss the various types of spatial information represented in human longterm spatial memory. As a guideline, I will pursue the graph approach to cognitive maps, in which places are considered the nodes of a graph while actions leading from one place to another are considered graph links. This idea dates back to Edward Tolman, who introduced the notion of a cognitive map, and has been formalized in theories of quantitative reasoning and robot navigation. Here, I will focus on behavioural evidence from humans, concerning both the specific types of information contained in the map, including in particular the role of metric information and spatial hierarchies. In the second part, I will focus on the role of working memory in spatial behaviour and on its interaction with spatial longterm memories. Working memory tasks in spatial cognition are often related to route planning either from longterm knowledge of the cognitive map, or from ongoing scene perception. As a simple case, obstacle avoidance in cluttered environments will also be discussed.

References
Cognition in Motion

The study of motor control has flourished in the hands of neuroscientists and, to an increasing degree, roboticists. Do cognitive psychologists also have something useful to contribute to this field? And can the study of motor control contribute to cognitive psychology? I will suggest that both questions can be answered in the affirmative. I will support this claim by presenting research that my colleagues have done on the planning and control of reaching and grasping movements. Some factors that we have found to be important might not have been found without behavioral experiments designed to expose the links between cognition and motion.


Research Interests:
General: Cognitive neuroscience, computer simulation, experimental psychology, human perception, cognition, and performance
Specific: Human motor control, perceptual–motor integration, timing, organization of personal space.
Prof. Dr. Stefan Schaal
Professor of Computer Science, Neuroscience, and Biomedical Engineering
University of Southern California

Stefan Schaal is Professor of Computer Science, Neuroscience, and Biomedical Engineering at the University of Southern California, and an Invited Researcher at the ATR Computational Neuroscience Laboratory in Japan, where he held an appointment as Head of the Computational Learning Group during an international ERATO project, the Kawato Dynamic Brain Project (ERATO/JST). Before joining USC, Dr. Schaal was a postdoctoral fellow at the Department of Brain and Cognitive Sciences and the Artificial Intelligence Laboratory at MIT, an Invited Researcher at the ATR Human Information Processing Research Laboratories in Japan, and an Adjunct Assistant Professor at the Georgia Institute of Technology and at the Department of Kinesiology of the Pennsylvania State University.

Dr. Schaal's research interests include topics of statistical and machine learning, neural networks, computational neuroscience, functional brain imaging, nonlinear dynamics, nonlinear control theory, and biomimetic robotics. He applies his research to problems of artificial and biological motor control and motor learning, focusing on both theoretical investigations and experiments with human subjects and anthropomorphic robot equipment.

Dr. Schaal has co-authored over 200 papers in refereed journals and conferences. He is a co-founder of the "IEEE/RAS International Conference and Humanoid Robotics", and a co-founder of "Robotics Science and Systems", a highly selective new conference featuring the best work in robotics every year. Dr. Schaal served as Program Chair at these conferences and he was the Program Chair of "Simulated and Adaptive Behavior" (SAB 2004) and the "IEEE/RAS International Conference on Robotics and
Automation" (ICRA 2008), the largest robotics conference in the world. Dr. Schaal is has also been an Area Chair at "Neural Information Processing Systems" (NIPS) and served as Program Committee Member of the "International Conference on Machine Learning" (ICML). Dr. Schaal serves on the editorial board of the journals "Neural Networks", "International Journal of Humanoid Robotics", and "Frontiers in Neurorobotics". Dr. Schaal is a member of the German National Academic Foundation (Studienstiftung des Deutschen Volkes), the Alexander von Humboldt Foundation, the Society For Neuroscience, the Society for Neural Control of Movement, the IEEE, and AAAS.

Recent relevant publications:


Research on the linguistic encoding of motion events has largely been concerned with cross-linguistic differences in the grammatical structure of motion clauses, for example, the encoding of the path of motion inside or outside the verb stem. Patterns of actual linguistic usage within individual languages have largely been ignored. In my talk, I will show how the quantitative analysis of large corpora enables us to uncover such patterns and how those patterns provide a fine-grained window to human conceptualization(s) of motion events and their components.


Curriculum Vitae (Short)
since August 2010 – Universität Hamburg, Professor of English Linguistics
2002–2010 – Universität Bremen, Professor of English Linguistics
2005–2007 – DFG-Nachwuchsnetzwerk Konstruktionsgrammatik, Principal Investigator (with Kerstin Fischer)
Title: FROM GAME THEORY TO GAME ENGINEERING
David H. Wolpert, NASA
Stefan Bieniawski, Stanford University
Juergen Jost, Max Planck Institute
Michael Harre, University of Sydney
James Bono, American University
Nilesh Kulkarni, NASA
Ritchie Lee, NASA
Abstract: In this talk I present recent work on combining game theory, statistical physics, and control theory. This combination provides new techniques for predicting / controlling any system comprising humans, human groups (e.g., firms, tribes), and / or adaptive automated systems (e.g., reinforcement learning robots).
As illustrations, I will focus on four projects:
1) Suppressing flutter in an airplane wing by controlling a set of autonomous micro-flaps at its trailing edge.
2) First raising taxes in a human economy, and then lowering them back to the starting values, to steer the economy to a Pareto superior equilibrium.
3) Designing a dynamic auction of arrival slots at a weather-impacted airport, to maximize social welfare.
4) Guiding human pilots during near mid-air collisions via automated recommender systems.
David Wolpert is a senior computer scientist at NASA's Ames Research Center where he formed the Collective Intelligence group. He is also a consulting professor in Stanford's Aeronautics and Aerospace Department. During the next year he will be the Ulam scholar at the Center for Nonlinear Studies in Los Alamos.

His two current primary areas of research are game theory (both experimental and theoretical) and distributed control. He also does work in optimization, complexity, and the foundations of physics. Previously he has concentrated on machine learning and Bayesian analysis.

Before coming to NASA he was a Research Manager at IBM Almaden Research Center. He had come to IBM from TXN Inc., a data-mining firm where he was Director of Research. Before that he was a postdoc at the Santa Fe Institute and the Center for Nonlinear Studies at Los Alamos. His degrees are in physics, from the University of California Santa Barbara, and Princeton University.

He is the author of two books, three patents, close to one hundred refereed papers, and numerous awards.
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Working Environment and Human Factors – Dortmund  

PhD student in behavioral neuroscience, bi-national PhD (France - Germany) under the supervision of Pr Temprado and Pr H. Heuer  
research interest: aging, haptic supplementation and motor contro  
Does postural stability of elderly people improve with the aid of haptic supplementation by a light grip of a mobility device in complex conditions?  
Technologically speaking, what kind of specific features would such a device embody?  

Arising with aging and/ or pathologies (stroke, diabetic,...) alterations of the sensorimotor mechanisms of postural control are often observed, provoking instabilities, in particular in perturbing conditions such as during locomotion. Among other objectives, our PhD project is aimed at studying how to improve postural control of the elderly, in particular by haptic supplementation during quiet stance posture and locomotion with the use of a stick.  

Until now, preliminary investigations (Albertsen et al., in press; Albertsen et al., in preparation) confirmed the stabilizing effect of haptic supplementation by a light touch of a mobile stick support equally in young and elderly people. Haptic cues provided by such a light contact of the fingers, combining tactile and proprioceptive information, played a functional role in reducing body oscillations by providing information about position and motion in space. A striking finding was that, in order to create functional haptic cues, a certain resistance in opposite direction to body oscillations had to be provided by the stick (e.g. scratch on a rough surface), which helped improving upright stance.  

Together with fundamental research on haptic supplementation, our project is also dedicated to explore possible future application for the conception of an interactive tool, i.e. a mobility device (stick) that would provide
functional haptic information about body oscillations to stabilize and, eventually, to reeducate elderly people with sensorimotor alterations. The conception of such a technical device typically requires knowledge about the cognitive (i.e. orientation in space) and sensorimotor mechanisms underlying the integration of supplementary sensory information. Our objective is to translate this knowledge into an intelligent mobility device that could help reestablishing a stable gait of elderly people either by its daily use or after rehabilitation training programs.

Ignazio Aleo
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University of Catania
Dipartimento di Matematica ed Informatica

Ignazio Aleo, born in Catania on December 19th 1985. I am a student attending the second year of the Ph.D. course in Electronic, Automation and Complex Systems Control at the University of Catania. From September 2003 to July 2006 I studied Electronic Engineering at University of Catania (first level degree with dissertation on “Innovative integration of MEMS for manual peripherals control”). From September 2006 to July 2008 I studied Automation Engineering and Control of Complex Systems at the University of Catania (master degree with dissertation on “A mathematical model of dynamic phenomenon of self-organization inside the city”). From November 2008 I have a Scholarship from STMicroelectronics as part of Ph.D. course in Electronic, Automation and Complex Systems Control at the University of Catania. Starting from analysis and going to synthesis, my current research line focuses on the formalization of models for body and motion representation and for environment interaction through dynamical systems.
In collaboration with STMicroelectronics, we are investigating novel strategies for motion detection and reconstruction (human body, mobile robots) through multiple distributed sensor information (e.g. accelerometers, gyroscopes and magnetometers). Moreover, I am currently involved in an European Project named SPARK II (Spatial–temporal patterns for action–oriented perception in roving robots II: an insect brain computational model) in which developed models are compared with experimental data.

Under these points of view, I am investigating basis of motor control to enhance capabilities of biologically inspired robots.

Ingmar Berger
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AG Applied Informatics

Ingmar Berger received his diploma degree in computer science with major in Machine Learning and Artificial Intelligence from the Albert-Ludwigs-University Freiburg, Germany, in January 2010. In his diploma thesis he investigated the predictability of apnea in premature infants using EEG signals. From February 2010 to April 2010 he worked as a research assistant at the Autonomous Intelligent Systems Lab in Freiburg headed by Prof. Burgard. In August 2010 Ingmar joined the Research Institute for Cognition and Robotics (CoR-Lab) and the Applied Informatics Group at the University of Bielefeld, Germany. Currently he is working in the MotiRob project.

His research interests include:
- Machine Learning and Data-Mining
- Probabilistic Reasoning and Decision Systems
- Feature generation and extraction
- Time series analysis
Perceptual Grounding of Spatial Reference Frames in Communication and Action - Influence of response actions on estimating directions and conceptualizing space regions with acoustic stimuli.
Marcella de Castro Campos, Bettina Bläsing, Constanze Vorweg, Thomas Schack

Abstract:
Spatial language can give us deep insights into the nature of spatial cognition in general. The concepts of front, back, right, and left regions have characteristics that reflect our typical interactions with space, and the way we conceptualize these regions depends overall on the task we have to do, or on the relation we have to find among them. In the present study we intend to analyze and to relate the verbal responses for recognizing of sound source location (SSL) to 4 different methods from localization and response: (a) no movement and verbal estimate of SSL; (b) turning to face the estimate SSL and verbal estimate; (c) turning to face the estimate SST, pointing with the hand and arm, and verbal estimate and (d) no big movement, touching with a special pen at a special screen, and verbal estimate. In addition we intend to estimate the relative sizes and resolutions of front, back, left, and right around oneself for each one of these conditions and to make a comparison among them.

Short Bio:
Graduated in Physical Education by Universidade Federal de Minas Gerais in Brazil (2004) and post graduated in Sports Training by Universidade do Grande Rio also in Brasil (2007). Worked as Sports teacher with at elementary
students

schools and as Sports Trainer in Sports Centers in Brazil. Currently is PhD Student at Center of Excellence Cognitive Interaction Technology (CITEC) at Bielefeld University and researches topics about space representation and orientation, specifically the Influence of response actions on estimating directions and conceptualizing space regions with acoustic stimuli, in the Project “Perceptual Grounding of Spatial Reference Frames in Communication and Action”.

Alessandro Filipeschi
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Scuola Superiore Sant’Anna, Pisa

Working title:
Study and development of multimodal systems for enhancing and/or recovering human motor skills

Bio Info
Alessandro Filipeschi (Eng.) is PhD student in Perceptual Robotics at the PERCRO lab, Scuola Superiore S. Anna, Pisa, Italy. He received a MSc in Mechanical Engineering in 2007, discussing a thesis on the mechanical design of a rowing simulator. Dr. Filipeschi’s current research focuses on analysis, design and implementation of systems for the human motion skills enhancement and/or rehabilitation, it is part of the research activities of the european project SKILLS IP.
Rebecca Förster
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CITEC – Cognitive Interaction Technology

ALIAS: Analyzing Learning, Interaction and Automatization in Speed Stacking

Abstract:
ALIAS investigates attentional guidance, motion paths and working memory during learning and automatization of a specific bimanual high-speed stacking task. The task consists of up stacking and down stacking pyramids of plastic cups in a predefined order as fast as possible (for an illustrative video visit http://www.speedstacks.com/about/history.php). Exemplary research questions are, how eye and hand movements change during learning and automatization, how a single gaze point is used to control simultaneous movements of the two hands, which information is gathered even under time pressure, which distractors and facilitators affect task performance and whether we can reliably predict action errors. We also investigate how an individual as well as two partners collaboratively accomplish the speed stacking task. Research is based on the analysis of motion paths, gaze patterns, task durations and error rates. Results may lead to a better understanding of the nature of human motor interaction and may also help to optimize it. Finally, the results of human–human interaction might help to improve human–machine interaction.

Goals:
- analyzing attention during the learning and automatization cycle
- focusing on the whole process of automatization
- investigating attention in dyadic interaction
- analyzing attention in a bimanual high-speed motor task
students

Cornelia Frank
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CITEC – Cognitive Interaction Technology

Mental Representation and Mental Practice
research group: Neurocognition and Action – Biomechanics

research interests
- mental representation of complex movement
- mental practice (imagery/imagery rehearsal) of complex movement
- visual perception and visual imagery of complex movement
- neural correlates of visually perceived, imagined and actual movement
- neural simulation of visually perceived, imagined and actual movement
- perceptual–cognitive hypothesis of mental practice

biographical information & education
Magistra Artium (M. A.) Sport and Exercise Science
Areas of focus: Psychology and Public Health
Thesis: Application of mental practice in competitive sports
Heidelberg University, Germany, 02/2008

research and teaching
Trainer in health and exercise/psychology. Planning, coordination and supervision of basic and advanced training of coaches in health and exercise/psychology Association of Gymnastics (HTV/DTB), Frankfurt, Germany, 02/2009 – 09/2010 Research assistant to Prof. Dr. RudiGER Heim and Prof. Dr. Jan Mayer, Paroject ‘Sport psychology in school’, ISSW, Heidelberg University, Germany, 09/2008 – 02/2009 Guest lecture in sport psychology, Sport psychology for students of the course Vision Science Department Sci Tec, Jena University of Applied Sciences, Germany, 01/2009
publications and editorial assistance

Julia Frankenstein
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University of Freiburg
SFB TR 8 Spatial Cognition

Research interests: Human spatial inferences in navigation and wayfinding in indoor and outdoor environments (theme of PhD thesis), (embodied) spatial cognition, sensomotor integration, motor abilities and their link to space perception (body and space), spatial reference frames, spatial representations, maps...

Some personal information
After studies in ergotherapy and working in this field, I started studying Psychology at Chemnitz University of Technology. I continued my studies at Tübingen University. I worked as a research assistant – and later on as diploma student – at the Max Planck Institute for Biological Cybernetics. After a research internship at College de France, Paris, I am currently working on my Ph.D. thesis at Freiburg University. Supervisor: PD Christoph Hölscher

Due to my education and being a passionate horse-back-rider, climber, unicyclist and doing acrobatics I am – on a daily as well as on a scientific basis – very interested in the self-perception of one's body position and balance and its influence on the perception of space and spatial orientation. When not dealing with sports or science, I enjoy playing clarinet, guitar, saxophone or viola.
Hi, my name is Andrej Gisbrecht and I am 27 years old. I studied computer science from 2004 to 2009 and continued after that with a PhD-study at the Clausthal University of Technology. In April 2010 I moved to the Bielefeld University where I work now at CITEC in the 'Theoretical Computer Science' research group.

I investigate and develop algorithms in the area of machine learning, such as methods for classification and visualization. In this context, I am especially interested in theoretical aspects of these techniques, like convergence behavior and robustness under special constraints. Currently, I am working on an adaptation of prototype-based visualization techniques for very large dissimilarity datasets. I am interested in the link between machine learning theory and biological learning processes.

Nicole Grützmacher
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pesonal details
born on 02.07.1984 in Karlsburg, D

PhD project title:
"Cognitive Representation and Motor Control in Manual Action"
EDUCATION RECORD
2004 Abitur in Wismar, Germany, 10/2004 – 05/2010 Studies of Sport science at Leipzig University, Specialized in Rehabilitation and Sports therapy, Diploma (final thesis: Motor Learning and Aging), Studies of Sports, English and Education for teaching, 1. Staatsexamen, 02/2009 – 07/2009 Student Assistant at Texas A&M University, USA, Department of Health and Kinesiology; 05/2007 – 05/2010 Student Assistant at Leipzig University, Faculty of Sports Science, Institute of General Kinesiology and Athletics, Field: Motor Activity; Track and Field; since 06/2010 PhD Student at Bielefeld University/CITEC, Faculty of Sports Science and, Neurocognition and Action Research Group
Project title: “Cognitive Representations and Motor Control in Manual Action”

PUBLICATIONS
students

Jahrbuch, Bundesinstitut für Sportwissenschaft, Bonn.

Patrick Holthaus
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Universität Bielefeld
SFB 673

Short Biography
2006   B.Sc. Bioinformatics and Genome Research, Bielefeld University
2009   M.Sc. Intelligent Systems, Bielefeld University
2009   Member of the Applied Informatics Group, Bielefeld University
        Member of the SFB 673, Project C1 “Interaction Space”

Project Overview
On the one hand, I am interested in the use of interpersonal distances before and during an interaction situation. There is already some research on how human's use and occupy space for themselves. It is one of our aims to find out whether humans use the same mechanisms if they are in an interaction situation with a robot. If yes, how can the robot use this information to facilitate the interaction?
On the other hand, also interaction situations on a table are explored. If the peripersonal spaces of the robot and a human overlap, a so-called interaction space is established. I am researching how a robot can occupy space for itself, deal with reference gestures of its interaction partner, and dynamically re-plan gestures if there are obstacles in the form of a human hand.
students

Current Work
My current work involves a receptionist robot which can guide you to different locations with the help of a map. To actively establish an interaction between the robot and a human, I have developed a spatial model for the robot and implemented an attention system that is connected to it. The resulting behaviors have been verified in an on-line video study. The questionnaire revealed that these behaviors are applicable and result in a robot that has been perceived as more interested in the human and shows its attention and intentions to a higher degree.

Michael Horst
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CITEC – Cognitive Interaction Technology

Michael Horst received his B.Sc. degree in Applied Computer Science in Natural Sciences with minor in physics at the Bielefeld University in 2009. The same year, he received a one-year scholarship from the Center of Excellence “Cognitive Interaction Technology” at the Bielefeld University. He is currently enrolled in the subsequent master degree course. After receiving his master degree, he intends to continue his studies as a Ph.D. student. His research interests include local visual navigation and FPGA-based implementations of visual navigation methods. He gained experience in these fields by several student projects.

Abstract:
Local visual homing is the ability to return to a previously visited (goal) position using only visual information. This consists of omnidirectional snapshot images taken at the goal position (snapshot) and the current
position (current view). By comparing these two images, a movement direction (home direction) can be derived which takes the robot closer to the goal position. Image-warping methods distort the current view, simulating robot movements according to a specific set of movement parameters. The resulting image is then compared to the snapshot. In order to derive the home direction, an exhaustive search is conducted to find the parameters yielding the best match. A variant of 2D-warping called min-warping leads to better results at the cost of more complex computations.

As the computations for different parameters during the search phase can be performed in parallel, hardware-based implementations can reduce the required processing time. Here, we present an implementation of min-warping on a FPGA (Field Programmable Gate Array). We compare this to a serial software-based implementation using the same precision. The experiments show that both implementations achieve identical results, while the hardware-based implementation is approx. 30 times faster.

Our hardware-implementation can be used for an autonomous robot with limited computational capacities as part of a more complex navigation strategy using, for example, topological maps.
students

Bidan Huang
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University of Bath

My area of research will be on improving the programmability of domestic robotics. My supervisor Dr Joanna Bryson's Behaviour Oriented Design (BOD) methodology is designed to let a conventionally-trained programmer, used to hierarchical and sequential thinking, program real-time AI systems with concurrent, conflicting goals. This is done by encapsulating components of the systems skills into modular, semi-autonomous concurrent behaviours, then prioritising the actions of these behaviours through a fairly conventional hierarchical plan structure which determines the goals, motivations and approaches of an agent. My PhD project will focus primarily on developing these behaviour modules for dexterous robots, at least initially by application of machine-learning techniques developed for similar problems in animation.

Charmayne M. L. Hughes
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Universität Bielefeld
CoR-Lab

Title: Physically coupling objects alters kinematics but not end-state comfort in bimanual placing

Abstract: People often grasp objects with an awkward grip to ensure a comfortable hand posture at the end of the movement. This end-state
comfort effect is a predominant constraint during unimanual movements. However, during bimanual movements the tendency for both hands to satisfy end-state comfort is affected by factors such as end-orientation congruency and task complexity. Although bimanual end-state comfort has been examined when the hands manipulate two independent objects, end-state comfort when the hands are required to manipulate two physically coupled objects has not been investigated. In the present task kinematics and grasp behavior during a unimanual and bimanual reaching and placing task when the hands manipulate two physically connected objects was examined. Forty five participants were assigned to one of three groups; unimanual, bimanual no-spring (the objects were not physically connected), and bimanual spring (the objects were connected by a spring), and instructed to grasp and place objects in various goal orientations, depending on condition. The properties of objects (e.g., how they were coupled) did not influence the satisfaction of end-state comfort, but did change the kinematics of the movement. However, end-state comfort was influenced by end-orientation congruency. Specifically, comfortable end postures were only reliably adopted when the objects were placed in identical orientations. Thus, planning and execution of bimanual movements are influenced by constraints such as object properties and end-orientation congruency.

Biographical Information: Charmayne is a post-doctoral fellow currently working in the Neurocognition and Action Laboratory, and the Cognition and Robotics Laboratory (COR-Lab). Charmayne is also a member of the Cognitive Interaction Technology Center of Excellence (CITEC) at Bielefeld University. Charmayne received her Master’s degree in Motor Control from San Diego State University, and her doctorate in Motor Control from Purdue University. Charmayne’s research centers primarily on the spatial and temporal constraints during bimanual coordination on both a kinematic and macroscopic level. Her previous work has extended the end-state comfort effect to bimanual movements, and examined increased callosal plasticity in trained musicians during discrete reaction time tasks.
Research Interests
- Sport Psychology: attentional focus, choking under pressure, imagery
- Psychology: cognitive and educational psychology, expertise, motivation, learning, program evaluation
- Kinesiology: movement variability, motor control and learning, motion analysis

Topics of Research
Dissertation Title: The Benefit of External Focus: Common-Coding or Attunement to Affordances?
Abstract: In recent years, a considerable amount of research has been conducted to delineate the effects of attentional focus on task performance (e.g., Wulf, 2007a). From this research, external focus has been shown to be beneficial to both motor learning and performance. Less clear, however, are the mechanisms through which external focus benefits performance (Poolton, Maxwell, Masters, & Raab, 2006). Traditionally, an information-processing perspective (e.g., common-coding theory) has suggested that external focus facilitates performance by triggering associated sensorimotor representations responsible for motor production (Wulf & Prinz, 2001). More recently, however, a constraints-led perspective has suggested that external focus aids performance by strengthening action-perception coupling through facilitating attunement to environmental affordances (Davids, Button, & Bennet, 2008). Consequently, the purpose of the present study was to delineate between a common-coding account and a constraints-led perspective regarding the beneficial role of external focus of attention. More specifically, the extent to which visual information underpins the advantage
of external focus was examined. The study examined skilled golfers \((n = 30)\) on a putting task under one of three attentional focus conditions (control, irrelevant, and external). Additionally, participants performed under full and occluded vision. Putting performance was measured via both outcome- and process-oriented approaches. Results from the present study indicated that visual information did not mediate the extent to which external focus impacted performance. Regardless of the availability of visual information, performance during external focus resulted in a greater number of successful putts. Furthermore, analyses of movement trajectory variability indicated that the degree of variability reduced from the start of the forward swing to the point of contact. Variability during external focus resulted in moderate levels of variability compared to the control and irrelevant focus conditions. Overall, results lend support to a common-coding account of external focus.

Biographical Information

William Land was born in Nashville, TN, moving shortly thereafter to Lawrenceburg, TN. He attended the University of Tennessee at Chattanooga on a golf scholarship where he earned a B.S. in psychology with a minor in philosophy. While at UTC, William received the UTC Outstanding Senior Award in Psychology, the Dale Mabry Award (highest male senior athlete GPA), and Southern Conference Academic Honors for golf. During college, William worked as a professional golf caddie including caddying on the Nationwide Tour. Due to his love of the game, he pursued graduate work at Florida State University where he completed a Masters degree in Sport Psychology in the Fall of 2007. Immediately following, William began working on his doctorate in Sport Psychology at FSU. During his time at FSU, William served as the President of the Sport Psychology Organization and Research Team, helping to organize the first annual SPEAR Sport Science conference. Additionally, he acted as the interim FSU women’s assistant golf coach during the Spring 2009 season. William completed his doctorate work at FSU during the Summer of 2010.
Biomechanical control and cognitive structure involved in the human gait adaptivity – influence of additional load

Author: Allan Brennecke
Supervisor: Prof. Dr. Thomas Schack

ABSTRACT
Human gait and its kinematical, kinetical and electromyographycal parameters as well as its strategies of learning and motor control has been widely investigated since a long time ago (ALLARD et al, 1995; BARNETT, 1956; CAVANAGH et al, 1981; CHAMBERS and SUTHERLAND, 2002; LIEBER, 1992; McClay, 1990; MURRAY, 1967; NOVACHEK, 1998; WINTER, 1976; WINTER, 2005; ZATSIORSKY, 2002). However, knowledge regarding adaptivity of human gait under different conditions of afferent feedback shows a lack of studies (NEUMANN et al 1992; LAM et al 2003; LAM et al 2008; ROYER et al, 2005; ARELLANO et al, 2009). Moreover, research concerning cognitive structures underlying the human gait is highly scarce (SCHACK, ENGEL & HEINEN – unpublished data). Additionally, studies combining such approaches constitute an emerging area of research but limited to dual-task methodology with none or only superficial integration between biomechanical and cognitive analyses (WOOLLACOTT and SHUMWAY-COOK, 2002). The combination of different approaches in the field of human gait investigation can be valuable to understand how these movements are controlled, learned and reproduced in an adaptive way even under lack of motor control. The aim of the present project is to investigate the complexity and adaptivity of human gait integrating biomechanical aspects and the
evaluation and selection of effective information by the cognitive control. Analyses will be accomplished under two conditions: without gait perturbation (normal walking) and with gait perturbation (walking while using ankle weights strapped around both ankle joints). In order to do so, the present project will apply different biomechanical and psychological methods analysing kinematical, dynamical and electromyographical (EMG) profiles as well as the mental representations in the long-term memory and attentional demands in the working-memory involved in human gait control. Understanding of how the human body controls and selects the motion strategies considering different afferent could be helpful on many levels within cognitive interaction technology and motion intelligence. In the context of general understanding of human movement control, the results can be helpful to understand human gait as a usual motor task requiring complicated volitional and automatic processes. In the context of technical systems, artificial agents and robots development, the results can hopefully contribute to the goal of providing them with more human-like interaction and movement control features. Finally, if it is possible to show connections between cognitive structures and the gait biomechanical factors controlling gait in adaptive way, it may also be imaginable to open up new approaches for training and rehabilitation.

Allan Brennecke Leite, M.Sc.
1998 – 2002 BA in Physical Education, University of São Paulo, Brazil and University of Porto, Portugal; 02/2003 Academic Merit Certificate conferred upon "The Best Academic Project in Physical Education" by the University of São Paulo"; 2004 – 2007 Master Degree in Biomechanics of Human Movement, University of São Paulo, Brazil; 2007–2008 Executive secretary and electronic editor of the Brazilian Journal of Biomechanics (BJB); 2009 PhD Student at Center of Excellence Cognitive Interaction Technology (CITEC) at Bielefeld University
Vittorio Lippi
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Scuola Superiore Sant'Anna, Pisa

Vittorio Lippi is PhD student in Perceptual Robotics at the PERCRO lab, Scuola Superiore S. Anna, Pisa, Italy. He received a MSc in Industrial Automation Engineering in the academic session of 2006/2007, discussing a thesis on Gesture recognition and interaction with virtual environments. Dr. Lippi's current research focuses on analysis, design and implementation of systems for the human motion skills enhancement, it is part of the research activities of the European project SKILLS IP.

Tamara Lorenz
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Ludwig–Maximilians Universität, München
CCRL–CoTeSys

Dipl.–Ing. Tamara Lorenz
Since 2009 PhD Student at the Graduate School of Systemic Neurosciences, LMU Munich, Research Scientist at Experimental Psychology Unit, LMU Munich, Project Work with CoTeSys – Cognition for Technical Systems, 2008 – 2009 Usability Consulting, Ergoneers GmbH, 2008 Diploma in Mechanical Engineering, TU Munich, Major in Ergonomics and Medical Engineering

Working title: JOINT ACTION IN HUMANS AND ROBOTS
The overall goal of all researchers working with humanoid robots is that humans and robots should live and work together in their daily life. With my research, I aim for improving the interaction between them by exploring
the motor coordination between humans. Via analyzing behavioural data I try to find mechanisms and rules that can be modelled and are applicable to a robotic platform. Therefore I plan and carry out motion tracking experiments in which human arm and hand movements are recorded in order to gain knowledge about the immediate interaction in simple pick and place tasks.

Bassam Mokbel
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CITEC – Cognitive Interaction Technology

Hello, my name is Bassam Mokbel, I am 29 years old and am a PhD-student with the 'Theoretical Computer Science' group at CITEC, Bielefeld University. I studied computer science at the Clausthal University of Technology where I received my Diploma degree in 2009. After that, I first became a research assistant in Clausthal, until I recently joined the CITEC in April 2010. My research focuses on methods to analyze and visualize data, mainly techniques from the data mining and machine learning field. Since these techniques are often embedded in analytical tools for human experts, I think it is important to integrate principles of human cognition, in order to extract useful information for the user. In this context, I want to investigate the application of such methods on real world data coming from different domains, such as digital music, literature or motion capturing. Currently, I am interested in cognitively-inspired forms of data and knowledge representation to improve visualization methods for perceptual data.
Spatial movement concepts in human–robot–shared environments especially narrow spaces

keywords:
non-verbal communication, body-movement, body-language, situation awareness, situational interaction, spatial interaction
What should a service-robot do in a home or office environment?
It should not be in the person's way or and trap people in narrow rooms. Therefore, it needs situational and spatial concepts to figure out the human intention.
In human–human interaction social signals or unconscious cues are sent and received by interaction partners, for example body language. These signals and cues influence the interaction partner wanted and unwanted – sometimes to achieve and communicate a distinct goal. To be aware of those signals, is crucial when an interaction between a robot and a human is modelled.
I focus on purposeful body-movements/language and robot–movements especially, to provide an alternative or a further way to speech in human–robot communication. Those purposeful movements are called prompts.
My general research questions regarding this topic are: do humans prompt robots? Is a human able to understand the robot's movements and attribute an intention? The focus lies on narrow rooms or hallways in which a human and a robot have to manage their space around each other well.

Current Study
The study was based on a guided tour scenario, i.e., we invited our
students

participants to meet "their" new service robot, which had to be instructed about its new working environment. Our participants interacted with the robot for about 15 minutes, presenting among others, a 1.5 m² small room and items in it to create a narrow situation.
During this interaction we collected video and robot sensor data, as well as we asked our participants to answer some questions about their background and also about their impression of the interaction and possible ideas of how a robot of this kind should "behave" in such a scenario.
A concrete question is: which are the prompts a person uses to make clear that she/he wants to go out of the room and therefore needs the robot to move out of the way?

Daniel Prusa
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Czech Technical University, Prague

Daniel Prusa participates in HUMAVIPS project. "Humanoids with auditory and visual abilities in populated spaces" (HUMAVIPS) is a three-year project which of ambition is to make humanoid robots more human by building algorithms that will enable robots to mimic so called "cocktail party effect" – the human ability to focus attention on just one person in the midst of other people, voices and background noise. The used experimental platform is NAO. The research groups involved in the project are INRIA, Aldebaran Robotics, IDIAP Research Institute, Bielefeld University and Czech Technical University. Within the project, Czech Technical University focuses on the face recognition and robot localization.
My research interests include dynamic transformations in motor control, human–robot interaction in motor learning, and visuomotor transformations in artificial stereoscopic space. I majored in psychology at the University of Heidelberg. Since 2006 I work as a research associate at the Leibniz Research Centre for Working Environment and Human Factors (IfADo) in Dortmund (Germany). In 2009 I joined the EU-funded project HUMOUR (Human behavioral modelling for enhancing learning by optimizing human–robot interaction). For my dissertation at the Technical University of Dortmund I worked on motor control after abrupt changes of dynamical transformations.

**Paola Reißig**

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CITEC – Cognitive Interaction Technology

Neurocognition and Action Research Group

PERSONAL DETAILS

Born on 11/04/1983 in Dresden, Germany

EDUCATION RECORD


Project–title: “Neuocognitive moduls of acquisition, execution and control of action and action knowledge”
students

Alexander Schubert
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Interdisziplinäres Zentrum für Wiss. Rechnen
Universität Heidelberg

Education

Research/Professional experience

Publications

Awards and Scholarships
2009: "Best Paper Award" for 2)
2009: Scholarship of the Heidelberg Graduate School “MathComp”, University of Heidelberg
Selene Scozzafava
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Dipartimento di Psicologia, "Sapienza" Universita di Roma

Title of research: "Reaching and Grasping"
I'm a Phd Student in "Cognitive Psychology, Psychophysiology and Personality" course, Sapienza University of Rome. I graduated in March, 2009 in interfaculty Psychology/Engineering: "Psychology of information processing and knowledge representation" with 110/110 cum laude. My degree course gave me a very good preparation on cognitive science and mathematics knowledge. Since February 2010 I qualified in the Profession of Psychology.

The research
It is well known that in everyday life, persons frequently use their upper limb in numerous and complex tasks in relationship with objects, environment and other persons. Planning and execution of reaching and grasping movements toward a target seem apparently simple operations performed without evident effort. On the contrary, for the CNS it is an extremely complex task that involve several and different type of information such as visual, spatial, proprioceptive and motor information that permit the correct execution of movement. During the first year of doctorate I'm preparing a systematic review of the literature about the topic "Reaching and grasping", collaborating, since November, 2009 with an interdisciplinary research team in the Movement Laboratory of the Neurorehabilitation Division of IRCCS Pediatric Hospital "Bambin Gesù" - Rome. With my team, I'm interested to determine the mature characteristics of the act of reaching and grasping and how different typology of grasping characteristics influence the reaching in healthy adults and hemiplegic children.
Christian Seegelke
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Universität Bielefeld
CoR-Lab

Education:
Since May 2010 PhD scholarship at Institute for Cognition and Robotics (CoR-Lab), Bielefeld University and member of the Neurocognition and Action Research group, Faculty of Psychology and Sport Sciences, Department of Sport Sciences, Bielefeld University
October 2008 – April 2010 Master student at Bielefeld University, Faculty of Psychology and Sport Sciences, Department of Sport Sciences, course of study: “Intelligence and Action”, Master Thesis (currently in progress): “Planning of action sequences in a drawer opening task”
October 2005 – September 2008 Bachelor student at Bielefeld University, Faculty of Psychology and Sport Sciences, Department of Sport Sciences, Bachelor Degree in Sport Sciences, Bachelor Thesis: “Zum Einfluss von Objekten und Kontext auf die mentale Repräsentation von Arbeitshandgriffen – Eine Überprüfung der Taxonomie nach Cutkosky”

Research interests
The focus of my work lies in the overlapping areas of human movement science and cognitive science, which involve studying the interplay between the performance of human movements and its underlying cognitive structures. The title of my project I am working on is called “Cognitive Planning and Motor Adaptation in Manual Action”. It focuses on the question of how structures of sensorimotor representations are established and gradually changed, while considering the physical properties of objects, task constraints (affordances) and perceptual discordances in sensorimotor adaptation tasks. For me, it is of interest to learn about the relationship between the structure of representations and the performance in the
planning of complex object manipulations, while focusing on sequential behavior. To gain more insights into these issues, methods of kinematic movement analysis as well as experimental methods to measure representation structures concerning objects and grasping movements in memory are used.

Marietta Sionti
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University of Athens

Working title: Computational processing of semantics based on sensorimotor data, with special reference to American English and Modern Greek verbs of motion.

Abstract: My research is situated at the heart of the interdisciplinary field of computational linguistics, combining my former linguistics background and my inclination to computer science. My current work examines language as a stimulus for cognitive processes. In my PhD I investigate language and mental processes that allow human brain to experience an event of the actual world. In an effort to better specify the minimum conceptual representation of a motion event that distinguishes it from all other, I combine linguistic knowledge from corpus data with sensorimotor data obtained experimentally. Sensorimotor data are collected by measuring the performance of speakers of American English and Modern Greek. As sensorimotor data allow for optimal linking between embodied experience and language (Johnson and Lakoff, 1999), I aim to (i) perceptually ground abstract notions, such as transitivity, typically used in linguistics to study and classify verbal semantic and syntactic properties and, (ii) shed some light to
long standing syntactic questions, eg. the troublesome minimal pair argument/adjunct (FrameNet; Galen, Grenager & Manning, 2004). This period of time I focus on the clustering of motor actions and its correspondence to previous linguistic classifications of American English (Levin, 1993; FrameNet) and Modern Greek verbs of motion (Antonopoulou, 1987). The detailed sensor data are analyzed to identify latent factors that represent stable patterns across the many dimensions of low level data. These factors appear as discrete sets (synergies) of joint angles and orientations associated with each action and correlated with linguistic descriptions. Based on these first observations, we focus on our ongoing work to propose a framework, which would establish joint-angle-based representation for parameters such as path and directionality, standard to linguistics' descriptions. The existing literature is mainly constricted in revealing the path of the action based on the gaze (Clark et al., 2000). Intuitively, we could assume that directionality is mainly shown by the gross motion, e.g. head and chest movement or the upward and downward motion derived from the y axis of the knees, but further analysis need to be done.

Biographical information: I hold two B.A degrees in Linguistics and Pedagogics from the University of Athens (www.uoa.gr) and a M.Sc. degree in Computational Linguistics from the Technical University of Athens (www.ntua.gr). Currently I am elaborating my PhD thesis at the section of Linguistics, University of Athens. Over the last year I visited Carnegie Mellon University's Language Technologies Institute (www.cmu.edu), in order to improve my computational skills, especially in Machine Learning. Within the same period I collected sensorimotor data, for my PhD, at the Center of Automation Research, University of Maryland (www.cfar.umd.edu). I have worked as a teacher both in elementary and high schools, teaching assistant at the faculty of Linguistics, as a computational linguist at the Institute for Speech and Language Processing (www.ilsp.gr) and as one of the supervisors/organizers of the evaluation of Greek R&T Centers and of several Greek and European research programs at the Secretariat for Research and Technology (www.gsrt.gr).
Matteo Taiana
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Instituto Superior Técnico, Lisboa

my PhD working title:
"Video-based human activity analysis for service robotics".

my PhD abstract:
"Robots used in typical human environments require advanced skills for perceiving human activities and to interact with people. This work aims at researching methods for detecting persons and recognizing their activities from the analysis of a single video-stream mounted onboard the robot. Single camera human detection and activity analysis have been the subject of extensive research on the domains of video surveillance, but its application to service robots poses novel challenges. Service robots require a significantly higher amount of interaction with humans, and the input stream of data is of a different nature, in terms of image distortions due to sensor geometry, perspective and motion. Furthermore, existing methods on detection, tracking and activity recognition are usually considered independently of each other. Instead, we take a holistic view of the process and will investigate methods to jointly model the different components of human activity analysis systems".

a short bio:
"Matteo Taiana was born in Como, Italy. He received his M.Sc. degree in Computer Engineering from Politecnico di Milano – Italy, in 2007. He is currently a Ph.D. student at the Computer Vision Laboratory (VisLab), which belongs to the Institute for Systems and Robotics (ISR) of Instituto Superior Técnico (IST) – Lisbon. His research interests are in Computer and Robot Vision and Robotics."
students

Daniel Venjakob

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Universität Bielefeld

AG Applied Informatics

In 2010 Daniel Venjakob joined the Applied Informatics group and the Research Institute for Cognition and Robotics (CoR-Lab) at the University of Bielefeld, where he is working towards his PhD supervised by Prof. Dr.-Ing. Franz Kummert. Among other things, he is interested in computer vision, navigation and autonomous and mobile robotics.

From 2004 to 2010 he studied computer science at the University of Bielefeld. He received the B.Sc. and M.Sc. degrees in computer science from the faculty of technology in 2007 and 2010, respectively. In his theses, both supervised by Prof. Dr.-Ing. Ralf Möller and Dipl.-Inform. Lorenz Gerstmayr from the Computer Engineering group, he worked on improvements of local visual homing methods ("Verbesserung des Blockmatching-Verfahrens durch Feature-Transformationen" and "Flusslinien-Matching mit beliebig ausgerichteten Bildern").

From 2001 to 2004 he was apprenticed as an "IT-Systemelektroniker" by Beckhoff Automation GmbH, a local company with main focus on PC-based automation technolog
Research related information:
The phenomenon choking under pressure is known to occur in well learned motor skills in situations fraught with performance pressure. In this perspective the impact of anxiety on a complex overlearned visuomotor skill combining EEG, eye-tracking and motion-tracking will be investigated. More specifically the influence of fear on different stages of motor processing including retrieval of motor sequences from memory, visuomotor integration and movement execution will be taken into account. This also implies considering how highly automated motor sequences are stored in memory.

Biographical Information:
After graduating in Psychology (2007) at the University of Triest (Italy) Johanna studied Human Factors (M.Sc.) at TU Berlin where she soon became interested in the research area of Brain Computer Interfaces (BCI) that allows to connect neuroscientific paradigms and issues from the area of Human–Machine Interaction (HMI). She engaged in several projects of the interdisciplinary junior research group PhyPA (Physiological Parameters for Adaptation) at the Chair for Human Machine Systems whose main focus lies on BCI research for healthy users with EEG, and completed her Master's thesis within the work group dealing with error-related potentials. From February to April 2010 Johanna completed a two month research training at the Swartz Center for Computational Neuroscience (SCCN, San Diego, USA). Since June 2010 she is working as a research fellow and doctoral student at the department of Sports Psychology at the Technical University of Munich.
students

Jan Westerholz
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CITEC – Cognitive Interaction Technology

Born on the 30th of December 1981 in Herford.

Education/Qualifications

Internships And Work Experiences
Sales person at the Eaton Centre in Toronto, ON, Canada. Military Service, 09/2001 – 05/2002
Medical soldier in Roth and Holzwickede.
Analysis of a sensory–motor interface: from optic flow parameters to action selection

Abstract

Modern autonomous technical systems still possess bulky hardware and resource hungry computational algorithms which are barely suitable for real time processing and decision making. Thus, there exist good reasons to explore those areas where nature has arrived at much simpler mechanisms which nevertheless provide solutions to complex problems. Intriguing examples are blowflies which are true artists of flight. In the brain of the blowfly there is a prominent group of visual interneurons, called lobula plate tangential cells (LPTCs), which are sensitive to visual motion in a direction-selective manner. Depending on their preferred orientation, LPTCs fall in two classes: horizontally and vertically sensitive cells. It was demonstrated that different parameters of self-motion can be separated by combining the responses of the ipsi- and contra-lateral HS (horizontal system) neurons [1]. In addition, it was shown in another study that the axis of self-rotation can be extracted with high accuracy from the population response of all VS (vertical system) neurons [2]. These studies explain present neural activity with respect to the past insect behavior. However, no effort has so far been made to predict the future behavior of the insect based upon the current neuronal activity. Our main objective is to reveal how the representation of optic flow provided by a subset of LPTCs is decoded and used to select appropriate actions. In this way, the principles of visually guided flight in blowflies will be used to offer novel and computationally elegant solutions for visually guided movement control in robotic agents.
students

References

Biographical information
Zaidi, Syed Jamal Haider, is a Phd candidate of the Center of Excellence Cognitive Interaction Technology (CITEC) at the University Bielefeld, Germany. He has received his M.S. in Applied Information Technology specializing in Intelligent Systems Design from Chalmers University of Technology (Sweden) in 2006, and his B.E. in Computer Systems Engineering from NED University of Engineering and Technology Karachi, Pakistan in 2002. He posses professional experience in programming of realtime mission control systems as he had enjoyed working in both national and international R&D facilities committed to the development of intelligent and sustainable real-time systems.

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CITEC – Cognitive Interaction Technology

Persönliche Angaben

Geburtsdatum 23.03.1981
Geburtsort Shenyang, Liaoning, VR China
Nationalität Chinesisch
Ausbildung

Berufliche Praxis

Projekte

Sprachen
Deutsch fließend, Englisch fließend, Chinesisch Muttersprache

EDV-Kenntnisse