Motor Cognition
The Cinderella of Psychology (Rosenbaum, 2005)

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Info

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Section: Neuropsychology,

Location: Y 122
Consultation hours upon request (email)

Specific Research Interests:
Action and cognition, Limb apraxia,
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Content

We will read and discuss publications that address action planning and action control.
Many movements that we perform occur apparently automatically, e.g. brushing our teeth or riding a bike. We quickly decide whether we can cross a road, or whether an object is within reach. But how do we get there?
The aim of this course is to receive an overview of motor cognition and learn about the coupling of action, perception and cognition from early models to modern approaches including brain functions.
Whenever possible, practical examples will be included in the course.
The group should read the basic material before each session. Students are expected to prepare a presentation and participate in the discussions of their peers' presentations.

Requirements

Language: Preliminary English

Literature: Literature will consist of book-chapters, reviews and relevant published studies providing basic knowledge.

PDFs can be found in ILIAS. E-book is available in the library

Compulsory Attendance: yes

Procedure

Everybody presents **twice**

2 presenters per session

Each Presenter:
30 Minutes presentation + 10 minutes lead of discussion:
- 10 minutes basics (chapter/ and or review)
- 20 minutes 1 study

please select the study to be discussed in detail **2 weeks before presentation**
- 10 minutes discussion including the group (discuss study)

Shared:
- 10 minutes practical (or 2x5)

be creative! I can help with brainstorming and in some cases with material

Course Assessment

Presentation:
- **Timing**
- **Clarity of presentation**
  - **with respect to comprehension** (e.g. well structured, clarifying explanations, clear description of data / images, difficult content is presented in a comprehensible manner)
  - **with respect to slide organization** (e.g. not overloaded, style is used to facilitate attentive listening)
- **What are the take-home messages? (clear summary of main points, what's the message?)**
- **Lead of discussion**

Helpful links

English
http://dict.leo.org
http://www.wordhippo.com/

Literature, e.g.:
http://www.ncbi.nlm.nih.gov/pubmed
http://scholar.google.de/

Session 1: Organization / General Introduction

Session 2: Introduction and Neurobiological Foundations

Hommel, Brown & Nattkemper: Human Action Control
Chapters 1-2

Session 3: Intention

Hommel, Brown & Nattkemper: Human Action Control
Chapter 3

- Egmose I., & Køppe S. (2017). Shaping of Reach-to-Grasp Kinematics by Intentions: A Meta-Analysis. *Journal of Motor Behavior*, 1-11.
- Haggard P. (2005). Conscious intention and motor cognition. *Trends in Cognitive Sciences, 9*, 290-295.
- Niu Y.-N., Zhu X., & Li J. (2017). The Age Effects on the Cognitive Processes of Intention-Based and Stimulus-Based Actions: An ERP Study. *Frontiers in psychology, 8*.
- **Kim S., Yu Z., & Lee M. (2017). Understanding human intention by connecting perception and action learning in artificial agents. *Neural Networks*. (to be discussed with JANNIS)**

Session 4: Perception
Routes

Milner A. D., & Goodale M. A. (2006). *The visual brain in action*: Oxford University Press, USA.

- Milner A. D., & Goodale M. A. (2008). Two visual systems re-viewed. *Neuropsychologia, 46*, 774-785.
- Schenk T., & Hesse C. (2017). Do we have distinct systems for immediate and delayed actions? A selective review on the role of visual memory in action. *Cortex*.
- Galletti C., & Fattori P. (2017). The dorsal visual stream revisited: stable circuits or dynamic pathways? *Cortex*.
- Binkofski F., & Buxbaum L. J. (2013). Two action systems in the human brain. *Brain and Language, 127*, 222-229.
- Rossit S., Harvey M., Butler S. H., Szymanek L., Morand S., Monaco S., & Mcintosh R. D. (2017). Impaired peripheral reaching and on-line corrections in patient DF: optic ataxia with visual form agnosia. *Cortex*.
- Kopiske K. K., Bruno N., Hesse C., Schenk T., & Franz V. H. (2016). The functional subdivision of the visual brain: Is there a real illusion effect on action? A multi-lab replication study. *Cortex, 79*, 130-152.

Session 5: Perception meets Action
Illusions

Describe different illusions: discuss, what does it tell us about the relation between action and perception?

- Li Y., Randerath J., Goldenberg G., & Hermsdorfer J. (2007). Grip forces isolated from knowledge about object properties following a left parietal lesion. *Neurosci Lett, 426*, 187-191.
- Kilteni K., Maselli A., Kording K. P., & Slater M. (2015). Over my fake body: body ownership illusions for studying the multisensory basis of own-body perception. *Frontiers in human Neuroscience, 9*.
- Manning C., Morgan M. J., Allen C. T., & Pellicano E. (2017). Susceptibility to Ebbinghaus and Müller-Lyer illusions in autistic children: a comparison of three different methods. *Molecular autism, 8*, 16.
- Rinsma T., Van Der Kamp J., Dicks M., & Cañal-Bruland R. (2017). Nothing magical: pantomimed grasping is controlled by the ventral system. *Experimental Brain Research, 235*, 1823-1833.
- Kopiske K. K., Bruno N., Hesse C., Schenk T., & Franz V. H. (2016). The functional subdivision of the visual brain: Is there a real illusion effect on action? A multi-lab replication study. *Cortex, 79*, 130-152.
- Kopiske K. K., Bruno N., Hesse C., Schenk T., & Franz V. H. (2017). Do visual illusions affect grasping? Considerable progress in a scientific debate. A reply to Whitwell & Goodale, 2016. *Cortex, 88*, 210-215.
- Kopiske K. K., Cesanek E., Campagnoli C., & Domini F. (2017). Adaptation effects in grasping the Müller-Lyer illusion. *Vision Research, 136*, 21-31.
- Whitwell R. L., Goodale M. A., Merritt K. E., & Enns J. T. (2017). The Sander parallelogram illusion dissociates action and perception despite control for the litany of past confounds. *Cortex*
- Dassonville P., & Reed S. A. (2015). The Two-Wrongs model explains perception-action dissociations for illusions driven by distortions of the egocentric reference frame. *Frontiers in human Neuroscience, 9*.
- Lanska J. R., & Lanska D. J. (2013). Alice in Wonderland syndrome: somesthetic vs visual perceptual disturbance. *Neurology, 80*, 1262-1264.
- O'toole P., & Modestino E. J. (2017). Alice in Wonderland Syndrome: A real life version of Lewis Carroll's novel. *Brain and Development*.
- Soliman T. M., Buxbaum L. J., & Jax S. A. (2016). The mirror illusion's effects on body state estimation. *Cognitive Neuropsychology, 33*, 102-111.

Session 6: Perception/Representations Simulation, Imagery, Mirror Neurons

Jeannerod: Motor Cognition, 2006, chapter 5.5, 6: the simulation hypothesis of Motor cognition (in my office)

- Ferrari P., Gerbella M., Coudé G., & Rozzi S. (2017). Two different mirror neuron networks: The sensorimotor (hand) and limbic (face) pathways. *Neuroscience, 358*, 300-315.
- Pulvermüller F. (2017). Neural Reuse Of Action Perception Circuits For Language, Concepts And Communication. *Progress in neurobiology*.
- Heyes C. (2010). Where do mirror neurons come from? *Neuroscience & Biobehavioral Reviews, 34*, 575-583.
- O'shea H., & Moran A. (2017). Does motor simulation theory explain the cognitive mechanisms underlying motor imagery? A critical review. *Frontiers in human Neuroscience, 11*.
- Oztop E., Kawato M., & Arbib M. (2006). Mirror neurons and imitation: a computationally guided review. *Neural networks : the official journal of the International Neural Network Society, 19*, 254-271.

Session 7: Perception/Representations Embodiment

- Raab et al. Chapter 14: Performance Psychology (in my office)
- Dijkstra K., & Post L. (2015). Mechanisms of embodiment. *Frontiers in psychology, 6*.

- .Blumberg M. S., & Dooley J. C. (2017). Phantom Limbs, Neuroprosthetics, and the Developmental Origins of Embodiment. *Trends in Neurosciences, 40*, 603-612.
- Costello M. C., & Bloesch E. K. (2017). Are older adults less embodied? A review of age effects through the lens of embodied cognition. *Frontiers in psychology, 8*.
- De Waal F. B., & Preston S. D. (2017). Mammalian empathy: behavioural manifestations and neural basis. *Nature Reviews Neuroscience, 18*, 498-509.
- Glenberg A. M. (2015). Few believe the world is flat: How embodiment is changing the scientific understanding of cognition. *Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale, 69*, 165.
- Körner A., Topolinski S., & Strack F. (2015). Routes to embodiment. *Frontiers in psychology, 6*.
- Wilson A. D., & Golonka S. (2013). Embodied cognition is not what you think it is. *Frontiers in psychology, 4*.
- Zwaan R. A. (2016). Situation models, mental simulations, and abstract concepts in discourse comprehension. *Psychonomic bulletin & review, 23*, 1028-1034.
- Stamatopoulou D. (2017). Empathy and the aesthetic: Why does art still move us? *Cognitive Processing*, 1-18.
- Jospe K., Flöel A., & Lavidor M. (2017). The Role of Embodiment and Individual Empathy Levels in Gesture Comprehension. *Experimental psychology*.
- Leshinskaya A., & Caramazza A. (2016). For a cognitive neuroscience of concepts: Moving beyond the grounding issue. *Psychonomic bulletin & review, 23*, 991-1001.
- Kiefer M., & Pulvermüller F. (2012). Conceptual representations in mind and brain: theoretical developments, current evidence and future directions. *Cortex, 48*, 805-825.

Session 8: Perception / Representation observation/others

Jeannerod, 2006, Chapter 5: How do we perceive and understand the actions of others (in my office)

- Cui F., Gu R., Zhu X., & Luo Y.-J. (2016). The temporal dynamics of perceiving other's painful actions. *Frontiers in psychology, 7*.
- Lehner R., Meesen R., & Wenderoth N. (2017). Observing back pain provoking lifting actions modulates corticomotor excitability of the observer's primary motor cortex. *Neuropsychologia, 101*, 1-9.
- Moreau Q., Galvan L., Nazir T. A., & Paulignan Y. (2016). Dynamics of Social Interaction: Kinematic Analysis of a Joint Action. *Frontiers in psychology, 7*.
- Podda J., Ansuini C., Vastano R., Cavallo A., & Becchio C. (2017). The heaviness of invisible objects: Predictive weight judgments from observed real and pantomimed grasps. *Cognition, 168*, 140-145.
- Turi M., Muratori F., Tinelli F., Morrone M. C., & Burr D. C. (2017). Autism is associated with reduced ability to interpret grasping actions of others. *Scientific Reports, 7*.

Session 10: Action Selection Affordances

- Gibson J. J. (1986). *The ecological approach to visual perception*: Lawrence Erlbaum. (in my office)
- Cisek P., & Kalaska J. F. (2010). Neural mechanisms for interacting with a world full of action choices. *Annual Review of Neuroscience, 33*, 269-298.
- De Wit M. M., De Vries S., Van Der Kamp J., & Withagen R. (2017). Affordances and neuroscience: Steps towards a successful marriage. *Neuroscience & Biobehavioral Reviews, 80*, 622-629.

- Breveglieri R., Galletti C., Bosco A., Gamberini M., & Fattori P. (2015). Object affordance modulates visual responses in the macaque medial posterior parietal cortex. *Journal of Cognitive Neuroscience*.
- Harrison H. S., Turvey M. T., & Frank T. D. (2016). Affordance-based perception-action dynamics: A model of visually guided braking. *Psychological Review, 123*, 305.
- Baber C., Khattab A., Russell M., Hermsdörfer J., & Wing A. (2017). Creating Affording Situations: Coaching through Animate Objects. *Sensors, 17*, 2308.
- Hirose (2001). The process of adaptation to perceiving new action capabilities. *Ecological Psychology, 13*, 49-69.
- Lamb M., Kallen R. W., Harrison S. J., Di Bernardo M., Minai A., & Richardson M. J. (2017). To Pass or Not to Pass: Modeling the Movement and Affordance Dynamics of a Pick and Place Task. *Frontiers in psychology, 8*, 1061.
- Morrongiello B. A., Corbett M., Milanovic M., & Beer J. (2015). Using a virtual environment to examine how children cross streets: Advancing our understanding of how injury risk arises. *Journal of pediatric psychology, 41*, 265-275.
- O'neal E. E., Jiang Y., Franzen L. J., Rahimian P., Yon J. P., Kearney J. K., & Plumert J. M. (2017). Changes in Perception–Action Tuning Over Long Time Scales: How Children and Adults Perceive and Act on Dynamic Affordances When Crossing Roads.

Session 11: Action Selection Rules

Hommel, Brown & Nattkemper: Human Action Control, chapter 5

- Rushworth M. F., & Behrens T. E. (2008). Choice, uncertainty and value in prefrontal and cingulate cortex. *Nature Neuroscience, 11*, 389.
- Heekeren H. R., Marrett S., & Ungerleider L. G. (2008). The neural systems that mediate human perceptual decision making. *Nature reviews. Neuroscience, 9*, 467.
- Gold J. I., & Shadlen M. N. (2007). The neural basis of decision making. *Annu. Rev. Neurosci., 30*, 535-574.
- Wendelken C., Munakata Y., Baym C., Souza M., & Bunge S. A. (2012). Flexible rule use: common neural substrates in children and adults. *Developmental Cognitive Neuroscience, 2*, 329-339.
- Bunge S. A. (2004). How we use rules to select actions: a review of evidence from cognitive neuroscience. *Cognitive, Affective, & Behavioral Neuroscience, 4*, 564-579.
- Bunge S. A., Wallis J. D., Parker A., Brass M., Crone E. A., Hoshi E., & Sakai K. (2005). Neural circuitry underlying rule use in humans and nonhuman primates. *The Journal of neuroscience, 25*, 10347-10350.

Session 12: Action Selection / Planning

Hommel, Brown & Nattkemper: Human Action Control, chapter 6

- Gallivan J. P., Johnsrude I. S., & Randall Flanagan J. (2015). Planning ahead: object-directed sequential actions decoded from human frontoparietal and occipitotemporal networks. *Cerebral Cortex, 26*, 708-730.
- Gulde P., Hughes C. M. L., & Hermsdörfer J. (2017). Effects of stroke on ipsilesional end-effector kinematics in a multi-step activity of daily living. *Frontiers in human Neuroscience, 11*.
- Rosenbaum D. A., Van Heugten C. M., & Caldwell G. E. (1996). From cognition to biomechanics and back: the end-state comfort effect and the middle-is-faster effect. *Acta Psychol (Amst), 94*, 59-85.
- Rosenbaum D. A., Chapman K. M., Weigelt M., Weiss D. J., & Van Der Wel R. (2012). Cognition, Action, and Object Manipulation.
- Randerath J., Valyear K. F., Philip B. A., & Frey S. H. (2017). Contributions of the parietal cortex to increased efficiency of planning-based action selection. *Neuropsychologia*.
- Vesia M., Barnett-Cowan M., Elahi B., Jegatheeswaran G., Isayama R., Neva J. L., Davare M., Staines W. R., Culham J. C., & Chen R. (2017). Human dorsomedial parieto-motor circuit specifies grasp during the planning of goal-directed hand actions. *Cortex, 92*, 175-186.

Session 13: Enactment

Zimmer, Cohen, Guynn, Engelkamp, Kormi-Nouri, Foley, 2001: Memory for action (in my office)
See subject index

- Charlesworth L. A., Allen R. J., Morson S., Burn W. K., & Souchay C. (2014). Working memory and the enactment effect in early Alzheimer's disease. *ISRN neurology, 2014*.
- Engelkamp J. (1995). Visual imagery and enactment of actions in memory. *British Journal of Psychology, 86*, 227-240.
- Krönke K.-M., Mueller K., Friederici A. D., & Obrig H. (2013). Learning by doing? The effect of gestures on implicit retrieval of newly acquired words. *Cortex, 49*, 2553-2568.
- Nyberg L., Eriksson J., Larsson A., & Marklund P. (2006). Learning by doing versus learning by thinking: An fMRI study of motor and mental training. *Neuropsychologia, 44*, 711-717.
- Nyberg L., Persson J., & Nilsson L.-G. (2002). Individual differences in memory enhancement by encoding enactment: Relationships to adult age and biological factors. *Neuroscience & Biobehavioral Reviews, 26*, 835-839.
- Wammes J. D., & Fernandes M. A. (2017). The residual protective effects of enactment. *Cognition, 164*, 87-101.

Session 14 Tool Use

Valyear et al., The neuroscience of human tool use, chapter 4.22 in
Kaas J. H. (2016). *Evolution of nervous systems*: Academic Press.

- Bentley-Condit V. K., & Smith E. (2010). Animal tool use: current definitions and an updated comprehensive catalog. *Behaviour, 147*, 185-132A.
- Kahrs B. A., Jung W. P., & Lockman J. J. (2013). Motor origins of tool use. *Child Development, 84*, 810-816.
- Lockman J. J., & Kahrs B. A. (2017). New Insights Into the Development of Human Tool Use. *Current Directions in Psychological Science, 26*, 330-334.
- Goldenberg G., & Spatt J. (2009). The neural basis of tool use. *Brain, 132*, 1645-1655.

Session 15 Controlling/Monitoring

Hommel, Brown & Nattkemper: Human Action Control
Chapter 8,9
Hoffmann, Performance Psychology, Chapter 10, 11

- Saj A., Vocat R., & Vuilleumier P. (2014). Action-monitoring impairment in anosognosia for hemiplegia. *Cortex, 61*, 93-106.
- Erb C. D., Moher J., Song J.-H., & Sobel D. M. (2017). Cognitive control in action: Tracking the dynamics of rule switching in 5-to 8-year-olds and adults. *Cognition, 164*, 163-173.
- Yazmir B., & Reiner M. (2017). I act, therefore I err: EEG correlates of success and failure in a virtual throwing game. *International Journal of Psychophysiology*.
- Gerbella M., Rozzi S., & Rizzolatti G. (2017). The extended object-grasping network. *Experimental Brain Research*, 1-14.

Session 16: Disorders in MC / Sports, Performance

Disorders: Apraxia, Alien hand, Ataxia

- Park J. E. (2017). Apraxia: Review and Update. *Journal of Clinical Neurology, 13*, 317-324.
- Zwicker J. G., Missiuna C., Harris S. R., & Boyd L. A. (2012). Developmental coordination disorder: a review and update. *European Journal of Paediatric Neurology, 16*, 573-581.
- Hassan A., & Josephs K. A. (2016). Alien hand syndrome. *Current neurology and neuroscience reports, 16*, 1-10.
- Pisella L., Rossetti Y., & Rode G. (2017). Optic ataxia in Bálint-Holmes syndrome. *Annals of physical and rehabilitation medicine, 60*, 148-154.
- Selvadurai L. P., Harding I. H., Corben L. A., & Georgiou-Karistianis N. (2017). Cerebral abnormalities in Friedreich ataxia: A review. *Neuroscience & Biobehavioral Reviews*.

Sports, Performance:

Performance Psychology, Chapter 7 / 14

Holmes P. S., & Wright D. J. (2017). Motor cognition and neuroscience in sport psychology. *Current Opinion in Psychology, 16*, 43-47.

Teques P., Araújo D., Seifert L., Del Campo V. L., & Davids K. (2017). The resonant system: Linking brain-body-environment in sport performance (☆). *Progress in brain research, 234*, 33.