6th Joint Action Meeting

July 1-4, 2015

Budapest, Hungary

Organized by:
Andrea Jenei, Günther Knoblich, Laura Schmitz,
Natalie Sebanz, and Cordula Vesper

Central European University

Program

Wednesday, July 1st	
9:00 – 10:00	Registration
10:00 - 10:15	Welcome
10:15 – 11:15	Talk session A: Coordination
11:15 – 11:45	Coffee break
11:45 – 12:45	Talk session B: Shared representations
12:45 – 14:15	Lunch break
14:15 – 15:15	Talk session C: Improvisation 1
15:15 – 15:45	Coffee break
15:45 – 16:45	Talk session D: Music 1
16:45 – 17:00	Break
17:00 – 18:30	Talk session E: Dialogue

Thursday, July 2nd	
9:00 – 10:30	Talk session F: Action perception
10:30 – 11:30	Poster session 1 + coffee break
11:30 – 12:30	Talk session G: Synchrony and synchronization
12:30 – 14:00	Lunch break
14:00 – 15:30	Talk session H: Coordination and communication
15:30 – 17:00	Poster session 1 + coffee break + impro workshop
17:00 – 18:30	Talk session I: Goals and intentions 1

Friday, July 3rd	
9:00 – 10:30	Talk session J: Autism and schizophrenia
10:30 – 11:30	Poster session 2 + coffee break
11:30 – 12:30	Talk session K: Wild JAMming
12:30 – 14:00	Lunch break
14:00 – 15:30	Talk session L: Subjective experience
15:30 – 17:00	Poster session 2 + coffee break + impro workshop
17:00 – 18:30	Talk session M: Human-robot interaction

Saturday, July 4th	
9:00 – 10:00	Talk session N: Goals and intentions 2
10:00 – 10:30	Coffee break
10:30 – 11:30	Talk session O: Improvisation 2
11:30 – 11:45	Break
11:45 – 13:15	Talk session P: Development
13:15 – 14:45	Lunch break
14:45 – 15:45	Talk session Q: Music 2
15:45 – 16:15	Coffee break
16:15 – 17:15	Talk session R: Perspective
17:15 – 17:30	Break
17:30 – 18:30	Talk session S: Cooperation
18:30 – 19:00	Final remarks
19:00 -	JAM dinner + party

Talk sessions

Talk session A: Coordination	Wed, 10:15 – 11:15

Richard Schmidt
Causality in entrainment explanations of joint action

Tehran J. Davis, Mikol Nguyen, and Gabriela Baranowski Pinto
Which stance leads the dance?: The emergence of role in interpersonal coordination

Jorina von Zimmermann and Daniel C. Richardson
Groups & collective speech

Talk session B: Shared representations	Wed, 11:45 – 12:45

Pamela Baess and Wolfgang Prinz
What is shared in co-representation: The role of social attention

Lucia M Sacheli, Vanessa Era, Gaetano Tieri, Salvatore M Aglioti, and Matteo Candidi
Causative role of left aIPS in coding shared goals during complementary joint actions: studies combining motion capture and TMS

Xun He, Sanjay Kumar, Jie Sui, and Glyn W. Humphreys
An inhibitory mechanism of interpersonal memory guidance revealed by ERPs

Talk session C: Improvisation 1	Wed, 14:15 – 15:15

Caroline Palmer, Mark T. Elliott, Dominic Ward, Ryan Stables, and Alan M. Wing
  Effects of leadership, spontaneous musical rate, and tempo flexibility in violin trio synchronization

Michael Kimmel
  Collaborative creativity: Cognitive bases, generative modes, and intersubjectivity skills

Léa Chauvigné, Michel Belyk, and Steven Brown
  It takes two to tango: The neural basis of movement partnering

Talk session D: Music 1	Wed, 15:45 – 16:45

Giacomo Novembre, Daniela Sammler, and Peter E. Keller
  Self-other entrainment and co-representation are linked via neural alpha oscillations in joint action

Anna Zamm, Chelsea Wellman, and Caroline Palmer
  Interpersonal coordination is enhanced between individuals with similar endogenous rhythms

Lauren V. Hadley, Giacomo Novembre, Peter Keller, and Martin J. Pickering
  Putting yourself in someone else's shoes (or at someone else's piano): A TMS study of motor simulation for temporally accurate musical duet interaction

Talk session E: Dialogue   Wed, 17:00 – 18:30

Herbert H. Clark and Mija M. Van Der Wege
Pointing-for as joint action

Gregory Mills
Making and breaking procedural conventions: partner-specific effects

Paul Hömke, Judith Holler, and Stephen C. Levinson
Blinking as addressee feedback in face-to-face conversation

Anna K. Kuhlen, Carsten Bogler, and John-Dylan Haynes
Brains in dialogue: Decoding neural preparation of communication with a conversational partner

Talk session F: Action perception   Thu, 9:00 – 10:30

Andreas F. Reichelt and J. Randall Flanagan
Predicting choice behavior in action observation

Brian A. Eiler, Michael J. Richardson, and Rachel W. Kallen
Perceiving others as joint-action: How movement impacts person perception

Antonia Hamilton and Harry Farmer
Social control of the actions we do together

MaryLauren Malone and Michael J. Richardson
Social coordination dynamics and deception

Talk session G: Synchrony and synchronization   Thu, 11:30 – 12:30

Veronica C. Ramenzoni
   Why the body matters for joint action

D. S. Fraser, J. J. Honisch, M. T. Elliott, K. A., Quinn, and J. T. Cacioppo
   Contributions of fluency to the synchrony-liking relationship

Jacques Launay
   Synchronised human movement and social bonding beyond the action-perception link

Talk session H: Coordination and communication   Thu, 14:00 – 15:30

Bruno Galantucci
   The development of sophisticated forms of communication in humans

Adrian Bangerter and Eric Mayor
   Coordinating concurrent joint activities: Walking and talking

Laura Bishop and Werner Goebl
   Nonverbal communication during ensemble performance: When and how musicians improve their own predictability

Cordula Vesper and Laura Schmitz
   Communicating in time: Exaggeration of action duration for joint action

Talk session I: Goals and intentions 1   Thu, 17:00 – 18:30

Olle Blomberg
Team-agency, framing and Frege cases

Angelica Kaufmann
Animal intention

Lincoln Colling
Can we do away with representations in social motor coordination?

Ed Baggs
Against "joint action": team sports as activities in a populated environment

Talk session J: Autism and schizophrenia   Fri, 9:00 – 10:30

L. Marin, R. N. Salesse, C. Bortolon, M. Gueugnon, Z. Zhao, S. Raffard, D. Capdevielle, R. C. Schmidt, N. Schmitz, J. Henriques, D. Stricker, M. Di Bernardo, K. Tsaneva-Atanasova, P. Slowinski, C. Zhai, and B. G. Bardy
The effect of similarity to enhance socio-motor performance in schizophrenia

M. Khoramshahi, A. Shukla, and A. Billard
From joint-attention to joint-action: Effects of gaze on human following motion

Veronica Romero, Paula Fitzpatrick, R. C. Schmidt, and Michael J. Richardson
Computational measurement of social communication dynamics in adolescents with autism spectrum disorder

Paula Fitzpatrick, Teresa Mitchell, Jean Frazier, David Cochran, C. Coleman, and R. C. Schmidt
Exploring the behavioural and neural processes of joint action in individuals with and without social deficits

Talk session K: Wild JAMming — Fri, 11:30 – 12:30

Michael J. Richardson, Rachel W. Kallen, Auriel Washburn, and Patrick Nalepka
Symmetry, magnetic snakes, and sheep herding: Building a double-decker bandwagon

J.Scott Jordan and Eric Wesselmann
The 'self' as a embodied others: Implications for the moral aspects of joint action

Asaf Bachrach, Jose Luis Ulloa Fulgeri, Yann Fontbonne, and Coline Joufflineau
The Labodanse project: A novel framework for the study of physiological, cognitive and experiential intersubjective modulations during a live dance performance

Talk session L: Subjective experience — Fri, 14:00 – 15:30

Michiel van Elk
Keeping together in time: the effects of joint synchronous movements on peripersonal space

Andrea Schiavio and Simon Høffding
Playing together without communicating? A Pre-reflective and enactive account of joint musical performance

Axel Seemann
Joint processes and their relevance for mindreading

Nicole Czemeres and Janeen Loehr
We or me? Investigating the sense of agency in joint action

Talk session M: Human-robot interaction   Fri, 17:00 – 18:30

Tamara Lorenz
Designing dynamics for human-robot joint action

Tariq Iqbal, Samantha Rack, and Laurel Riek
Will you join the dance? Toward synchronous joint action in human robot teams

Sandra Devin, Aurelie Clodic, and Rachid Alami
A Theory of Mind for human-robot joint action

Astrid Weiss and Markus Vincze
Exploring joint action to inform human-robot collaboration: How to build something together?

Talk session N: Goals and intentions 2   Sat, 9:00 – 10:00

Corrado Sinigaglia
Acting together: Collective goals and motor representations

Anna Strasser
Can artificial systems join a joint action? Towards a minimal account of joint actions of mixed groups

Marianna Ginocchietti
Individual actions and shared actions: The trouble of individuation

Talk session O: Improvisation 2   Sat, 10:30 – 11:30

Lior Noy
Mirror games: recent studies applying the mirror game paradigm to study joint improvisation

P. Slowinski, C. Zhai, F. Alderisio, L. Marin, R. N. Salesse, B. G. Bardy, M. di Bernardo, and K. Tsaneva-Atanasova
Evidence of individual motor signature and kinematic similarity in the mirror game

Ashley Walton, Auriel Washburn, Charles Coey, Peter Langland-Hassan, Anthony Chemero, and Michael J. Richardson
Musical improvisation: Spatiotemporal patterns of coordination

Talk session P: Development   Sat, 11:45 – 13:15

Nicole Rossmanith, Alan Costall, Beatriz López, and Vasudevi Reddy
The many faces of "jointness" in the development of triadic infant-caregiver-object interactions over the first year or life

Nicolas Lindner
Children's joint action – always a matter of joint intentions?

Markus Paulus and Nike R.H. Tsalas
The development of children's understanding of others' effort and its relation on their partner selection in collaborative learning

Anna Ciaunica
Modelling the self through others: a developmental perspective

Talk session Q: Music 2   Sat, 14:45 – 15:45

Peter E. Keller, Rasmus Koenig, and Giacomo Novembre
Social communicative functions of the "beacon effect" in music performance

Kerry L. Marsh , Alexander Demos, and Roger Chaffin
Coordination of movement through music

Peta Mills and Peter Keller
The influence of perceived agency on rhythmic coordination with virtual partners

Talk session R: Perspective   Sat, 16:15 – 17:15

Francesca Capozzi, Caterina Ansuini, and Cristina Becchio
Implicit processing of group perspective: Here is a group!

Pavel Voinov, Günther Knoblich, and Natalie Sebanz
Interpersonal integration of perceptual judgments at an object location task

John Michael, Günther Knoblich, and Natalie Sebanz
From coordination to commitment

Talk session S: Cooperation — Sat, 17:30 – 18:30

Cédric Paternotte
Team reasoning and joint intentions

Anne Böckler
Changing for the better? Differential effects of meditation based trainings on different components of prosocial behavior

Daniel C. Richardson and Jorina von Zimmermann
The Hive: Experimenting with the group mind

Poster sessions

Sonia Betti, Umberto Castiello, and Luisa Sartori
The role of spatial attention on motor resonance: The case of complementary actions

Daniel L. Bowling and Tom Fritz
Musical agency modulates pain

Steven Brown, Kevin Mahiri Gitau, and Léa Chauvigné
The neural basis of audiomotor entrainment: A meta-analysis of neuroimaging studies

Birgitta Burger, Manuel Varlet, Kate Stevens, Petri Toiviainen, and Peter Keller
Effects of joint sensorimotor synchronization on individual performance in a music-induced movement task

Vincent T. Cialdella, Eric D. Wesselmann, and Jerome S. Jordan
Ostracism and false memory

Steve Croker and J. Scott Jordan
Social constraint: Joint action reduces response complexity in the Simon task

A. Curioni, L. M. Sacheli, M. Candidi, M., and I Minio Paluello
Follow the leader: Synchrony and imitation during motor interactions between autistic and neurotypical individuals

Stephan de la Rosa, Yannik Wahn, Heinrich Bülthoff, Laura Fademrecht, Aurelie Saulton, Tobias Meilinger, and Dong-Seon Chang
Does the two streams hypothesis hold for joint actions?

Vanessa Era, Lucia Maria Sacheli, Loredana Canzano, Gaetano Tieri, and Matteo Candidi
Limb apraxia and joint-actions

Tim Faber, Michiel van Elk, and Kai Jonas
Imitative and complementary actions in peri- and extrapersonal space

Luca Ferraro, Luisa Lugli, and Roberto Nicoletti
The strength to be in twain: angry faces with direct gaze are perceived as less threatening

Martin Freundlieb, Natalie Sebanz, and Ágnes M. Kovács
Evidence for spontaneous visuospatial perspective-taking during social interactions

M. Gueugnon, R. N. Salesse, B. G. Bardy, Z. Zhao, R. C. Schmid, and L. Marin
Improvement of motor improvisation during mirror game task

Masaharu Kato, Haruto Hirose, and Makio Kashino
Evidence of dynamic phase-synchronization of steps between paired walkers and its effect on building of interpersonal relationships

Michael Kimmel
Micro- and macro-coordination in Tango argentino

Sophie Milward, Ian Apperly and Natalie Sebanz
Active participation versus observation learning of joint actions

Reneeta Mogan, Ronald Fischer, and Joseph Bulbulia
Synchrony's effects on social and cognitive outcomes

Romy Müller
Joint spatial and temporal response-effect compatibility: Do anticipated reactions of a partner affect the planning and execution of hand movements?

Kieran J. O'Shea and Dale J. Barr
Tailoring descriptions to suit the listener's needs: Does retrieval fluency processing impact upon audience design in joint communication?

Sandra M. Pacione, Kimberley Jovanov, Emma Yoxon, and Timothy N. Welsh
Welcome to the Jungle: Evidence that cross-species body-part mapping is class-specific

Michaela Pfundmair, Geoffrey Whetherell, and Dieter Frey
Who is good, who is bad? Ostracism promotes group moralization

Vassilis Sevdalis
Know thy sound: Perceiving self and others in musical contexts

Chia-huei Tseng, Miao Cheng, and Masaharu Kato
Gender difference in implicit walking synchrony: female syncs better

Johanna E. van Schaik, Hinke Endedijk, Janny Stapel, and Sabine Hunnius
Motor interference and synchronization in young children: Biological or also social?

Manuel Varlet, Giacomo Novembre, and Peter E. Keller
Dynamical modulation of corticomotor excitability during rhythmic movement observation

E. Vilarem, J. Armony, and J. Grèzes
Effects of threat-related emotions on attention and action within realistic interaction context

Tim Welsh and Joseph Manzone
Hearing is not enough: Vision of the response is needed to generate social inhibition of return

Mateusz Wozniak and Guenther Knoblich
Self-prioritization of avatar faces

Jun Yin, Haokui Xu, Xiaowei Ding, Rende Shui, and Mowei Shen
Social constraints from an observer's perspective: Coordinated actions make agent's position more predictable

Emma Yoxon and Timothy N. Welsh
The relationship between action execution, imagination, and perception in children

Gregory Zelic, Jeesun Kim, and Chris Davis
Influence of phonetic constraints on spontaneous speech-gesture coordination: the compatibility of place of articulation in CVCV words

C. Zhai, F. Alderisio, P. Slowinski, K. Tsaneva-Atanasova, and M. di Bernardo
Design and implementation of an interactive cognitive architecture for a virtual player in joint action tasks

Jing Zhang
Simon task as a way to measure virtual hand illusion

Xuan Zhao, Corey Cusimano, and Bertram F. Malle
Activating spontaneous visual perspective taking: Actions, space, and the mind

Asaf Bachrach and Lior Noy

Timo Ahlers
Experimental evolution of grammar: Joint action dynamics in the Extended Embodied Communication Game (EECB)

Caterina Ansuini, Andrea Cavallo, Atesh Koul, Marco Jacono, Davide Quarona, and Cristina Becchio
Pretending to grasp it: the effect of weight in pantomimed actions

Cédric Beuzit, Michèle Guidetti, and Rachid Alami
Toward a framework for designing and studying human-robot joint activities

Adam Boncz, Natalie Sebanz, and Günther Knoblich
Processing communicative cues

Dong-Seon Chang
Blindly judging other people: Social interaction with an egoistic vs. cooperative person while being connected with a rope without seeing or hearing each other

Miao Cheng, Masaharu Kato, and Chia-huei Tseng
Individuals with higher autistic traits synchronize less when walking with strangers

Merryn D. Constable, Jay Pratt, Raynae S. Dumpfrey, and Timothy N. Welsh
Separate minds don't blink alike: The attentional blink does not transfer to joint contexts

Alexander P. Demos, Marcelo M. Wanderley, and Caroline Palmer
Comparisons of action simulation and motor synergies in piano duets

Dominik Dötsch and Anna Schubö
Social categorization and cooperation in motor joint action: Evidence for a joint end-state comfort

Brian A. Eiler, Rachel W. Kallen, Steven Harrison, R.C. Schmidt, Elliot Saltzman, and Michael Richardson
The effect of collision cost on behavioral dynamics: How changes in avoidance are captured by behavioral dynamics

Fruzsina Elekes, Máté Varga, and Ildikó Király
Evidence for spontaneous level-2 perspective taking in adults

Terry Eskenazi, Amelie Jacquot, Julie Grezes, Joelle Proust, and Laurence Conty
Metacognitive evaluations (post-decision confidence) modulates neural response to social feedback

Harry Farmer, Matthew Apps, and Manos Tsakiris
Trust in action: Modulation of the action observation network by trustworthiness

Joanna Hale and Antonia Hamilton
How fast should I mimic you? The timing of being mimicked

Dimitrios Kourtis, Günther Knoblich, and Natalie Sebanz
On the effect of switching tasks and partners on "self" and "other" task representations in joint action planning: An EEG study

Jarosław R. Lelonkiewicz and Chiara Gambi
Adaptation in Motor Imitation: Models Use Visual Feedback to Adapt to Imitators' Actions

Luisa Lugli, Anna Chiara Obertis, and Anna M. Borghi
Imitative and complementary actions evoked by individual vs. social hands movements

Luke McEllin, Natalie Sebanz, and Günther Knoblich
It's time to strike! Using a virtual xylophone to investigate signalling of procedural and declarative knowledge

Marlene Meyer, Robrecht P.R.D. van der Wel, and Sabine Hunnius
Adjusting my actions to you: Joint action planning during early childhood

Lynden K. Miles, Joanne Lumsden, Natasha Flannigan, Jamie Allsop, Martha Von Werthern, and Caitlin Taylor
Syncing thoughts: Interpersonal coordination and joint decision making

Sara Parmigiani, Luigi Cattaneo, and Corrado Sinigaglia
How motor representation shapes action experience

Rebecca Pedinoff, Anna K. Kuhlen, Jelle Demanet, John-Dylan Haynes, and Marcel Brass
Instruction-based task-sets in a social setting

Céline De Looze, Caterina Petrone, Keren Benittah, Adeline Trambert, Alain Ghio, Noémie Moreau, and Laurent Renié
Effects of cognitive disorders in dialogic conversation

Matthew Ray and Timothy N. Welsh
The influence of probability and space on the selection and planning of anticipatory sequential joint actions

L. M. Sacheli, M. Meyer, E. Hartstra, H. Bekkering, and S. Hunnius
Shared goals influence performance in joint action: a study with preschoolers and adults

Daniel S. Schloesser, Jiuyang Bai, Drew H. Abney, and J. Scott Jordan
Joint action coordination in a computer control task

Laura Schmitz, Basil Wahn, Günther Knoblich, and Peter König
Let's move it together: The costs and benefits of shared action control

Sarah Schwarzkopf
Individual and cooperative functions of shared visual attention

Caroline Szymanski, Timothy R. Brick, Dionysios Perdikis, Viktor Müller, and Ulman Lindenberger
'Stay with me': phase synchronization during one-sided vs. two-sided joint action in EEG hyperscanning

Alessia Tosi, Jaroslaw Roman Lelonkiewicz, and Holly Branigan
Partner perception, coordination and linguistic alignment in joint action

Johanna E. van Schaik and Sabine Hunnius
Mimic your friends not your foes: The development of behavioral mimicry during early childhood

Ashley Walton, Joubert Lucas, Rachel W. Kallen, Charles Coey, and Michael J. Richardson
Behavioral dynamics of joint-action and social movement coordination

Auriel Washburn, Rachel W. Kallen, Charles Coey, Kevin Shockley, and Michael J. Richardson
   Delays in temporal visual-motor feedback facilitate interpersonal anticipatory synchronization

Alexandra Westley, Thomas Atkinson, Colin Chambers, and Shirley-Ann Rueschemeyer
   'I know something you don't know': Online modelling of conversation partners in adolescence

Thomas Wolf, Cordula Vesper, Natalie Sebanz, and Günther Knoblich
   Do you believe in Mozart? - The influence of beliefs on representing joint action outcomes

Z. Zhao, R. N. Salesse, M. Gueugnon, R. C. Schmidt, L. Marin, and B. G. Bardy
   Does physical attractiveness influence interpersonal motor coordination

Abstracts

(in alphabetical order)

Experimental evolution of grammar: Joint action dynamics in the Extended Embodied Communication Game (EECB)

Timo Ahlers

University of Vienna, Department of German Studies

The study is situated in the field of experimental semiotics (Galantucci, 2009) and focuses on the evolution of non-verbal grammar systems in a computer based joint action task. For this purpose the embodied communicaton game (Scott-Phillips et al., 2009) was extended. Stimuli combinations of colours, shapes and local relations were added in order to evoke not only lexical communication systems but to foster joint semiosis processes that result in communication systems exhibiting a grammar. The game design follows the classification of communication systems by (Gärdenfors, 1995). Besides the joint development of grammar systems, other team processes are observed and evaluated: Which interaction conventions (e. g. turn taking strategies) are developed? How do they contribute to a successful teamplay? Which activity distributions among players and which personality trait combinations correlate with successful teamplay? First results of the pilot study with 24 players make processes of convergence and variation in individual interactions and the whole population visible.

Pretending to grasp it: the effect of weight in pantomimed actions

Caterina Ansuini[1][§], Andrea Cavallo[2][§], Atesh Koul[1], Marco Jacono[1], Davide Quarona[2], and Cristina Becchio[1,2]

[1]Department of Robotics, Brain and Cognitive Sciences, Italian Institute of Technology, Genova, Italy; [2]Centre for Cognitive Science, Department of Psychology, University of Torino, Torino, Italy; [§]equal contribution

Previous work has shown that the hand reaches for and grasps an object differently depending on its weight. For instance, the maximum grip aperture increases and the wrist peak velocity occurs later for heavy than for light objects. Capitalizing on this evidence, in the present study we test whether the actual grasp of an object is a prerequisite for weight-related effect to emerge. We ask participants to reach for, grasp and lift a glass that was present (real grasp) or visible but displaced (pantomimed grasp). The glass could be either empty (light object) or full (heavy object). Results indicate that pantomimed actions resemble, but are not indistinguishable from actual ones. In particular, kinematics assessment revealed that object's weight effect was restricted only to some of the parameters that were actually affected in real movements. For instance, while movement duration increases for grasp performed towards heavy than light object in both actual and pantomimed condition, the effect of weight on the timing of maximum grip aperture was evident only when the grasp was actually executed (i.e., being reached earlier for heavy than for light object). Taken together, these findings suggest that while some kinematics parameters reproduce the presence of the object, others fail. Possible implications for action-observation paradigms will be discussed.

The Labodanse project: A novel framework for the study of physiological, cognitive and experiential intersubjective modulations during a live dance performance

Asaf Bachrach, Jose Luis Ulloa Fulgeri, Yann Fontbonne, and Coline Joufflineau

Projet Labodanse Labex ARTS H2H

The Labodanse project combines physiological measures (heart / breathing rates) from public and dancers, online/offline experiential reports and cognitive tests to construct a multidimensional perspective regarding the subjective and intersubjective dynamics during a dance performance. Our first case study has been the work of the Choreographer Myriam Gourfink who uses Energy Yoga to bring her dancers to a state of altered consciousness. The resulting dance is extremely slow and hypnotic. We wanted to evaluate to what extent the public physiologically synchronizes with the dancers, how their time perception is affected by the slow pace and to what extent these different dimensions are correlated. In one study we found that the extent of breathing synchronization between public members and the dancers was correlated with reported attention to breath (one's own and that of the dancers). In a second study we found, using a duration estimation protocol, that slowing down of one's internal pacemaker was correlated with the degree of their engagement with the dance. We are now analyzing the results of further studies where we combined physiological monitoring and online experiential report and a variety of time-related cognitive tasks (tempo rating, duration estimation and apparent motion) before and after the performance.

What is shared in co-representation: The role of social attention

Pamela Baess[1,2] and Wolfgang Prinz[2]

[1]University of Hildesheim, Institute of Psychology, Hildesheim, Germany; [2]Max-Planck-Institute for Human Cognitive and Brain Sciences, Department of Psychology, Leipzig, Germany

Talking about co-representation during joint action, two different accounts can be suggested regarding temporal aspects of co-representation: a 'late' co-representation of the partner's response or an 'early' co-representation of the partner's stimuli. In order to differentiate between these two possibilities, we developed a paradigm, which enabled us to differentiate between the processes of stimulus identification, response preparation and the actual response. In the present EEG study, pairs of participants performed a simple Go/NoGo-reaction time task together. The participants responded to four action-associated stimuli triggering either the response of one participant, both participants or no-one's response. The same task was carried out together with a partner (joint Go/NoGo condition) and when the partner was not present (single Go/NoGo condition). We found smaller N1-respones for the action-associated stimuli in the joint Go/NoGo condition compared to the physically identical stimuli in the single Go/NoGo condition. The N1 responses differed further depending on the involvement of the partner. The observed differences in the N1-response occurred during the stimuli identification processes, clearly before the response preparation, thus favoring the idea of an 'early' co-representation account. Moreover, it is suggested that differences in the allocation of attention might be the driving source for the observed results.

Against "joint action": team sports as activities in a populated environment

Ed Baggs

University of Edinburgh

It has traditionally been assumed that individual actions are the output of mental processes. To talk of "joint action" is to imply that individual action is primary, and that social activity is a special case in need of additional explanation. But there is no reason why this should be so. Instead, we might reject outright the concept of mental content. And rather than create a divide between two types of action, individual and joint, we might talk of a single type of action: behaviour in a populated environment. On this view, the basic fact about action is that it involves animal-environment relations. A feature of our environment is that it is shared with other animals: anything we do to perturb the structure of our own environment necessarily alters the structure of the environment for everyone else. Action is therefore intrinsically social. Coordinating action with other animals does not require any special explanation in terms of "joint" activity. The mystery has simply dissolved. To illustrate this I discuss some phenomena in team sports: ball possession in soccer and slip catches in cricket. These can be completely described in terms of relations between actors and objects, and without appealing to mental content.

Coordinating concurrent joint activities: Walking and talking

Adrian Bangerter and Eric Mayor

University of Neuchatel, Switzerland

We report an experiment on how two concurrent joint activities, walking along an itinerary using a map and conversing, are coordinated. Forty dyads were videotaped using a videocamera mounted on a mobile perch while conversing (a narrator narrated a story to a listener) in four different within-subject conditions of mobility. The stories were narrated while participants were (a) stationary (control condition), (b) walking in a straight line, (c) navigating a complex itinerary, and (d) navigating a complex itinerary without the constraint of telling a story. Participants were randomly assigned to one of two between-subjects conditions. In one condition the narrator was responsible for the map. In the other, it was the listener. We transcribed talk and coded the occurrence of multimodal behaviors (gaze, gestures) involved in coordinating either the narrative task or the navigation task. Results show how multimodal resources like gaze are flexibly allocated to either the narrative or navigation depending on the momentary constraints of the situation. Selected examples show the range of strategies used to navigate bottlenecks (e.g., when a complex itinerary featured a change of direction). The experiment opens up a range of theoretical and empirical issues related to the coordination of multiple concurrent joint activities.

The role of spatial attention on motor resonance: The case of complementary actions

Sonia Betti, Umberto Castiello, and Luisa Sartori

Department of General Psychology, University of Padova

A large body of evidence indicates that observing actions can activate corresponding motor representations in the observer's brain. However, studies from our laboratory recently demonstrated that in interactive social contexts this imitative tendency could turn into readiness to perform a dissimilar complementary action. It is currently believed that the observation-execution matching process occurs relatively automatically with no need for top-down control. Nevertheless, the automaticity of the visuomotor transformation process has been poorly investigated. The aim of the present study was to clarify the role of spatial attention during the shift from motor resonance to reciprocity. Single-pulse Transcranial Magnetic Stimulation (TMS) was used to assess corticospinal excitability facilitation while participants observed actions sequences evoking imitative or complementary movements. The allocation of exogenous spatial attention was manipulated by means of a colored cue. Results showed that motor facilitation during the observation of social and non-social actions can be modulated by attention's allocation. The present finding suggests that attention seems to have a key role during social interactions, enabling our motor system to resonate just for actions that are relevant to our goals.

Toward a framework for designing and studying human-robot joint activities

Cédric Beuzit[1,2,3], Michèle Guidetti[1], and Rachid Alami[2]

[1]ECCD/Octogone (EA4156), Université de Toulouse Jean-Jaurès, Toulouse, France; [2]LAAS/CNRS (UPR8001), Toulouse, France; [3]Université de Toulouse Paul Sabatier, Toulouse, France

There is little doubt that knowledge in psychology can help research in interactive robotics; yet, the opposite is certainly just as true. Interactive robotics already started to produce some capable platforms, which might be seen as simple and controllable models to researchers in humanities, life, social and cognitive sciences, useful to develop and experiment with their theories, to verify, produce and reproduce some observations. Based upon Vygotsky's idea of artifact-mediated activities, its developments as the Activity Theory, and some related investigations, we are elaborating a comprehensive framework for collaborative robots that can engage into situated joint activities with humans. Gathering and articulating together some empirical and experimental data from various sources (such as primatology, anthropology, semiotics, cognitive and developmental psychology) with some more conceptual theories (from linguists, philosophers, psychologists, etc.), the motive is not only to model and build some useful and friendly mechanical companions, but also to make robots a tool of choice for helping to grasp a better understanding of the processes and mechanisms underlying joint action, like attention, engagement and turn-taking.

Nonverbal communication during ensemble performance: When and how musicians improve their own predictability

Laura Bishop[1] and Werner Goebl[1,2]

[1]Austrian Research Institute for Artificial Intelligence (OFAI), Vienna, Austria; [2]Institute for Music Acoustics, University of Music and Performing Arts Vienna, Austria

Successful synchronisation between two people requires at least one person to be able to predict the actions of the other. Prediction can be difficult when actions follow imprecisely-specified timing patterns, however, as during music ensemble performance. In such situations, performers modify their behaviour to make themselves more predictable. We present two studies investigating the nonverbal cues that musicians exchange to improve their own predictability and facilitate synchronisation during duet performance. Study 1 tested pianists' reliance on auditory and visual cues in musical contexts where timing was more- or less-precisely specified by the score. While participants relied primarily on auditory cues to synchronise, visual cues were important at points where timing was ambiguous - especially at re-entry points, where playing resumed following a long pause (> 2 s). Study 2 (currently ongoing) maps the gestures musicians use to cue each other in at the starts of pieces. Forwards-backwards head acceleration is hypothesised to indicate the timing of initial note onsets, while gesture duration is hypothesised to indicate piece tempo. Together, these studies further our understanding of the language used by ensemble musicians to improve their own predictability, and show how this language can be adapted to different musical contexts to maintain synchronisation.

Team-agency, framing and Frege cases   I

Olle Blomberg

Center for Subjectivity Research, Department of Media, Cognition and Communication, University of Copenhagen

In order for several agents to participate in a joint action directed at a goal G, each agent must arguably believe that G is a single goal each is aiming at. However, many accounts of joint action fail to rule out cases where agents don't believe this because the agents represent the goal of their own action and the goal of the others' actions under different aspects and then fail to realize that these are indeed aspects of a single goal G. Such "Frege-style" cases appear to be especially troubling for accounts of joint action that are intended to capture what is going on in young children's joint activities, at least if young children aren't capable of representing and comparing how different agents represent a goal under different aspects. Blomberg (2015) has presented a Frege-style counterexample of this kind to Butterfill's (2012) account of goal-directed joint action and provided a cognitively undemanding solution. In this talk, I argue that Pacherie's (2011, 2013) team-agency account of children's joint activities faces a similar counterexample, and that a similar solution for dealing with the counterexample is available. The argument raises some interesting questions about the theory of "team reasoning" that Pacherie draws on.

Changing for the better? Differential effects of meditation based trainings on different components of prosocial behavior

Anne Böckler

Max Planck Institute for Human Cognitive and Brain Sciences, Department of Social Neuroscience, Leipzig, Germany

Prosocial behavior – from offering seats to the elderly to taking in refugees - is a form of social interaction that is crucial for functioning societies. The present studies aimed at investigating i) the structure and ii) the plasticity of different facets of prosocial behavior. In order address the first goal, fourteen measurements of prosocial behavior from different research traditions were integrated, ranging from self-reports to game theoretical paradigms. Using factor analyses in two independent samples, we identified and confirmed four meaningful and reliable sub-components of prosociality: altruistically motivated-, norm motivated-, strategically motivated-, and self-reported prosocial behavior. Subsequently, we investigated how the identified sub-components changed as a function of three specific, twelve-week mental training techniques, focusing either on attention and awareness (Presence), loving kindness and caring motivation (Affect), or metacognitive and perspective taking (Perspective). Results revealed that truly altruistic behavior was most efficiently enhanced by the affect-based training, while norm-driven behavior was reduced particularly by the perspective taking training. Interestingly, (changes in) self-reported and behavior-based prosociality were not correlated, suggesting that people who consider themselves (increasingly) altruistic don't necessarily behave in that manner. Taken together, our results suggest that different facets of prosocial preferences can be identified and differentially altered by specific mental trainings.

Adam Boncz, Natalie Sebanz, and Günther Knoblich

Social Mind and Body Center, Central European University, Budapest

A communicative signal is often considered as insufficient for comprehension by itself. Instead, a signal might be viewed as a piece of evidence for the intended meaning of the communicator that is needed to be combined with context for understanding. More specifically, in the case of a signal without a conventional meaning, the comprehension process is hypothesized to include the analysis of the possible intentions and capabilities of the communicator and the potential meanings offered by the environment. Thus, in a task situation, a piece of information (e.g. a precue) coming from a co-actor should be processed in a different way than if it were the same information but with a different source (e.g. a precue as traditionally used in many experimental designs). Our goal was to test this hypothesis. We used a communicative precuing paradigm where participants had to perform a spatial compatibility task where stimuli were always preceded by precues. Across four experiments, we manipulated the source of the precue (selected by another participant or generated by the computer) and task complexity. We measured reaction times and error rates. Our results suggest an effect of the source of the precues in the case of the complex task.

Daniel L. Bowling[1] and Tom Fritz[2]

[1]Department of Cognitive Biology, University of Vienna. Vienna, Austria; [2]Department of Neurology, Max Plank Institute for Human Cognitive and Brain Sciences

Performing music is often a physically intense experience. Singers and instrumentalists regularly exert considerable effort to produce their desired sound. The connection between exertion and music production is examined here using a "jymming" paradigm. This paradigm combines exercise machines designed for weight training with digital sensors to manipulate musical sounds in real time. Previous work using this paradigm has shown that when motor actions are systematically coupled to the manipulation of musical sounds (a condition referred to as musical agency) subjects experience improvements in mood, reductions in perceived effort, and enhanced metabolic efficiency over and above control conditions. The physiological mechanism(s) by which these positive effects are realized remains unknown. One intriguing possibility is that muscular exertion in the service of music triggers the release of endogenous opioids in the central nervous system. We examined this possibility here by comparing changes in pain sensitivity following exercise sessions with and without musical agency. The results show significantly greater decreases in pain sensitivity following sessions with musical agency than without. This result provides evidence for physiological mechanisms underlying the rewards of motor-music coupling, shedding light on benefits that may have been enjoyed by our ancestors, and adding to a growing biological framework for understanding the evolution of music.

The neural basis of audiomotor entrainment: A meta-analysis of neuroimaging studies

Steven Brown, Kevin Mahiri Gitau, and Léa Chauvigné

NeuroArts Lab, Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, ON, Canada

Synchronization of body movement to an acoustic timekeeper is a major form of entrainment, such as occurs in dance. This is exemplified in experimental studies of finger tapping. Entrainment to a beat is contrasted with movement that is internally driven and is therefore self-paced. In order to examine brain areas important for entrainment to an acoustic beat, we meta-analyzed the functional neuroimaging literature on finger tapping (43 studies) using activation likelihood estimation (ALE) meta-analysis with a focus on the contrast between externally-paced and self-paced tapping. The results demonstrated a dissociation between two subcortical systems involved in timing, namely the cerebellum and the basal ganglia. Externally-paced tapping highlighted the importance of the spinocerebellum, most especially the vermis, which was not activated by self-paced tapping. In contrast, the basal ganglia, including the putamen and globus pallidus, were active during both types of tapping, but preferentially during self-paced tapping. These results indicate a central role for the spinocerebellum in audiomotor entrainment.

Effects of joint sensorimotor synchronization on individual performance in a music-induced movement task

Birgitta Burger[1], Manuel Varlet[2], Kate Stevens[2], Petri Toiviainen[1], and Peter Keller[2]

[1]University of Jyväskylä, Finland, Department of Music; [2]University of Western Sydney, Australia, The MARCS Institute

Carrying out tasks in coordination with another person requires individuals to adapt their motor behavior to one another. The present study investigated whether the effects of such behavioral modifications extend beyond the episode of joint coordination to influence subsequent individual performance on a task requiring sensorimotor synchronization with music. Sixteen pairs of individuals were recorded with a motion capture system while either swaying sideways or bouncing up and down to musical stimuli. Participants first performed the tasks individually, then jointly with the other participant, and then individually again. From the bounce and sway data, inter-onset-interval (between extrema in the vertical/horizontal position per movement cycle) variability and smoothness of the movement were calculated. Comparing the difference in paired individuals' movement characteristics in pre-joint and post-joint conditions revealed that the two participants' smoothness of swaying and variability in bounce timing was significantly more similar in the second individual session (after moving together). The effect for bouncing was relatively small in pairs in which only one participant reported to have changed movement behavior between individual and joint conditions. This result suggests that the mutual adaptation of co-performers' movement characteristics during joint coordination has an assimilative influence that carries over to subsequent individual performance.

Implicit processing of group perspective: Here is a group!   R

Francesca Capozzi[1], Caterina Ansuini[2], and Cristina Becchio[1,2]

[1]Center for Cognitive Science, Department of Psychology, University of Torino, Torino, Italy; [2]Robotics, Brain and Cognitive Sciences, Istituto Italiano di Tecnologia, Genova, Italy

Previous research suggests that, in simple visual perspective tasks, the viewpoint of another person (e.g., a human avatar) is implicitly processed without instruction to do so and even when it interferes with participants' judgments of their own perspective (altercentric intrusion; Samson et al. 2010). Here we asked whether the number of avatars in the scene modulates the strength of the altercentric intrusion effect. To investigate this issue, we adapted the paradigm used by Samson and colleagues (2010), to include three, five, or seven avatars in the scene. Our results indicate that altercentric intrusions tend to increase as the group size increases: the higher the number of avatars, the stronger the interference from the avatars' perspective, with a significant threshold between three and five avatars (Experiment 1). This modulation was not observed when the avatars were replaced by parallelepipeds (Experiment 2). Humans, as a group-living species, benefit from the experience of others to monitor the environment and detect threats and resources (Van Vugt, 2014). These findings suggest that group size modulates the relative importance we assign to others' visual experience. When more than three people look at an object, this is something you cannot miss!

Blindly judging other people: Social interaction with an egoistic vs. cooperative person while being connected with a rope without seeing or hearing each other

Dong-Seon Chang

Max Planck Institute for Biological Cybernetics

When two people interact, they adjust their behavior to each other. For this, they utilize verbal or non-verbal communicative signals which are in most cases either visual or auditory. But how do people adjust their behavior with a partner when there are no possibilities to exchange visual or auditory cues? Furthermore, do people make social inferences about each other in such a situation? In a novel experimental setup, we connected two people with a rope and they had to accomplish a joint motor task together while being separated by a blind and not able to see or hear each other. However, the participant's confederate was always an experimenter who behaved either egoistically or cooperatively in a consistent manner. We measured the point-collecting behavior and speed of coordination during the interaction, and person-related judgments about the confederate after the interaction (n=24). Results showed strong partner-dependent changes in behavior depending on whether the partner was egoistic or cooperative ($t(23)=24.21$, $p<0.001$). In addition, an egoistic partner was more often judged as a male and bigger in size compared to a cooperative partner. These results demonstrate that partner-dependent changes in behavior and automatic judgments occur naturally even when possibilities for communication are minimal.

It takes two to tango: The neural basis of movement partnering

Léa Chauvigné, Michel Belyk, and Steven Brown

Department of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, Ontario, Canada

We present here the results of the first neuroimaging study to look at the neuralmechanisms underlying the joint movement that occurs when two people move as a couple with physical contact. In this functional MRI study, each subject interactedphysically with an experimenter standing next to the bore of the MRI magnet so as to permit partnered movements through physical contact at the hands, where the subject alternated between being the "leader" and "follower" of these improvised joint movements. This was compared with "solo" condition (improvised, no partnering) andwith a "mutual" condition, in which the partners performed a pre-learned movement pattern (i.e., with no leader or follower). Eighteen subjects (nine of each gender) with partner dancing experience participated. Comparing partnered movement with solo ovement indicated the importance of neural systems involved in somatosensory and proprioceptive contact-based interaction. Comparing leading and following showed that leading activated areas involved in spatial navigation, motor planning and force production, while following activated areas involved in social cognition as well as an area typically associated with visual motion. Mutual movement showed a profile much closer to following than leading, whereas solo movement showed a profile much closer to leading than following.

Individuals with higher autistic traits synchronize less when walking with strangers

Miao Cheng[1*], Masaharu Kato[2], and Chia-huei Tseng[1]

[1]Department of Psychology, University of Hong Kong, Hong Kong;
[2]Human Information Laboratory, NTT Communication Science Laboratories, NTT Corporation, Kanagawa, Japan

Numerous studies indicated interpersonal body synchrony could be affected by psychological factors, such as group membership, punctuality, and etc. However, whether implicit body entrainment is predisposed by permanent traits is still little investigated. The current research associates walking synchrony with autistic personality. We simulated the situation when people first meet. Participants unknown to each other were paired up to walk and chat under a pleasant natural environment, while their walking steps were recorded by motor sensors attached above ankle. Importantly, participants were misled that the sensors were GPS device, which assured unawareness of motor recording so that the entrainment was completely implicit. Before walking, autistic trait was assessed by Autism Spectrum Quotient questionnaire (Baron-Cohen et al., 2001). Results suggested that dyads with higher AQ synchronized less. Further analysis from AQ subscales indicated that only social skills, attentional switching, and imagination were involved in utilizing body entrainment during social interaction, but not attention to details and communication skills. Our study suggests that individuals' autistic tendency predisposed their body coordination with others, and possible mechanisms from conceptual, perceptual, and mortorical levels are discussed.

Vincent T. Cialdella, Eric D. Wesselmann, and Jerome S. Jordan

Illinois State University

Ostracism (being ignored and excluded) threatens social connection and makes individuals more vulnerable to social influence. We investigated if ostracized individuals also experience increased cognitive vulnerability, measured by false memory. We hypothesized ostracized participants would recall more false memories than included participants or participants in a non-social control condition. One hundred forty-three participants either played Cyberball, a computer game commonly used to manipulate ostracism, or engaged in a non-social control task (i.e., visualizing themselves making breakfast). All participants then listened to an audio file which presented 82 words, 72 of which corresponded to one of 6 false memory critical lures. Participants completed a 2-minute distraction task and then freely recalled words from file. We found marginally significant differences between the inclusion and control conditions in false memory, the number of words incorrectly recalled and the total number of unique words recalled. Unexpectedly, there was a significant interaction between condition and the participants' self-reported history being bullied. Participants in the non-social control condition who reported more victimization reported feeling more excluded (and other negative outcomes associated with ostracism) than in the other two social conditions; there was no difference in conditions for participants with little victimization history.

Modelling the self through others: a developmental perspective

Anna Ciaunica

Institute of Philosophy, Porto; Centre for the Study of Senses, Institute of Philosophy, University of London (UK)

Recent work on predictive coding suggested that the basic experience of being a self is the result of an ongoing predictive coding process within a generative model that is centred onto the organism. (Friston 2009; Hohwy 2007; Clark 2013). Yet, it is not clear whether this "ongoing" dynamic aspect refers exclusively to a self-centred continuity or encompasses self-other relatedness as well. In this paper I draw on recent empirical findings on the developmental primacy of social versus visual perspective-taking (Moll and Kadipasaoglu 2013) to provide a nuanced understanding of the notion of basic self-awareness. Indeed the sensorimotor synchronization of bodily coupling between infant/caregiver supports the formation of interpersonal bonds. Infants process a rudimentary sensorimotor understanding of how modulations of bodily movements and attentional focusing affect sensory change. Here I argue that at the basic level, minimal self-awareness might be modelled through 'bodily coupling' and synchronization with others. In other words, for the system's self-modelling to be successful, the self needs to be embedded not only into the causal network of the physical world (Knoblich et al. 2003; Metzinger 2004a, 2005), but also into the socially interactive world (Bruineberg & Rietveld 2014).

Pointing-for as joint action   E

Herbert H. Clark and Mija M. Van Der Wege

Stanford University, Carleton College

People don't merely point at things. They point at things for others. When A points at something for B, the two of them act to jointly locate the indicatum (what A is pointing at) and to jointly identify the referent (what A is referring to), all within the duration of A's pointing. To examine this account, we asked nine engaged or married couples to furnish a suburban house by placing decals on a blueprint. From six hours of recordings, we randomly selected 150 pointing gestures for analysis. When people point with a deictic reference (e.g., "this room" or "here"), the phrase indexes the gesture, so people don't need to synchronize the gesture with the phrase, and in our data, they didn't. But when people point without a deictic reference, it is the timing of the gesture that indexes the phrase it is affiliated with, so here it is necessary to synchronize the gesture with the phrase, and in our data, people did. Finally, whenever people point, they should maintain the gesture until they have evidence they and their partners have jointly located the indicatum, and this is just what people in our study did.

Can we do away with representations in social motor coordination?   I

Lincoln Colling

Department of Cognitive Science, Macquarie University

The behavioural dynamics approach to social motor coordination (e.g., Schmidt et al, 2011) is often taken to be an alternative to approaches based on internal representations, such as simulation/emulation approaches (e.g., Colling, Sebanz, Knoblich, 2013). Where they are not seen as alternatives, behavioural dynamics based approaches to social motor coordination might be viewed as proposing an explanation for some simple kinds of coordination without the need to invoke representations. It is because the behavioural dynamics approach does not invoke internal representations yet still manages to be predictively powerful that is taken as its great strength. Indeed, internal representations are notoriously under-specified and their use in explanations has been roundly criticised by philosophers (e.g., Chemero, 2011). In this paper, we aim to show the push to exorcize internal representations from investigations of social motor coordination is mistaken. In particular, it is mistaken because behavioural dynamics approaches to social motor coordination are explanatorily under-specified. By employing an approach to explanation, sometimes called the covering-law approach (Chemero, 2011), but more accurately termed predictivism (Kaplan and Betchel, 2011), the explanations posited by the behavioural dynamics approach leaves certain explanatory gaps in the causal story of the system's behaviour (Colling and Williamson, 2014). Once an alternative explanatory approach is adopted, the causal-mechanical approach (Betchel, 2008; Craver, 2007) the case for anti-representationalism is no longer clear.

Separate minds don't blink alike: The attentional blink does not transfer to joint contexts

Merryn D. Constable, Jay Pratt, Raynae S. Dumpfrey, and Timothy N. Welsh

University of Toronto

A number of psychological phenomena that are present when individuals act alone are also present when pairs act together. For example, the Simon effect, the Flanker effect, the SNARC effect and IOR effects all have social counterparts. We sought to determine if an attentional blink can emerge when pairs of participants complete an RSVP task. Participants were asked two identify two targets: a white letter and a black X in a stream of black letters. This task was completed both individually (one participant responded to both targets) and jointly (one participant responded to the white letter and one the black letter). A typical attentional blink was observed in the individual condition. Specifically, a decrease in the detection rate of the X was observed when it was presented three letters after the first target as compared to when presented one, five or seven letters after the first target. This pattern of results was not observed in the joint condition where the detection rate of the X remained constant across all letter positions. These findings indicate that processes underlying joint action phenomena are not detected in an attentional blink task, suggesting that co-representation may not readily exert influence over low-level perceptual processes.

Social constraint: Joint action reduces response complexity in the Simon task

Steve Croker and J. Scott Jordan

Department of Psychology, Illinois State University

We examined the effects of individual versus joint action on response complexity in the Simon task. Participants responded with a mouse movement rather than a button press. Participants (N=60) completed three tasks (100 trials each). Each trial consisted of a left- or right-pointing hand wearing either a green or red ring. In the individual task, participants clicked a box at either edge of the screen, depending on ring color (i.e., left for red, right for green). The other two tasks involved dyads in which one member was a confederate. Participants always clicked right for a green ring. In the joint-color task, confederates responded left to red rings, and in the jointdirection task, confederates responded to the direction of the hand. Trials on which the hand direction pointed away from the correct response are spatially ncompatible, and trials on which both the direction and color indicate the same response are spatially compatible. Entropy measurements for each mouse movement (Dale et al., 2007) revealed sample entropy was significantly higher on the individual task than on the joint tasks, and significantly higher on spatially incompatible versus spatially compatible trials. We interpret these findings in terms of response conflicts and socially motivated inhibition.

Follow the leader: Synchrony and imitation during motor interactions between autistic and neurotypical individuals

A. Curioni[1,2], L. M. Sacheli[1,2,3], M. Candidi[1,2], and I. Minio Paluello[1,2]

[1]Department of Psychology, Sapienza University, via dei Marsi 78, 00185, Rome, Italy; [2]IRCCS, Fondazione Santa Lucia, via Ardeatina 306, 00100, Rome, Italy; [3]Department of Psychology, University of Milano-Bicocca, Milan, Italy

Individuals with Autism Spectrum Disorder (ASD) are characterized by impaired social skills. We explored how 16 pairs of ASD (without cognitive disability) and Neurotypical (NT) participants interacted in a joint motor task in which they had to grasp bottle-shaped objects as synchronously as possible using either precision or power grips. Performance (i.e. grasps' synchrony) and hand kinematics were measured. Each participant was asked to either guide the interaction (Leader) or adapt to the partner's action (Follower). Partners' actions could be either congruent or incongruent depending on the location and therefore the type of grasp to be performed. Participants performed a control Non-Social task in which they had to synchronize their congruent/incongruent grasp with a dot moving on a screen toward the upper or lower part of the object. Results suggested that, when acting as Followers, only ASD were significantly worse in synchronizing in the Non-Social condition, while groups' performance didn't differ in the Social condition. Conversely, analyses on Grip Aperture kinematics revealed that, when acting as Followers, both ASD and NT showed stronger imitative behaviors in the Social vs. Non-Social condition. However, ASD kinematics revealed that their behavior was less modulated by the interaction with a partner.

We or me? Investigating the sense of agency in joint action   L

Nicole Czemeres and Janeen Loehr

Department of Psychology, University of Saskatchewan

When people act alone, they typically experience a sense of self-agency or control over actionsand their effects. When people act in coordination with others, they may instead experience a sense of joint agency or shared control. The current study examined two factors hypothesized to influence the experience of joint agency. Pairs of participants coordinated their actions to produce eight-tone sequences that matched the pace set by a metronome. The degree to which participants adapted to each other was manipulated by having them produce tones either in alternation or sequentially (one participant produced the first four tones and the other produced the last four). For each sequence, each participant was either the leader, who produced the first tone(s), or the follower. After each sequence, both participants rated their sense of joint agency on a scale that ranged from shared to independent control. Ratings were lower (indicating shared control) for alternating compared to sequential sequences, and for followers compared to leaders. Differences between leaders and followers were greater for sequential sequences. These findings suggest that both the degree of adaptation and one's role in a joint action contribute to the experience of joint agency.

Which stance leads the dance?: The emergence of role in interpersonal coordination

Tehran J. Davis, Mikol Nguyen, and Gabriela Baranowski Pinto

University of Connecticut, USA

Achieving a shared goal usually requires co-actors to adopt complementary roles. In many cases, who adopts which role is not explicitly predetermined, but instead emerges provided differences in the relative constraints and abilities of each actor. Perhaps the most basic roles that actors fall into are "leader" and "follower". Here, we investigated the emergence of a "leader-follower" dynamic in interpersonal coordination using a supra-postural manual coordination paradigm (Athreya, Riley, & Davis, 2014; Ramenzoni, Davis, Riley, Shockley, & Baker, 2011). Pairs of actors were tasked with holding two objects in alignment (each actor manually controlled one of the objects) as they faced differing demands to maintaining upright stance (stable v. difficult) and control (who controlled the larger object). Our results indicate that when actors were in identical stances, neither led the coordination by any appreciable amount (as measured using CRQA, Coco & Dale, 2013). Alternatively, when asymmetries in postural demands were introduced, the actor with the more stable stance led the coordination. This effect, however, was mitigated if the opposite actor controlled the larger object. Perhaps most intriguing, pairs performed this task best (as measured by time spent in alignment) when one of the actors was in the more difficult stance condition, that is, when they adopted complementary "leader-follower" roles.

Does the two streams hypothesis hold for joint actions?

Stephan de la Rosa, Yannik Wahn, Heinrich Bülthoff, Laura Fademrecht, Aurelie Saulton, Tobias Meilinger, and Dong-Seon Chang

Max Planck Institute for Biological Cybernetics, Department for Perception, Cognition, and Action

Associating sensory action information with the correct action interpretation (semantic action categorization (SAC)) is important for successful joint action, e.g. for the generation of an appropriate complementary response. Vision for perception and vision for action has been suggested to rely on different visual mechanisms (two streams hypothesis). To better understand visual processes supporting joint actions, we compared SAC processes in passive observation and in joint actions. If passive observation and joint action taps into different SAC processes, then adapting SAC processes during passive observation should not affect the generation of complementary action responses. We used an action adaptation paradigm to selectively measure SAC processes in a novel virtual reality set up, which allowed participants to naturally interact with a human looking avatar. Participants visually adapted to an action of an avatar and gave a SAC judgment about a subsequently presented ambiguous action in three different experimental conditions: (1) by pressing a button (passive condition) or by either creating an action response (2) subsequently to (active condition) or (3) simultaneously with (joint action condition) the avatar's action. We found no significant difference between the three conditions suggesting that SAC mechanisms for passive observation and joint action shares similar processes.

Effects of cognitive disorders in dialogic conversation

Céline De Looze[1,2], Caterina Petrone[1,3], Keren Benittah[3], Adeline Trambert[3], Alain Ghio[1,3], Noémie Moreau[1,4] , and Laurent Renié[4]

[1]Laboratoire Parole et Langage, CNRS; [2]Phonetics and Speech Laboratory, CLCS, Trinity College Dublin, Ireland; [3]Aix-Marseille Université, France; [4]Neurology Department, Pays d'Aix Hospital, Aix-en-Provence, France

Participating in a dialogic conversation requires complex skills for inter- and intra-personal coordination. During turn-taking, for instance, conversational partners have to rapidly agree on who speaks next and when. This requires that they start planning their utterances already when listening to their interlocutors. The present study investigates speech planning in French dialogues, by determining whether the size of the planning unit depends on speakers' cognitive abilities. Cognitive constraints are investigated by looking at the effects of working memory capacity in healthy adults and in individuals with cognitive disorders, i.e., with patients affected by multiple sclerosis (MS). An interactive card game was created, in which cognitive load was manipulated by requiring the conversational partners (8 pairs of healthy-healthy speakers vs. 8 pairs of healthy-MS speakers) to recall the images displayed on the cards while talking. A battery of neuropsychological tests allowed assessing individual cognitive abilities. Preliminary results suggest that MS patients with low working memory realize longer pauses at the beginning of their utterance and their speech is characterized by higher number of pauses and slower speech rate. This suggests that individual differences should be taken into account by models of language processing.

Comparisons of action simulation and motor synergies in piano duets

Alexander P. Demos[1], Marcelo M. Wanderley[2], and Caroline Palmer[1]

[1]Department of Psychology, McGill University, Montreal, CANADA;
[2]Department of Music Research, McGill University, Montreal, CANADA

Action simulation and motor synergy theories were compared in a piano duet task. Pianists (n = 32) performed two-part music, both alone (solo) using two hands, and with a partner (duet), each using one hand. Auditory feedback created by the left, right, or both hands was removed unpredictably and temporarily from sound delivered to both pianists over headphones. Disruption during feedback removal and return was measured by tones' temporal variability. Both theories predict that feedback removal in solo performance should not disrupt pianists because the same motor system produces both parts. For duet performance, action simulation predicts that a performer should not be disrupted by the removal of their own (familiar) feedback, whereas motor synergies predict that feedback removal from either part will disrupt both performers, as the pair's real-time coupling is broken. Unexpectedly, right-hand feedback removal in the solo condition disrupted the timing of the right-hand part (melody), suggesting that performers relied on the melody's auditory feedback. Left-hand feedback removal disrupted both performers in the duet condition, while right-hand feedback removal disrupted only the left-hand part. Overall, the findings support motor synergy predictions, but asymmetries in disruption between hands suggests that assumptions of equal coupling between actors are incorrect.

A Theory of Mind for human-robot joint action

Sandra Devin, Aurelie Clodic, and Rachid Alami

Univ de Toulouse, INP, LAAS

In robotics, one of the actual research interest is to create robots that are able to work jointly with humans in manufacture or to help them in their everyday life. To do so, robots need to be able to perform Joint Actions. Based upon a state of the art in robotics and social sciences, we use a simple joint task (a human and a robot building a stack of cubes together) for which we study several possibles scenarios to:
- Identify which challenges robots have to handle during Joint Action execution.
- Determine what is the minimal knowledge that robots have to have about other people mental states to solve these issues.
- Formalize how a robot can represent other people mental states.
- Define several kinds of process that robots can use to estimate and influence other people mental states.

This work allows our robot to have what we think is a minimal Theory of Mind to achieve meaningful human-robot Joint-Actions.

Social categorization and cooperation in motor joint action: Evidence for a joint end-state comfort

Dominik Dötsch and Anna Schubö

Cognitive Neuroscience of Perception and Action, Faculty of Psychology, Philipps University Marburg, Germany

We investigated to what extent group membership affects an actor's representation of their partner's task in cooperative joint action. Participants performed a joint pick-and-place task in a breakfast-table-like paradigm where they transported a wooden cup across a table, with one actor moving it to an intermediate position from where their partner transported it to a goal position. We varied the required goal angle of the cup's handle and used 3D motion tracking to assess whether the first actor adapted their movement to it, thereby facilitating the partner's subsequent movement. Before the joint action task, participants were categorized as belonging to the same or different groups, supposedly based on an assessment of their cognitive styles. Results showed that how actors picked up the cup and in what rotation they placed it on the intermediate position depended on the joint action goal. Male actors demonstrated such cooperative behavior only when performing the task together with an ingroup partner, while female actors did so irrespective of categorization. These results suggest that actors tend to represent a partner's end-state comfort and integrate it into their own movement planning in cooperative joint action. However, social factors like group membership may modulate this tendency.

The effect of collision cost on behavioral   **2**
dynamics: How changes in avoidance are
captured by behavioral dynamics

The effect of collision cost on behavioral dynamics: How changes in avoidance are captured by behavioral dynamics

Brian A. Eiler, Rachel W. Kallen, Steven Harrison, R.C. Schmidt, Elliot Saltzman, and Michael Richardson

University of Cincinnati, Center for Cognition, Action and Perception

Individuals are experts at avoiding each other during everyday interaction and navigation. The current project investigated how changes to task-goal constraints (i.e. the relative cost of colliding) are captured by the behavioral dynamics of an interpersonal collision avoidance task (Richardson et al., in press) and how changes in model parameterization successfully describe these patterns. Across three studies, we demonstrate how changing the costs associated with colliding influence the stability and symmetry of the movement dynamics observed between co-actors in a manner that is consistent with those predicted by the collision-avoidance model (Richardson et al., in press). The model predicts differences in individuals' movement trajectories as a function of scaling the ratio of the repeller coupling parameter between co-actors. Collectively, these results provide evidence that the behavioral dynamics that shape interpersonal or joint-action behavior are not only defined by the physical and informational properties of a task, but also by the strength and importance of the shared task goal. Here we will briefly overview the dynamical model and parameters, discuss the empirical findings, and propose how using the behavioral dynamics approach provides an effective modeling framework for understanding joint action more broadly.

Perceiving others as joint-action: How movement impacts person perception

F

Brian A. Eiler, Michael J. Richardson, and Rachel W. Kallen

University of Cincinnati, Center for Cognition, Action and Perception

Humans are able to successfully detect characteristics about others that serve to guide interaction, yet the source of this information is unclear. Because joint-action is fundamentally a social activity between co-actors, determining how this information is detected is important for understanding joint action and person perception more broadly. We hypothesized that biological motion specifies sex and race/ethnicity as these invariant categorical characteristics often influence initial social interaction and tend to influence interactions extended in time. Furthermore, we hypothesized that movement coordination would impact the judgments that people make about others. Because coordination dynamics underlie many joint action tasks, we will argue that perceiving others is a joint-action endeavor. Results indicated that movement kinematics are necessary but not sufficient for accurate sex detection and that race is detectable when movement is produced by Caucasians but not African Americans, and only when kinematic information is embedded in body structure. We will also discuss how coordination impacts social cognition, and how the stability of the coordination between individuals relates to person perception and perceived quality of interaction. Our results suggest that social psychological perspectives on person perception should be integrated with our understanding of the dynamics of joint action.

Evidence for spontaneous level-2 perspective taking in adults

Fruzsina Elekes[1,2], Máté Varga[3], and Ildikó Király[1,2]

[1]Department of Cognitive Psychology, Eötvös Loránd University, Budapest; [2]Cognitive Development Center, Central European University, Budapest; [3]Department of Cognitive Science, Budapest University of Technology and Economics, Budapest

The ability to take someone's perspective underlies successful social interactions including joint action. Unlike tracking which objects others have visual access to (level-1), representing how those objects appear to them (level-2) was found not to emerge spontaneously. We propose that level-2 PT can occur involuntarily for real social partners. However, as PT builds on visual perception, the attention based selectivity that features vision should also feature PT. In our study pairs of participants sat opposite each other and saw symmetric (0,8) and asymmetric (6,9) stimuli presented on a screen, laid between them. Participants either had the same task (number verification) or different tasks (number verification and n-back based on the color of the characters). They participated in both individual and joint blocks of trials. In the same task group, jointness enlarged RT-s for the asymmetric numbers more than it enlarged RT-s for symmetric numbers. In the different tasks group no such interaction was found. Results suggest that level-2 contents can be computed quickly and involuntarily in relation to real social partners. The other's irrelevant perspective interfered only if participants were engaged in the same task, suggesting that level-2 perspective taking is sensitive to the other's attentional dispositions.

Limb apraxia and joint-actions 1

Vanessa Era[1,2], Lucia Maria Sacheli[1,2], Loredana Canzano[1,2], Gaetano Tieri[2,3], and Matteo Candidi[1,2]

[1]Department of Psychology, Sapienza University of Rome, Italy; [2]Braintrends Ltd, Applied Neuroscience, Rome, Italy; [3]IRCCS, Fondazione Santa Lucia, Italy

Apraxia refers to a difficulty in performing actions upon request that is typically less pronounced in response to contextual demands and inner needs. Interacting with others might be one of these needs. Here we aim to investigate whether interacting with another individual facilitates movement execution in apraxic patients. Left hemisphere brain damaged patients with (A+) or without (A-) limb apraxia were required to perform either complementary or imitative reach-to-grasp movements in synchrony with a virtual partner. The movements were performed under two different conditions: 1) Instructed coordination, in which patients received explicit instructions concerning where to grasp an object; 2) Interactive coordination, which required patients to chose where to grasp the object adapting to the partners' movements. Accuracy and synchrony with the partner were collected together with the patients' hand kinematics. Results show that, while A- control patients were able to perform both conditions with similar efficiency, A+ patients showed deficits in the Instructed condition only. Thus, interacting with a partner helps apraxic patients to achieve a better performance. These results might inform the development of future rehabilitation protocols.

Metacognitive evaluations (post-decision confidence) modulates neural response to social feedback

Terry Eskenazi*, Amelie Jacquot, Julie Grezes, Joelle Proust, and Laurence Conty

LNC, ENS, Paris

Much is known about the cognitive and neural underpinnings of social influences on decision making; however, the role metacognition plays in the processing of social information is still open to investigation. In two behavioural experiments we previously showed that metacognitive evaluations of prior decisions (post-decision confidence) are modulated by non-verbal social feedback, suggesting a role of social information in the way we assess our decisions. This fMRI study asks if post-decision confidence modulates the valuation of social information and the associated neural response. Participants performed a forced-choice task before providing a confidence rating on their answer, which was followed by nonverbal social feedback. Parametric analyses revealed a lack of differential neural response to feedback with increasing levels of confidence. However, with decreasing levels of confidence the response to positive feedback and to negative feedback diverged. Positive feedback when decreasingly confident engaged the medial frontal cortex (conflict detection) and negative feedback engaged the lateral prefrontal cortex (metacognitive accuracy). These results show a clear interaction with confidence and response to social feedback, suggesting that confidence could serve to prospectively reconfigure the system determining how the external information will be received. We discuss our findings in terms of 'epistemic vigilance' (Sperber et al., 2010).

Imitative and complementary actions in peri- and extrapersonal space   1

Tim Faber, Michiel van Elk, and Kai Jonas

University of Amsterdam

In the domain of motor cognition several studies have shown both imitative and complementary effects between observed and performed hand gestures (e.g., Liepelt, Prinz, & Brass, 2010). These findings are typically interpreted in terms of a dynamic coupling between perception and action, thereby facilitating either an imitative (i.e. making the same gesture) or a complementary (i.e. making a different gesture) movement. Experimental paradigms have often used low-informative stimuli that do not allow to test the boundary conditions for both gesture type effects. Here we investigated how the perceived ability to mimic or interact with others affects response movement latencies, by instructing participants to make an imitative or complementary hand gesture in response to actors presented in peri- or extrapersonal space. Across two studies, we observed faster reaction times for complementary relative to imitative hand movements in response to open hand gestures (i.e. 'hand-shaking') irrespective of the perceived distance of the actor. No RT difference was found for closed hand gestures. These results suggest that people automatically respond in a complementary fashion to handshaking irrespective of the perceived ability to interact with the other and thereby have important theoretical implications for the role of context and affordances on perception-action coupling.

Trust in action: Modulation of the action observation network by trustworthiness   2

Harry Farmer, Matthew Apps, and Manos Tsakiris

Institute of Cognitive Neuroscience, University College London

The current study employed fMRI to investigate whether the trustworthiness of an observed actor led to a differential activation of the AON. Based on the findings of previous studies it was hypothesised that observing a trustworthy actor would lead to a greater activation of the AON than would observing an untrustworthy actor. In fact the results showed the opposite pattern with greater activation in the AON for actions made by an untrustworthy actor. In addition, it was found that this effect was stronger for covert unobserved actions than for overtly observed actions. This finding suggests an evolutionarily important role for the AON with a focus on the simulation and prediction of potentially threatening actions.

The strength to be in twain: angry faces with direct gaze are perceived as less threatening

Luca Ferraro, Luisa Lugli, and Roberto Nicoletti

Department of Philosophy and Communication, University of Bologna

Time perception could be modulated by the emotional and psychological states: time slows down when being at a boring lecture, while it flies in a funny party. Recent studies demonstrated that emotional stimuli are perceived as lasting longer if compared to neutral ones. More specifically, angry faces/direct gaze combination elongated the perceived duration of the stimulus. These results are in line with the account of an augmented of attentional resources for stimuli that communicate that the target of the approaching threat is the observer. What happened when the observer is paired with a co-actor and the face could directly look at one of the two participants or at nobody? In the present study a time-bisection paradigm was adapted to measure the perceived durations of angry/neutral face in a context in which dyads of participants performed the task together. Results showed that angry faces with gaze directed to the other participant were perceived as lasting longer than to the one with the gaze directed to the self. Findings speak in favor of a social elaboration of a threatening stimulus: the threatening value of the same stimulus differs when the observers are alone with respect to when they are coupled.

Exploring the behavioural and neural processes of joint action in individuals with and without social deficits

J

Paula Fitzpatrick[1], Teresa Mitchell[2], Jean Frazier[2], David Cochran[2], C. Coleman[1], and R. C. Schmidt[3]

[1]Assumption College; [2]University of Massachusetts Medical School; [3]College of the Holy Cross

Intentional and unintentional synchronization of body movements during joint action play an essential role in social communication. While considerable research has investigated social synchrony at the behavioral level, researchers are only beginning to explore the relationship between synchronization and social deficits, such as those in autism, and measure the underlying neural activity. Here, we compared synchronization ability of adolescents with and without autism. We found that adolescents with autism demonstrated less synchronization in both unintentional and intentional coordination and intentional synchronization loaded with attention and social competence while unintentional loaded with intelligence and theory of mind. These findings suggest intentional and unintentional synchronization may be distinct components of social connection with different underlying neural circuitry. We then evaluated differences in neural activity for intentional and unintentional synchronization in a neuro-typical population. We measured EEG activity in the upper alpha mu band and found more mu suppression in posterior brain regions during synchronization with the most mu suppression during unintentional synchronization. In addition, we found more mu suppression during less stable synchronization. Taken together, this research suggests understanding joint action at both the behavioral and neural level could advance understanding of social problems like those in autism. Acknowledgements: This project was partially supported by a Uni-versity of Massachusetts Medical School Department of Psychiatry and Assumption College Collaborative Pilot Research Program (CPRP) grant.

Contributions of fluency to the synchrony-liking relationship   G

D. S. Fraser[1], J. J. Honisch[1,2], M. T. Elliott[1,3], K. A. ,Quinn[1,4], and J. T. Cacioppo[5]

[1]School of Psychology, University of Birmingham, UK; [2]School of Psychology and CLS, Reading University, UK; [3]Warwick Manufacturing Group, University of Warwick, UK; [4]Department of Psychology, DePaul University, USA; [5]Department of Psychology, University of Chicago, USA

When multiple behavioral elements synchronize, they may create a perceptual unit. This kind of perceptual chunking has been shown to ameliorate cognitive load, increasing perceptual fluency and resource availability. In the current research, we examined whether interpersonal synchrony produces fluent processing, as indexed by the flexible allocation of attention, and whether this fluency contributes to positive social outcomes. Participants were 3D motion-tracked while bouncing to an auditory metronome and watching video of a task partner moving either synchronously or asynchronously, or not moving at all. Simultaneously, participants also reported orally whether letters presented in the periphery of the large projected screen were ps or qs. Response time did not differ with condition; however, letter-identification accuracy was facilitated in the synchronous versus asynchronous and control conditions. In addition, interpersonal synchrony, relative to asynchrony or baseline, elicited positive affect towards the task partner. These results are compatible with the reasoning that interpersonal synchrony leads to fluent processing of a task partner's movements by creating a single unitized motor representation that encompasses both one's own and one's partner's movements, and that this fluency contributes to the beneficial outcomes of interpersonal synchrony. This unitization increases both processing capacity and positive affect toward one's partner.

Evidence for spontaneous visuospatial perspective-taking during social interactions

Martin Freundlieb, Natalie Sebanz, and Ágnes M. Kovács

Central European University, Department of Cognitive Science

Background: There is an on-going controversy about whether, when and how instances of spontaneous perspective-taking occur (cf. Samson et al., 2010; Heyes, 2014). *Aims*: We investigated the underlying factors as well as boundary conditions that could lead to the spontaneous adoption of another person's visuospatial perspective (VSP) during social interactions. *Method*: We used a novel paradigm, in which both a participant and a confederate performed a simple stimulus-response (SR) paradigm in a 90° angle next to each other. Crucially, only the spatial orientation of the confederate yielded an overlap between the SR dimensions. *Results*: In a series of 6 experiments we found that participants reliably adopted the VSP of the confederate, as long as he was perceived as an intentionally acting agent with whom they shared the same visual access to the stimuli. *Conclusions*: Our results show that humans spontaneously adopt a differing VSP during social interactions. Moreover, we differentiate the specific circumstances that can lead to, or constrain, the spontaneous adoption of another agent's VSP. Finally, we argue that spontaneous VSP-taking can effectively facilitate and speed up spatial alignment processes accruing from dynamic interactions in multi-agent environments.

The development of sophisticated forms of communication in humans

Bruno Galantucci

Yeshiva University; Haskins Laboratories

One of the hallmarks of our species is that we develop sophisticated forms of communication. However, there is growing evidence that we exhibit important limitations when we are asked to perform tasks that require communicative sophistication. I will illustrate some of this evidence, which comes in part from research on the emergence of novel communication systems in the laboratory and in part from research on the use of natural language. Then I will focus on the question of how individuals who have limited communicative skills manage to develop sophisticated forms of communication. I propose three non-mutually exclusive hypotheses to address the question. The first hypothesis is that communicative sophistication does not originate from sophisticated individuals but emerges in the public arena, as the result of a cultural ratchet effect. The second is that there may be great variability in communicative skills within the human population and that the development of sophisticated forms of communication may be driven by a minority ofexceptional communicators. The third hypothesis turns the question on its head,suggesting that human communication may often be much less sophisticated than we think. I will present various kinds of evidence supporting the second and the third hypotheses and argue that the latter can help us reduce the conceptual gap between the study of human communication and the study of other forms of coordination in humans and animals.

Joint action in live music performance   Q

Andrew Geeves, Doris McIlwain, and John Sutton

Macquarie University, Sydney, Australia

Live music performance teems with examples of joint action behaviours. Yet, despite the potential live music performance holds for offering rich insights into joint action, only a small number of previous studies have examined joint action in this real-world context (e.g. Clayton 2007a, 2007b; Doffman, 2009, 2013; Moran 2010, 2013). Inspired by such research, we make use of fieldwork data gathered by Geeves (2012) to investigate joint action amongst a group of four Australian professional musicians. Drawing on Sebanz and Knoblich's (2009) taxonomy, we identify and explore examples of these musicians predicting the what, when and where of each others' actions during live music performance. We then trace the way in which joint action develops between these musicians from their first rehearsal to their last performance together, highlighting the links between joint action and the individual learning that transpires. Finally, expanding on ideas presented by Geeves, McIlwain & Sutton (2014), we reflect on the implications of our findings and the broader questions about joint action its study in the context of live music performance raises.

Individual actions and shared actions: The trouble of individuation

N

Marianna Ginocchietti

University of Trieste

Individual actions are typically individuated in terms of effects or outcomes of bodily movements (e.g., offending someone instead of moving the mouth). What about shared actions? Some of them are individuated by the description of a common outcome achieved by participants (e.g., playing a duet), some others are individuated by a shared goal (e.g., protesting against the Minister). This talk aims to frame the individuation of shared actions in relation to the individuation of individual actions. Firstly, I distinguish «the agent's doing something» from «the agent's action»: Among the different doing-descriptions that can include one effect rather another, the action is identified by the most appropriate description, where the appropriateness is conceived in terms of appropriateness of attribution of responsibility to the agent for one effect rather another. Secondly, I apply the above distinction to the case of shared action: «doing something together» is not, immediately, a «shared action»: Among the different descriptions that can include a shared goal rather than a common outcome, the shared action is individuated by the most appropriate description. Here, the appropriateness is conceived in terms of appropriateness of attribution of responsibility to single participants for a shared goal or for a common outcome.

The judgment of agency in gaze joint actions 1

Ouriel Grynszpan

Institut des Systèmes Intelligents et de Robotique, Université Pierre et Marie Curie, CNRS

The sense of agency is a recurrent theme in the study of joint action. The present empirical study focuses on the sense of agency in gaze. Gaze is pivotal in joint attention and joint attention is a crucial element of joint action. For joint attention to emerge, an individual needs to feel that her/his own eye movements have some influence on her/his partner's gaze orientation. We sought to examine the feeling of control that one can have when using her/his gaze to perform an action. The experimental paradigm relies on a gaze contingent graphic display based on eye-tracking technology. Twenty four participants were facing a screen that displayed either a human avatar or an arrow. We varied the degree of control that participants could exert on the avatar (respect. arrow) with their eyes. Participants were asked to judge how much they controlled the avatar (respect. arrow). Results showed that participants ceased to judge that they were in control when the delay between their eye movements and the movements of the avatar (respect. arrow) was superior to a specific threshold. They could also better discriminate movements that was due to them when they were facing the avatar compared to the arrow.

Improvement of motor improvisation during mirror game task

Gueugnon M.[1], Salesse R.N.[1], Bardy B.G.[1], Zhao Z.[1], Schmidt R.C.[2], and Marin L.[1]

[1]Movement To Health Laboratory, EuroMov, Montpellier University, France; [2]Department of Psychology, College of the Holy Cross, Worcester, Massachusetts, USA

GOAL OF THE STUDY: Recent findings indicated that improvisation competences in dance, music or theater can be improved. Moreover, literature showed that unintentional interpersonal synchronization improves rapport and pro-social behaviors such as cooperation between interactants. The goal of this study was to investigate how to improve joint improvisation situations. More specifically, we sought how to enhance novices' performance towards expert's behaviors. We believed that the use of unintentional synchronization task should improve improvisation competences evaluated by a joint action game. METHOD: 46 dyads were split in two groups and performed unintended interpersonal coordination tasks in which synchronization was manipulated: Synchronized group (SG) or Non-synchronized (NSG) group. Both groups performed before and after each unintended coordination step, a mirror game task in which either a leader was designated (Leader-Follower (LF) rounds) or not (Joint Improvisation (JI) trials). RESULTS-DISCUSSION: Dyads from SG improved intentional synchronization in JI rounds, and performed faster movements whereas dyads from NSG did not improve their performance. Although SG was still better in LF rounds, our results indicated that unintended synchronization promotes the increase in improvisation competences towards expert's behaviors. Our study suggests that synchronization is an important phenomenon in transferring unintended coordination to intentional interaction. Acknowledgements: This study was funded by the European Project of AlterEgo (Grant#600610 / FP7).

Putting yourself in someone else's shoes (or at someone else's piano): A TMS study of motor simulation for temporally accurate musical duet interaction

D

Lauren V. Hadley[1], Giacomo Novembre[2], Peter Keller[2], and Martin J. Pickering[1]

[1]University of Edinburgh; [2]The MARCS Institute, University of Western Sydney, Australia

Coupling between sensory and motor representations has been well documented for familiar actions, and is strongest when the series of actions has been previously practiced. One explanation for such coupling is the use of internal motor simulations to predict the outcome of both observed and produced acts. In this study we investigated the causal role of simulation in joint musical action, specifically its role in turn-taking. We constructed piano duets in which each pianist used only one of their hands in a series of alternating solos. Participants memorised the duets, half of which included their co-performer's part. In the experiment pianists played the right hand of these duets with a videoed partner, during which we temporarily disrupted the right dorsal premotor cortex (dPMC) or the supplementary motor area (SMA) using double-pulse transcranial magnetic stimulation around the turn-switch. Only when pianists had previously practiced their co-performer's part did stimulation of the dPMC significantly reduce entry accuracy. Stimulation of the SMA caused no performance decrement. This shows that the motor simulation of a partner's part is causally involved in planning the accurate entry of one's own part, suggesting that simulation functions to facilitate temporal coordination in interaction.

How fast should I mimic you? The timing of being mimicked

2

Social control of the actions we do together   F

Antonia Hamilton and Harry Farmer

Institute of Cognitive Neuroscience, University College London

Successful social interaction requires rapid, almost automatic responding. For example, when someone reaches out to shake hands, you should extend your hand simultaneously to avoid awkwardness. These rapid social actions must also be modulated by context – people might be faster to shake hands with an attractive or likeable person than an unlikeable one. This paper will present a series of recent studies of how social cues modulate automatic social responding. First, four experiments testing over 100 participants show that changing the social status of an interaction partner does not alter mimicry of finger movements despite having a robust impact on likeability judgements. In newer studies, we explore how gaze and similarity cues affect rapid complementary actions such as shaking hands. Together, the results show how social coordination depends on a subtle interaction between top-down control systems and motor systems.

An inhibitory mechanism of interpersonal memory guidance revealed by ERPs

Xun He[1], Sanjay Kumar[2], Jie Sui[3,4], and Glyn W. Humphreys[4]

[1]Department of Psychology, Bournemouth University; [2]Department of Psychology, Oxford Brookes University, UK; [3]Department of Psychology, Tsinghua University, China; [4]Department of Experimental Psychology, Oxford University, UK

It has been suggested that the spatial allocation of attention in visual search can be guided not only by images held in our own working memory (WM) (intrapersonal WM guidance), but also by images to be held by co-actors (interpersonal WM guidance) when people are jointly engaged in a similar WM-and-search task. Previous studies have found that this effect is sensitive to various social factors. However, the timing and neural underpinnings of these socially-mediated effects are not understood. The current study investigated this issue using event-related potentials (ERPs), in particular looked at the relationship between the interpersonal WM guidance effects in reaction times (RTs) and those in ERP components at an individual level. The results indicated that larger interpersonal effects on RTs are associated with stronger anterior N1 activity related to the processing of the images to be memorized, and also with reduced activity in several components of the ERPs to the search display. These data suggest that the interpersonal WM guidance effect is a product of top-down inhibition of the information only relevant to the co-actors. This inhibition process is active until the moment when the WM maintenance is not needed anymore.

Blinking as addressee feedback in face-to-face conversation

Paul Hömke, Judith Holler, and Stephen C. Levinson

Language and Cognition Department, Max Planck Institute for Psycholinguistics

In face-to-face conversation, addressees are not passive receivers but active collaborators providing vocal and visual feedback while speakers are speaking (hm-hm, nodding; Clark, 1996). The goal of this study was to investigate blinking in conversation (cf. Cummins, 2011) as one potential type of visual addressee feedback. We built a video-corpus of spontaneous, informal Dutch conversation (N=10 dyads) and identified addressee blinks during extended, multi-unit speaker turns. We categorized these into short (<400ms) and long (>400ms) blinks and measured their occurrence with respect to speakers' unit boundaries within turns. Preliminary analyses reveal that the majority of short and long blinks were timed to the ends of units within speakers' turns. Long blinks were less frequent and, in contrast to short blinks, occurred primarily following speakers' (1) self-corrections and clarifications, (2) affective stance taking, and during (3) turn competition. These findings suggest that addressee blinking is not random but closely linked to the structures of speakers' turns, and that short and long blinks may fulfill different feedback functions. In addition to potential cognitive functions, blinking may thus function as a social signal facilitating coordination in conversation. Analyses in progress investigate the influence of addressee blinks on speaker-behavior to firm up this possibility.

Will you join the dance? Toward synchronous joint action in human robot teams

M

Tariq Iqbal, Samantha Rack, and Laurel Riek

University of Notre Dame

In groups, the activities of each member continually influences others, which can lead to synchronous joint action (SJA). In addition to modeling its occurrence in human teams, SJA is also of interest in humanrobot teaming (HRT) (Nikolaidis, Lasota, Rossano, Martinez, Fuhlbrigge, & Shah, 2013; Hoffman & Weinberg, 2010; Mörtl, Lorenz, & Hirche, 2014). Robots aware of SJA can better determine how to contingently engage with people, and are thus more likely to be accepted (Riek, 2013). Previously, we introduced a novel, eventbased method to automatically detect SJA in human teams (Iqbal & Riek, 2014; Iqbal, Gonzales, & Riek, 2014). In contrast to other methods, our method takes multiple types of events into account, model "non-events", and work with nonperiodic time series data. It can automatically estimate both individual and group synchronization, and has been validated across several psychomotor activities (the cup game, marching). Our current work extends this method to building autonomous mobile robots which can competently act in HRTs. We recently designed a synchronous dance scenario as an experimental testbed, where a mobile robot can estimate the entrainment of the group in realtime, and use it to inform its actions (Rack, Iqbal, & Riek, 2015). Our results suggest that our model was capable of anticipating future moves of team members, and execute its own actions appropriately. We hope this work will prove useful for other researchers working in SJA.

The 'self' as a embodied others: Implications for the moral aspects of joint action

J.Scott Jordan and Eric Wesselmann

Department of Psychology, Illinois State University

The 'self' is often conceptualized as a centrally located decision making system (i.e., executive function) that generates cognitive inferences (i.e., a theory of mind—ToM—Lieberman, 2013; Nettle & Liddle, 2008) about the mental states of others via direct observation of behavior. Recent findings in cognitive euroscience, developmental psychology, and ecological psychology indicate the following: (1) we perceive others in terms of plans, not behaviors, (2) perceiving others in terms of plans renders our behavior immensely vulnerable to the behaviors of others, (3) the 'self' must continuously regulate who will be granted access to one's planning, and (4) the regulating 'self' emerges developmentally out of our persistent interactions with others as emergent cortical inhibition provides us the ability to inhibit socially-primed actions. Data further indicate that this 'embodied other,' regulating 'self' (1) does not cause behaviors as much as it constrains them, and (2) is distributed, as opposed to centralized, in that it moves fluidly across action, perception, and cognition as predictions at each level are violated in real time. Collectively, these findings indicate that assessing the pro-social quality of behavior should be conceptualized as a contextually emergent, multi-scale task for both the behaving 'self,' and the interested scholar.

Evidence of dynamic phase-synchronization of steps between paired walkers and its effect on building of interpersonal relationships

Masaharu Kato, Haruto Hirose, and Makio Kashino

NTT communication science laboratories

When walking alongside someone, you may find that your legs move in synchrony with theirs. This type of interpersonal synchronization of body movements is regarded as an implicit social coordination. In previous studies, experiments were conducted in laboratories, but a laboratory setting differs significantly from a daily situation. The contribution of synchrony towards interpersonal relationships has also been a major concern but has not been proved so far. Here, we show that the characteristic pattern of footsteps during paired walking in a natural situation provides a good fit with a physical model of coupled oscillators, indicating the emergence of a dynamic phase-synchronization process. Moreover, after experiencing a synchronized walk for a longer duration, walkers reported more positive impressions about their walking partners. This effect was only obvious when they were newly acquainted. Following experiment revealed that walkers could not achieve phase synchronization of steps deliberately, suggesting phase synchronization of steps is an implicit process. We propose that unintentional interpersonal synchronization of body movements, such as paired walking, play a role in implicit communication, fostering the building of new relationships.

Animal intention   I

Angelica Kaufmann

Centre for Philosophical Psychology, University of Antwerp

Can nonhuman animals collectively plan their actions, or simply engage in goal-oriented anticipatory behaviour? Action planning qualifies many future-directed actions as fundamentally different from goal-oriented anticipatory behaviour. The distinctiveness of action planning can be identified by its constitutive element: distal intentions (Bratman, 2014). These mental states figure as the necessary mental causal antecedents of action planning. Recent findings from cognitive ethology (Boesch & Boesch, 2000; Osvath, 2009) show that chimpanzees are capable of action planning, and if so, then, they are by default capable of articulating distal intentions. In line with these findings, I offer a parsimonious account of the distinctive cognitive requirements for distal intentions: memory studies on animal cognition (Raby & Clayton, 2012) have focused on the relationship between planning capacities and the episodic memory system. The result of this research program is a set of behavioural criteria that fit the paradigm of action planning and allows to ascribe distal intentions to many animal species, including chimpanzees.

Social communicative functions of the "beacon effect" in music performance

Q

Peter E. Keller[1], Rasmus Koenig[2], and Giacomo Novembre[1]

[1]The MARCS Institute, University of Western Sydney, Australia; [2]Max Planck Institute for Human Cognitive & Brain Sciences, Leipzig, Germany

A number of animal species (e.g., fireflies and frogs) engage in synchronous behavioural displays that are produced by males in order to attract females. The current study investigated potential social communicative functions of this "beacon effect" in human musical behaviour. The voices of members of the renowned St Thomas Boys Choir were recorded with head-worn microphones as they performed a short concert program first with an all-male audience, then with female peers in the audience, and finally with an all-male audience again. Acoustic analyses revealed that the basses (the oldest boys with the deepest voices) increased the energy in a high frequency band (2500-3500 Hz) of voice's spectrum when females were in the audience. Consistent with a beacon effect, this frequency band--known as the "singers' formant"--adds brilliance and carrying power to the voice. Subsequent perceptual judgment tasks showed that some listeners were able to identify the performances sung in the presence of females, and that there was a slight preference for these performances. The reliability of these results was higher in male than female listeners, suggesting a vestigial function of the beacon effect in alerting competing males to the (presumably desirable) presence of females.

From joint-attention to joint-action: Effects of gaze on human following motion   J

Khoramshahi, M. Shukla, A., and Billard A.

École Polytechnique Fédérale de Lausanne EPFL, Switzerland

Gaze discrimination impairment in Schizophrenia severely affects socialinteractions and deteriorates patients' quality of life. The AlterEgo develops therapeutic games using humanoids. To better understand these impairments we investigate in a systematic manner the effects that gaze has in dyadic joint action tasks. Specifically, we study the role that gaze cues play using the mirror game, a naturalistic scenario in which two players imitate each other's hand motions. One of the two player is a humanoid robot, whose gaze can be controlled to give or not cues as to where it will move its hand next. In this talk, we report on a pilot study with healthy subjects. We measure the effect that the resence of these gaze cues have on the human subject's performance at synchronizing her movement with that of the robot. Through post-hoc questionnaire, we also assess whether subjects perceive the robot as acting more human-like when producing gaze cue.A total of 43 subjects participated in the study. Results show that subjects are able to exploit the gaze cue in order to improve their performance. Moreover, participants found the robot not only more human-like, but also easier to interact with, in presence of gaze cue.

Collaborative creativity: Cognitive bases, generative modes, and intersubjectivity skills

Michael Kimmel

Independent researcher affiliated with the University of Vienna

I present a theory of dialogic embodied improvisation, drawing on micro-genetic data of tango argentino dancers. Unpremeditated interactive creativity is contingent on the interplay of sensorimotor, expressive, and coordinative skills: "having to improvise" (due to adaptive pressures) and "wanting to improvise" (following one's fancy) are both essential. Initially, expert improvisers train multiple cognitive bases (basic action units, mini-scripts, "homebases", affordance detection capabilities, etc.) which they mix within various generative modes: adapting mini-scripts, basic unit chaining, "surfing" a matrix of decision points, or soft-assembling genuinely new solutions from generic representations of tango logic. For collaborative creativity couples must equally ensure synchrony, micro-coordination, functional complementariness, and joint dynamic stability: Well-coordinated creativity presupposes proper individual habits like remaining aligned, poised and action-ready (metastable), providing structured muscle conduits, and micro-sensory routines. Secondly, both partners must heed "interaction grammar", a stable configurational framework providing a bidirectional resonance loop via permanent breastbone opposition, musculoskeletal inter-body chains, etc. Thirdly, dancers apply role- and task-specific phase triggers and control laws to ensure coordinated action increments within respect to the partner. Finally, to deal with the unexpected dancers train micro-skills for interaction repairs, reciprocal compensation, and opportunistically exploiting emerging alternatives.

Micro- and macro-coordination in Tango argentino

Michael Kimmel

Independent researcher affiliated with the University of Vienna

I shall introduce methods for investigating complex coordination dynamics in Tango argentino. A cognitive task analysis, based on ideomotor concepts, perceptual triggers, and node point representations was "frontloaded" into a motion capture study with six couples (VICON, 42 reflector markers). To biomechanically monitor multi-body part coordination patterns beyond simple in- or anti-phase relations, we defined an informational model of criss-crossing signals circulating between partners and hereupon determined inter-body contingencies (e.g. only the follower's leg reacts to leader's torso as a step begins). Secondly, we considered how and where experts reduce degrees of freedoms: A prerequisite for all further dance synergies are permanently enabling patterns in individuals (e.g. postural alignment) and the dyadic configuration (e.g. breastbone opposition). Temporary task-specific patterns arise from this: Velocity, phasing and geometric signatures were found in individual techniques like pivoting and collaborative elements such as relative trajectories in "orbiting" around the partner, rotating around a joint-center, leg hooks, or "invasions". Furthermore, kinematic signatures of interpersonal (micro-)coordination provided rapport measures and validated the dance's leader-follower dynamics. Kinematic data largely refracts previously documented concepts dance experts used for proper technique and rapport, while providing further information about timing, relative sub-action onsets, etc.

On the effect of switching tasks and partners on "self" and "other" task representations in joint action planning: An EEG study

Dimitrios Kourtis[1], Günther Knoblich[2], and Natalie Sebanz[2]

[1]Department of Experimental Psychology, Ghent University, Ghent, Belgium; [2]Department of Cognitive Science, Central European University, Budapest, Hungary

We investigated the effects of task and partner switching on the representation of a co-actor's task during the planning phase of a joint action. The experiment consisted of three persons planning and performing joint actions (i.e. passing an object) and solo actions (i.e. lifting an object), following the display of visual cues. EEG was recorded by one person; the other two persons were confederates. The experiment was divided into two halves. In the first half, the participant interacted only with one of the confederates, either "giving" or "receiving" the object. In the second half, the participant switched tasks and partners meaning that (s)he interacted with the second confederate, and also performed the task that was complimentary to the task (s)he performed in the first half (e.g. from "giving" in the first half to "receiving" in the second half).. The behavioural analysis showed that, in both experimental halves, the 'giver' behaved in a similar way as in the solo action condition, whereas it was the "receiver" who was driving the interpersonal coordination. The EEG analysis showed that in the first half of the experiment, the parietal P3 component was larger when the participant was planning to engage in joint action compared to solo action, irrespective of the particular task. Interestingly in the second half the P3 was larger during joint action planning only when the participant was planning a giving action. On the other hand, when the participant was planning a receiving action the P3 was as large as before solo action. These results show that representation of a co-actor's action may take place when planning a joint action irrespective of task distribution. However, after switching partners and tasks, the participants represented in advance the co-actor's action only when the co-actor was the person who was driving the interpersonal coordination.

Brains in dialogue: Decoding neural preparation of communication with a conversational partner

Anna K. Kuhlen[1,2,3], Carsten Bogler[2,3], and John-Dylan Haynes[1,2,3]

[1]Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Berlin, Germany; [2]Bernstein Center for Computational Neuroscience Berlin and Charité, Berlin, Germany; [3]Berlin Center of Advanced Neuroimaging, Charité – Universitätsmedizin Berlin, Berlin, Germany

In dialogue, language processing is adapted to the conversational partner. We hypothesize that the brain facilitates partner-adapted language processing through preparatory neural configurations ("task sets") that are tailored to a particular conversational partner. In this experiment we measured neural activity with functional magnetic resonance imaging (fMRI) while healthy participants in the scanner (a) engaged in a verbal communication task with a conversational partner outside of the scanner, or (b) spoke outside of a conversational context (to "test the microphone"). Using multivariate pattern classification we identify cortical regions that represent information on whether speakers plan to speak to a conversational partner or without having a partner. Most notably regions that have been associated with communicative intent, mentalizing and task representation, such as the medial prefrontal and the bilateral frontal cortex, are involved in encoding the communicative context. Our results suggest that speakers prepare, in advance to speaking, to the social context in which they will speak.

Synchronised human movement and social bonding beyond the action-perception link   G

Jacques Launay

Department of Experimental Psychology, University of Oxford

Evidence suggests that synchronising movements with another person can make us feel socially closer to that person, help them more and trust them more (Hove & Risen, 2009), and this effect has often been explained as a loss of sense of self occurring when performing action oneself at the same time as perceiving identical movement of a co-actor (Overy & Molnar-Szakacs, 2009). However, it is highly likely that any social bonding effects of synchronised movements are the consequence of multiple interacting factors that tend to co-incide in this form of activity. Our recent results suggest that minimal levels of shared attention can cause people to report feeling socially closer to one another (Wolf, Launay & Dunbar, under review), exertion is a significant predictor of social bonding beyond synchronisation (Tarr, Launay, Cohen & Dunbar, in prep.), as is shared success (Launay, Dean & Bailes, 2013), and that coordinated movement may be perceived as similarly socially bonding as synchronised movement. While synchronisation can influence relationships between people, empirical data suggests that this is only partially attributable to the movement itself, and a myriad of interacting factors should be included in any model of joint action and social bonding.

Jarosław R. Lelonkiewicz and Chiara Gambi

School of Philosophy, Psychology and Language Sciences, University of Edinburgh

Action initiation is faster when it matches an observed movement (Heyes, 2011). Pfister et al. (2013) showed it is also faster when we know that somebody will imitate us. The authors argued that we anticipate others' actions, and when they match our own, action selection is facilitated. But alternatively, we might adapt to others' response speed when we observe their actions. In Experiment 1, 24 participants (12 pairs) were assigned the roles of "leader" (model) and "follower" (imitator). On each trial, the screen changed from black to red/green, prompting the model to press a key for a short (1-150ms) or long time (200-600ms). In separate blocks, the follower either imitated or counterimitated the model's action. Importantly, the imitator could see the model's hands, but not vice versa. Models were not faster when imitated, $t(23)=1.10$, $p=.28$. Furthermore, imitator's RT on the preceding trial did not predict model's RT on the current trial, suggesting that models were unaffected by imitators' behaviour ($\beta=1.04$, $t=0.68$). Interestingly, in a direct replication of the original design (Experiment 2) this relationship was significant ($\beta=12.14$, $t=7.35$). In sum, we suggest that models use visual feedback to automatically adapt to their partners' actions, but they do not necessarily anticipate their actions.

Children's joint action – always a matter of joint intentions? P

Nicolas Lindner

Department of Philosophy, Heinrich-Heine-Universität Düsseldorf

What is the glue that holds the single actions of individuals together as a joint action? Most philosophical accounts of collective actions (Searle 1990; Bratman 1993) assume that underlying joint or collective intentions play this role. Recently, researchers, most prominently Tomasello (2005), have proposed that joint action is pivotal to the acquisition of socio-cognitive abilities. Endorsing this claim, I will show that accounts of joint intention, also the most promising one by Bratman, cannot explain joint action as displayed by young children. I will formulate an alternative view, which suggests that such non-demanding cases of (seemingly) joint action are rather effects of the lack of representing one's own intentions as one's own (it is just represented as an intention that is there).This lack ultimately leads to behavior that looks like joint action. This account has the advantage of specifying joint action's pivotal role in children's socio-cognitive development. To conclude my talk, I will present an overview of empirical data supporting this alternative view and suggesting how these cases of (seemingly) joint action in young children are initiated and carried out (e.g. affordances, alignment and pointing gestures).

Designing dynamics for human-robot joint action M

Tamara Lorenz

General and Experimental Psychology, Faculty of Psychology and Pedagogics, Ludwig-Maximilians University; Institute for Information-oriented Control, Faculty of Electrical Engineering and Information Technology, Technische Universität München

In the near future, robots are intended to be helpful machines that support human life, especially when human capabilities vanish, such as for the elderly, or are limited, such as in industrial settings or after serious diseases. However, if robots should coordinate their actions directly with humans, it is required to design their interaction dynamics. Here, one strategy is to observe human interpersonal coordination in order to derive design principles for robot action dynamics in an interaction situation. Thus, different aspects covering spatial and temporal features of the joint action dynamic have to be considered to enable a successful human-robot interaction (HRI). In this line, I will outline the relevance of the following aspects: (1) Movement velocity and reaction times: If temporal aspects are not realistically reflected in the robot's behavior, this may affect the representation of the robot's abilities. (2) Movement profile: The minimum-jerk movement profile is considered to be human-like and therefore provides the best standard in HRI research. However, little is known about how humans actually perceive and accept this behavior with respect to its application on different robots/robotic arms. (3) Adaptation behavior: Little is known about adaptation behavior in human joint action. Nevertheless, it might tip the scales with respect to the uncannyness of the interaction.

Imitative and complementary actions evoked by individual vs. social hands movements

Luisa Lugli[1], Anna Chiara Obertis[1], and Anna M. Borghi[2,3]

[1]Department of Philosophy and Communication, University of Bologna;
[2]Department of Psychology, University of Bologna; [3]Institute of
Cognitive Sciences and Technologies, Italian National Research
Council, Rome

Is somebody going to caress us? We prepare ourselves, leaning forward toward the other person. Is somebody going to hurt us? We draw back. The ability to respond adequately to action performed by others underscores any form of social interaction. The present study investigates the interplay between imitative and complementary actions activated while observing actions performed by people of the same/different gender. Female and male participants were required to discriminate the gender of biologically and artificially colored hands moving toward or away from their body. The hands displayed both individual (i.e. actions directed toward an object, e.g. grasping) and social actions (i.e. actions directed toward the other with the intent to engage in a social interaction, e.g. giving and punching). Results indicated that biological hands evoked imitative automatic imitation, while more specific distinctions between the observed hands, such as that between male and female gender and the type of action, elicited complementary mechanisms. Furthermore, responses reflected gender stereotypes: giving actions were more associated to females, punching actions to males. Implications of these results for literature on joint action and on the imitative vs. complementary role played by the mirror neuron system will be discussed.

Social coordination dynamics and deception   F

MaryLauren Malone and Michael J. Richardson

Center for Cognition, Action, and Perception, University of Cincinnati, USA

On average, lies comprise one quarter of conversational content, most of which go undetected. Major challenges of deception research include identifying the behavioral processes that differentiate truthful and deceptive interactions, and determining how these processes are modulated by properties of the social environment. Despite decades of research, however, it remains unclear how the coordinated behavior of liars differs from that of truth tellers. This lack of understanding may be due to the historic challenge of objectively capturing and quantifying the time-evolving and adaptive nature of human motor behavior during complex joint action. Given recent advances in process-oriented nonlinear time- and event-series analysis methods, however, it is now possible to evaluate these dynamics. We present data from a study examining the dynamic structure, complexity, and stability of social motor coordination that occurs between co-actors during a series of covert deception tasks. We also assess the effects of various social aptitude measures on emergent joint action dynamics and task success, as well as the relationships among behavioral coordination, communicative understanding, and rapport. Collectively, the results imply that identifying the social and informational properties that influence joint action during deception may inform as to how behavior differs between honest and deceptive joint activity.

The effect of similarity to enhance socio-motor performance in schizophrenia

J

Marin, L.[1], Salesse, R.N.[1], Bortolon C.[2], Gueugnon, M.[1], Zhao, Z.[1], Raffard, S.[2], Capdevielle, D.[2], Schmidt, R.C.[3], Schmitz, N.[4], Henriques, J.[4], Stricker, D.[4], Di Bernardo, M.[5], Tsaneva-Atanasova, K.[6], Slowinski, P.[6], Zhai, C.[5], and Bardy, B.G.[1]

[1]Movement To Health Laboratory, EuroMov, University of Montpellier, France; [2]University Department of Adult Psychiatry, Montpellier Hospital, France; [3]Department of Psychology, College of the Holy Cross, Worcester, Massachusetts, USA; [4]Augmented Vision, DFKI GmbH, Kaiserslautern, Germany; [5]University of Bristol, UK; [6]University of Exeter, UK

GOAL OF THE STUDY: Schizophrenia regularly induces social deficits. Recent findings have shown that the pathology leads to poorer socio-motor coordination and nonverbal behavior during face-to-face interaction. In this study we investigate how the social-motor competences (SMC) of these patients can be increased by the concept of similarity. Since such a concept predicts that the synchronization probability is maximized with similar systems, we propose that morphologically and behaviorally similar avatars will enhance SMC in a joint-action task. METHOD: We compared synchronization between schizophrenics (N=30) and healthy (N=29) participants in a Pretest-Exposure-Posttest protocol. Participants moved a handle attached on a string at the shoulder level while facing a morphologically similar or dissimilar avatar, while moving with a similar or a dissimilar kinematic in comparison to the participant. RESULTS-DISCUSSION: Anovas revealed a higher synchronization in similar (morphology and kine-matic) conditions. However, the level of synchronization remained the same throughout the experiment in similar conditions, whereas it increased in dissimilar conditions for patients only. Following the Similarity concept predictions, our results revealed fundamental tools for a rehabilitation protocol dedicated to enhance SMC in schizo-phrenics. Acknowledgements: This study was funded by the European Project of AlterEgo (Grant#600610 / FP7).

Coordination of movement through music   Q

Kerry L. Marsh[1] , Alexander Demos[2], and Roger Chaffin[1]

[1]University of Connecticut; [2]Department of Psychology, McGill University, Montreal, CANADA

Previous research has shown that even under circumstances of minimal interaction, where there is no shared goal and no interpersonal interaction, information about the movement of another person (through visual or auditory information) can lead individuals to spontaneously be pulled to coordinate their movements with another person. With rhythmic movement such as rocking in a rocking chair, or shaking maracas, a bidirectional coupling of oscillators (mutuality of influence) describes such effects. In the last few years we have also explored whether music might provide an avenue for indirect coupling of people's movements, via each individual unidirectionally coupling to music (Demos et al., 2012). In such research we test whether music can enhance interpersonal coordination or disrupt such coordination (by interfering). We also explored the degree to which coordination with music might provide an experience that provides a "social glue" function. I will present our most recent findings in this area, including a test of the "mooring hypothesis" (do skilled others aid less skilled in responding to rhythms of the world), individual differences in interpersonal/music coordination (e.g., using dyslexic participants), and the impact of motivational manipulations on these processes (e.g., using agreeable or disagreeable confederates).

It's time to strike! Using a virtual xylophone to investigate signalling of procedural and declarative knowledge

Luke McEllin, Natalie Sebanz, and Günther Knoblich

Central European University, Department of Cognitive Science

In joint actions, co-actors send communicative signals to their partners through the same channel as the executed actions, this has been labelled signalling (Pezzulo, Donnarumma & Dindo, 2013). This is characterized by actions which are slower or more exaggerated (Vesper et al. 2010), allowing one to be more predictable and comprehensible for a co-actor. Previous research has tested signalling of declarative task relevant knowledge, but not of procedural task knowledge. This study compares signalling of declarative and procedural knowledge. Firstly participants learn xylophone melodies declaratively, by studying a list of sequences; and procedurally, by passively responding to cued xylophone keys. Trained participants then play the melodies synchronously on a virtual xylophone, with non-trained participants. Motion data is used to examine communicative signals sent from trained participants, and asynchrony is measured to look at how effectively the participants coordinate. This data is compared across procedurally and declaratively learned sequences. If signalling requires declarative knowledge, participants will signal and coordinate more effectively when they have declarative knowledge of the melodies. Conversely, if signalling is driven by the motor system, procedurally learned melodies will be signalled more effectively, because a motor program of the relevant knowledge is more accessible for the motor system to communicate. Data collection for this experiment is ongoing.

Adjusting my actions to you: Joint action planning during early childhood

Marlene Meyer[1], Robrecht P.R.D. van der Wel[2], and Sabine Hunnius[1]

[1]Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, The Netherlands; [2]Department of Psychology, Rutgers University, Camden, NJ, US

Fundamental to smooth joint action is the understanding of others' actions in relation to one's ownand vice versa (Barresi & Moore, 1996; Brownell, 2011). It has been suggested that this understanding develops asymmetrically (Brownell, 2011). Whereas young children typically understand how others' actions relate to their own, their understanding of how their behaviour affects others is still limited. We investigated whether and at what age children not only understand others' actions, but adjust their own actions to accommodate co-actors.We tested 86 children from four age groups (21/2, 3, 31/2 5 years) in a joint cup-stacking task. Children had to pass cups to their partner who had only one free hand (alternating over time). By recording their choices (i.e. choosing to pass the cup on the free or occupied side for their partner), we investigated whether children adjusted their behaviour to accommodate their partner. From the age of three children acted according to their partner's limitations from the start of the experiment. We also found an age-related increase in the number of children who accommodated their partner flexibly throughout the joint action. Thus, while by age three children spontaneously take others into account the ability to accommodate others' actions is present but still progressing throughout early childhood.

From coordination to commitment   R

John Michael, Günther Knoblich, and Natalie Sebanz

Department of Cognitive Science, Central European University

The minimal approach to commitment (Michael, Knoblich & Sebanz, under review) predicts that coordination within a joint action generates commitment to the joint action. To test this, we conducted two online experiments using Survey Monkey. In both experiments, participants viewed 40-second videos of a joint action involving either a high degree of coordination (two agents form a chain to clean up a pile of sand, with one agent scooping up a bucket of sand and passing it to the second agent, who then empties it into a container) or a low degree of coordination (the two agents work alongside each other without forming a chain). In experiment 1 (within design, n=221), participants were told that one agent was helping for a bit because his way was blocked by the pile of sand, and were asked to estimate how long he would continue to help. The results revealed higher estimates in the chain condition. In experiment 2 (between design, n=200), one agent's phone rang as the video ended, and participants were asked how likely they themselves would be to answer the phone in this situation. The results revealed a lower reported likelihood in the chain condition.

Syncing thoughts: Interpersonal coordination and joint decision making   2

Lynden K. Miles, Joanne Lumsden, Natasha Flannigan, Jamie Allsop, Martha Von Werthern, and Caitlin Taylor

University of Aberdeen

Synchronous interpersonal behaviour lays a platform for the unfolding of effective joint action. Grounded in the science of coordination dynamics, the extant literature documents numerous consequences of synchrony that serve as building blocks for social exchange (e.g., rapport, cooperation, person memory). Here we explored whether these foundations for interaction pave the way for demonstrable, functional changes in the outcomes of a social exchange. Participants completed a joint problem solving task after a period of interaction involving synchronous or asynchronous movement (or a no coordination control condition). The results revealed that synchrony promoted dyadic problem-solving accuracy. Inspection of the levels of spontaneous coordination that emerged during the problem-solving task indicated, however, a potentially more complex explanation. These results are discussed with respect to their implications for models of social behaviour.

Making and breaking procedural conventions: partner-specific effects

Gregory Mills

University of Groningen, Department of Communication and Information Sciences, Center for Language and Cognition Groningen

A key problem for accounts of joint action is to explain how coordination is achieved and sustained. Recent work has demonstrated that in addition to referring conventions, interlocutors also rapidly establish procedural conventions for identifying, signalling, and resolving procedural co-ordination problems in the interaction. It is currently unclear, however, whether interlocutors associate these procedural conventions with specific conversational partners. To address this question, we report a collaborative 3-participant computer-mediated task which presents participants with the recurrent co-ordination problem of ordering their actions and utterances into a single coherent sequence. To investigate partner-specific effects, all participants' turns are intercepted automatically in real-time, permitting experimental manipulation of their content and timing. This technique is used to generate artificial clarification requests that query the procedural function of participants' turns. The apparent origin of these clarification requests is manipulated to appear as if they originate from either of the 2 other participants. We demonstrate that participants' responses to these clarification requests provide evidence of interlocutors associating procedural conventions with specific partners, and, drawing on global interaction patterns in the task, we also argue that these partner-specific effects are sensitive to the specific sequential location in the dialogue where problematic understanding is signalled.

The influence of perceived agency on rhythmic coordination with virtual partners

Q

Peta Mills and Peter Keller

The MARCS Institute, University of Western Sydney

Rhythmic interpersonal coordination requires individuals to anticipate and adapt to their partner's movement timing. Knowledge that a synchronisation partner is an active intentional agent may, however, influence temporal anticipation and adaptation by modulating the individual's expectations about the partner's cooperativiy. To address this issue, the present study simulated a social context in a drumming task using a virtual partner (a computer-controlled pacing sequence that mimicked human adaptive processes) while varying task instructions to manipulate whether participants believed that they were synchronising with another person or a computer. The degree of virtual partner adaptivity was set to be either minimally or optimally adaptive. After completing the task, participants rated whether they found it easier to synchronise with the 'computer' or 'human'. Results indicated that participants engaged in less anticipation and less error correction when the pacing sequence was optimally adaptive. Synchronisation accuracy was also highest under these conditions, but only when participants were synchronising with the partner (human vs. computer) that they rated as being easier to synchronise with. Beliefs about the perceived agency of a synchronisation partner may thus influence rhythmic coordination in a manner that is modulated by an individual's preference for interacting with an intentional or unintentional agent.

Sophie Milward[1], Ian Apperly[2], and Natalie Sebanz[1]

[1]Central European University, Hungary; [2]University of Birmingham, UK

Classical theories of development argue that children learn to perform tasks by initially participating in the task with an adult and subsequently mastering the task independently as a result of this scaffolding (Wood et al., 1976; Vygotsky, 1978). If so, it is interesting to ask how active participation is beneficial over and above observation of actions. Recent social cognitive and neuroscientific theories have highlighted the importance of studying social interactions as independent from detached observations of social stimuli (Schilbach et al., 2013; Gallotti & Frith, 2013). This study aims to investigate whether children can learn to perform a bimanual piano-playing task from either actively taking part in the task with an adult (each participant performing half of the task unimanually) or from observing two adults dividing the task between them in the same way. Preliminary data suggest that, in contrast to classical scaffolding theories and modern theories of interaction, children are more likely to bimanually replicate an action sequence if they have observed two adults perform it rather than if they have actively participated themselves. This has practical implications for optimum teaching of bimanual tasks, as well as theoretical implications for children's representation and learning of joint actions.

Reneeta Mogan, Ronald Fischer, and Joseph Bulbulia

Victoria University of Wellington, New Zealand

Various activities we perform involve an element of synchrony, including dance, music and sports. Synchrony has been found to increase group cohesion. Though often viewed in a positive light, group cohesion is also likely to increase groupthink which is associated with a lack of divergent thinking – a key component of creative thinking. We aim to examine synchrony's effects on social (group cohesion) and cognitive (creative thinking) outcomes. Our meta-analysis of 42 previous studies (3183 total participants) on the effects of experimentally manipulated synchrony on social cohesion found some weak to moderate effect sizes. The effect was slightly stronger for actual behaviour (cooperation) than for perceptions. Group size moderated the effectiveness of synchrony to induce social outcomes in complex ways. Examining cognitive outcomes, in a field study of various synchronous and asynchronous sports activities, we found that synchrony in the real world leads to lower divergent thinking compared to control groups. All effect sizes were small to moderate sized, suggesting that synchrony's effects are relatively fragile and synchrony may interact in complex ways with other group process variables. Overall, our findings suggest that synchronous behaviours enhance within-group cooperation and cohesion, but at a cost to independent thinking.

Romy Müller

Institut für Psychologie III, Technische Universität Dresden

Automatic imitation refers to the finding that actions can be performed more easily when they match the observed actions of others. But how does imitation affect the planning and execution of the actions performed by the person who is being imitated? In a social version of the response-effect compatibility paradigm, subjects' actions were predictably followed by compatible, incompatible or unpredictable reactions of a partner. To create a more naturalistic joint task setting, two multi-touch experiments were conducted in which two people jointly manipulated virtual objects. Experiment 1 varied spatial compatibility: Subjects relocated virtual objects with drag gestures and a partner subsequently performed swipe gestures on either the same or a different object. Neither in the initiation times, movement durations nor movement trajectories reliable compatibility effects were observed. Experiment 2 varied temporal compatibility: Subjects performed either slow or fast swipe gestures on objects and the partner reacted with a gesture of the same or opposite speed. Initiation times were lower with compatible than incompatible reactions, whereas movement durations revealed contrast effects. The results suggest that it is possible for anticipated partner reactions to influence action control processes, but also highlight difficulties in transferring simplistic paradigms to more naturalistic settings.

Self-other entrainment and co-representation are linked via neural alpha oscillations in joint action

D

Giacomo Novembre[1,2], Daniela Sammler[2], and Peter E. Keller[1]

[1]The Marcs Institute, University of Western Sydney, Australia; [2]Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

Interpersonal shared knowledge and coordination are prerequisites for most forms of social-collaborative behavior. However, cognitive vs. dynamical approaches to joint action have confined these capacities to separate constructs such as co-representation and self-other entrainment. Here we used a musical joint action paradigm to show that co-representation and self-other entrainment rely on a shared neural process –indexed by EEG alpha oscillations– regulating the balance between self-other integration and segregation in real time. Pairs of pianists performed short musical items while reciprocal action familiarity and interpersonal synchronization accuracy were manipulated within a 2x2 factorial design. Enhancing both action familiarity and self-other synchronization led to an external focus on others' actions during co-representation, resulting in higher self-other integration, as indexed by alpha suppression over right-centro-posterior brain regions. Conversely, action familiarity in conjunction with weaker self-other synchronization encouraged greater reliance on internal knowledge and thus led to self-other segregation, indexed by alpha enhancement. These findings illuminate a gating function played by alpha oscillations in coordinating the processing of information about self and other depending on the compatibility of internal (knowledge) and external (environmental) information. Alpha oscillations thus provide a common neurophysiological ground upon which dynamical and cognitive approaches to social-collaborative behavior may be linked.

Mirror games: recent studies applying the mirror game paradigm to study joint improvisation

O

Lior Noy

The Theatre Lab, Weizmann Institute of Science, Herzel 234, Rehovot, Israel

The mirror game (MG), in which synchronized motion is co-created by two players, serves as a model-system for studying joint improvisation. Players can enter a state of co-confident motion (CC) creating complex and highly synchronized motion, without the typical jitter of a reactive follower. We previously suggested that CC periods in the one-dimensional MG can serve as a proxy for the dyadic state of togetherness. I will describe a series of published and on-going studies from our lab applying the mirror game paradigm. These studies include: (1) studying the dyadic motion before, during and after CC periods; (2) studying the motor control mechanisms of followers and leaders in the MG using fixed stimuli; (3) measuring the physiological correlates of CC periods; (4) correlating behavior in the MG to personality measures such as attachment styles; (5) evaluating and developing the MG control model; (6) extended MG experimental setups, e.g., for studying dyads playing the whole-body MG; and (7) applying the MG as an assessment tool for clinical populations. Several on-going studies from other labs using the MG paradigm will be also highlighted.

Tailoring descriptions to suit the listener's needs: Does retrieval fluency processing impact upon audience design in joint communication?

Kieran J. O'Shea and Dale J. Barr

Institute of Neuroscience and Psychology, University of Glasgow

Successful communication depends upon the speaker's ability to adapt their referential descriptionto meet the addressee's informational needs. This process of audience design is one of the most important aspects of spoken language. Although speakers abide by Grice's (1975) 'cooperative principle', attempts to provide a minimally sufficient description to the addressee are often influenced by egocentric tendencies - where speakers include misleading information to the listener. Our study investigates whether speakers judge the appropriateness of a given referring expression as a function of retrieval fluency. Participants played the role of 'Director' in an interactive communication game with the confederate playing as the 'Matcher'. The participants' task was to describe target letters to the 'Matcher' who was facing a separate computer screen. In a series of training trials, participants were entrained upon particular ways of describing referents ('the little L'). In the test trial the context within the display was altered rendering the entrained description inappropriate. Processing fluency was manipulated by altering the context variability (high vs. low) and direction of shift (competitor target letter present vs. not present). Preliminary results suggest fluency effects produce more egocentric errors in speech when context change is low compared to a highly variable context.

Welcome to the Jungle: Evidence that cross-species body-part mapping is class-specific

Sandra M. Pacione, Kimberley Jovanov, Emma Yoxon, and Timothy N. Welsh

University of Toronto

Although humans typically empathize, mimic, and understand the actions of other humans, humans can also engage in these processes with nonhuman animals. The present study was conducted to investigate how humans code homologous body parts of nonhuman mammalian, reptilian, and avian animals. Participants completed body-part compatibility tasks in which responses were made to coloured stimuli that were superimposed over the foot (hindlimb), hand/wing (forelimb), or head of images of animals in different postures. The images were of mammals with human-like limbs (meerkat and human), reptiles (lizard), and aves (penguin and owl) in bipedal or quadrupedal postures. Consistent with previous findings, body-part compatibility effects were observed for the meerkat and human in a bipedal posture suggesting that the limbs of human and nonhuman mammalian animals were mapped onto the human body schema. Interestingly, body-part compatibility effects were not observed for the lizard, penguin, or owl in the bipedal posture. Body-part compatibility effects did not emerge when observing any animal in quadrupedal postures. Additional research exploring body-part matching with nonhuman mammals with less human-like limbs (e.g., seals) clarified the role of limb similarity and class in modulating body-part mapping. Overall, the results indicate that the bipedal body representation may be taxonomical class-specific.

Effects of leadership, spontaneous musical rate, and tempo flexibility in violin trio synchronization

C

Caroline Palmer[1], Mark T. Elliott[2,3], Dominic Ward[3,4], Ryan Stables[4], and Alan M. Wing[3]

[1]Department of Psychology, McGill University, Montreal, Canada.
[2]Institute of Digital Healthcare, University of Warwick, Coventry, UK.
[3]School of Psychology, University of Birmingham, Edgbaston, UK.
[4]Digital Media Technology Lab, Birmingham City University, Birmingham, UK.

Synchronisation between musicians is critical for ensembles: we investigate factors that influence performers' adjustments to tempo fluctuations. We tested whether asynchronies are proportional to differences in endogenous rhythms, reflected in each performer's spontaneous musical tempo (Zamm, Pfordresher, & Palmerl, 2015). We also compared asynchronies with individual measures of rate flexibility. Finally, we tested whether designation of a musical leader is reflected in the timing corrections (Wing, Endo, Bradbury, & Vorberg, 2014) of each performer being weighted towards the leader. Three trios of student violinists from a symphony orchestra were tested. In the first session, each violinist played a familiar tune in solo performances, as measures of their spontaneous musical rate (SMR). Large SMR differences were obtained across violinists, but consistent rates within violinist. Next, they performed with a metronome at rates surrounding their SMR; asynchronies became more negative for rates slower than the SMR and more positive for faster rates. In the second session, violin trios performed the piece with instructions that the Leader was responsible for the tempo. Tone onsets were extracted from audio recordings, and asynchronies calculated from pairwise differences of tone onset times between violinists. We present analyses to test that the amount of asynchrony is predicted by SMR differences (Leader - Followers) and by individual measures of rate flexibility. We further fit a linear phase correction model to the asynchronies to investigate if leadership assignment influences the estimated correction gains between performers. Findings are discussed in terms of the roles of individual performance measures.

How motor representation shapes action experience　　　　**2**

Sara Parmigiani[2], Luigi Cattaneo[2], and Corrado Sinigaglia[1]

[1]Department of Philosophy, University of Milan; [2]CIMeC Centro Interdipartimentale Mente/Cervello, University of Trento

There is a great deal of studies showing that motor representations and processes are involved in the sub-personal processing of others' actions. However, so far little research has directly explored whether our own motor system may affect how we make experience of others' actions. How and to what extent our motor processing of others' actions may influence our perceptual experience of them? To tackle this issue we designed and tested a behavioural model. This model could be an optimal tool for investigating the representation of other's actions and, in particular, to test the possible role of our own movement and somatosensory feedback in action experience. In more detail, we propose the use of paradigms as use-dependent plasticity and deafferentation plasticity combined with our tool, to manipulate the observer's motor system state and investigate the possible changes in action experience as function of this manipulation.

Team reasoning and joint intentions   S

Cédric Paternotte

Ludwig-Maximilians University, Munich

Developed by economists, team reasoning is supposed to rationally explain human coordination and cooperation (Sugden 2000, Bacharach 1999, 2006). Team reasoners do not do what is best for themselves but their part of what is better for a group. Consequently, several philosophers have argued that team reasoning is crucial for joint intentions. However, their analyses seem inconsistent. Gold and Sugden (2007) see team reasoning as a fundamental building block of joint intentions, present in all its forms. By contrast, Hakli, Miller and Tuomela (2010) reveal close conceptual parallels between team reasoning and Tuomela's (2007) demanding account of joint action. Finally, Pacherie (2011) claims that team reasoning best fits joint action among children. I argue that there is no inconsistency by showing that these analyses focus on different forms of team reasoning. However, I also show that, although an abstract form of team reasoning is present in all forms of joint action, problems arise as soon as more specific versions are envisaged. In particular, fully specific versions of team reasoning may make joint action unlikely or impossible. This casts doubt about the relevance of team reasoning for the study of joint action.

The development of children's understanding of others' effort and its relation on their partner

P

Markus Paulus and Nike R.H. Tsalas

Ludwig-Maximilians-Universität München, Munich, Germany

Successful joint action requires to take others' abilities into account. Two experiments with n=120 children investigated the development of children's understanding of others' learning abilities and their partner selection in a joint learning task. Experiment 1 presented 3-, 5-, and 7-year-olds (each n=20) with video sequences of an actor showing either an effortful facial expression, a neutral facial expression, or ease when learning paired associates. After each trial, children were asked to evaluate the other's learning performances (judgment-of-learning; JoL). Five- and 7-year-olds', but not 3-year-olds' JoLs differed for all three conditions, with the highest JoLs given for the effortless trials. Experiment 2 presented 3-, 5-, and 7-year-olds (each n=20) with three different persons who either showed an effortful facial expression, a neutral facial expression, or ease while learning. Subsequently, children were asked to choose amongst the three persons 1) one partner to help them with a difficult learning task and 2) another one whom they want to help with her task. Three-year-olds performed on chance. Five- and 7-year-olds choose the effortless learning person as a helper and decided to support the effortful learning person. The findings are discussed with respect to current theoretical approaches on the development of joint action.

Rebecca Pedinoff[1], Anna K. Kuhlen[2,3,4], Jelle Demanet[5], John-Dylan Haynes[2,3,4], and Marcel Brass[5]

[1]Department of Psychology, Free University, Berlin, Germany; [2]Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Berlin, Germany; [3]Bernstein Center for Computational Neuroscience Berlin and Charité, Berlin, Germany; [4]Berlin Center of Advanced Neuroimaging, Charité – Universitätsmedizin Berlin, Berlin, Germany; [5]Department of Experimental Psychology, Ghent University, Ghent, Belgium

When people switch between tasks, responses to the first task are automatically activated despite the context of the second task. Recently, a series of studies have shown that task-sets formed merely on the basis of instructions can cause interference with another task (Liefooghe, Wenke & De Houwer, 2012; Liefooghe et al., 2013). In this experiment we want to investigate this so-called instruction-based task-rule congruency effect in a social setting (cf. the Social Simon Effect). Two participants each perform separate parts of a distributed task. First, participant A instructs participant B to either (i) match an object with its paired location, or (ii) confirm the instructed object-location pairing. Next, A must classify the same words as presented in the instructions according to a font-location pairing. Then B executes the previously instructed task. We expect that in condition (i) participant A co-represents B's actions, resulting in lower reaction times and errors when A's response is congruent with the response in B's task. Furthermore, we expect no such effect in condition (ii) as the participants only represent the second task as an abstract rule (i.e. not as an intended action). Thus, our study investigates specifically how task-sets are formed and stored, and furthers our understanding of the conditions under which a partner's task set is co-represented in joint-action.

Michaela Pfundmair[1], Geoffrey Whetherell[2], and Dieter Frey[1]

[1]Ludwig-Maximilians University of Munich; [2]DePaul University Chicago

People have a strong need to belong, and try to restore their sense of belonging when they are ostracized. In two studies, we investigated whether people who are most sensitive to ostracism (i.e., those who are high in need to belong) would increase their adherence to moral beliefs of their group following ostracism. We moreover explored whether this increase of moral beliefs would drive a sense of willingness to engage in aggressive behavior on behalf of the group. After playing Cyberball, participants wrote about a social group they belong to and responded to measures of moral agreement and willingness to fight and die for their group. As expected, the results showed that participants high in need to belong were more likely to believe in the moral righteousness of their group's values after ostracism than after inclusion. Moreover, moralization of group beliefs lead to subsequent endorsement of violence on behalf of the group. Thus, our findings add another mechanism to cope the pain of ostracism, moralization, which translates into a willingness to protect the group.

Why the body matters for joint action   G

Veronica C. Ramenzoni

Department of Cognitive Science, Central European University

What are the mechanisms that enable people to imitate continuous actions? Studies on the imitation of discrete actions have proposed two mechanisms for the cognitive system to map features of observed actions to performed actions: one that matches actions in terms of their spatial characteristics and another that maps actions in terms of their postural or anatomical features. This study explored whether these mechanisms are used to generate continuous real-time predictions necessary to give rise to and sustain stable temporal relations. In a series of experiments, participants were asked to synchronously imitate a model's bimanual hand or feet actions presented in different spatial and topological configurations. We investigated participants' ability to match both the timing of observed actions and the spatial position of the observed body. The results show that spatial and topological mapping mechanisms were simultaneously used to generate mappings between observed and performed actions and that automatic establishment of topological mappings can interfere with maintaining spatial mappings. This was particularly obvious in musicians who have expertise in establishing topological mappings in continuous performance. Together the results suggest that synchronous imitation of continuous action sequences depends on flexible predictive models that simultaneously apply spatial and topological mapping constraints to enable an actor to perform synchronously with action sequences observed in a model.

The influence of probability and space on the selection and planning of anticipatory sequential joint actions

Matthew Ray and Timothy N. Welsh

Faculty of Kinesiology and Physical Education, University of Toronto, Center for Motor Control

In sequential joint actions, the initial actor of the pair may anticipate their co-actors needs and plan their action to facilitate them. The present experiment was conducted to investigate how cue validity and space influence the planning of the initial action in sequential joint actions. Participants placed a wooden dowel in between four potential target locations following spatial cues (25%, 50%, or 75% validity). The location of initial dowel placement was the dependent measure. In the joint task, the confederate (who sat across the table) had to move the dowel to the target from wherever their partner had placed it. In the individual task, both steps were completed by the participant. The results revealed an effect of probability in both tasks; the dowel was placed closer to the cued location as cue probability increased. It was also found that the dowel placement was biased towards the participants' body in the individual task, but not towards their co-actors body in the joint task. Overall, the results indicate that the probability of the response can be represented, but that when co-actors have different viewpoints the initiator does not fully adopt the body-centered frame of reference of their partner.

Predicting choice behavior in action observation   F

Andreas F Reichelt[1] and J. Randall Flanagan[1,2]

[1]Centre for Neuroscience Studies; [2]Department of Psychology, Queen's University, Kingston, Canada

When looking at another person's actions, we predictively shift our gaze to contact events, as we do when guiding or own actions provided we are attuned to the other person's upcoming actions. Here we investigate gaze behavior when observing an actor selecting and "harvesting" one of two targets in a virtual environment while target values and spatial constellation are varied. In this context, observers need to appreciate the relative values of the 2 targets and the actor's movement costs to shift gaze to the correct target ahead of time. We document and characterize different gaze strategies adopted by observers (anticipating, guessing, extrapolating) and show that observers flexibly integrate their knowledge of target value with the current spatial target configuration to monitor the actor attain their target in real time. In the present version our task involves scripted roles for observers and actors taking turns rather than joint action in the strict sense. However, predicting the other's next move based on shared values under conditions of uncertainty is likely a crucial aspect for smooth action coordination and will be discussed as an initial step to make gaze coordination patterns in unscripted interactions tractable.

The Hive: Experimenting with the group mind   S

Daniel C. Richardson and Jorina von Zimmermann

Department of Experimental Psychology, University College London

Many findings in psychology are based on individuals sat in cubicles, staring at fusty computer screens, or sometimes on pairs or small groups. Claims about large groups, however, are often based on swarm behaviour found in animals, computer models of abstract agents, or are the result of data from participants on social media who are not co-present. These methodologies might miss many of the key phenomena of group behaviour. We have developed a new tool called the Hive, which allows us to experiment upon many people at the same time, in the same room. Each individual moves a dot on the touch screen of a phone or tablet, and everyone's dot is visible on a large central screen. We then ask participants to make difficult choices, report their opinions, or let them decide to cooperate with each other or not in public goods games. By making the dots visible or hidden, we test how information about group members' responses biases and polarises individuals' opinions. By assigning colours to the dots randomly or by individuals' choices, we investigate how a minimal social identity modulates social influence. Together, our results show how social identity, social influence and co-presence affect group behaviour.

Symmetry, magnetic snakes, and sheep herding: Building a double-decker bandwagon

K

Michael J. Richardson, Rachel W. Kallen, Auriel Washburn, and Patrick Nalepka

Center for Cognition, Action and Perception, University of Cincinnati, OH, USA

How is the patterning of joint-action organized? Who or what decides what joint-action behaviors are possible? Is there a complementary relationship between the low-level physical laws that constrain the mechanics of socially situated, perceptual-motor behavior and the higher level cognitive, representational, and linguistic aspects of joint-action? Using a selection of phenomena from physics, biology, cognitive-science, and computational-cognition, we will explore whether symmetry and the formal language of symmetry (i.e., group theory) might provide a way of answering these questions. In particular, how the theory of symmetry-breaking can be employed to both describe and understand the interrelated physical, neural and cognitive structures that underlie joint-action.

Computational measurement of social communication dynamics in adolescents with autism spectrum disorder

Veronica Romero[1], Paula Fitzpatrick[2], R. C. Schmidt[3], and Michael J. Richardson[1]

[1]Center for Cognition, Action and Perception, University of Cincinnati, USA; [2]Department of Psychology, Assumption College, USA; [3]Department of Psychology, College of the Holy Cross, USA

Children with Autism Spectrum Disorder (ASD) exhibit impairments in social interactions and at the core of these impairments are social communication deficits. Recent advances in the quantitative and computational measurement of conversational content has resulted in a novel set of methods that might provide a more objective and reliable way of identifying the conversational biomarkers of ASD, as well as a better understanding of the time-evolving dynamics of social communication in these individuals. Children previously diagnosed with ASD completed the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) and a battery of social motor coordination tasks. The conversations that each participant had with the clinician during the ADOS-2 administration were evaluated using Discursis, a computational time-series method that analyzes the conceptual and semantic content of an exchange between two or more individuals. Various measures were extracted to quantify different aspects of the conversation (e.g. self-similarity, other-similarity). Additionally, a measure of the child's social motor coordination ability was obtained (e.g. coherence). Of particular interest is the relationship between ASD symptom severity and the dynamical measures of communication and social motor coordination and the degree to which these dynamical measures better predict ASD communication deficits.

The many faces of "jointness" in the development of triadic infant-caregiver-object interactions over the first year or life

Nicole Rossmanith, Alan Costall, Beatriz López, and Vasudevi Reddy

Centre for Situated Action and Communication, Department of Psychology, University of Portsmouth, Portsmouth, UK

Triadic infant-caregiver-object interactions - requiring infants to coordinate engagement between objects and people, are considered to play an important role for the development of communicating "about" something, joint action, cooperation, and cultural learning. We challenge the widely held view of their late occurrence, supposedly mediated by a newly emerging capacity of joint attention and knowledge of people as intentional agents. Visiting 10 infants at home once a month from 3-12 months of age we sampled infant's everyday activities over the course of the first year. Using ethnographic methods and qualitative micro-analysis we document a wide range of infant-caregiver-object interactions with different activity structures, object functions, and goal characteristics (rigidly structured towards task completion, others open-ended, guided by infant's interests), and a wide range of forms of active infant participation, attention and action coordination (from whole-body motor coordination in shared object routines to object mediated social and socially mediated object interactions). This diversity of early forms of participation in the joint creation and multimodal structuring of shared spaces of meaning and action in different ecological contexts calls for a more nuanced view of the development of triadic interactions, understanding intentional actions, participation, joint attention and action, cooperation, and cultural learning.

Causative role of left aIPS in coding shared goals during complementary joint actions: studies combining motion capture and TMS

Lucia M Sacheli[1,2*], Vanessa Era[1,2], Gaetano Tieri[1,2], Salvatore M Aglioti[1,2], and Matteo Candidi[1,2]

[1]Department of Psychology, University of Rome "Sapienza", I-00185, Italy; [2]IRCCS, Fondazione Santa Lucia, Rome, I-00179, Italy. (*) Now at University of Milano-Bicocca

Successful interpersonal coordination requires that two or more agents synchronize and adapt to each other's movements. Behavioral studies suggest that performing effective complementary (i.e. non-imitative) actions like for example "passing an object" implies the sharing of a common overarching goal (e.g. passing the object from one person to the other), which in turn depends on the achievement of two different sub-goals, each specific for each co-agent (e.g. handing/receiving). However, much less is known about the neurocognitive bases of "shared goal" representation during realistic complementary interactions. In three experiments, we combined off-line inhibitory Transcranial Magnetic Stimulation and motion capture analyses to investigate the causal role of two key motor regions (left anterior Intra-Parietal Sulcus, aIPS, ventral Premotor Cortex, vPM) in supporting the ability to perform complementary interactions with a virtual partner. Results showed that only aIPS (and not vPM or control regions) inhibition selectively impairs performance during complementary interactions leaving unaffected individual motor execution. This effect was present only when the task required participants to take the partner's movement into account to achieve a common goal. Thus, left aIPS causatively influences "shared goal coding", namely the ability to integrate the partner's sub-goal into one's own movement planning during motor interaction.

Shared goals influence performance in joint action: a study with preschoolers and adults   S

L. M. Sacheli[1,2], M. Meyer[3], E. Hartstra[3], H. Bekkering[3], and S. Hunnius[3]

[1]Department of Psychology, Sapienza University of Rome, and IRCCS, Fondazione Santa Lucia, Rome, I-00179, Italy. [2]Department of Psychology, University of Milano-Bicocca, Italy. [3]Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, The Netherlands

Shared goals structure co-agents' behaviors into joint actions: the complementary moves of a dancing couple become coordinated when both partners share the overarching goal of performing a smooth choreography together. This overarching goal might be inherent to the relation between partner's movements (as in dancing) or involve their action outcome (e.g. when building a tower together). The aim of this study is to investigate whether "shared goals" at different levels of the action hierarchy (i.e. movements/outcomes) differently modulate individuals' behavior during joint action. At the age of 3½ years children master social interactions, yet their executive control system is not fully mature: to investigate the impact of executive control on shared goal representation we tested 3½-year-olds and adults. Participants were asked to coordinate with a confederate by performing congruent/incongruent button presses, while either sharing a complementary goal at the action outcome level ("dress a bear together" on the screen by pressing the buttons) or sharing a goal at the movement level ("coordinate" in a congruent/incongruent fashion). Results showed that – in both groups – incongruent movements were facilitated when co-agents shared a complementary goal at the action outcome level. This suggests that overarching goals modulate action-perception coupling during interaction since early childhood.

Playing together without communicating? A Pre-reflective and enactive account of joint musical performance

Andrea Schiavio[1] and Simon Høffding[2]

[1]Music Mind Machine in Sheffield Research Centre, Department of Music, The University of Sheffield, UK; [2]Centre for Subjectivity Research, Department of Media, Cognition and Communication, University of Copenhagen, DK

In this paper we examine the role of pre-reflective, embodied and interactive intentionality in joint musical performance. Relying on qualitative data emerging from interviews with the Danish String Quartet we explore the dynamics of collective musical behaviours, adopting a phenomenologically informed approach. In contrast to standard representational models, we defend an enactive view on collective musical performance and propose that dynamical, non-linear, patterns of action and perception play the key role in such intersubjective context. We firstly present the theoretical framework structuring our analysis introducing theories on cognitive functions in ensemble performance from psychology of music, mainly focussing on contributions by Peter Keller and Frederik Seddon. From here we construct three main claims on necessary and sufficient conditions of ensemble performance and use the interviews to assess the validity of these claims. We conclude that ensemble performance can take place without attention to either shared goals, or to the other ensemble musicians. In light of this, we advocate shifting the theoretical focus away from Joint Musical Attention (JMA) to Joint Musical Experience (JME) arguing that if we wish to understand what it is like to play with other musicians, then we must take the pre-reflective, embodied and enactive approaches into account.

Joint action coordination in a computer control task 2

Daniel S. Schloesser[1], Jiuyang Bai[1], Drew H. Abney[2], and J. Scott Jordan[1]

[1]Department of Psychology, Illinois State University; [2]Department of Cognitive and Information Sciences, University of California, Merced

The present experiment examined the dynamics of how groups and individuals organize their actions to complete a computer control task. Participants pressed computer keys to keep a moving box stimulus within a rectangle. Specifically, pressing the A-key or L-key caused the box to move right or left, respectively, for as long as the key was pressed. Switching between the A and L keys (i.e., turning) proved challenging: concurrently pressing both keys made the stimulus move upward, while pressing neither key made it move downward. Participants completed the task either alone or with a partner they could neither see nor hear. Such tasks are difficult for groups when members lack information regarding the timing of each other's actions (Knoblich & Jordan, 2003; Van Der Wel, Knoblich, & Sebanz, 2011). In the present task, individuals performed better than dyads because they turned the dot near the edge of the rectangle and let it coast back and forth within the rectangle. Dyads turned the dot in the middle of the rectangle because they simply pressed their buttons as quickly as possible. We assert they did so because they did not know when their partner planned to press their button.

Causality in entrainment explanations of joint action

<div align="right">A</div>

Richard Schmidt

College of the Holy Cross, Worcester, MA, USA

Recent work (e.g., Colling & Williamson, 2014) has argued that entrainment analyses of joint action are not sufficient explanations in that they do not provide a mechanistic, causal account of joint action like those provided by internal model/neural explanations. Whereas having a causal account of, and embracing the role of the nervous system in, creating behavior are very important goals for behavioral science, I will argue that entrainment analyses are indeed causal explanations and that such explanations will be important for providing a veridical account of the nervous system's role in helping form behavior in general and joint actions in particular. At issue, however, is how such dynamical accounts of neural function can embrace the "mental" causation underlying planning, remembering, and anticipating (in which the present environment has nothing to do with the current behavioral state) in such a way as to avoid representational, internal model narratives. I will argue using data from dyadic interaction tasks that a dynamical system account which includes multi-scaled dynamics operating at nested time scales corresponding to a task's subgoals may be a way to conceive of how past and future states can influence the current dynamical state of a joint action system.

Let's move it together: The costs and benefits of shared action control

Laura Schmitz[1*], Basil Wahn[2*], Günther Knoblich[1], and Peter König[2,3]

[1]Department of Cognitive Science, Central European University, Oktober 6 utca 7, 1051 Budapest, Hungary; [2]Institut für Kognitionswissenschaft – Neurobiopsychologie, Universität Osnabrück, Albrechtstr. 28, 49069 Osnabrück, Germany; [3]Institut für Neurophysiologie und Pathophysiologie, Universitätsklinikum Hamburg-Eppendorf, Hamburg, Germany

When acting alone, an individual can internally coordinate her actions. But when two or more individuals act together, action coordination is more challenging because the co-actors cannot rely on shared internal processes. On the other hand, acting together with others allows co-acting individuals to distribute or share action control, whereas an individual must control and coordinate all action alternatives herself. In the present study, we investigate the costs and benefits of inter- and intrapersonal coordination to determine which type of coordination cost is higher. Individuals and dyads performed a computerized navigation task which required coordinating actions in a two-dimensional space. Individuals controlled both vertical and horizontal movement dimensions, while co-actors in a dyad each controlled either vertical or horizontal dimension (Experiment 1: "Distributed Control") or each controlled both dimensions (Experiment 2: "Redundant Control"). Results show that in both experiments, dyads performed faster than individuals, suggesting larger intra- than interpersonal coordination costs. However, despite their overall performance advantage, co-actors with redundant control experienced substantial interpersonal coordination costs when spatially precise navigation was necessary. Taken together, these findings indicate that it is cognitively more costly to coordinate action alternatives intrapersonally than between co-actors, leading to a benefit for shared over individual action control.

Individual and cooperative functions of shared visual attention   2

Sarah Schwarzkopf

Center for Cognitive Science, Institute of Computer Science and Social Research, University of Freiburg

When we follow the gaze of another person and look at the same object, we establish a shared visualattention. This is essential for many cooperative actions, but it can also have individual functions. Although shared visual attention is a broadly discussed phenomenon, research doesn't clearly differentiate between its contexts and functions. This is particularly the case due to the diverse disciplines working in this field (e.g., cognitive science, philosophy, psychology, robotics) without agreeing on consistent terms and definitions. The aim of my theoretical work is to classify related phenomena and processes. To differentiate between individual and cooperative functions of shared visual attention I will focus on perspective taking and intentional joint visual attention. Furthermore, I will discuss the status of implicit and explicit processes and declarative knowledge in relation to shared visual attention. Finally I will present a taxonomy to classify the connected concepts. I propose that the main differentiation criterion is the existence of intentionality and also whether this is driven by the aim for cognitive cooperation or by individual goals.

Joint processes and their relevance for mindreading L

Axel Seemann

Department of Philosophy, Bentley University

Most joint actions involve some form of joint perception. Typically the discussion of this form of perception is conducted under the label of 'joint attention'. In this talk, I argue that this label is a misnomer and that we should think of joint encounters as a form of experience rather than attention. I develop the idea that these encounters involve a phenomenal contrast between two distinct experiences. These experiences are 'of' objects and 'with' persons, respectively, and are linked by working memory. While experiences of objects are perceptual in nature, experiences with persons are intermodal – they involve an interaction that has both perceptual and proprioceptive phenomenal components. The resulting view conceives of joint encounters as temporally extended processes. I contrast this 'process view' with its main rivals. I argue that it is better suited than these rivals to explain a cognitive milestone human infants reach towards the end of the first year of life. This milestone is the ability to distinguish between bearers of mind and other objects. I end by showing that the process view advances the debate about the development of the capacity for 'mindreading' in humans.

Know thy sound: Perceiving self and others in musical contexts

Vassilis Sevdalis

German Sport University Cologne/University of Cologne, Germany

This presentation discusses findings from empirical studies that investigated recognition of an action's agent by using music and/or other auditory information. Embodied cognition accounts ground higher cognitive functions in lower level sensorimotor functioning. Action simulation, the recruitment of an observer's motor system and its neural substrates when observing actions, has been proposed to be particularly potent for actions that are self-produced. This presentation examines evidence for such claims from the music domain. It covers studies in which trained or untrained individuals generated and/or perceived (musical) sounds, and were subsequently asked to identify who was the author of the sounds (e.g., the self or another individual) in immediate (online) or delayed (offline) research designs. The presentation is structured according to the complexity of auditory–motor information available and includes experimental work on: 1) simple auditory information (e.g., clapping, piano, drum sounds), 2) complex instrumental sound sequences (e.g., piano/organ performances), and 3) musical information embedded within audiovisual performance contexts, when action sequences are both viewed as movements and/or listened to in synchrony with sounds (e.g., conductors' gestures, dance). The reported findings are examined in relation to cues that contribute to agency judgments, and research concerning joint action understanding and applied musical practice.

Acting together: Collective goals and motor representations

Corrado Sinigaglia

Department of Philosophy, University of Milan

Acting together is a familiar feature of everyday life. People move objects together, drink toasts together and play piano duets. In many such cases there are two or more actions involving multiple agents which have collective goals in this sense: among all of their actual and possible outcomes, there is one or more to which the actions are collectively directed. But in virtue of what are any actions involving multiple agents collectively directed to outcomes? A standard approach to answering this question involves a notion of shared (or 'collective') intention. In this talk I consider a different approach – one which involves identifying an interagential structure of motor representations. Our actions having collective goals is not always only a matter of shared intention: fully understanding collective goals will also require invoking motor representation. This has consequences for understanding joint action and shared intention.

Evidence of individual motor signature and kinematic similarity in the mirror game

O

Slowinski, P.[1], Zhai, C.[2], Alderisio F.[2], Marin, L.[3], Salesse, R.N.[3], Bardy, B.G.[3], di Bernardo, M.[2,4], and Tsaneva-Atanasova, K.[1]

[1]University of Exeter, UK; [2]University of Bristol, UK; [3]Movement To Health Laboratory, EuroMov, University of Montpellier, France; [4]Department of Electrical Engineering and Information Technology, University of Naples Federico II, Italy

GOAL OF THE STUDY: The theory of similarity predicts that coordination in joint-action tasks is enhanced if the participants are similar in terms of morphology, behaviour matching and kinematics (Bardy, Salesse, Gueugnon, Zhao, Lagarde, & Marin, 2014). The goal of this study is to present and validate experimentally a method for quantifying the kinematic similarity between the movement of different players in the mirror game. METHODS: We define the individual motor signature (IMS) as the probability density function of the velocity of the movement of each player. We quantify differences between IMSs by using the earth mover's distance (EMD) (Slowinski, Rooke, di Bernardo, & Tsaneva-Atanasova, 2014) and analyze them by means of multidimensional scaling. Experimental data was recorded using a platform based on the use of a leap-motion controller. RESULTS-DISCUSSION: Our analysis revealed that IMS as defined above is a time-invariant kinematic characteristic of a player's motion and can be detected from the one-dimensional motion of the human hand of each player. Furthermore, EMDs between IMS of different players can be used to quantify their kinematic similarity. That allows us to gain deeper insight into the performance of different human players in the mirror game and to design different joint-action tasks performed by a virtual player driven by a novel interactive cognitive (Zhai Alderisio, Tsaneva-Atanasova, & di Bernardo, M., 2014). Acknowledgments: This study was funded by the European Project of AlterEgo (Grant#600610 / FP7).

Can artificial systems join a joint action?   N
Towards a minimal account of joint actions
of mixed groups

Anna Strasser

Humboldt-Universität zu Berlin

Any theory of joint action should enable us to distinguish joint actions from cases we should better describe as tool-use or simple stimulus-response behavior, additionally we should clarify how demanding presupposed abilities of involved participants are. I will argue for the claim that being an agent of a joint action does not necessarily presuppose the demanding conditions that common views in philosophy postulate as necessary for being an intentional agent. It is not primarily intentionality that matters, but social abilities that play a crucial role. Asymmetric cases in which the abilities of the participants differ show that at least not all have to fulfill such demanding conditions. Joint actions involving artificial systems and human beings will serve as a showcase: If we can ascribe abilities to coordinate and take the other as a mental agent in a certain sense we can engage in a joint action. This may not require higher-order representational abilities. Looking at such cases of joint agency it is at least extremely counter-intuitive to describe the participating artificial system as merely a tool.

'Stay with me': phase synchronization during one-sided vs. two-sided joint action in EEG hyperscanning

Caroline Szymanski[1], Timothy R. Brick[2], Dionysios Perdikis[1], Viktor Müller[1], and Ulman Lindenberger[1]

[1]Max Planck Institute for Human Development; [2]Penn State University

This experiment was motivated by the theoretical idea that interacting individuals constitute a coupled system on the behavioral level as well as the brain level. We addressed one key question: 1. Is interbrain phase synchronization sensitive to the degree of coupling in joint action? Two participants played a computer game while we recorded their EEG simultaneously. Both participants had to navigate a circle with a joystick through a virtual environment of falling squares. While participants were coordinating their actions with this external environment, they further had to align their movements with each other in order to minimize the distance between their circles. The experiment consisted of four conditions: 1. Alone (no interaction) 2. Together (two-way interaction) 3. Replay (recording of one player's path during a together game; one-way interaction) 4. Replay master (recording during a together game of a different pair; one-way interaction with different behavioral dynamics) Our main measure of performance was distance between player's circles. The EEG-data was analyzed for inter-brain phase synchronization using phase locking value (PLV). Mean-centered task partial least squares analysis detected significant differences in the correlation between distance and PLV during two-sided interaction (together condition) and one-sided interaction (replay and master condition).

Alessia Tosi, Jaroslaw Roman Lelonkiewicz, and Holly Branigan

University of Edinburgh

Recent findings show that successful coordination in joint tasks is characterised by greater linguistic alignment (Bahrami et al., 2010). This has been interpreted as evidence for the dynamic systems framework, suggesting that coordination spreads across different levels of behaviour, e.g., from the performance on the task to language use (Fusarolli et al., 2012). However, it has also been shown that linguistic alignment is driven by social factors, e.g., how people perceive their partner (Branigan et al., 2011). Our study (in progress) attempts to uncover the interplay between the dynamic systems and the social account. In a between-subjects design, we manipulate the participants' perception of the interactional partner. Participants play a Public-Goods Game interacting with a partner that is trying to maximize his only gains (individualistic) or the gains of both (collectivist). Subsequently, participants engage in a joint discussion. We measure the degree to which participants coordinate with their partner's behaviour during the game and align their language use during the discussion. We expect the perception of the partner to affect linguistic alignment, but the effect to be modulated by the degree of behavioural coordination. Our work provides new insight into the interplay between social factors, behavioural coordination and linguistic alignment in joint tasks.

Gender difference in implicit walking synchrony: female syncs better

Chia-huei Tseng[1*], Miao Cheng[1], and Masaharu Kato[2]

[1]Department of Psychology, University of Hong Kong, Hong Kong;
[2]Human Information Laboratory, NTT Communication Science Laboratories, NTT Corporation, Kanagawa, Japan

Implicit interpersonal bodily entrainment, as a subtle kind of body language, has been largely discussed recently. However, few research probe into this topic in regard of gender. Comparing to male, female individuals perform better at reading body language, such as recognizing facial emotion and detecting emotion from biological motion. This led us to ask: Are females more responsive to others' body movement as well unconsciously as well? Here we estimate synchronous walking steps of female dyads and male dyads in an outdoor path similar to real life situation to increase ecological validity. We recorded all dyads' steps by a motion sensor attached above ankle and conceal its real function to ensure the implicit nature of walking entrainment. Results showed that female dyads exhibited a significantly greater extent of walking synchrony than male after considering other known modulating factors such as autistic traits, height, weight, and age. It indicated that besides the superiority in processing nonverbal cues, women are also more motionally responsive to other's body movement than men, specifically, tune self movement to synchronize with others' movement in a synchronous fashion. Together with other studies suggesting that females in average have lower autistic traits and higher empathy, our findings imply that gender difference significantly molds social interaction style.

Keeping together in time: the effects of joint synchronous movements on peripersonal space

L

Michiel van Elk

University of Amsterdam

'Keeping together in time' is central to many religious and cultural rituals and likely plays an important role in facilitating group cohesion. In line with this suggestion, many studies have shown effects of joint synchronous movements, such as joint walking, dancing, singing or tapping, on prosocial behavior. However, relatively little is known about the neurocognitive mechanisms underlying the relation between behavioral synchrony and prosocial behavior. Here we investigate the hypothesis that behavioral synchrony results in an extension of peripersonal space (PPS; i.e. the space surrounding the body), thereby increasing the identification with others. Participants moved in dyads either synchronously or asynchronously and subsequently PPS was measured using the audio-tactile interaction task. In this task participants responded to vibrotactile stimuli that were concurrently presented with looming or receding sounds between both participants. It was found that participants identified more strongly with the other and felt more part of a team, when moving in synchrony compared to moving out of sync. However, no consistent effect of synchronous movements on the perception of PPS was observed. In follow-up experiments it will be investigated whether PPS is selectively extended only during 'online' synchronous movements.

Motor interference and synchronization in young children: Biological or also social? 1

Johanna E. van Schaik, Hinke Endedijk, Janny Stapel, and Sabine Hunnius

Donders Institute for Brain, Cognition, and Behavior, Radboud University, Nijmegen, the Netherlands

One aspect of interpersonal coordination is shown in the increased deviances in motion path found when one carries out a continuous, back-and-forth hand movement while observing another person performing the same movement but in an incongruent direction (e.g. horizontal vs. vertical). Developmental studies demonstrate that children also experience such 'motor interference'. However, in both adult and child studies, movement type (i.e. biological vs. non-biological) has been confounded with social factors (e.g. model identity: human vs. robot). This study aimed to disentangle the effects of these two factors on young children's motor interference. After a novel-group manipulation, four- to six-year-old children (N=70) drew back-and-forth on a tablet computer that was concurrently displaying a video. Each video showed an ingroup or outgroup member moving her arm congruently or incongruently with a biological or non-biological motion path. A main effect of congruency was found, replicating the motor interference effect. Moreover, there was an interaction between movement type and model identity. Following Richardson, Campbell, and Schmidt (2009), additional synchrony measures best explain these results, the details of which will be discussed at the conference. This study illustrates that already during early childhood, interpersonal coordination is multifaceted and sensitive to movement type and model identity.

Mimic your friends not your foes: The development of behavioral mimicry during early childhood

2

Johanna E. van Schaik and Sabine Hunnius

Donders Institute for Brain, Cognition, and Behavior, Radboud University, Nijmegen, the Netherlands

Behavioral mimicry is a form of interpersonal coordination that entails copying an interaction partner's behaviors largely outside of awareness. The adult mimicry literature stresses that mimicry acts as a bonding mechanism between interaction partners, yet it is unknown how mimicry develops this role. Here we investigated whether young children mimic and at what point during early childhood mimicry becomes socially-sensitive. Children between three and six years of age participated in a study in which, after choosing a novel group based on color, they observed ingroup- and outgroup-members carrying out typically-mimicked behaviors. The children's behavior was coded for the target behaviors both before and while observing the models' behaviors, serving as the baseline and mimicry period, respectively. Results indicate that, whereas both age groups mimic (i.e. behavior rates were higher during the mimicry period than during baseline), younger children mimicked both ingroup- and outgroup-members while older children selectively mimicked ingroup-members. The emerging pattern suggests that mimicry is present during toddlerhood and that between the ages of four and six mimicry becomes socially-sensitive. Placed in the context of sociocognitive development, these findings are consistent with considerable advances in social expertise and inhibitory control between the ages of three to six.

Dynamical modulation of corticomotor excitability during rhythmic movement observation

Manuel Varlet, Giacomo Novembre, and Peter E. Keller

The MARCS Institute, University of Western Sydney, NSW, Australia

Action observation modulates corticomotor excitability. Such modulation has been understood to be the result of a simulation of the observed action. Alternatively or complementary to this perspective, growing evidence in behavioral research shows that changes in motor activity during observation of rhythmic movements can occur via direct visuomotor couplings and dynamical entrainment. In-phase and anti-phase entrainment spontaneously occur, characterized by movements proceeding simultaneously in the same or opposite direction, respectively. Here we investigate corticomotor excitability during the observation of vertical oscillations of an index finger using Transcranial Magnetic Stimulation. Motor Evoked Potentials were recorded from flexors and extensors of participants' right index finger, placed in either a maximal comfortable flexion or extension position, with stimulations delivered at maximal flexion, maximal extension or mid-trajectory of the observed finger oscillations. Facilitation was found in participants' flexors for in-phase and anti-phase coordination but not for unstable $90°$ coordination, supporting the occurrence of dynamical motor entrainment. Interestingly, anti-phase motor facilitation contrasts with action simulation predictions as it involves activity in the motor system different from the one needed for the execution of the observed movement. These findings open new perspectives for understanding motor activity during action observation and the processes underlying interpersonal coordination.

Communicating in time: Exaggeration of action duration for joint action

Cordula Vesper and Laura Schmitz

Department of Cognitive Science, Central European University

Recent studies have shown how people in a joint action context exaggerate different kinematic parameters of their action to communicate information to a co-actor. This 'signaling' behavior facilitates prediction of observed movement for another person. However, action prediction is also possible in the absence of visual information. This raises the question whether interaction partners might also communicatively exaggerate non-visual action information when performing actions together. To test this hypothesis, we instructed pairs of participants to perform a sequential joint movement task in which one person (Leader) moved her hand to one of three possible target locations and a second person (Follower) subsequently tried to move to the corresponding target location. Task knowledge was distributed asymmetrically such that Followers did not know in advance which target location would be correct, but they received auditory feedback when Leaders reached the target. In a series of experiments, we show that when co-actors had no visual access to each other, Leaders differentially exaggerated the duration of their action, thereby facilitating target prediction for the Followers. These findings provide evidence that signaling behavior indeed generalizes to non-visual contexts. The role of motor simulation and implications for the emergence of communication systems are discussed.

Effects of threat-related emotions on attention and action within realistic interaction context

E. Vilarem, J. Armony, and J. Grèzes

Laboratoire de Neurosciences Cognitives (INSERM U960), Ecole Normale Supérieure

Facial expressions of emotion constitute powerful signals that are critical for survival and successful social interaction (Darwin, 1904; Ohman, 1993). In order to react efficiently to emitted social cues, one must first identify relevant information in the environment by deploying one's spatial attention, then prepare an appropriate action. Our project aims at investigating these two crucial steps leading to the elaboration of an adaptive behavior in the context of potential threat. Indeed, the literature suggests that threatening stimuli capture and prioritize attention more efficiently than positive or neutral ones (Esteves et al., 1994; Fox et al., 2000; Moratos, 2011). But, these stimuli can elicit opposite action tendencies depending on the nature of the emotion that is being displayed (Marsh et al., 2005; Bossuyt et al, 2013; Hammer & Marsh, 2015). Through two behavioral paradigms manipulating emotions of anger and fear in a realistic context of interaction, we have shown that these emotions induced opposite effects on both spatial attention and upcoming action-based decisions, consistent with the different information value they transmit to the observer: while anger signals a direct threat and prompts avoidance behaviors, fear elicits affiliative approach behaviors.

Interpersonal integration of perceptual judgments in an object location task

R

Pavel Voinov, Günther Knoblich, and Natalie Sebanz

Department of Cognitive Science, Central European University

The age-old question of collective wisdom (Condorcet, 1785) has received renewed interest with an emerging field of group psychophysics. Its methodological novelty is to employ perceptual tasks to study how groups integrate information available to their constituting individuals to make decisions better (Bahrami et al., 2010, 2012; Sorkin et al., 2001). We've used a new object location task to investigate how pairs of individuals would combine continuous judgments and whether they use cognitive mechanisms alternative to those utilized at binary-choice group decision-making (Bahrami et al., 2010, Ernst, 2010). Participants were asked to locate objects in 2D projections of 3D objects. We generated projections from different camera view angles to simulate different perspectives on the same layout. In a series of experiments we systematically manipulated: a) angular difference between two individual views; b) possibility to verbally communicate; c) presence of feedback in trials. In our results we demonstrate how pairs outperform best individuals even in absence of communication under certain conditions. We also discuss why the impact that communication and feedback have on performance is different for integrating continuous judgments and for integrating categorical decisions.

Groups & collective speech   A

Jorina von Zimmermann and Daniel C. Richardson

Department of Experimental Psychology, University College London

Anybody who has taken part in a demonstration, prayed with others, sang together with a huge crowd at a concert, or chanted in unison with thousands of other football fans, probably knows the powerful sensation which collective speech action can produce. It has been speculated that synchronous activities enhance group bonding and facilitate group action. To test if this holds true for collective speech, we conducted studies in which large groups of participants either chanted words together or spoke them out loud individually and out sync. Later, groups played a group coordination game, collectively keeping a tightrope walker balanced, took a memory test for the words they had spoken, and rated their perceptions of the group. Our results show that participants who chanted together in synchrony did better at the group coordination task, felt more attached to each other, and even remembered more of the words they had previously repeated. This suggests that synchronised speech can have the same positive effects on group affiliation, which others have found in relation to synchronised body movement, while it also improves group action coordination and individuals' memories.

Ashley Walton, Joubert Lucas, Rachel W. Kallen, Charles Coey, and Michael J. Richardson

Center for Cognition, Action & Perception, University of Cincinnati

Performing everyday goal-directed tasks such as clearing a table or loading a dishwasher with a spouse or family member requires movement coordination that gives rise to and is affected by environmental constraints and designated action roles. Behavioral dynamics provides a way to understand how this coordinated activity between agents emerges and dissolves throughout joint-action tasks. To describe the self-organizing dynamics of physical interactions among socially coordinated human agents, a more experimentally controllable version of every day tasks was created. In a multi-agent object-moving task two participants moved around a virtual environment depicted on a tabletop from one location to another. Participants interacted with the virtual tabletop environment in real time via wireless motion tracking sensors attached to the hands/fingers. Start, goal positions, and obstacle locations were manipulated to reveal how these environmental constraints influenced the motion trajectories and coordination patterns, over the course of the interaction timespan. Results indicated that what, when, where and how to move or act during a social interaction can be implicit in the dynamics of the task, and that patterns of coordinated social movement can emerge spontaneously from these dynamics with little a priori planning. Finally, a low dimension dynamical model is presented that captures the behavioral dynamics observed.

Musical improvisation: Spatiotemporal patterns of coordination

O

Ashley Walton, Auriel Washburn, Charles Coey, Peter Langland-Hassan, Anthony Chemero, and Michael J. Richardson

Center for Cognition Action and Perception, University of Cincinnati

Interpersonal coordination plays a key role in improvised musical performance, with musical competence demanding the collective synchronization of both the auditory and kinesthetic dimensions. The current study was designed to investigate the dynamic structure of this interpersonal coordination, how it emerges between improvising musicians, and how it relates to the quality of the musical outcome. We recorded the playing behavior and full-body movements of pairs of expert pianists over the course of several improvisation sessions, manipulating the visual information available (could see each vs. cannot see each other) and backing musical structure (i.e., musical key, chord progression, rhythm). Using a range of nonlinear time-series techniques we evaluated how the time-evolving patterns and fluctuations of interpersonal coordination between musicians both modulate and constrain the musical structure that results. Our findings suggest that the dynamic stabilities of the behavioral coordination are related to the musical structure of the background conditions such that there is a "sweet spot" between background conditions that impose either too much, or too little constraint. We discuss how quantifying these spatiotemporal patterns can provide an understanding of the dynamics that potentiate the novelty of improvisational expression and creativity.

Delays in temporal visual-motor feedback facilitate interpersonal anticipatory synchronization　　　**2**

Auriel Washburn, Rachel W. Kallen, Charles Coey, Kevin Shockley, and Michael J. Richardson

Center for Cognition, Action & Perception, Department of Psychology, University of Cincinnati

Effective interpersonal coordination is fundamental to robust social interaction, and the ability to anticipate a co-actor's behavior is essential for achieving this coordination. However, coordination research has focused on the behavioral synchrony that occurs between the simple periodic movements of co-actors and, thus, little is known about the anticipation that occurs during complex, everyday interaction. Research on the dynamics of coupled neurons, human motor control, electrical circuits, and laser semiconductors universally demonstrates that small temporal feedback delays are necessary for the anticipation of chaotic events. We therefore investigated whether similar feedback delays would promote anticipatory behavior during social interaction. Results revealed that co-actors were not only able to anticipate others' chaotic movements when experiencing small perceptual-motor delays, but also exhibited movement patterns of equivalent complexity. This suggests that such delays, including those within the human nervous system, may enhance, rather than hinder, the anticipatory processes that underlie successful social interaction.

Exploring joint action to inform human-robot collaboration: How to build something together?

Astrid Weiss and Markus Vincze

ACIN Institute of Automation and Control, Vienna University of Technology

If we assume Human-Robot Coordination as a bilateral process, we need to better understand, what human interaction partners monitor others for during collaboration and how common goals are achieed and alternative solutions are found for unsolvable situations. We present a human-human study on a collaborative task which was performed in order to inform joint action in human-robot interaction. We designed a user study to reveal how two human partners negotiate and agree on a common task outcome, how they monitor for both vocal and gestural evidence, and how they use this evidence in the course of reaching the common goal, which can only be reached by using the resources of two different workspaces (due to an intended manipulation of the study design). Therefore, two participants were asked to build a specific object out of Lego bricks together, namely a house, a tree, and a steamboat (6 dyads in total). We analysed behavioural and self-reporting data to gain insights on the grounding procedures. We present the different dialogue structures, time and errors, words and turns, and gestures and other actions performed. Findings show different strategies used in the two studies and first suggestions how these could be transferred to human-robot interaction.

Hearing is not enough: Vision of the response is needed to generate social inhibition of return

Tim Welsh and Joseph Manzone

University of Toronto

The social inhibition of return effect (sIOR) refers to the finding that reaction times to targets are longer when the target is presented at the same location as a co-actor's previous response relative to when the target is presented at a different location. It has been proposed that the sIOR effect emerges because the observation of the response generates a simulation of the response in the observer. This simulation subsequently activates the inhibitory mechanisms that lead to sIOR. To determine if knowledge of the response alone is sufficient for sIOR, two experiments were conducted in which participants did not witness the response but knew the target/response location because they heard a response-contingent effect tone (Experiment 1) or a colour word indicating the response location (Experiment 2). In contrast to predictions based on the knowledge-of-response hypothesis, sIOR was not observed when participants' only heard auditory information associated with the response. Thus, vision of the co-actor's response seems to be critical for the generation of sIOR. The results of these and other experiments will be discussed with regards to the potentially independent roles of response co-representation and shifts of attention in activating the mechanisms leading to the sIOR effect.

'I know something you don't know': Online modelling of conversation partners in adolescence

Alexandra Westley, Thomas Atkinson, Colin Chambers, and Shirley-Ann Rueschemeyer

University of York

Conversation is a complex form of joint action. Learning to navigate everyday conversation is crucial to social cognitive development. This study examines adolescent's abilities in two important components of conversation: (1) the ability to update one's interpretation of a word based on linguistic context, and (2) the ability to track what joint-listeners comprehend. In the current study we used event-related potentials (ERPs) and the Joint Comprehension Task (Rueschemeyer et al., 2015) to examine the influence of both linguistic and social context in adolescent language comprehension. The results indicate that adolescents are sensitive to linguistic context: while a semantically implausible sentence without disambiguating context information resulted in an N400-Effect, semantically implausible sentences within disambiguating context resulted in the attenuation of the N400-Effect. This indicates that semantic implausibility can be overridden by discourse context. In addition, adolescents were sensitive to the ability of co-listeners to comprehend sentence stimuli: specifically a Social N400-Effect was elicited by sentences that made sense to the adolescent if they were in the presence of a confederate they believed could not understand the sentence. We conclude that adolescents use both linguistic and social context in primary language comprehension.

Do you believe in Mozart? - The influence of beliefs on representing joint action outcomes 2

Thomas Wolf, Cordula Vesper, Natalie Sebanz, and Günther Knoblich

Department of Cognitive Science, Central European University

Actors in joint action situations are able to represent the joint outcomes of their actions (Vesper, Butterfill, Knoblich, & Sebanz, 2010). However, it is not clear on what level these representations of joint action outcomes can be influenced. In the present study, we used a piano paradigm to investigate the influence of belief on joint outcome representations and interpersonal coupling. We tested 8 pairs of adult piano novices in a within-subjects 2 x 2 design with the factors Belief (Together, Separate) and Key (Same, Different). In the Belief condition Together, participants were told that the melodies were intended and composed to be played together as duets. In the condition. Separate, participants were told that the melodies were not intended to be played together. All 24 melody-sets were generated by a python script and followed the chord progression I-IV-V7-I. In 12 melody-sets, the melodies were in the same musical key. In the other 12 melody-sets, the musical key within the set differed. We predicted a significant difference in the strength of the terpersonal coupling in the Together condition, but not in the Separate condition. Preliminary data analysis reveals a significant interaction between the two factors suggesting an effect of beliefs about the composer's intentions on joint outcome representations and interpersonal coupling.

Mateusz Wozniak[1,2] and Guenther Knoblich[2]

[1]Institute of Psychology, Jagiellonian University, Cracow, Poland;
[2]Department of Cognitive Science, Central European University,
Budapest, Hungary

Humans tend to process self-related stimuli in a special way. Classic studies have demonstrated that people remember words related to themselves better and encode self-related information in different way than information about other people. Other results indicate that these effects include better and faster visual processing of self-related stimuli, especially pictures of own face. Recent study (Sui et al. 2012) has shown that similar effects in facilitating visual processing can be elicited for neutral stimuli (geometric shapes) by rapid self-association. Current study has investigated if rapid self-association can lead to similar effects for avatar faces. In comparison to geometrical shapes, faces constitute a special kind of social stimuli serving as possibly the most important source of knowledge about people's identity. Using a modified Sui et al. 2012 self-prioritization paradigm we have shown that people were faster to detect neutral faces which they have encoded as "themselves" than faces encoded as "stranger". Faces encoded as best friend have generated more complicated pattern of results, indicating an interference effect. Overall, the results show that people can easily associate neutral faces with their self-representation by showing self-prioritization effect, but find it much more difficult for representation of their best friend. It may indicate much more plastic representation of self than close others.

Jun Yin, Haokui Xu, Xiaowei Ding, Rende Shui, and Mowei Shen

Department of Psychology and Behavioral Sciences, Zhejiang University

Action prediction, a crucial ability to support social activities, is sensitive to the individual goals of observed actions. Our research reports a novel finding that action prediction is influenced and even enhanced by interpersonal coordination that is implemented to achieve a collective goal (i.e., joint actions). Specifically, we manipulated the coordination information by presenting coordinated and individual chases (i.e., two chasers and one common target) and their paired-controls, including backward replay(Experiment 1), making the chasing target invisible (Experiment 2), and a more direct intervention to disrupt coordination information (Experiment 3). The task of subjects was to predict the expected position (i.e., action) for one chaser after it became momentarily invisible by clicking the mouse. The results showed that the prediction error for invisible chasers depended on whether or not the second chaser was coordinated with it, and this effect vanished when the chasers behaved with exactly the same motions, but without interaction meaning; furthermore, this influence is exhibited by enhancing prediction performance. These findings extend the influencing factors of action prediction to the level of observed interaction information, implying that the functional characteristic of mutual constraints of coordinated actions can be utilized by the vision.

The relationship between action execution, imagination, and perception in children 1

Emma Yoxon and Timothy N. Welsh

University of Toronto

According to common coding theory, representations of actions and perceptions are linked in a common domain such that the perception of an effect can increase the tendency to perform the associated action. Although this theory is often used in acocunts of action planning and execution, this theory has been expanded to include action imagination and observation. In support of this approach, previous research has shown that, in neurotypical adults, action possibility judgments and imagined movements are subject to the same speed-accuracy trade-off (Fitts' law) as actual movements. The current experiment investigated the relationship between action perception, imagination and execution in children. To this end, children aged 7-12 completed execution, imagination and perception tasks that all involved reciprocal upper limb aiming movements to targets of varrying width and amplitude. Consistent with previous literature, we predicted that Fitts' law would be present in action execution as well as in imagination. Additionally, because common coding theory suggests that action perception and imagination share the same representational domain, we also predicted that Fitts' law should be present in the action perception task. The results of the study will be discussed with respect to the development of the common coding network.

Interpersonal coordination is enhanced between individuals with similar endogenous rhythms

D

Anna Zamm, Chelsea Wellman, and Caroline Palmer

Dept of Psychology, McGill University, Canada

Joint actions such as ensemble music performance require that partners with different endogenous rhythms synchronize the timing of actions with one another. We tested how differences in partners' endogenous rhythms affected their ability to coordinate joint behavior, using a music performance task: 40 skilled pianists' endogenous rhythms (measured by their Spontaneous Musical Rate, SMR; mean beat interonset interval) were assessed in solo performance of melodies, which were used to assign pianists to duet pairs in which partners were either matched (< 10 ms difference in partners' SMRs) or mismatched (> 100 ms difference in SMRs) in their endogenous rhythms, while mean SMR was equated across groups. Duet partners performed novel melodies together, using either right or left limb (arm, hand, and finger) movements. Synchronization of duet performance was more accurate for pairs with matched spontaneous rates than for mismatched pairs, providing confirmatory evidence for a causal link between endogenous rhythms and synchronization of music performance. Temporal synchronization was enhanced for matched partners regardless of limb movements, suggesting that coupling of endogenous rhythms is not a function of limb-specific motor synergies. These findings support similar but weaker constraints on human synchronization abilities to those found in other species.

Influence of phonetic constraints on spontaneous speech-gesture coordination: the compatibility of place of articulation in CVCV words

Gregory Zelic, Jeesun Kim, and Chris Davis

The MARCS Institute, University of Western Sydney, Sydney, NSW, Australia

In daily activity it is common to talk and be moving at the same time. These two ubiquitous skills are tightly connected, with mutual entrainment revealed either in the context of speech communication, or in non-communicative tasks (e.g., repeatedly uttering a syllable while finger tapping). Recently we showed that the spontaneous coordination between speech (repetitive CV utterances) and gesture (continuous finger flexion-extension) was affected by the type of syllable uttered, presumably due to changes in speech stability resulting from the different phonetic constraints. The present study further examined whether spoken phonetic properties affect speech-gesture coordination. Participants repeatedly uttered a CVCV nonsense word while performing a rhythmic gesture task. We manipulated the compatibility of the place of articulation of the first and second syllable, such that they were "place compatibles" (alveolar /tada/; bilabial /paba/) or "place incompatibles" (alveolar-bilabial /taba/; bilabial-alveolar /pada/). The more complex coordination of the speech articulators for phonetic incompatibility was expected to favor the stability of the speech performance and to reinforce the spontaneous speech-gesture coordination. We discuss the extent to which the spontaneous coordination between the different speech articulators (i.e. tongue, jaw, lips) and the manual gesture is affected by these phonetic speech constraints.

Design and implementation of an interactive cognitive architecture for a virtual player in joint action tasks

Zhai, C.[1], Alderisio, F.[1], Slowinski, P.[2], Tsaneva-Atanasova, K.[2], and di Bernardo, M.[1,3]

[1]Department of Engineering Mathematics, University of Bristol, UK; [2]College of Engineering, Mathematics and Physical Sciences, University of Exeter, UK; [3]Department of Electrical Engineering and Information Technology, University of Naples, Italy

GOAL OF THE STUDY: The main goal of this study is the design of an interactive cognitive architecture (ICA), which allows a virtual player (VP) to generate human-like interaction, with given kinematic characteristics, during the mirror game. METHOD: The ICA controls interaction between the VP and the HP by means of an algorithm based on optimal-adaptive feedback control theory. It takes into account both the desired motor signature and level of temporal correspondence between players in different joint action conditions. Movement of the end-effector of the VP in the mirror game is modeled by means of a feedback controlled HKB oscillator. Several control parameters can be "tuned" to change the VP behavior ad hoc and explore different types of interactions. To assess how coordination level changes when kinematic similarity between the HP and VP is varied, we allow the ICA to change the kinematic signature of the VP during the game. RESULTS–DISCUSSION: Our analysis confirmed that the ICA allows the VP to exhibit human-like behavior with a desired kinematic signature in fundamental joint action tasks, such as the mirror game. By using the VP, we show that different kinematic similarity between players affects their coordination level. Acknowledgements: This study was funded by the European Project of AlterEgo (Grant#600610 / FP7).

Simon task as a way to measure virtual hand illusion 1

Jing Zhang

Leiden Institute for Brain and Cognition, Leiden University (Netherlands); Center for the Study of Language and Cognition, Zhejiang University (China)

Virtual hand illusion is a revised version of rubber hand illusion which has become a very popular model system to study issues related to the conscious experience of the self. Questionnaire and proprioceptive drift are two common methods to measure the illusion of virtual hand. However, both of them have certain shortcomings. In the present study, we try to adopt Simon Task as a way to measure virtual hand illusion. We create a virtual environment where participants can see a virtual keyboard and a virtual screen on a real computer screen while they are asked to do the Simon Task through a real keyboard which is hidden from their sights. In Experiment 1, both virtual hands have the synchronous movements with the participants'. In Experiment 2, either the left or right virtual hand has the asynchronous movements with the participants'. In Experiment 3, both virtual hands have the asynchronous movements with the participants'. We compare the effects of Simon Task with their reports on illusion questionnaire. The results suggest that the effects of Simon Task can been seen as an index of the illusion degree of virtual hand.

Activating spontaneous visual perspective taking: Actions, space, and the mind

Xuan Zhao, Corey Cusimano, and Bertram F. Malle

Brown University

Visual perspective taking (VPT) – people's ability to represent the physical world from another agent's viewpoint – plays a fundamental role in social cognition. In five recent between-subject studies on Amazon Mechanical Turk, we investigated under what conditions VPT could be activated spontaneously. Spontaneous VPT is measured as people's tendency to read an ambiguous number from another agent's imagined perspective ("6") rather than from one's own default visual perspective ("9"). We found that, first, people's tendency to represent an agent's visual perspective increased from conditions of the agent's mere presence to object-directed gaze to reaching. However, this differential effect was eliminated when participants were explicitly prompted to perform VPT. Second, observing an agent's gaze or reaching toward one object triggered spontaneous VPT even for an object with which the agent was currently not engaged—a form of "global VPT." Third, the triggering effect of gaze and reaching held largely true even if such behaviors were displayed by a humanoid robot. Based on current results and our ongoing studies, we are developing a conception of "the sphere of spontaneous VPT"—the physical space within which people are most likely to take an agent's visual perspective when exposed to certain triggering conditions.

Does physical attractiveness influence interpersonal motor coordination

Zhao, Z.[1], Salesse, R.N.[1], Gueugnon, M.[1], Schmidt, R.C.[2], Marin, L.[1], and Bardy, B.G.[1,3]

[1]Movement To Health Laboratory, EuroMov, University of Montpellier, France; [2]Department of Psychology, College of the Holy Cross, Worcester, Massachusetts, USA; [3]Institut Universitaire de France

OBJECTIVE: Previous studies on social coordination have shown that interpersonal motor coordination is sensitive not only to biomechanical factors such as coordination pattern, oscillating frequency, and individual differences, but also to psychosocial factors such as interpersonal relationship and social competence. In social psychology, the controversy upon the social stereotype of "what is beautiful is good" suggests a lack of consensus on the impact of physical attractiveness on other's reaction. We adopted the dynamical approach to investigate whether physical attractiveness genuinely influences our coordination with another person. METHOD: 34 participants performed a motor coordination task with a physically attractive (virtual) agent and with a less physically attractive agent, on a tactile device. At the same time, they answered a reaction time task to measure the attentional cost of motor coordination. RESULTS-DISCUSSION: Participants exhibited a higher stability of motor coordination with the physically attractive agent than with the less physically attractive agent. But the result could not be interpreted by a specific attention allocating strategy. The circular relationship between likability and interpersonal motor coordination may provide a reasonable explanation. Our study shows that physical attractiveness affects interpersonal coordination, and it suggests that between-people joint action is a way to express likability. Aknowledgments: This study was funded by the European Project of AlterEgo (Grant#600610 /FP7).

Participants

Ahlers, Timo, University of Vienna, timo.ahlers@univie.ac.at

Alami, Rachid, Université de Toulouse, Rachid.Alami@laas.fr

Alderisio, Francesco, University of Bristol, f.alderisio@bristol.ac.uk

Almer, Alexander, University of Gothenburg, alexander.almer@ait.gu.se

Altinok, Nazli, Central European University, altinok.nazli@gmail.com

Ansuini, Caterina, Italian Institute of Technology, caterina.ansuini@iit.it

Bachrach, Asaf, Projet Labodanse Labex ARTS H2H, asafbac@gmail.com

Baess, Pamela, University of Hildesheim, pamela@neuro.hut.fi

Baggs, Ed, University of Edinburgh, ed.baggs@gmail.com

Bangerter, Adrian, University of Neuchatel, adrian.bangerter@unine.ch

Bardy, Benoit, University of Montpellier, benoit.bardy@univ-montp1.fr

Becker, Markus, University of Southern Denmark, mab@sod.dias.sdu.dk

Betti, Sonia, University of Padova, sonia.betti@studenti.unipd.it

Beuzit, Cédric, Université de Toulouse, cedric.beuzit@laas.fr

Bishop, Laura, Austrian Research Institute for Artificial Intelligence, laura.bishop@ofai.at

Blomberg, Olle, University of Copenhagen, olle.blomberg@gmail.com

Böckler, Anne, Max Planck Institute for Human Cognitive and Brain Sciences, anneboeckler@gmail.com

Boncz, Adam, Central European University, Boncz_Adam@phd.ceu.edu

Bowling, Daniel, University of Vienna, dan.bowling@univie.ac.at

Brown, Steven, McMaster University, stebro@mcmaster.ca

Burger, Birgitta, University of Jyväskylä, birgitta.burger@jyu.fi

Buttelmann, Frances, Central European University,
visbuttelmann@ceu.edu

Capozzi, Francesca, University of Torino, francesca.capozzi@unito.it

Castillo, Lucia, University of Edinburgh,
lucia.castillo.iglesias@gmail.com

Chang, Dong-Seon, Max Planck Institute for Biological Cybernetics,
dong-seon.chang@tuebingen.mpg.de

Chauvigné, Léa, McMaster University, chauvila@mcmaster.ca

Cheng, Miao, University of Hong Kong, yvonne.720@live.cn

Ciaunica, Anna, University of Porto; University of London,
ciaunica@yahoo.com

Clark, Herbert H., Stanford University, clark@stanford.edu

Clodic, Aurélie, Université de Toulouse, aurelie.clodic@laas.fr

Cohen, Laura, École Polytechnique Fédérale de Lausanne,
laura.cohen@epfl.ch

Colling, Lincoln, Macquarie University, lincoln@colling.net.nz

Constable, Merryn D., University of Toronto,
merryndconstable@gmail.com

Croker, Steve, Illinois State University, s.croker@ilstu.edu

Csibra, Gergely, Central European University, csibrag@ceu.hu

Curioni, Arianna, Sapienza University; Central European University,
curioniarianna@gmail.com

Czemeres, Nicole, University of Saskatchewan,
nicole.czemeres@usask.ca

Davis, Tehran J., University of Connecticut, tehran.davis@uconn.edu

de la Rosa, Stephan, Max Planck Institute for Biological Cybernetics,
delarosa@tuebingen.mpg.de

De Looze, Céline, CNRS; Trinity College Dublin, deloozec@tcd.ie

Demos, Alexander P., McGill University,
    alexander.demos@mail.mcgill.ca

Devin, Sandra, Université de Toulouse, sdevin@laas.fr

di Bernardo, Mario, University of Bristol, m.dibernardo@bristol.ac.uk

Dötsch, Dominik, Philipps University Marburg,
    dominik.doetsch@uni-marburg.de

Eiler, Brian A., University of Cincinnati, eilerbn@mail.uc.edu

Elekes, Fruzsina, Eötvös Loránd University; Central European
    University, elekes.fr@gmail.com

Era, Vanessa, Sapienza University of Rome, vanessa.era@uniroma1.it

Eskenazi, Terry, ENS Paris, terryeskenazi@gmail.com

Faber, Tim, University of Amsterdam, t.w.faber@uva.nl

Farmer, Harry, University College London, h.farmer@ucl.ac.uk

Finta, Györgyné (Réka), Central European University, Szabor@ceu.edu

Fitzpatrick, Paula, Assumption College, pfitzpat@assumption.edu

Fraser, Dagmar S., University of Birmingham, d.s.fraser@bham.ac.uk

Freundlieb, Martin, Central European University,
    mfreundlieb@googlemail.com

Fuller, Tim, University of Cincinnati, fullertc@mail.uc.edu

Fürlinger, Anton, Vienna, fuerlinger@hominisation.at

Galantucci, Bruno, Yeshiva University; Haskins Laboratories,
    bruno.galantucci@gmail.com

Ginocchietti, Marianna, University of Trieste,
    marianna.ginocchietti@phd.units.it

Grynszpan, Ouriel, Université Pierre et Marie Curie, CNRS,
    ouriel.grynszpan@upmc.fr

Gueugnon, Mathieu, Montpellier University, mathieu.gueugnon@univ-montp1.fr

Hadley, Lauren V., University of Edinburgh, lauren.hadley@cantab.net

Hale, Joanna, University College London, jo.hale.13@ucl.ac.uk

Hamilton, Antonia, University College London, a.hamilton@ucl.ac.uk

He, Xun, Bournemouth University, xhe@bournemouth.ac.uk

Hobeika, Lise, CNRS, lise.hobeika@gmail.com

Hömke, Paul, Max Planck Institute for Psycholinguistics, paul.hoemke@mpi.nl

Iqbal, Tariq, University of Notre Dame, tariq.iqbal.5@nd.edu

Jenei, Andrea, Central European University, JeneiA@ceu.edu

Jordan, Scott J., Illinois State University, jsjorda@ilstu.edu

Jording, Mathis, University Hospital of Cologne, mathis.jording@uk-koeln.de

Jovanov, Kimberley, University of Toronto, kim.jovanov@mail.utoronto.ca

Kato, Masaharu, NTT Corporation, maskato@mail.doshisha.ac.jp

Kaufmann, Angelica, University of Antwerp, angelica.kaufmann@uantwerpen.be

Keller, Peter E., University of Western Sydney, p.keller@uws.edu.au

Khoramshahi, Mahdi, École Polytechnique Fédérale de Lausanne, mahdi.khoramshahi@epfl.ch

Kimmel, Michael, University of Vienna, michael.kimmel@univie.ac.at

Király, Ildiko, Eötvös Loránd University; Central European University, kiraly.keszei.ildiko@gmail.com

Knoblich, Günther, Central European University, KnoblichG@ceu.edu

Kourtis, Dimitrios, Ghent University, Dimitrios.Kourtis@UGent.be

Kuhlen, Anna K., Humboldt-Universität; Bernstein Center for
   Computational Neuroscience; Charité ,
   anna.kuhlen@hotmail.com

Launay, Jacques, University of Oxford, jacques.launay@psy.ox.ac.uk

Lelonkiewicz, Jarosław R., University of Edinburgh,
   J.R.Lelonkiewicz@sms.ed.ac.uk

Lindblad, Gustaf, University of Gothenburg,
   gustaf.lindblad@sskkii.gu.se

Lindner, Nicolas, Heinrich-Heine-Universität Düsseldorf,
   nicolas.lindner@uni-duesseldorf.de

Loehr, Janeen, University of Saskatchewan, janeen.loehr@usask.ca

Lorenz, Tamara, Ludwig-Maximilians University; Technische Universität
   München, t.lorenz@tum.de

Lowe, Robert, University of Skövde; University of Gothenburg,
   robert.lowe@his.se

Lugli, Luisa, University of Bologna, l.lugli@unibo.it

Magyari, Lilla, Pázmány Péter Catholic University,
   lillamagyari@gmail.com

Malone, MaryLauren, University of Cincinnati, malonemo@mail.uc.edu

Marin, Ludovic, University of Montpellier,
   ludovic.marin@univ-montp1.fr

Marsh, Kerry L., University of Connecticut, kerry.l.marsh@uconn.edu

Mascaro, Olivier, Central European University,
   olivier.mascaro@gmail.com

Maye, Alexander, University Medical Center Hamburg-Eppendorf,
   a.maye@uke.de

McEllin, Luke, Central European University, mcellin_luke@phd.ceu.edu

Meyer, Marlene, Radboud University, m.meyer@donders.ru.nl

Michael, John, Central European University, michaelj@ceu.edu

Miles, Lynden K., University of Aberdeen, lynden.miles@abdn.ac.uk

Mills, Gregory, University of Groningen, g.j.mills@rug.nl

Mills, Peta, University of Western Sydney, p.mills@uws.edu.au

Milward, Sophie, Central European University, MilwardS@ceu.edu

Mogan, Reneeta, Victoria University of Wellington, reneeta.mogannaidu@vuw.ac.nz

Müller, Romy, Technische Universität Dresden, romy.mueller@tu-dresden.de

Novembre, Giacomo, University of Western Sydney; Max Planck Institute for Human Cognitive and Brain Sciences, giacomonovembre@gmail.com

Noy, Lior, Weizmann Institute of Science, lior.noy.1@gmail.com

O´Shea, Kieran J., University of Glasgow, k.o'shea.2@research.gla.ac.uk

Pacione, Sandra M., University of Toronto, sandra.pacione@mail.utoronto.ca

Palmer, Caroline, McGill University, caroline.palmer@mcgill.ca

Parmigiani, Sara, University of Trento, Sara.Parmigiani@unitn.it

Paternotte, Cédric, Ludwig-Maximilians University, cedric.paternotte@lrz.uni-muenchen.de

Paulus, Markus, Ludwig-Maximilians-Universität München, markus.paulus@psy.lmu.de

Pedinoff, Rebecca, Free University Berlin, pedinoff@zedat.fu-berlin.de

Pfundmair, Michaela, Ludwig-Maximilians University of Munich, michaela.pfundmair@psy.lmu.de

Raith, Lisa, University Regensburg,
lisa.raith@psychologie.uni-regensburg.de

Ramenzoni, Veronica C., Central European University,
vramenzoni@gmail.com

Ray, Matthew, University of Toronto, matthew.ray@utoronto.ca

Reichelt, Andreas F., Centre for Neuroscience Studies,
andreas.reichelt@queensu.ca

Richardson, Daniel C., University College London, dcr@eyethink.org

Richardson, Michael J., University of Cincinnati,
richamo@ucmail.uc.edu

Riek, Laurel, University of Notre Dame, lriek@nd.edu

Romero, Veronica, University of Cincinnati,
romero.veronica.c@gmail.com

Rossmanith, Nicole, University of Portsmouth,
nicole.rossmanith@port.ac.uk

Sacheli, Lucia M., University of Rome "Sapienza", lucisac@gmail.com

Salesse, Robin, University of Montpellier, robin.salesse@univ-montp1.fr

Schiavio, Andrea, The University of Sheffield,
a.schiavio@sheffield.ac.uk

Schloesser, Daniel S., Illinois State University,
danielschloesser01@gmail.com

Schmidt, Richard, College of the Holy Cross, rschmidt@holycross.edu

Schmitz, Laura, Central European University,
schmitz_laura@phd.ceu.edu

Schmitz, Norbert, German Research Center for Artificial Intelligence
GmbH, norbert.schmitz@dfki.de

Schubö, Anna, Philipps-Universität Marburg,
anna.schuboe@staff.uni-marburg.de

Schwarzkopf, Sarah, University of Freiburg,
s.schwarzkopf@googlemail.com

Sebanz, Natalie, Central European University, SebanzN@ceu.edu

Seemann, Axel, Bentley University, aseemann@bentley.edu

Sevdalis, Vassilis, German Sport University Cologne; University of
Cologne, v.sevdalis@dshs-koeln.de

Sinigaglia, Corrado, University of Milan, corrado.sinigaglia@unimi.it

Slowinski, Piotr, University of Exeter; University of Bristol,
p.m.slowinski@exeter.ac.uk

Strasser, Anna, Humboldt-Universität zu Berlin,
anna.strasser@hu-berlin.de

Szymanski, Caroline, Max Planck Institute for Human Development,
caroline.szymanski@icloud.com

Tosi, Alessia, University of Edinburgh, s1157690@exseed.ed.ac.uk

Tsaneva-Atanasova, Krasimira, University of Exeter,
k.tsaneva-atanasova@exeter.ac.uk

Tseng, Chia-huei, University of Hong Kong, ch_tseng@alumni.uci.edu

van Elk, Michiel, University of Amsterdam, m.vanelk@uva.nl

van Schaik, Johanna E., Radboud University,
j.e.vanschaik@donders.ru.nl

Varlet, Manuel, University of Western Sydney, m.varlet@uws.edu.au

Varoqui, Deborah, University of Montpellier,
deborah.varoqui@univ-montp1.fr

Vesper, Cordula, Central European University, vesperc@ceu.edu

Vicary, Staci, Brunel University London, staci.vicary@brunel.ac.uk

Vilarem, Emma, Ecole Normale Supérieure, emmavilarem@gmail.com

Voinov, Pavel, Central European University, voinov_pavel@ceu-budapest.edu

von Zimmermann, Jorina, University College London, j.v.zimmermann@gmail.com

Wahn, Basil, Universität Osnabrück, bwahn@uos.de

Walton, Ashley, University of Cincinnati, waltonal@mail.uc.edu

Washburn, Auriel, University of Cincinnati, washbual@mail.uc.edu

Weiss, Astrid, Vienna University of Technology, astrid.weiss@tuwien.ac.at

Welsh, Tim, University of Toronto, t.welsh@utoronto.ca

Wesselmann, Eric D., Illinois State University, edwesse@ilstu.edu

Westley, Alexandra, University of York, alexandrawestley@gmail.com

Wolf, Thomas, Central European University, thomaswolf.cogsci@gmail.com

Wozniak, Mateusz, Jagiellonian University; Central European University, mgwozniak@gmail.com

Xu, Haokui, Zhejiang University, haokuixu.psy@gmail.com

Yin, Jun, Central European University, yinj@ceu.edu

Yoxon, Emma, University of Toronto, emma.yoxon@mail.utoronto.ca

Zamm, Anna, McGill University, anna.zamm@mail.mcgill.ca

Zelic, Gregory, University of Western Sydney, g.zelic@uws.edu.au

Zhai, Chao, University of Bristol, chao.zhai@bristol.ac.uk

Zhang, Jing, Leiden University; Zhejiang University, j.zhang@fsw.leidenuniv.nl

Zhao, Xuan, Brown University, xuan_zhao@brown.edu

Zhao, Zhong, University of Montpellier, zhong.zhao@univ-montp1.fr