The 16th European Workshop on Imagery and Cognition

From World to Mind: Images and Representations

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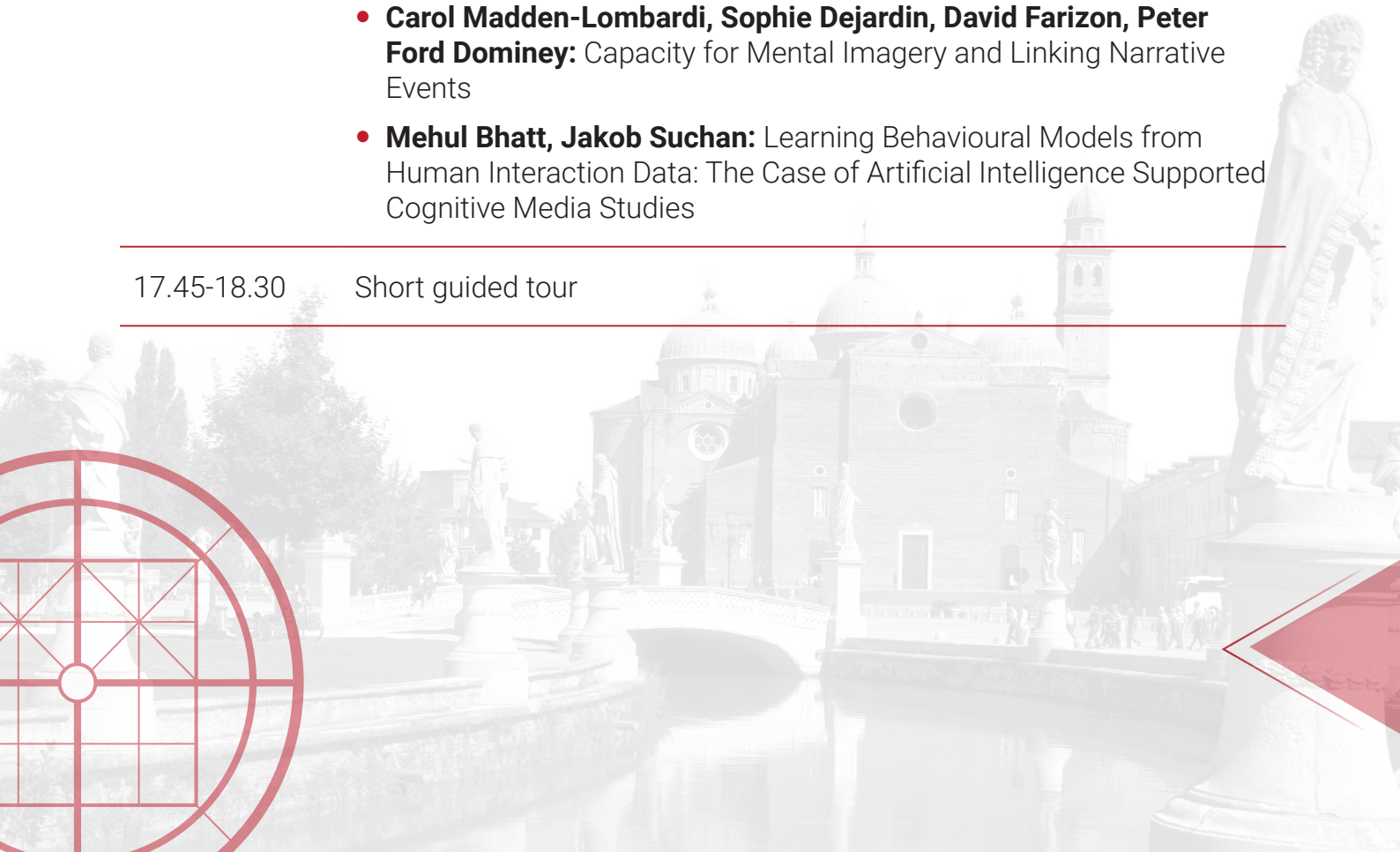
ABSTRACTS

JUNE 7

8.30-9.00	**Registration**
9.00-9.30	**Welcome & Introduction**
9.30-10.30	**KEYNOTE 1** (Cesare Cornoldi, University of Padova) **Mental imagery in the totally congenitally blind** Chair: Valerie Gyselinck
10.30-11.10	**SESSION 1 IMAGERY AND BLINDNESS** Chair: David Pearson • **Amandine Afonso Jaco, Laetitia Guezenec, Pascale Piolino:** Impact of visual deprivation in episodic autobiographical construction across past and future temporalities • **Zaira Cattaneo, Luca Rinaldi, Lotfi B. Merabet, Tomaso Vecchi:** The ego-moving metaphor of time relies on visual experience: no representation of time along the sagittal space in the blind
11.10-11.40	Coffee Break
11.40-12.40	**SESSION 2 MULTI-MODAL INTEGRATION AND LEARNING** Chair: Tomaso Vecchi • **Boris Suchan:** Learn to read by touch • **David Peebles:** Multiple representations and visual mental imagery in cognitive architectures • **Malika Auvray, Gabriel Arnold, Jacques Pesnot-Lerousseau:** Seeing the thunder while still hearing it. Functional plasticity with a visual-to-auditory sensory substitution device
12.40-13.00	**Poster Spotlight presentation - Session 1**
13.00-14.30	**Lunch Time & Poster Session 1**

14.30-15.30	**KEYNOTE 2** (Daniel Schacter, Harvard University) **Constructive episodic simulation in memory and imagination** Chair: Francesca Pazzaglia
15.30-16.10	**SESSION 3 CREATIVITY AND IMAGERY** Chair: Malika Auvray • **David Pearson:** Mental imagery and external representations during creative mental synthesis tasks • **Riccardo Brunetti, Allegra Indraccolo, Claudia Del Gatto:** Creativity in action: Exploring how physical action and posture affect convergent and divergent thinking
16.10-16.30	Coffee Break
16.30-17.30	**SESSION 4 SPACE AND IMAGERY IN LANGUAGE PROCESSING** Chair: Zaira Cattaneo • **Simona Sacchi, Valentina Tobia, Sara Manca, Veronica Cerina, Ferdinando Fornara:** "Close to me": Effects of space organization and interpersonal distance on cognitive mindset • **Carol Madden-Lombardi, Sophie Dejardin, David Farizon, Peter Ford Dominey:** Capacity for Mental Imagery and Linking Narrative Events • **Mehul Bhatt, Jakob Suchan:** Learning Behavioural Models from Human Interaction Data: The Case of Artificial Intelligence Supported Cognitive Media Studies
17.45-18.30	Short guided tour



POSTER SESSION 1

P1-1	**Stephanie Pantelides, Marios Avraamides, Albert Postma:** Integrating spatial memories encoded through haptics and language
P1-2	**Francesco Ianì, Monica Bucciarelli, Silvia Chiesa, Carla Tinti:** The nature of concepts: The enactment effect in blind people speaks in favor of the modality-invariant hypothesis
P1-3	**Lisa Molto, Ladislas Nalborczyk, Richard Palluel-Germain, Nicolas Morgado:** Action-Specific Effects on Distance Perception: A Multilevel Bayesian Meta-Analysis
P1-4	**Silvia Chiesa, Susanna Schmidt, Carla Tinti, Cesare Cornoldi:** Spatial representation of a town: allocentric and contra-aligned representations in blind people
P1-5	**Divya Bhatia, Pietro Spataro, Clelia Rossi Arnaud:** You and the hand: investigating the effects of other-performed pointing movements on visuo-spatial memory
P1-6	**Malgorzata Piskunowicz, Jan Kłopocki, Agnieszka Skopowska, Alina Borkowska:** The association between postural balance, cognitive performance and anxiety in healthy young adults. Preliminary results
P1-7	**Angelica Benson, Ed.M.:** The Imagery-Language Connection: A Sensory-Cognitive Foundation for Language Comprehension and Reading
P1-8	**Maddalena Boccia, Valentina Sulpizio, Alice Teghil, Liana Palermo, Laura Piccardi, Gaspare Galati, Cecilia Guariglia:** Different dynamic mechanisms underlie imagery and perception within the high-level visual cortex
P1-9	**Vasiliki Kondyli, Mehul Bhatt:** Visual attention distribution during indoor wayfinding. A case study of active navigation in healthcare environments

P1-10	**Nicola Mammarella, Beth Fairfield, Alberto Di Domenico:** Emotion and Visual Imagery: the Finke & Pinker' s study revisited
P1-11	**Marcel Dorer, Hanspeter Mallot, Gregor Hardiess:** Distributed representations – The role of eye movements in mental problem solving
P1-12	**Audrey Mazancieux, Céline Souchay, Chris Moulin:** Terminal visual feedback advantage in procedural learning
P1-13	**Olesya Blazhenkova:** Mental extrapolation beyond boundaries of cropped inverted faces
P1-14	**Raffaella Nori, Massimiliano Palmiero, Alessia Bocchi, Laura Piccardi, Elisa Gambetti, Fiorella Giusberti:** The Enhanced Cognitive Interview: could individual differences in Visuo-Spatial Working Memory explain differences in recalling an event?
P1-15	**Ladislas Nalborczyk, Marcela Perrone-Bertolotti, Céline Baeyens, Romain Grandchamp, Elsa Spinelli, Ernst H. W. Koster, Hélène Lœvenbruck:** Can articulatory suppression disrupt repetitive negative thinking?
P1-16	**Riccardo Brunetti, Allegra Indraccolo, Roberta Meloni, Aurora Rizza, Marta Olivetti Belardinelli:** A pilot study on how different musical genres affect autonomic response
P1-17	**Laura Di Giunta, Stefano Sdoia, Carolina Lunetti, Eriona Thartori, Emanuele Basili, Concetta Pastorelli, Laurence Steinberg, Jennifer E. Lansford, Dario Bacchini, Irene Fiasconaro:** Response Inhibition, anger regulation, self-efficacy about anger regulation, and aggressive behaviors in adolescence
P1-18	**Adamantini Hatzipanayioti, Marcel Bechtold, Betty Mohler, Heinrich Bülthoff, Tobias Meilinger:** Collaborative vs Individual Problem Solving

JUNE 8

8.30-9.50 **SESSION 5 SPATIAL PROCESSING AND SPATIAL REPRESENTATION**

Chair: Boris Sucham

- **Christos Michaelides, Marios Avraamides:** Developmental changes in updating memorized spatial relations among multiple objects
- **Giorgia Cona, Cristina Scarpazza:** Where is the "where" in the brain? A meta-analysis of neuroimaging studies on spatial cognition
- **Banafsheh Grochulla, Hanspeter Mallot:**Imagery of distant places depends on perceived current position
- **Andrea Bosco, Alessandro O. Caffò, Antonella Lopez:** A method to disentangle coordinate and categorical spatial relationships in sketch maps

9.50-10.50 **KEYNOTE 3** (Cecilia Guariglia, Sapienza University of Rome

Don't neglect to imagine your way

Chair: Michel Denis

10.50-11.10 Coffee Break

11.10-12.30 **SESSION 6 IMAGERY COMPONENTS AND COGNITIVE STYLES**

Chair: Olesya Blazhenkova

- **Maria Kozhevnikov, Han Zi Teo, Li Yahui:** Object Visualization Ability and Its Sub-components: A Comparison across Cultures and Professions
- **Mark Price, Nicolas Rothen:** Visual imagery or spatial imagery? Not always so obvious
- **Andrea Orlandi, Elisa Arno, Silvia D'Incà, Alice Mado Proverbio:** Kinesthetic imagery and action representation: an insight from dance expertise
- **Massimiliano Palmiero, Raffaella Nori, Laura Tascón, Alessia Bocchi, José Manuel Cimadevilla Redondo, Laura Piccardi:** Navigational styles and mental imagery abilities

12.30-13.00 **Poster Spotlight presentation – Session 2**

13.00-14.30 **Lunch Time & Poster Session 2**

14.30-17.00 **SESSION 7 SHORT TALKS**

COGNITIVE MAPS, SPATIAL STRATEGIES AND NAVIGATION

Chair: Francesca Pazzaglia

- **Veronica Muffato, Chiara Meneghetti, Rossana De Beni:** The role of visuo-spatial abilities in environment learning from maps and navigation over the adult lifespan
- **Elise Grison, Amandine Afonso Jaco:** How do we construct a spatial representation from haptic and proprioceptive exploration? Comparison of verbal, visuo-spatial, and embodied strategies
- **Vasiliki Kondyli, Mehul Bhatt:** Spatial knowledge update in rotational locomotion. On the role of visuo-spatial cues and familiarity
- **Aurora Rizza, Marta Olivetti Belardinelli, Valerio Santangelo:** Internal representation of visual and auditory maps: an fMRI study

SOCIAL COGNITION IN SPACE AND TIME REPRESENTATION

Chair: Gennaro Ruggiero

- **Laurie Compère, Eirini Rari, Thierry Gallarda, Adèle Assens, Marion Nys, Sandrine Coussinoux, Pascale Piolino:** "Women are less spatial and more emotional than men" but gender identity better than sex explains differences in autobiographical memory
- **Caterina Suitner e Anne Maass:** A spatial schema to envisage social roles

VISUO-SPATIAL THINKING: PROCESSES AND PRACTICES

Chair: Petra Jansen

- **Angelica Moè:** Improving mental rotation abilities through motivational trainings
- **Nady Hoyek, Stéphane Champely, Patrick Fargier:** The influence of physical activity, gender and frame of reference on mental rotation performance
- **Benedict C. O. F. Fehringer, Anna Klingauf, Stefan Münzer:** Different approaches to identify spatial thinking processes automatically based on eye tracking data
- **Nadine Dijkstra, Pim Mostert, Floris de Lange, Sander Bosch, Marcel van Gerven:** Temporal dynamics of visual imagery

INDIVIDUAL DIFFERENCES AND FALSE MEMORIES FOR VISUAL INPUTS

Chair: Chiara Meneghetti

- **Kouloud Abichou, Valentina La Corte, Pascale Piolino:** Phenomenological evaluation of false memory production in younger and elderly via a virtual reality task
- **Chiara Mirandola, Enrico Toffalini, Emilia Ferruzza, Cesare Cornoldi, Francesca Pazzaglia:** The dark side of personality: Individual differences in personality and their impact on emotional false memories for pictorial scripted events

17.30-22.00 Visit to Catajo Castle and dinner in Arquà Petrarca (Euganean Hills)

POSTER SESSION 2

P2-1 **Merve Akca:** Retrieval-Induced Forgetting Effects in Retrospective and Prospective Memory in Normal Aging: An Experimental Study

P2-2 **Ramona Cardillo, Irene C. Mammarella:** Visuo-constructive abilities and visuospatial working memory in Nonverbal Learning Disabilities and Autism Spectrum Disorders

P2-3 **Caterina Artuso, Paola Palladino, Paola Ricciardelli:** Age-related differences in updating emotional faces

P2-4 **Celia Mores:** Mental space representation deficits in schizophrenic patients are related to a binding deficit

P2-5 **Andrea Ciricugno, Tomaso Vecchi, Chiara Ferrari, Zaira Cattaneo:** The role of the cerebellum in space representation: a TMS study

P2-6 **Anna Lardone, Marianna Liparoti, Francesca Jacini, Laura Mandolesi, Giuseppe Sorrentino, Pierpaolo Sorrentino, Fabio Baselice, Antonietta Sorriso, Rosaria Rucco:** Can meditation change brain connectivity? A magnetoencephalography study.

P2-7 **Andria Shimi, Pavlos Fanis, Vassos Neocleous, Dianne Newbury, Leonidas Phylactou, Savvas Papacostas:** Dopamine transporter (DAT1) gene modulates individual differences in visual working memory capacity

P2-8 **Marianna Pagkratidou, Adamantini Hatzipanayioti, Marios Avraamides:** Spatial memory reasoning at familiar vs. unfamiliar environments

P2-9 **Veronica Muffato, Chiara Meneghetti, Nicola Mammarella, Rossana De Beni:** Do people go out less as they get older? A self-report lifespan study on orientation experiences and emotions

P2-10 **Chiara Meneghetti, Elizabeth Maria Doerr, Barbara Carretti, Tommaso Feraco:** Dancing: A spatial activity that enhances visuospatial skills?

P2-11 **Francesca Pazzaglia, Angelica Moè:** Mental rotation and perspective taking skills of professional dancers

P2-12 **Elena Carbone, Chiara Meneghetti, Erika Borella:** Young and older adults walk in the Corsi test: the role of age and visuo-spatial factors

P2-13 **Martina Rahe, Vera Ruthsatz, Claudia Quaiser-Pohl:** Gendered effects of material and strategy in a chronometric mental-rotation test with male- or female-stereotyped objects

P2-14 **Ilaria Santoro, Mauro Murgia, Fabrizio Sors, Tiziano Agostini:** The effect of walking on spatial updating within described environments

P2-15 **Tina Iachini, Francesco Ruotolo, Mariachiara Rapuano, Angela Bartolo, Gennaro Ruggiero:** Mental rotation from childhood to elderly age: the effect of body-related stimuli

P2-16 **Mirko Saunders, Claudia Quaiser-Pohl, Martina Rahe:** The identification of solution strategies in a mental-rotation test - An exploratory eye-tracking approach

P2-17 **Ioanna Markostamou, Kenny Coventry:** Visuospatial perspective taking through language across the adult lifespan

P2-18 **Avishai Henik, Danit Geva:** Visual Spatial Perspective Switching

JUNE 9

8.30-9.50

ROUND TABLE COGNITION AND IMAGERY: WHAT APPLICATIONS?
Chiara Meneghetti: Introduction

- **Olesya Blazhenkova:** Visual imagery in different professions.
- **Petra Jansen:** Imagery and sport activity.
- **Jodene Fine:** Neurodevelopmental visuospatial syndrome: Phenotypic outcomes for visual-spatial impairment.
- **Ineke J.M. van der Ham:** Spatial navigation impairment after stroke.

Michel Denis: Discussant

9.50-10.50

Keynote 4 (Yann Coello, University of Lille)
Object and space perception in social contexts
Chair: Tina Iachini

10.50-11.20 Coffee Break

11.20-13.00

SESSION 8 EMBODIED COGNITION AND MOTOR IMAGERY
Chair: Marios Avraamides

- **Sandra Fortuna, Luc Nijs:** Embodied Music Cognition and Visual Representation.
- **Arnaud Saimpont, Elodie Saruco, Lea Multari, Aymeric Guillot:** Effects of different ratios of physical and mental practice on performance in a complex postural task in young adults.
- **Simon Lhuillier, Valérie Gyselinck, Serge Nicolas:** Sensorimotor simulation during route learning: mental imagery and spatial cognition in a grounded framework
- **Francesco Ruotolo, Gennaro Ruggiero, Teresa Pia Arabia, Gianluca Scotto di Tella, Wassila Elmardi, Laurent Ott, Tina Iachini, Angela Bartolo:** The role of imagery in the pantomime production of objects used toward and away from the body.
- **Jocelyne Ventre-Dominey, Guillaume Gibert, Marielle Bosse-Platiere, Alessandro Farne, Peter Ford Dominey, Francesco Pavani:** Experiencing robot embodiment facilitates self-other proximity.

13.00-14.00 Lunch Time

14.00-15.20 **SESSION 9 VISUO-SPATIAL WORKING MEMORY**

Chair: Ineke van der Ham

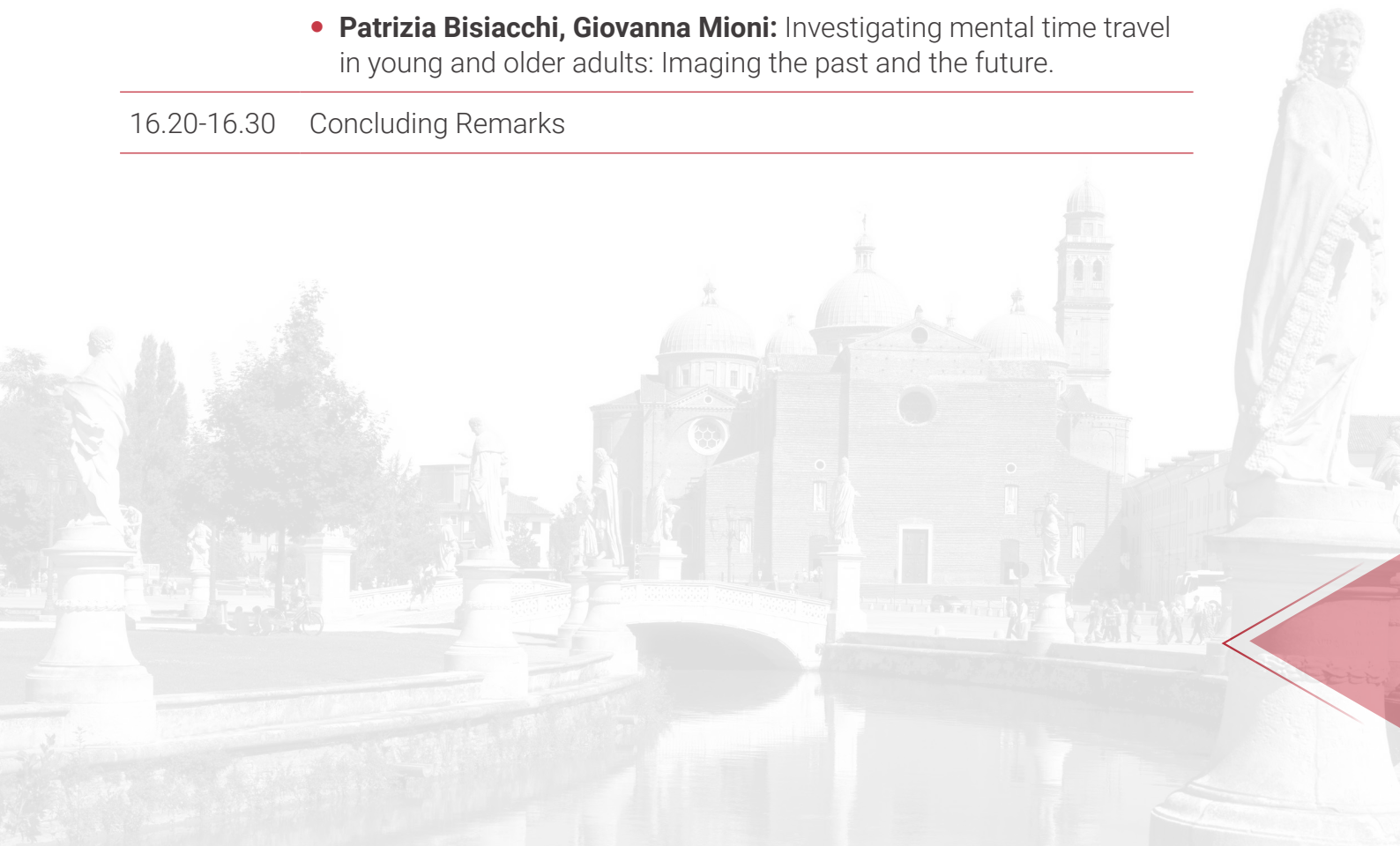
- **Katie Linden, Colin Hamilton:** Single versus multiple item visual short term memory task performance: the interesting case of individual differences associated with autistic-like characteristics.
- **Tadamasa Narimoto, Naomi Matsuura, Michio Hiratani:** Impaired Visuospatial Short-Term Memory in Children with ADHD.
- **Maria Chiara Passolunghi, Hiwet Mariam Costa, Chiara De Vita:** The relation between different working memory domains and processes and different math tasks: a cross-sectional study.
- **Luísa Superbia-Guimarães, César Galera, Flávia Heloísa Santos, Pedro B. Albuquerque:** Visual search impairs retro-cue's effect in visuospatial working memory task.

15.20-16.20 **SESSION 10 IMAGERY AND NEURODEGENERATIVE DISORDERS**

Chair: Tina Iachini

- **Marta Olivetti Belardinelli, Thomas Huenefeldt, Chiara Esposito, Simone Migliore, Sabrina Maffi, Ferdinando Squitieri:** Reduced mindreading capability as early indicator of the Huntington Disease.
- **Valentina La Corte, Agnès Michon, Sophie Ferrieux, Maria Abram, Marc Teichmann, Bruno Dubois, Pascale Piolino:** Episodic future thinking as a function of temporal distances: evidence from Alzheimer's disease and semantic dementia.
- **Patrizia Bisiacchi, Giovanna Mioni:** Investigating mental time travel in young and older adults: Imaging the past and the future.

16.20-16.30 Concluding Remarks



Keynote Speaker

Cesare Cornoldi
University of Padova

JUNE 7 09:30 - 10:30

Keynote Title:
Mental imagery in the totally congenitally blind

Traditionally mental imagery has been associated with visuospatial processes and it has been assumed that these processes are supported or even require visual experience. However, surprisingly, individu-als who never had visual experience report to have mental images and often behave in mental imagery tasks as sighted individuals.

In my presentation, based on 40 years of research on totally congenitally blind, I will review some situ-ations where blind fail and compare them with other situations where they do not fail, looking for fac-tors that may explain the difference. In particular I will focus on recall of verbal material encoded via imagery processes, on working memory processes concerning spatial arrays and on representation and memory of real environments. The conclusion will be that these processes can be carried out also using information derived from other sources than visual experience but the latter offers sometimes a crucial support that however can be compensated by a rich non-visual experience.

JUNE 7 10:30 - 11:10

SESSION 1 - IMAGERY AND BLINDNESS

10:30 - 10:50

Impact of visual deprivation in episodic autobiographical construction across past and future temporalities

A. Afonso Jaco[1,2], L. Guezenec[1,2], P. Piolino[1,2]

[1]Memory & Cognition Lab, Paris Descartes University, France

[2]Center of Psychiatry and Neurosciences, INSERM, France

Autobiographical memory underlies the personal identity and the temporal continuity of individuals, as the ability for mental projection in the future. It encompasses both episodic memories and personal semantic knowledge. Most of autobiographical memory models (e.g., Conway, 2005) suggest that episodic memories contain a summary of sensory and perceptual processing, and predominantly visual images, which seem more involved in personal remembering (Brewer, 1986; Rubin & Kozin, 1984), than the other modalities (Eardley and Pring, 2006; Williams et al., 1999).

Remarkably, few studies focused on testing autobiographical memory in blind individuals. Nowadays, only three studies have been conducted by comparing groups of blinds and sighted persons on autobiographical memory tasks (Ogden and Baker, 2001; Eardley and Pring, 2006; Teckan et al., 2015). The findings revealed deficits in the recalls of specific autobiographical events in blind persons, which paralleled their deficits in imagination of specific events.

The aim of the present study was to further investigate how visual deprivation affects episodic autobiographical memory and future thinking. We submitted 4 groups of participants (early blind, late blind, blindfolded sighted, sighted) to the TEMPau Chronestesia (Abram et al., 2014). This paradigm allows, from the autobiographical verbal fluency of the participants, to explore the recall of memories and the phenomenon of projection. Our results mainly show that blind participants do have specific episodic autobiographical memories and episodic future thinking, but use different sensory and perceptual details than sighted participants. In conclusion, our findings show evidence of how vision is crucial to elaborate autobiographical memories and future projections, and stress differences between blind participants according to their visual experience.

Finally, our data demonstrate that the visual imagery is not the sole format of episodic representations, but that all sensory imagery may play a crucial role in the establishment of episodic autobiographical memories and episodic future thinking.

10:50 - 11:10

The ego-moving metaphor of time relies on visual experience: no representation of time along the sagittal space in the blind

Z. Cattaneo[1,2], L. Rinaldi[1], L.B. Merabet[3], T. Vecchi[4,5]

[1]Department of Psychology, University of Milano-Bicocca, Italy

[2]Brain Connectivity Center, IRCCS Mondino Foundation,, Italy

[3]Department of Ophthalmology, Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, United States

[4]Department of Brain and Behavioral Sciences, University of Pavia, Pavia, Italy

[5]Brain Connectivity Center, IRCCS Mondino Foundation, Pavia, Italy

In many cultures, humans conceptualize the past as behind the body and the future as in front. Whether this spatial mapping of time depends on visual experience is still not known. In a recent study, we addressed this issue by testing early blind participants in a space–time motor congruity task requiring them to classify a series of words as referring to the past or the future by moving their hand backward or forward. Sighted participants showed a preferential mapping between forward movements and future-words and backward movements and past-words. Critically, blind participants did not show any such preferential time-space mapping.

Furthermore, in a questionnaire requiring to think about past and future events, blind participants did not appear to perceive the future as psychologically closer than the past, as it is the case of sighted individuals. These findings suggest that normal visual development is crucial for representing time along the sagittal space.

JUNE 7 11:40 - 12:40

SESSION 2 - MULTI-MODAL INTEGRATION AND LEARNING

11:40 - 12:00

Learn to read by touch

B. Suchan[1]

[1]Ruhr University Bochum, Germany

The aim of the current study was to investigate the neural basis of tactile semantic learning. Subjects were first trained using a specific or unspecific tactile training for one week. After this training we added semantic information to tactile “Braille” like stimuli. Sensory discrimination training was reflected by a shift from bilateral orbitofrontal cortex to bilateral basal ganglia activation. Adding semantic information to the tactile stimuli lead to additional activation in the angular gyrus, a place that has been associated with semantic processing. This activation was accompanied by basal ganglia activation like that found after tactile discrimination training.

Results show the process of tactile learning of “Braille” like stimuli in healthy subject. They further illustrate an overlap of sensory processing in combination with well known semantic functions in the brain. Beside this, current results emphasise the need for tactile training before the acquisition of tactile semantic information.

12:00 - 12:20

Multiple representations and visual mental imagery in cognitive architectures

D. Peebles[1]

[1]University of Huddersfield, United Kingdom

Human cognition is multi-representational. It typically requires the coordination of different information representations, both external (e.g., text, tables, diagrams, maps, computer interfaces etc.) and within the mind (e.g., logical and probabilistic inference with abstract, amodal, propositional representations, perception based depictive representations, including visual mental imagery where transformations and comparisons are conducted in the "mind's eye").

This has important implications for researchers developing human level artificial agents or computational models of the human mind in that they must consider the types of data structures and reasoning processes required to use and integrate multiple representations, in particular those that underlie visual mental imagery.

In this talk I will make the case for taking multiple representations and visual mental imagery seriously and describe various options for representing visual-spatial information in cognitive architectures. I will argue that in order to obtain human level cognition, artificial agents must incorporate multiple representational formats and meta-cognitive processes that operate on them.

12:20 - 12:40

Seeing the thunder while still hearing it. Functional plasticity with a visual-to-auditory sensory substitution device

M. Auvray[1], G. Arnold[1], J. Pesnot-Lerousseau[1]

[1]CNRS - ISIR, France

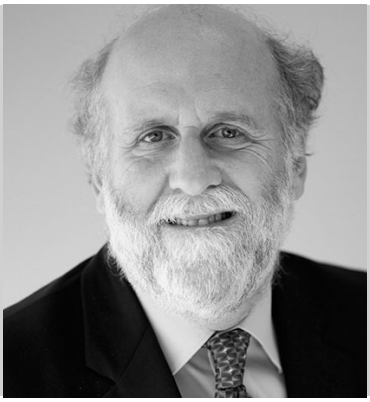
William James made the hypothesis that, if our eyes were connected to the auditory brain areas, and our ears to the visual brain areas, we would "hear the lightning and see the thunder" [1]. Research suggests that modality-specific brain areas, such as the visual cortex, can process auditory stimuli, for instance in the case of brain alteration (e.g., rewired ferret's brain) or sensory deprivation (e.g., blindness).

The study we conducted aimed at investigating behaviourally this question, by using a non-invasive technique of sensory plasticity. The participants learned to use a visual-to-auditory sensory substitution device, which translates visual images recorded by a camera into soundscapes. Both before and after training, they completed a Stroop-like task in which they had to recognize soundscapes while being simultaneously presented with task-irrelevant visual lines. Before training, the visual images did not influence the participants' responses. However, after training, they disturbed the participants' response when the auditory soundscape did not correspond to the conversion of the visual image.

This visual interference effect reveals that visual imagery can be associated to auditory stimuli. In addition, the participants' performance during training for localisation and recognition tasks, as well as their associated phenomenology, depended on their auditory abilities, revealing that processing finds its roots in the input sensory modality. Our results bring behavioural evidence to the thesis that experience with sensory substitution devices is neither strictly visual nor auditory, but the functional plasticity at stake is complex, and based on a multisensory architecture [2]. Altogether, they suggest that brain plasticity allows people to see the thunder while still hearing it.

[1] James, W. (1890). Principles of Psychology. New York: Holt.
[2] Arnold, G., Pesnot-Lerousseau, J. & Auvray, M. (2017). Individual differences in sensory substitution. Multisensory Research, 6, 579-600.

Keynote Speaker



Daniel Schacter
Harvard University

JUNE 7 14:30 - 15:30

Keynote Title:
Constructive Episodic Simulation in Memory and Imagination

Studies of memory have mainly focused on remembering the past, but an important function of mem-ory is to allow individuals to simulate or imagine future experiences. A rapidly growing number of recent studies have shown that simulating future events depends on much of the same neural and cognitive machinery as does remembering past events. According to the constructive episodic simulation hypothesis, simulation of future events depends importantly on episodic memory, which allows individuals to draw on the past in a manner that flexibly extracts and re-combines elements of previous experiences.

This talk will consider neural, cognitive, and functional aspects of episodic simulation and memory, and consider evidence from recent studies have used specificity inductions in an attempt to identify and enhance the contribution of episodic retrieval to a range of cognitive tasks.

JUNE 7 15:30 - 16:10

SESSION 3 - CREATIVITY AND IMAGERY

15:30 - 15:50

Mental imagery and external representations during creative mental synthesis tasks

D. Pearson[1]

[1]Anglia Ruskin University, United Kingdom

External representations such as drawings and sketches are considered by artists and designers to be a vital tool in the creative process. However, previous research has suggested that the externalisation of mental imagery during the creative process may not be necessary to create effectively. Research findings will be presented that have examined whether the externalisation of mental images plays an important role during the subjective experience of creativity by facilitating the deeply focused, optimal state of consciousness termed 'flow' (Csíkszentmihályi, 1990). In a series of studies participants were asked to carry out the creative mental synthesis task, in which sets of alpha-numeric and geometric shapes are combined into patterns that depict recognisable objects (Finke, 1990).

Synthesised patterns were generated either entirely mentally before participants committed to a final drawing, or with additional external perceptual support provided through sketching. Working memory load was also varied by using either three- or five-shape sets during the creative synthesis trials. Findings from the studies demonstrate that allowing participants to sketch during creative synthesis results in a greater experience of flow and lower perceived task difficulty. However, working memory load did not affect flow and there was also no interaction between load and sketching conditions. This suggests that external representation of mental imagery during creative synthesis can increase flow experience, and that this is not dependent on any associated reduction in overall working memory load.

15:50 - 16:10

Creativity in action: Exploring how physical action and posture affect convergent and divergent thinking

R. Brunetti[1], A. Indraccolo[1], C. Del Gatto[1]

[1]Cognitive and Clinical Psychology Laboratory, Dept. of Human Sciences, Università Europea di Roma, Italy

Creative thinking, namely the capacity to generate ideas that are novel and useful, has been extensively related to physical activity. The effect of physical activities has been shown also for logical thinking, namely the ability to find the best answer to a problem. Previous studies assert that this link between body posture/action and thinking is mediated by a language-related process and, specifically, by individuals' ability to reason through metaphors. Namely, creativity is largely defined as fluid and flexible; by contrast, logical thinking is thought as more rigid and precise.

The aim of this study is to explore whether this physical effect on convergent and divergent thought needs the mediation of language or, maybe, whether there is a direct influence of the body posture and movement, without the medium of language.

In Experiment 1, we aim to highlight the effects of body posture on creative and logical thinking. Participants were asked to perform a physical movement or to maintain a specific position and then were asked to complete Gulford's Alternative Uses test of creativity or Baddeley's Reasoning Test of logical thinking.

The results confirm the effect of specific actions and postures on the different thought processes we tested. In Experiment 2, we aim to verify the role of language. For this purpose, we use the same design of Exp.1, but now actions were followed by a dot-probe task, in which we use words and images representing possible linguistic and symbolic meaning of actions and postures (i.e. words: open and close; images: an opened or closed circle). Results are discussed in light of the understanding of embodied cognition and metaphorical thought and how the body may affect thought processes.

JUNE 7 16:30 - 17:10

SESSION 4 - SPACE AND IMAGERY IN LANGUAGE PROCESSING

16:30 - 16:50

“Close to me”: Effects of space organization and interpersonal distance on cognitive mindset

S. Sacchi[1], V. Tobia[1], S. Manca[2], V. Cerina[2], F. Fornara[2]

[1]University of Milano-Bicocca, Italy

[2]University of Cagliari, Italy

Psychological distance (temporal, spatial and social) is the subjective experience that something is close or far away from the self, here, and now (Trope & Liberman, 2010). It is related to different level of mental construal. High-level construals would be relatively abstract, coherent, and superordinate mental representations compared to low-level construals, thus affecting perception, evaluation, and action. Starting from these assumptions and from a more classic literature in social psychology on the effects of interpersonal distance (e.g., Amit, Wakslak, & Trope, 2012; Felipe & Sommer, 1966), the research investigated the influence of social distance on construal level and on language comprehension. More specifically the experimental studies explored how the distance between the individual and the information source affects the understanding of metaphoric texts (e.g., Dialogue between Nature and an Icelander by Giacomo Leopardi).

Overall, the findings revealed that greater proximity fostered the access to a more abstract and symbolic meaning of the text; moreover the results showed that interpersonal closeness led participants toward a higher construal level when they were asked to interpret sentences describing actions (BIF; Vallacher & Wegner, 1989). These effects were moderated by individual variables and individual preferences for social proximity (e.g., Kaitz, Bar-Haim, Lehrer, & Grossman, 2004). This line of research may have relevant implications for the definition of architecture and design of learning environments.

16:50 - 17:10

Capacity for Mental Imagery and Linking Narrative Events

C. Madden-Lombardi[1,2], S. Dejardin[1], D. Farizon[1], P.F. Dominey[1,2]

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The present study investigates the ability to understand mini-narratives (pairs of sentence or pictures) that vary in their predictability or coherence. The second event could be a logical follow up to the preceding event (The woman waits in line at the bakery. She buys a baguette.), or it could reflect an abrupt change in topic (The man drops the envelope into the mailbox. The woman buys a baguette). Two intermediate conditions maintained coherence of the agent, while shifting the action topic (same-agent: The woman drops the envelope into the mailbox. She buys a baguette), or vice versa (same-action: The man waits in line at the bakery. The woman buys a baguette).

Results suggest that the capacity to mentally simulate events (and not necessarily general language skill) is crucial in creating meaningful links between events, as high imagers provided higher coherence ratings in general. This was especially the case for the same-agent condition, in which we observed an interaction between imagery group and coherence. High imagers were especially likely to create a simulation that connects actions performed by the same agent. Word-by-word reading times as well as recorded verbalizations for similar sentence pairs in a follow-up experiment suggest that this increased connect-ability for incoherent pairs with the same agent comes at a processing cost, perhaps due to generating inferences.

The present results offer a novel link between research on imagery and discourse coherence, with specific contributions to our understanding of comprehension and production patterns for high and low imagers. Our results are in line with research showing better comprehension with increased imagery, as well as embodied or perceptually situated theories of language comprehension.

17:10 - 17:30

Learning Behavioural Models from Human Interaction Data: The Case of Artificial Intelligence Supported Cognitive Media Studies

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Cognitive media studies has developed as an area of research at the interface of disciplines as diverse as aesthetics, psychology, neuroscience, film theory, and cognitive science. In this context, the focus of this talk is on the foundational significance of artificial intelligence and visuo-spatial cognition and computation for the design and implementation of integrated analytical-empirical methods for the (multi-modal) analysis of human behaviour data vis-a-vis a range of digital visuo-auditory narrative media.

The presentation focusses on the methodological foundations and assistive technologies for systematic formalisation and empirical analyses aimed at, for instance, the generation of evidence, establishing and characterising correlates between principles for the synthesis of the moving image, and its cognitive --perceptual, embodied visuo-auditory, emotional etc-- recipient effects and influence on observers. In the backdrop a range of completed and ongoing experiments, we emphasize the core results on the semantic interpretation of human behaviour vis-a-vis digital narrative media and their visuo-auditory reception. We demonstrate the manner in which semantic interpretation of human behaviour, founded on AI-based models for machine coding, inference and learning, serves as basis to externalise explicit and inferred knowledge about embodied visuo-auditory reception, e.g., using modalities such as diagrammatic representations, natural language, complex (dynamic) data visualisations.
The presentation will particularly showcase (with demos) methods and tools developed to perform perceptual narrativisation or sensemaking with multi-modal, dynamic human-behaviour data (e.g., involving visuo-spatial imagery such as video, eye-tracking, head-tracking) for a chosen set of experimental material based on existing films, as well as lab-developed experimental content. We particularly emphasise computational learning of (qualitative) behavioural models in the context of ongoing large-scale experiments (involving visual perception of the moving image).

JUNE 7 12:40 - 13:00

Poster Spotlight presentations - Session 1

P1-1 Integrating spatial memories encoded through haptics and language

S. Pantelides[1,2], M. Avraamides[1], A. Postma[3]

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[3]Utrecht University, Netherlands

In two experiments we examined whether people integrate haptic and verbal spatial information they encode across different experiences into a single representation at the time of encoding or whether they maintain separate representations until the time of retrieval, when the task requires them to relate information across representations. While blindfolded, participants learned the locations of 6 objects placed on a table in front of them. They touched half of the objects and encoded the other half by listening to descriptions of the form "a shoe is placed at 1 o' clock".

Participants studied the two layouts either from the same (Experiment 1) or from different viewpoints (Experiment 2). Then, they carried out a series of perspective taking trials (e.g., "Imagine facing the ball, point to the pot") involving objects learned from the same or different modalities.

Results revealed equal pointing error and latency for same and different modality judgments when the layouts were learned from the same viewpoint (Experiment 1). In contrast, when learning occurred from different viewpoints (Experiment 2), participants were faster and more accurate for same- than different-modality judgments.

These findings suggest that people readily integrate into a single memory representation spatial information derived from haptic and verbal experiences, provided that it was learned from a common viewpoint. However, when integration is more difficult due to encoding from different viewpoints, people maintain a separate representation for each learning experience.

P1-2 The nature of concepts: The enactment effect in blind people speaks in favor of the modality-invariant hypothesis

F. Ianì[1], M. Bucciarelli[1], S. Chiesa[1], C. Tinti[1]

[1]University of Turin, Italy

Memory for action sentences is favored when they are accompanied by gestures at encoding (Feyereisen, 2006). Studies revealed that this enactment effect relies on motor resources (Masumoto et al., 2006). Within the "embodied" view of cognition, it is difficult to distinguish between the modality-flexible hypothesis according to which embodied concepts must be sensory, but they need not be visual (e.g., Gallese & Lakoff, 2005), and the modality-invariant hypothesis according to which many concepts are largely abstract and modality-invariant (e.g., Carey, 2009).

These hypotheses imply different predictions for the enactment effect in blind people. The modality-flexible hypothesis predicts that the enactment effect should not occur in blind people: since action sentences processing in blind people compared to sighted people relies more on motor processes because of the impossibility to acquire concepts through visual images (Meteyard et al., 2012), then inviting them to accompany with gestures action sentences at encoding, compared to a condition in which they stay still, should not offer any further room for improvement in memory at recall.

The modality-invariant hypothesis predicts that the enactment effect should occur in blind people: if action related concepts have also abstract and modality-invariant features, then inviting blind people to accompany with gestures action sentences, compared to a condition in which they stay still, should offer room for improvement in memory at recall through the motor encoding introduced at encoding.

The congenitally blind participants in our experiment listened to a series of action sentences in two conditions: accompanying each sentence with congruent gesture, and staying still. In each condition, after listening the sentences they were invited to recall as many sentences they could. The results reveal the occurrence of the enactment effect: accurate recollections were greater in the gesture compared to the no-gesture condition. These results are in favor of the modality-invariant hypothesis.

P1-3 Action-Specific Effects on Distance Perception: A Multilevel Bayesian Meta-Analysis

L. Molto[1], L. Nalborczyk[2], r. palluel-germain[1], N. Morgado[3]

[1]LPNC Université de Grenoble, France

[2]Univ. Grenoble Alpes, France

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People take into account different variables to produce voluntary movements. Several studies suggested that these variables (i.e., action constraints) affect the way people perceive their environment. For instance, people's ability to reach a target influence their perception of the distance to the target. To estimate the overall effect size of action constraints on distance perception, we are currently conducting a multi-level Bayesian meta-analysis. So far, we have collected 40 experiments (N = 942).

The overall effect size for these studies is Hedge's g = 0.42, 95% CrI [0.22, 0.64], suggesting a medium effect of action constraints on distance perception. Some authors argued that action constraints affect judgment of distance rather than perception, so that distance estimation are influenced by experimental demands. For instance, they suggested that verbal measures of distance compared to action-based measures would reflect a judgmental effect and not a perceptual effect. We are running moderator's analyses to test to what extent experimental demand can explain the observed effects.

Preliminary results suggested that experimental demand might not explain all of the effect of action constraint on visual perception: Verbal measures does not seem to produce greater effect sizes than action-based measures. This work is still in progress and a more exhaustive meta-analysis is needed to confirm and detail our conclusions.

P1-4 Spatial representation of a town: allocentric and contra-aligned representations in blind people

S. Chiesa[1], S. Schmidt[1], C. Tinti[1], C. Cornoldi[2]

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Moving in the environment relies on complex cognitive abilities such as representing space from different viewpoints. The role of vision in the building of spatial images in blind individuals is still unclear (Cornoldi et al., 2009; Ruggiero et al., 2012), as sometimes blind people behave like sighted people do, while other times they present difficulties.

In this study, we investigated the ability of blind and blindfolded sighted participants to form spatial representations either from different perspectives or in a contra-aligned condition, with particular attention to the influence of the strategies used to perform the task.

Nineteen blind adults and 19 blindfolded sighted participants explored a tridimensional tactile map and memorized the localization of different landmarks. After the exploration, participants performed two pointing tasks: in the first one they had to imagine to move from one landmark to another and to point to other landmarks. In the second one, participants were first invited to point to the landmarks from their own position with the map in front of them, and then asked to do the same in a contra-aligned way.

Results suggest interesting outcomes about the difficulties that people encounter when they have to create a representation characterized by different degrees of mental rotation, or from a contra-aligned perspective, showing that these difficulties are particularly evident for the blind.

The examination of the strategies adopted during the tasks shows interesting differences between participants and an influence of the strategies on the performances: only a small group of blind participants adopted a survey strategy and this group had a better performance with respect to people who adopted route or verbal strategies. Results provide an important contribution for the comprehension of spatial ability in blind people.

P1-5 You and the hand: investigating the effects of other-performed pointing movements on visuo-spatial memory

D. Bhatia[1], P. Spataro[1], C. Rossi- Arnaud[1]

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Previous studies have shown that self-performed pointing movements at encoding facilitate performance in a visuo-spatial recognition task. In the present study we investigated whether other-performed movements can produce similar effects and if the effect is limited to a human co-actor. Participants observed and were instructed to remember two consecutive arrays of three or four items, one encoded only by visual observation, the other by visual observation accompanied by pointing movements.

In three experiments, pointing movements were performed either solely by the experimenter (Exp. 1), or by the participant alternating with the experimenter (Exp. 2) or with an animated hand (Exp. 3). We found that pointing movements performed by the experimenter facilitated array recognition only when they were alternated with self-performed movements. The same results hold when the human co-actor was replaced by an animated hand in Exp. 3. The results suggest that observing other's performing the movement leads to active motor simulation only when it is associated to the self- execution of the same movement.

P1-6 The association between postural balance, cognitive performance and anxiety in healthy young adults. Preliminary results.

M. Piskunowicz[1], J. Kłopocki[1], A. Skopowska[1], A. Borkowska[1]

[1]Nicolaus Copernicus University, Poland

Introduction: In this paper the preliminary analyses of relation between cognitive skills, anxiety, and postural balance parameters in young healthy adults are presented.

Participants: 52 healthy participants (30 men and 22 women; mean age 30,0, SD 6,0; mean BMI 23,3, SD 3,4; mean numer of years of education 16,1, SD 2,1).

Methods: Cognitive tools: Guay's visualization of viewpoints test (GVV), Corsi block-tapping test (CBTT), Ruff Figural Fluency Test (RFFT), Visual Simple Reaction Time (SRT) task. The State-Trait Anxiety Inventory assessing presence and severity of current symptoms of anxiety (state) and a general tendency to be anxious (trait). Balance parameters were examined on the computer balance platform (Sigma). During standing parameters of the center of feet pressure (COP) movement were measured, both with open and closed eyes. Two parameters were used for the analysis of body balance the COP path length (PL) and the surface area (SA).

Results: In the whole sample there was a weak but significant negative correlation between anxiety state and balance paremeter (PL) while both eyes open ($r = -0,295$, $p = 0,034$) and eyes closed ($r = -0,296$, $p = 0,033$). When analyzing women separately there was a significant negative correlation between anxiety state and balance (SA) with eyes closed ($r = -0,454$, $p = 0,034$). In women SA with eyes open significantly correlated with numer of unique designs in RFFT ($r = 0,443$, $p = 0,044$) and PL with eyes closed was significantly negatively related to performance in CBTT. In men SA while eyes open negatively correlated with performance in GVV.

Conclusions: In women the higher state anxiety the better balance performance which could be explained by freezing response to anxiety. Both in male and female participants balance parameters correlated with performance in selected cognitive tests.

P1-7 The Imagery-Language Connection: A Sensory-Cognitive Foundation for Language Comprehension and Reading

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Imagery is the silent partner to language in human cognition. Behavioural neuroscience has validated the role of visual imagery in education as foundational to cognition, specifically for oral and written language comprehension. Recent neurological and behavioural research documents the role of visual imagery in remediating deficits in the area of visual imagination as related to corresponding deficits in language comprehension. These studies are grounded in Dual Coding Theory (DCT), which posits that the dual coding of verbal and nonverbal information underlies human cognition. The application of DCT in a systematic instructional approach has successfully stimulated the nonverbal code of imagery for language in individuals of all ages.

Based on 32 years of instructional experience with over 40,000 children in the United States, the United Kingdom, and Australia, five important aspects of the imagery-language connection have been revealed: 1) there are dramatic individual differences in the ability to generate visual imagery, 2) there is a significant correlation between visual imagination and language comprehension, 3) individuals can be taught to consciously generate visual images, resulting in significant gains in reading and language comprehension, 4) linking the sensory input of imagery to language results in significant neurological changes and reading improvements in children with dyslexia, and 5) stimulating the imagery-language connection in children with autism spectrum disorder improves language comprehension that is accompanied by fundamental changes in the connectivity of the brain regions involved in reading comprehension.

P1-8 Different dynamic mechanisms underlie imagery and perception within the high-level visual cortex

M. Boccia[1], V. Sulpizio[1], A. Teghil[1,2], L. Palermo[1,3], L. Piccardi[1,4], G. Galati[3,5], C. Guariglia[1,5]

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Visual mental imagery and visual perception have been widely demonstrated to rely on the same content-dependent brain areas in the high-level visual cortex (HVC). However, little is known about the dynamic mechanisms occurring in these areas during imagery and perception. Here, we aimed to disentangle local and inter-regional dynamic mechanisms underlying imagery and perception in the HVC and the hippocampus (HC), a key region for memory retrieval during mental imagery.

To this aim 19 healthy right-handed college students were enrolled in an fMRI experiment, which consisted of imagery and perception tasks on two perceptual categories known to be well-represented in the HVC, namely famous faces and familiar landmarks. Content-dependent brain areas of the HVC and the HC, were localized individually by using functional localizer fMRI sessions and an automatic segmentation of the T1-weighted structural image, respectively. We found that the neural code of familiar landmarks and famous faces was widely distributed in the HVC and the HC, and that it generalized across imagery and perception.

However, different regional adaptation effects and different inter-regional functional couplings were detected for faces and landmarks during imagery and perception. Thus, even if imagery and perception share the same neural code in the HVC and the HC, different dynamic local and inter-regional mechanisms allow for this information to be processed as a function of the task to be performed.

These findings contribute new important information about the dynamic networks underlying imagery and perception in the HVC. Also, they shed some light upon the thin line between imagery and perception which has characterized the neuropsychological debates on mental imagery.

P1-9 Visual attention distribution during indoor wayfinding. A case study of active navigation in healthcare environments.

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Visual attention during wayfinding: Previous studies suggest that environmental features influence the visual attention and consequently the navigation performance [Carpman and Grant, 2002; Wiener et al., 2012]. In this study, we investigate how the visual attention is distributed during a real-world navigation experience in an indoor environment. We explore the wayfinding behaviour in relation to visual perception and cognition of newcomers in unfamiliar environments to emphasise the importance of visuo-spatial cues and visual distractions in spatial knowledge acquisition and decision making.

A multi-modal behavioural analysis: In an empirical wayfinding study in two healthcare large-scale buildings at the Parkland hospital (Dallas, Texas), we collect and analyse multi-modal behavioural data of the embodied visuo-locomotive experience of 25 participants during active navigation. We use eye-tracking, egocentric gaze analysis, external cameras, behavioural mapping by the experimenters, questionnaires, and orientations tasks; together with the morphological analysis of space. Our approach is founded in Spatial Reasoning, Cognitive Vision, and Environmental Psychology [Bhatt et al., 2016a,b; Kondyli et al., 2017] and it focuses on the aspects of visual perception, decision making, orientation, and spatial knowledge acquisition.

Visual distractions and visibility indications during navigation: The analysis suggests that visual attention is distributed according to the available visuo-spatial cues during indoor navigation, and these cues play a significant role in visual distraction. We observe that physical obstacles, manifest cues (signage, landmarks), functional, geometrical and architectural features, as well as the flow of other people in space, may lead to cognitive loading and deteriorate the wayfinding performance. We present examples of visual attention distribution in key positions of the navigation route in relation to morphological and behavioural analysis, and we pinpoint the role of visual access, visual interconnectivity and angle of view during indoor navigation.

P1-10 Emotion and Visual Imagery: the Finke & Pinker' s study revisited

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We developed an emotional version of the classical Finke & Pinker (1982)'s experiment. In the original paradigm, participants freely inspected a simple black dot pattern that was presented for 5 s. Subsequently, the pattern was removed and an arrow appeared at an unexpected location. The main task was to judge as quickly as possible whether the arrow pointed at any of the dots previously presented. Here we used a pattern of positively-, negatively-charged or neutral dots (smiles, Experiment 1; green, red or blue dots, Experiment 2). Results showed that participants' reaction times were faster when the arrow pointed at any of the locations previously occupied. However, participants' performance specifically increased with negatively-charged dots compared with positive and neutral dots. These findings are discussed in terms of the emotion-visual imagery interaction.

P1-11 Distributed representations – The role of eye movements in mental problem solving

M. Dorer[1], H. Mallot[1], G. Hardiess[1]

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Mental processing and motoric behavior are parts of an inseparable representation system, which is distributed across the internal mind and the external environment. This system provides the basis for accomplishing a multitude of cognitive tasks, such as problem solving.

Eye movements, as a directed, motoric behavior, are of fundamental importance for cognition since they not only acquire information of the external environment, but also directly support mental processing (i.e. epistemic actions, imagery, etc.) during visuo-spatial problem solving.

A variety of studies documented the importance of working memory in combination with the mutual interplay of eye movements and cognition during visuo-spatial problem solving. Nevertheless, neither the specific contribution of working memory nor the detailed purpose and function of eye movements during the mental solving of spatial problems are understood. A deeper investigation of those processes would be a substantial requirement to better describe and therefore understand mental problem solving.

Utilizing a passive disk transfer task as modification of the spatial Tower of Hanoi (ToH) puzzle, here, we linked eye movements with mental processing in (i) a variety of problem complexities and (ii) manipulations of stimulus accessibility. Furthermore, (iii) the individual working memory capacity was assessed using standardized memory tasks.

Overall, participants were found regularly to fixate systematically on areas in the ToH stimulus in order to support mental problem solving. But, the degree of such externalization behavior varied between subjects, problem complexities, and ToH manipulations. Comparing the variance concerning eye patterns, task performance, and working memory capacity, we provide new findings explaining individualized adaptations to distributed representations.

P1-12 Terminal visual feedback advantage in procedural learning

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Metacognition have been particularly studied in the context of education because these skills are important in learning processes. Using different cues, people evaluate their performance and use this assessment to control and regulate their cognitive activity (Nelson & Narens, 1990). Although this relationship between monitoring and control processes have been largely shown in cognitive activities such as episodic and sematic memory, reading comprehension and problem solving, few studies have been focus on the benefit of metacognitive awareness in procedural motor learning. We suppose that procedural learning as well as other learning is based on metacognitive assessment of performance which could be enhanced with salient cues as visual terminal feedback.

Forty participants performed the procedural learning task. Participants were presented different shape (e.g., square, star), and were asked to copy these shapes with eyes closed. They were instructed to be as precise as possible. Half of the participants had a terminal visual feedback of what they drawn between each trial. They all performed 6 successive trials by shape and had 12 shapes to draw. Participants' performance was estimated by measuring the deviation between the ideal shape and the shape drawn. We found the performance increase over trial and that this improvement was higher in the feedback condition.

This preliminary study suggests that participants used the terminal visual feedback as a cue for regulate motor activity. We suppose that it allows a self-monitoring of performance which leads to regulate this motor activity and to the increase performance. We are currently running a second experiment using metacognition prediction in both procedural and episodic word learning in order to understand more about the implication of metacognition in motor learning.

P1-13 Mental extrapolation beyond boundaries of cropped inverted faces.

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To overcome the constraints of limited visual input, our visual system makes the predictions about the environment. In case of boundary extension, people extrapolate missing information just beyond the edges of a view. The limited view of a scene may activate a perceptual representation of the expected layout outside the visible boundaries, which subsequently manifests as a false memory error. People confidently recall the surrounding regions of a scene, which were not visible during the encoding. Our previous research demonstrated boundary extension effect in cropped upright face images. More pronounced boundary extension errors were observed for forehead-cropped than for chin-cropped faces.

Furthermore, individual differences in emotional ability and object, but not spatial, imagery were associated with boundary extension in face processing (however, only during the delayed memory test). The present research explored boundary extension in inverted faces. Eye-tracking and performance data were collected. The present work revealed the asymmetry of boundary extension. In contrast to findings for upright faces, boundary extension was more pronounced for chin-cropped than for forehead-cropped inverted faces. Thus, boundary extension was greater for images cropped in the upper part than for those cropped in the lower part, independent of whether the face was inverted or normally oriented.

The examination of oculomotor behavior during the encoding showed that for both, upright and inverted, faces, a greater attention was paid to the upper part of the face. While both'eyes' and 'mouth' were the most salient regions, for the upright faces, 'eyes' attracted more attention than'mouth'; however, for the inverted faces, 'mouth' attracted more attention than 'eyes'. These results suggest that boundary extension could be affected by visual attention.

P1-14 The Enhanced Cognitive Interview: could individual differences in Visuo-Spatial Working Memory explain differences in recalling an event?

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Reports provided by witnesses and victims are crucial for criminal investigation and can have a considerable impact on a jury's verdict. However, the testimony of witnesses is often incomplete and inaccurate: what witnesses report rarely fully corresponds to the fact observed. Psychologists have tried to develop several interview techniques with the aim of enhancing eyewitness recall. The Enhanced Cognitive Interview (ECI) is one of the most useful witness interviews, consisting of 5 techniques (context reinstatement: CR, report everything: RE, mental imagery: MI, change order: CO, change of perspectives: CP) aimed at increasing both the quantity and the quality of elements recalled. All the techniques require mental imagery skills.

The present study investigates the relationship between forward and backward visuo-spatial working memory (VSWM) and correct elements recalled through the ECI with respect to its techniques. 99 college students (48 males) watched a color videotape of a fictional crime and performed on the Corsi task, both in forward and backward conditions. They were interviewed 24 hours later about what they had seen. Results showed that high forward VSWM capacity increases the total amount of correct information recalled ($F_{2,98}= 3.57$, $p<.05$; $\beta=.28$), in particular when using the MI technique ($F_{2,98}=7.74$, $p<.001$). High VSWM individuals utilize a more effective retrieval strategy whereby they are better than medium and low VSWM individuals at encoding information as distinct, finding more specific cues/probes at retrieval.

P1-15 Can articulatory suppression disrupt repetitive negative thinking ?

L. Nalborczyk[1,2], M. Perrone-Bertolotti[1], C. Baeyens[3], R. Grandchamp[1], E. Spinelli[1], E.H.W. Koster[2], H. Lœvenbruck[1]

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Repetitive negative thinking (e.g., rumination) is a predominantly verbal process (Goldwin & Behar, 2012; McLaughlin, Borkovec, & Sibrava, 2007), and has been considered as a dysfunctional kind of inner speech (Perrone-Bertolotti, Rapin, Lachaux, Baciu, & Lœvenbruck, 2014). Research on physiological correlates of inner speech shows that the neural processes involved in overt and covert speech are very similar, both modes involving inferior frontal areas, as well as motor and auditory cortices (Lœvenbruck et al., in press). This supports the hypothesis that inner speech is a simulation of overt speech (e.g., Jeannerod, 2006; Postma & Noordanus, 1996), in the same way as imagined walking can be considered as the result of a simulation of actual walking (e.g., Decety, Jeannerod, & Prablanc, 1989).

The motor simulation hypothesis implies that the speech motor system should be involved during inner speech production, and that some residual muscular activity could be observed during inner speech, resulting from incomplete inhibition of motor commands. In line with this hypothesis, a recent study has shown an increase in speech muscle activity during induced rumination (Nalborczyk et al., 2017).

In the current study, rumination was induced in 106 healthy participants who were subsequently asked to perform repetitive motor activities. One group engaged in silent mouthing (articulatory suppression condition) and the other in finger-tapping (control). State rumination was assessed using visual analogue scales, before and after induction, and after five minutes of motor activity. The motor simulation hypothesis predicts that verbal rumination –as a kind of inner speech– should be disrupted by concurrent involvement of the speech muscles. While highly variable between participants, self-reported levels of rumination showed a slightly larger decrease after silent mouthing compared to finger-tapping. However, this decrease was not modulated by the reported modality of rumination (verbal vs. visual).

P1-16 A pilot study on how different musical genres affect autonomic response

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The cognitive processes and emotions experienced by individuals during music listening is affected by the specific musical genre of the incoming piece. Specifically, previous studies showed that the categories of Tonality and Salience have different effects in perception and memory at the behavioural and cerebral level. In light of Tulving's memory model, Tonality, that is based on tonal grammar - implicitly known to every listener in Western culture, seems to be linked to Semantic Memory; on the other side, Salience, based on perceived characteristics, seems to be related to Episodic Memory.

Interestingly, listeners' cognitive processes and reactions to music were recently studied by exploring pupil dilation response. The aim of this study is to investigate possible pupillary changes, in perception and recognition, based on four categories of stimuli divided for Salience and Tonality (Salient/Tonal, Salient/Non-tonal, Non-salient/Tonal, Non-salient/Non-tonal), and to examine the extent to which recollection quality is revealed by pupillometry.

Twelve music experts (at least five years of musical experience) and fourteen naïve participants listened to 24 short unknown melodies, equally divided in the four categories based on Tonality and Salience and presented in random order. Afterwards, participants were presented with a test list containing 48 stimuli (24 old melodies and 24 new ones) and they had to respond whether each melody: was in the study list ("Remember" response according Tulving's model; "R"); evoked a sense of familiarity ("Know" response; "K"); or was not recognized at all ("New"). Behavioural results confirm the link between Salience and Episodic Memory (Salient R > Non-Salient R), Tonality and Semantic Memory (Tonal K >Salient K). Pupillometry data highlight the different cognitive load required by Salience and Tonality in relation to different: tasks (perception, recognition), expertise (experts, naïves), gender (males, females) musical style (Salience, Tonality).

P1-17 Response Inhibition, anger regulation, self-efficacy about anger regulation, and aggressive behaviors in adolescence

L. Di Giunta[1], S. Sdoia[1], C. Lunetti[1], E. Thartori[1], E. Basili[1], C. Pastorelli[1], L. Steinberg[2], J.E. Lansford[3], D. Bacchini[4], I. Fiasconaro[1]

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There is considerable evidence suggesting that adolescents who have greater response inhibition difficulties engage more in aggressive behaviors (e.g., Romer, 2010; Young et al., 2009). In addition, failure to use emotion regulation strategies in response to anger has fairly consistently been associated with adolescents' aggressive behaviors (e.g., Blake & Hamrin, 2007). Moreover, evidence also suggests that among adolescents' greater self-efficacy beliefs about anger regulation is associated with less aggressive behaviors (Di Giunta et al., 2017). The present study examines how response inhibition, anger regulation, and self-efficacy beliefs about anger regulation are associated with aggressive behaviors in adolescence. Pursuing this goal may lead to a better understanding of self-regulation-related processes in adolescence, which in turn could advance researchers' knowledge of key targets for prevention and early intervention strategies seeking to thwart the adolescent onset of behavioral and mental health issues.

Participants included 192 adolescents (M age = 14.25, SD = .66; 51% female) from the Parenting Across Cultures study (e.g., Lansford et al., 2014). Response inhibition difficulties were assessed with the amount of time that elapses (in milliseconds) between the presentation of each problem and the participants' first move at the Tower of London task (Asato, Sweeney, & Luna, 2006; Steinberg et al., 2008). Anger dysregulation was self-reported via the Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992). Self-efficacy beliefs were self-reported via the Regulatory Emotional Self-Efficacy Scale (Caprara et al., 2008; Di Giunta et al., 2015). Aggressive behaviors were assessed via the Youth Self-Report (Achenbach, 1991).

Data were analyzed using multiple regression. Findings show the significant contribution of greater response inhibition difficulties, higher anger dysregulation, and lower self-efficacy beliefs in dealing with anger on aggressive problems in adolescence.

P1-18 Collaborative vs Individual Problem Solving

A. Hatzipanayioti[1], M. Bechtold[1], B. Mohler[1,2], H. Bülthoff[1], T. Meilinger[1]

[1]Max Planck Institute for Biological Cybernetics, Germany

[2]Darmstadt University of Technology, Germany

In everyday life we come across numerous problem solving situations that we either resolve alone or in collaboration with another person. The aim of the present study was to examine the underlying cognitive mechanisms that are involved in collaborative problem solving using virtual reality technology. Participants worked either individually or in pairs (collaborative condition) to solve a virtual rubik's cube type puzzle task. The puzzle-task included 9 cubes with different colours on different sides and a solution space with 4 empty cube positions. Participants were instructed to choose the correct cubes among the distractor ones and arrange them within the solution space such that each side of the solution space displayed a single color.

In the collaborative condition participants stood opposite to each other, allowing for communication, and each person was represented within the virtual world by a virtual head and a virtual controller. Results showed that participants were faster in solving the task when they were working in pairs compared to individually. Moreover, they employed a strategy of dividing the cube space according to their physical position in space.

Our conjecture is that pairs, given their location in space, had access to all relevant information of the problem at a single point in time, compared to individuals. That is, together they could view all sides and all colors of the solution space, whereas individuals had to remember the color of cubes that were not visible from their perspective (i.e. the back side of the solution space).

In this interpretation access from multiple perspectives at once, as in the collaborative condition allows for better problem solving. In a follow up experiment, we are currently testing whether collaborative problem solving from adjacent problem solvers is similar to individual performance.

JUNE 8 08:30 - 09:50

SESSION 5 - SPATIAL PROCESSING AND SPATIAL REPRESENTATION

8:30 - 8:50

Developmental changes in updating memorized spatial relations among multiple objects

C. Michaelides[1], M. Avraamides[1]

[1]University of Cyprus, Cyprus

Our everyday functioning requires the ability not only to form and maintain in memory stable representations containing spatial relations between objects, but also to update them while moving in space. The goal of our study was to experimentally assess the ability of children at various ages (6-, 7-, 8-, 9-, 10-, 11-year olds) and adults (19-, 35-, 60-year old) to accurate represent the positions of multiple objects and update these memorized representations, in order to characterize the developmental trajectory of spatial updating ability. Participants studied an array of 4 objects placed at predetermined locations on the circumference of a 3m-round carpet. Once they memorized it and while blindfolded, in the orientation phase, they were asked to point to the objects from the initial learning orientation. Subsequently, in the updating phase, they were again asked to point to them after a 45 degrees physical rotation. By comparing different directional error measures (i.e., constant, pointing and variable error) for the two phases across the 9 different age-groups, we were able to assess the developmental trajectory of this spatial ability.

Analysis on constant error showed that all participants -regardless of their age- remained significantly oriented while blindfolded in both the experimental phases, indicating that idiothetic cues were sufficient to update their orientation relative to the stable environment. The analysis on pointing and variable error documented a significant increase for all age-groups between the orientation and the updating phase, while within each phase younger children were less accurate than older children and adults. The observed increase between the orientation and the updating phase shows that the process of updating memorized spatial relations between multiple objects remains a possible source of error throughout the lifespan. Although not a perfect process, spatial updating from the age of 7 and onward remains equally efficient, regardless of age.

8:50 - 9:10

Where is the “where” in the brain? A meta-analysis of neuroimaging studies on spatial cognition

G. Cona[1], C. Scarpazza[1, 2]

[1]University of Padua, Italy
[2]King’s College London, United Kingdom

Spatial representations are encoded and processed in the service of different cognitive functions, including visuo-spatial attention, spatial working memory, mental rotation and spatial imagery, long-term memory and navigation. These functions involve distinct cognitive operations and neural substrates, but they may also share common neural mechanisms.

In the present study, the coordinate-based Activation Likelihood Estimation (ALE) method of meta-analysis was used to reveal both the specific neural activations associated with each of these functions, and the shared activations among them. These would represent the ‘core’ neural network deputed to process spatial information. Following the PRISMA procedure, a total of 133 fMRI and PET studies were included in the meta-analysis according to the inclusion criteria. Using Ginger ALE software, the areas with a convergence of reported coordinates across experiments were identified following the most recent guidelines. Statistical significance was set at p=0.05 cluster-level-corrected.

The overall analysis showed that the core network of spatial processing comprises brain regions that are symmetrically distributed on both hemispheres and that include dorsal frontal and parietal regions, supplementary motor areas (SMA) and anterior insula. Regions specifically recruited for each spatial function were also found contrasting the brain activation for each specific function versus the activation for the remaining functions. Based on the findings of both the overall and the specific meta-analyses, we developed a new neurocognitive model of spatial cognition. According to this model, the dorsal fronto-parietal network, which is commonly activated in all spatial tasks, would contain priority maps of space, namely “prioritized” representations of relevant locations in the visual fields. The ventral fronto-parietal network of the right hemisphere is selectively involved in the exogenous shift of attention. Long-term memory and mental navigation are mediated by right parahippocampal gyrus, retrosplenial cortex, and precuneus. Imagery elicits activation mainly in precuneus, dorsal premotor and parietal cortices and SMA.

9:10 - 9:30

Imagery of distant places depends on perceived current position

B. Grochulla[1], H. Mallot[1]

[1]University of Tübingen, Germany

In outdoor interviews with pedestrians in downtown Tübingen, Röhrich et al.(PlosONE 2014) and Meilinger et al. (Psych. Bul. 2014) showed that imagery of distant places is biased towards the perspective that would appear if the target was approached from the respective interview location. This indicates that a working memory of distant places is maintained and spatially updated when walking in a familiar city environment. Here, we develop and test a laboratory version of this experiment using vir-tual environments. Subjects are seated in a rotating chair and wearing Oculus Rift virtual reality goggles. They are placed in the center of a virtual pan-orama of a familiar city square in the historic city center of Tübingen (drawing location) and asked to produce a sketch map of one of three close-by but out-of-sight target locations. Sketch map production is captured with a cam-era and inserted into the virtual environment, such that immersion is main-tained while drawing. In order to control body orientation while drawing, the virtual sketch pad appeared in one of two directions, either towards the (not visible) target or away from it.

In total, 100 participants who had lived in Tübingen for more than two years were recruited. Sketch maps were rated by three independent raters for ori-entation (North, East, South or West drawn upwards on sheet). Results indicate that subjects prefer to draw the target location from the per-spective of an imagined approach from the drawing location. When oriented away from the target location, subjects prefer to draw the imagined location from a general, position-independent perspective. We suggest that produced perspective is a mixture of the position-dependent approach perspective and a canonical view of the target retrieved from longterm memory.

9:30 - 9:50

A method to disentangle coordinate and categorical spatial relationships in sketch maps

A. Bosco[1], A.O. Caffò[1], A. Lopez[1]

[1]University of Bari, Italy

One of the most powerful dichotomy in the study of spatial mental representation regards landmark relationships based on coordinate (A is near to / far from B) and categorical (A is left / right of B) spatial judgments. Previous research investigated categorical and coordinate spatial relationships throughout specific questions: participants had to judge the relationship between two objects in terms of metric or positional properties. The aim of the present study is to evaluate the opportunity to derive distinct coordinate and categorical scores from an integrated representation of space: sketch maps.

We answered the following questions regarding sketch maps: a) Could the categorical and coordinate relationships be considered virtually independent? b) Could they be measured separately? And if so, c) Are these measures reliable and valid?

The case study is based on a corpus of core maps representing three very well-known landmarks of the local university area provided by a large sample of undergraduate students. A method of analysis of coordinate and categorical measures in sketch maps will be proposed. Sketch maps have among others two major advantages a) they did not required to verbally recode spatial information, and b) sketch maps are a widespread and concise technique to collect information on spatial mental representation originated by both navigation and map study. The research on coordinate and categorical spatial relationships may be improved by this theoretical and methodological supplement.

Keynote Speaker

Cecilia Guariglia
Sapienza University of Rome

JUNE 8 09:50 - 10:50

Keynote Title:
Don’t neglect to imagine your way

In the present lecture, I will discuss the hypothesis that mental representation of environments is sub-served by a specific neurocognitive system, the Navigational Information Processing System (NIPS), which is specifically devoted to process navigational information. Neuropsychological data about the double dissociations among NIPS and systems representing vi-suo-spatial information in non-navigational space (i.e., the reaching space) will be reported together with fMRI data describing NIPS neural correlates. Behavioral and connectivity data will also be presented in the attempt to describe factors determining individual differences in navigational skill. Di.Vi.Na. Neuropsychological Lab: http://hsantalucia.it/laboratorio-neuropsicologia-disturbi-visuo-spaziali-navigazione

JUNE 8 11:10 - 12:30

SESSION 6 - IMAGERY COMPONENTS AND COGNITIVE STYLES

11:10 - 11:30

Object Visualization Ability and Its Sub-components: A Comparison across Cultures and Professions

M. Kozhevnikov[1], H.Z. Teo[1], L. Yahui[1]

[1]National University of Singapore, Singapore

Object visualization ability is the ability to process information about visual appearance of objects and their pictorial properties (e.g. shape, color and texture). Although previous research has shown that it is distinct from spatial visualization ability, there has yet to be in-depth research into the subcomponents underlying object visualization ability. Furthermore, despite being proven to be uniquely related to specialization in visual art in previous research, the relationship between object visualization ability and other related professional specializations has been not examined. Neither have there been prior attempts to conduct cross-cultural comparison of object visualization.

The goal of the current research is to examine the subcomponents underlying object visualization ability (e.g., shape, texture and color) and how these subcomponents contribute to differences in object visualization ability in different professional specialization and cultures. Experiment 1 investigates whether object visualization is a homogenous ability or whether shape, color and texture imagery represent different object visualization subcomponents. Experiment 2 examines the relationship between different subcomponents of object visualization ability and different areas of professional specialization with a cross-cultural comparison between Singaporean and Italian artists.

The results of Experiment 1 revealed two underlying factors. While all shape assessments were loaded on the first factor, color and texture assessments were loaded on the second factor, suggesting that object visualization ability comprises at least two separate subcomponents. Experiment 2 revealed no significant differences between Italian and Singaporean artists on any object visualization assessments, but there were significant differences between professions. Overall, architects and artists performed significantly better on all object visualization assessments than scientists. While artists, sculptors and architects performed significantly better than scientists on shape imagery assessments, the sculptors' scores on color and texture assessments were not significantly better than scientists' scores. The results suggest further need to explore object visualization subcomponents required for different professions.

11:30 - 11:50

Visual imagery or spatial imagery? Not always so obvious.

M. Price[1], N. Rothen[2]

[1]Psychology Faculty, University of Bergen, Norway

[2]Institute of Psychology, University of Bern and Distance Learning University, Switzerland

Debate over the extent of individual differences in visual mental imagery fuels continued discussion over whether "stronger" experience of imagery is useful, detrimental or epiphenomal. Resolving these questions is hindered by lack of simple, reliable and predictive measures of individual differences in visual imagery. Self-report instruments tend to be imprecise and correlate weakly with behavioural tests. Behavioural tests often seem to measure other skills than imagery (e.g., perception, visual knowledge, short term memory), or may confound different types of imagery – in particular the visual and spatial components.

We adapted a behavioural paradigm, previously used to measure visual imagery abilities, which seemed potentially less prone to these criticisms. Participants imagined letters superimposed over displayed patterns and judged the relative overlap of their image with different parts of the pattern. Performance was compared to self-reported visual and spatial imagery (OSIQ, SUIS, Psi-Q) and to a behavioural measure of spatial imagery. Over 3 large samples (each N ≥ 79), with variation in procedure and population, we consistently found that better performance in the behavioural paradigm was predicted by self-report and behavioural measures of spatial imagery, and that stronger self-reported visual imagery was, if anything, detrimental to performance.

Findings were unchanged even when we tried to minimise the contribution of extraneous individual difference variables (e.g., motivation, motor response speed) and of spatial skill by comparing performance to a control task in which mental imagery was not required.

Results stress the importance of empirically verifying whether proposed behavioural measures of visual imagery are rate limited by visual as opposed to spatial imagery. They return us to the question of whether the difficulty of finding robust correlations between self-report and behavioural measures of visual imagery derives from imprecision of these measures, or is because visual imagery experience is generally an unimportant predictor of behavioural performance.

11:50 - 12:10

Kinesthetic imagery and action representation: an insight from dance expertise

A. Orlandi[1], E. Arno[1], S. D'Incà[1], A.M. Proverbio[1]

[1]University of Milano-Bicocca, Italy

Several lines of research have shown that neural network behind kinesthetic imagery partially overlaps with brain areas also engaged in action execution and observation, including premotor, parietal and inferior frontal regions. Moreover, an increased corticospinal excitability during motor imagery (relative to rest) was found, together with an enhanced fronto-central negative potential and a modulation of theta, alpha and low beta rhythms.

In the present study, the ability to imagine complex actions, varied in terms of muscular effort, was investigated by comparing participants with different expertise, by mean of the EEG/ERP technique. In this regard, 16 professional ballet dancers and 16 non-dancer controls were recruited. Before EEG recording, they were engaged in a practical training to let them familiarize with the physical sensation that underpins kinesthetic imagery. They were subsequently presented with 326 short videos depicting a professional male dancer executing effortful or relatively effortless technical ballet movements. They were instructed to observe each action and image reproducing it at a visual cue. A negative potential was found at approximately 450 ms over fronto-central regions, larger in experts than non-experts and more negative over the left than right hemisphere.

Moreover, effortful (vs. effortless) movements elicited an increased negative response in non-dancers, while the opposite modulation was found in dancers. A swLoreta source reconstruction was performed on the difference wave Effortful-minus-Effortless and showed an enhanced activity in visuomotor (BA 40, 6, 5, 3) and body-related visual regions (BA 20) in the brains of dancers, while the main active dipoles were located in prefrontal regions (BA 10) in non-dancers. Overall, these evidences seemed to suggest that imagination of effortful actions led to an increased cognitive load in individuals without a specific action representation, while professionals were able to simulate the movements in kinematically refined detail, due to acquired motor knowledge.

12:10 - 12:30

Navigational styles and mental imagery abilities

M. Palmiero[1,2], R. Nori[3], L. Tascón[4], A. Bocchi[5], J.M. Cimadevilla Redondo[4], L. Piccardi[5,6]

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[6]Neuropsychology Unit, I.R.C.C.S. Fondazione Santa Lucia, Rome, Italy

People can adopt three different cognitive styles to carry out navigational tasks. The landmark style is based on the recall of familiar landmarks without the combination of them with directional information; the route style requires the association between landmarks using egocentric information about direction; the survey style relies on holistic representations (e.g., maps) of the environment. In this study, the relationships between performances on navigational tasks (landmark, route and survey) and mental imagery skills (generation, inspection and rotation) were explored using a between design. The navigational tasks were implemented by a virtual environment (Boxes Room task) containing several cues for disambiguating spatial locations (e.g., door, pictures on the walls).

The landmark task required participants to memorize the position of marked boxes, presented from a specific viewpoint (sample picture) and subsequently decide if marked boxes showed in 10 pictures occupied the same position as in the sample picture. The route task required to assume a first-person view and use a joystick to move around the room in order to find rewarded boxes. The survey task required to assume a map-like perspective to find rewarded boxes in 10 subsequent trials presented from different viewpoints. The imagery tasks required to generate images to make comparisons with four possible alternatives; mental inspect images, based on previously seen pictures, upon a specific verbal request; rotate images to make comparisons with pictures presented with different orientations.

The mental rotation ability negatively predicted errors of all the three navigational tasks, whereas the mental generation abilities negatively predicted errors of the landmark and survey navigational tasks. These results showed that navigation requires basically mental rotation abilities, but also mental generation abilities when the navigational style involve processing objects (landmark) or survey/holistic representations (map). The issue why mental inspection abilities were not significant remains to be addressed.

JUNE 8 14:30 - 17:00

SESSION 7 - Short Talks

14:30 - 14:40

The role of visuo-spatial abilities in environment learning from maps and navigation over the adult lifespan

V. Muffato[1,2], C. Meneghetti[1], R. De Beni[1]

[1]University of Padova, Italy

[2]Department of Psychological, Health and Territorial Sciences, University of Chieti, Italy

Visuo-spatial abilities have an important role in environment learning in young people and, though they decline with age, some evidence suggests this applies to older adults too. The aim of the present study was to explore whether visuo-spatial abilities can mediate the relationship between age and spatial recall after environment learning, from maps and videos, across the adult lifespan.

The study involved 431 participants from 25 to 84 years old, who were assessed for their visuo-spatial working memory, and object-rotation and perspective-taking abilities. Then they learned environments from a map and a video, and performed pointing, map drawing, and route repetition tasks after each learning phase. The resulting path models showed that age directly influences visuo-spatial abilities and, in some cases, spatial accuracy too. Visuo-spatial factors mediate the relationship between age and spatial accuracy, in terms of pointing errors and partially in map drawing and route repetition tasks. Overall, visuo-spatial factors support spatial learning not only in the young, but across the adult lifespan, and into old age.

14:40 - 14:50

How do we construct a spatial representation from haptic and proprioceptive exploration? Comparison of verbal, visuo-spatial, and embodied strategies

E. Grison[1], A. Afonso Jaco[2]

[1]Ifsttar, France
[2]Université Paris Descartes, France

It is commonly admitted that when moving through an environment human perceive various kind of information, such as sensorial, motor, proprioceptive, visual, or auditory ones. Some of them will be encoded into memory and used to construct a representation of the environment. A large body of literature refer to the theory of Mental Model (i.e., Spatial Models) firstly initiated by Johnson-Laird (1983) to explain the construction of such a spatial representation. At the same time, we also observed a growing body of literature accumulating evidences for an embodied spatial cognition (Dutriaux & Gyselinck, 2016b; Tversky, 2009).

However, while both theories allow the consideration of sensory-motor information, literature has been mostly restricted to the visuo-spatial and verbal ones (Gyselinck, Grison & Gras, 2015; Meilinger, Knauff & Bülthoff, 2008). The objective of the two experiments conducted are (1) to demonstrate that sensory-motor information are integrated in Spatial Models, and (2) to show that the information represented in Spatial Models are affected by the encoding modality. In both experiments, participants (sighted or blindfolded) had to explore and memorize the spatial arrangement of 12 objects, disposed on 3 tables. During this phase, participants had to perform a dual task, verbal or visuospatial, or none in the control condition.

In the second experiment, dual tasks were to decide whether a texture was smooth or; or whether an action was doable with only one hand or not. After this learning phase, 5 tasks were performed. Results show classical effects for both verbal and visuospatial tasks for sighted participants only, and effects of both sensory-motor dual tasks for all participants. These results suggest that sensory-motor information are involved in Spatial Models construction, especially for the blindfolded participants. Our study brings new arguments in favor of an embodied view of Spatial Models.

14:50 - 15:00

Spatial knowledge updated in rotational locomotion. On the role of visuo-spatial cues and familiarity.

V. Kondyli[1], M. Bhatt[2]

[1]DesignSpace Group, Germany

[2]University of Bremen and Örebro University, Germany

Spatial knowledge updating is the ability to keep track of one's position and orientation while moving with respect to the locations such as the starting point. In everyday navigation tasks that involve rotational locomotion, spatial updating frequently fails as a result of the alignment effect, referring to human's inability to coordinate various spatial representations and reference frames, and human's tendency to ignore proprioceptive, visual and auditory cues, as a result of changes in perspective, scale, or orientation.

In our empirical study conducted in a large-scale built-up environment, the railway station in Bremen, we investigate if and how rotational locomotion affects the navigation performance in a naturalist every-day task of departure and arrival. The experimental group performs an ego-turn of 360◦ as part of the route while they are able to use all the proprioceptive, visual and auditory cues available to initiate a corresponding counter-rotation of the world. The control group performs the same task without rotational locomotion. Participants were categorised according to the level of familiarity with the environment. We use a multi-modal approach (e.g. orientation task, eye-tracking, questionnaires, videos) to investigate user's spatial behaviour, focusing on the disorientation effect, and the visuo-spatial features they use for reorientation.

Primary results confirm previous studies suggested that spatial updating is not automatic, it is affected by rotational locomotion and it depends on the level of familiarity of users with the environment. Familiar users tend to proceed an instantaneous spatial updating using different visuo-spatial features than unfamiliar users. Individual differences (gender, mental rotation abilities) are excluded in this study but they are considered significant as a next step. We conclude that people are affected differently by the rotational locomotion, they follow various strategies for reorientation, and so the environment should provide a range of visuo-spatial information to address the user groups.

15:00 - 15:10

Internal representation of visual and auditory maps: an fMRI study

A. Rizza[1], M. Olivetti Belardinelli[2,3], V. Santangelo[4,5]

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How people internally represent external information is a fundamental issue to understand human cognition. Here we investigate whether internal representation of complex visual-spatial and audio-spatial information during active exploration of virtual maps is sustained by supra-modal or modality-specific brain circuits. During fMRI scanning, we asked participants to explore virtual environments represented by grids of three or six cells (low vs. high memory load conditions, L/HML) using four arrow keys.

During their active exploration, participants had to encode the position of different shades of green color (visual grids) or the positions of different pitches (auditory grids). At retrieval, participants were presented with a target shade or pitch on a given cell of the grid. Participants indicated whether that target stimulus was the same or not as in the original grid, and then provided a confidence judgment. The behavioral results showed lower performance for HML vs. LML trials, irrespective of the sensory modality, and greater performance for auditory vs. visual trials, irrespective of load.

At the neural level, successful encoding and retrieval of HML vs. LML trials increased activity in the dorsal fronto-parietal cortex, irrespective of trial modality. Together with this supra-modal circuit, we found increased activity in the left insula and superior temporal cortex during the encoding of HML auditory trials, which may support the behavioral advantage in the auditory task. Altogether, these findings highlight common and distinct neural correlates supporting internal representation of visual and auditory information during active exploration of virtual maps.

15:20 - 15:30

“Women are less spatial and more emotional than men" but gender identity better than sex explains differences in autobiographical memory

L. Compère[1], E. Rari[2], T. Gallarda[2], A. Assens[1], M. Nys[1], S. Coussinoux[2], P. Piolino[1]

[1]Paris Descartes University, Memory and Cognition Lab, France
[2]University Hospital Service, Sainte-Anne Hospital, France

A number of recent studies suggest that performance differences between men and women in episodic autobiographical memory are better explained by gender identity (i.e., individual identification of typical features of a gender) than by sex as a binary variable. This study aimed to test this hypothesis on the structural and functional aspects of autobiographical memory and future thinking. On the one hand, the structural aspects were investigated by asking participants to fulfill a comprehensive evaluation of episodic and semantic autobiographical memory, conceptual self and projection into the future.

On the other hand, the functional aspects were investigated by studying the mechanisms of encoding new information via self-reference in order to examine the mnemonic benefit associated with the connection with autobiographical memory (i.e., self-reference effect).

Finally, participants' gender identity was measured by the Bem Sex Role Inventory, which allowed us to compare sex and gender identity related differences. Few sex-related differences were identified, and gender identity was generally a better predictor of interindividual differences in autobiographical memory, future thinking and self-reference effect than sex.

Feminine gender identity was associated with clear differences in emotional aspects that were expressed in the various components of autobiographical memory and future thinking and self. In conclusion, our results support the hypothesis that inter-individual differences in autobiographical memory are better explained by gender identity than by sex, extending this assumption to the self memory system in its entirety.

15:30 - 15:40

A spatial schema to envisage social roles.

C. Suitner[1], A. Maass[1]

[1]University of Padova, Italy

The spatial direction prompted by writing trajectories is investigated as a cue of social agency, a fundamental characteristic that stereotypically differentiates social groups. Study 1 addresses the symbolic representation of agency, which is systematically associated the rightward direction by Italian participants. In Study 2, spatial cues affect agency attribution, with rightward facing targets being ascribed more agency than leftward facing targets by Italian observers.

This association is modified in a spatial conditioning paradigm, showing that learning that women (vs. men) are associated to the rightward profile (vs. leftward) leads to subsequent reduced benevolent sexism among Italian participants (Study 3). Finally, in Study 4, spatial cues are used to promote the ingroup in a specular way by Italian and Arabic participants. Together the studies suggest that spatial cues are a subtle but persistent means of social construction.

15:50 - 16:00

Improving mental rotation abilities through motivational trainings

A. Moè[1]

[1]University of Padua, Italy

Mental rotation is a spatial ability which gives raise to one of the largest gender difference ever studied. Men outscore women even up 1 SD. This has a great impact in women degree and career choice. In fact, mental rotation is a critical ability for succeeding in Science, Technology, Engineering, and Mathematics (STEM) fields.

Previous research has shown that women can improve their performance if trained to use effective strategies and if they practice with spatial tasks. However, nevertheless the importance of motivational factors in explaining women and girls performance in mental rotation tasks, motivation has never been included in training aimed at fostering mental rotation abilities.

This presentation will describe results from four studies testing the hypothesis that training motivation is an effective tool to increase women's mental rotation scores. Women trained to believe they can succeed and instructed to use holistic strategies increased their mental rotation scores as much as 1 SD, to the point of reaching or going beyond men's scores before training. High school girls increased till doubling their mental rotation abilities when trained to believe they can succeed and taught to adopt holistic strategies. The results were achieved with university students in a 1 h training session and by comparing both repeated testing and active control groups, and with high school students in three collective training sessions. The discussion focuses on the importance of motivational factors in explaining the gender gap in mental rotation and in STEM careers and on ways to help women and girls to believe more in their spatial and mental rotation abilities.

16:00 - 16:10

The influence of physical activity, gender and frame of reference on mental rotation performance

N. Hoyek[1], S. Champely[1], P. Fargier[1]

[1]Lyon 1 University, France

Mental Rotation (MR) is the ability to mentally rotate two- or three-dimensional objects (e.g.: Voyer et al., 1995). MR is a particular type of spatial ability (Linn and Petersen, 1985; Xue et al., 2017) and one of the key aspects of human intellectual performance (Johnson and Bouchard, 2005).

Different tasks were designed to realize neuroimaging studies of MR. This led to show the possible involvement during MR of sensorimotor brain areas, also known to be involved in the preparation of a motor act (e.g.: Tomasino and Gremese, 2016; Zacks, 2008).

Such results contributed to raise the question of the effect of physical activity on MR performance (e.g.: Jansen et al., 2012; Hoyek et al., 2014). In this framework the adopted frame of reference to perform MR (allocentric, Allo, Vs egocentric, Ego, e.g.: Carpenter and Proffitt, 20001) and gender (Jansen en al., 2012) were neglected factors. The aim of the present study was thus to examine MR performance with regards to the subjects physical activity practice (dance / artistic gymnastics, futsal, sedentary people), the gender, the frame of reference to be used during MR (Allo, Ego), and the spatial plane (transverse, sagittal and frontal planes) of the imagined rotation.

The results showed a main effect of gender on MR performance. Males outperformed females as it was generally observed in the literature (e.g.: Voyers, 2011). Better MR performance was found in the transverse plane especially in Ego (as found by Carpenter and Proffitt, 2001). In addition, an influence of the practiced sport was found, according the 3 spatial planes. Interestingly the results suggested that the influence of sport experience on MR performance is greater than that of gender.

16:10 - 16:20

Different approaches to identify spatial thinking processes automatically based on eye tracking data

B.C.O.F. Fehringer[1], A. Klingauf[1], S. Münzer[1]

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Analyses of eye tracking data have been utilized to identify cognitive processing steps in spatial thinking. However, too complex items, visually overlapping relevant item features, and heterogeneous stimulus materials hamper detailed diagnostics of cognitive processes with eye tracking data. Therefore, a new test (R-Cube-Vis) measuring visualization as the first factor of spatial thinking, was developed and validated for the usage of eye tracking. In the first study (N = 56), eye movements were recorded during performance of the R-Cube-Vis test and the data were analyzed by standard measures such as fixation numbers and durations. In addition, n-grams, Hidden Markov Models (HMMs), and entropy values, were analyzed.

The results showed higher effects of n-grams and HMMs than fixation numbers and durations with respect to the prediction of overall test performance. In a second study (N = 28), algorithms were implemented to automatically detect three cognitive processing phases (search, transform, and confirm phase) in the eye tracking data. These algorithms took the duration of the fixations (Dur-Alg), their positions (Pos-Alg), and both measures combined (PosDur-Alg) into account.

The algorithms were evaluated with respect to their distributions of the relative fixation durations and the relative numbers of saccades over all phases. Both expected distributions could only be found for the PosDur-Algorithm. Moreover, algorithms were evaluated with respect to their relative deviation from a manual rating regarding the thresholds between the phases. Lower deviations from that rating were derived for the Pos- respectively PosDur-algorithm at both thresholds than for the Dur-algorithm. Both studies demonstrate that the stimulus materials of the R-Cube-Vis test are suitable for eye tracking research in spatial thinking.

Furthermore, the results also demonstrate the potential of elaborative algorithms to identify cognitive processing steps and to distinguish cognitive processing phases based on eye tracking data.

16:20 - 16:30

Temporal dynamics of visual imagery

N. Dijkstra[1], P. Mostert[1], F. de Lange[1], S. Bosch[1], M. van Gerven[1]

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Visual perception and imagery rely on similar representations in visual cortex. During perception, visual activity is characterized by distinct processing stages: first activation spreads in a feedforward sweep from low-level, posterior visual areas to high-level, anterior areas after which feedback processing is assumed to further stabilize the percept. In contrast, the temporal dynamics underlying the activation of visual areas during imagery remain unclear. Unlike perception, during imagery, visual activation is not triggered by information arriving at the senses but is instead caused by purely top-down processes. Therefore, the order in which different levels of the visual hierarchy are activated is likely different than during perception.

Here, we investigated the dynamics of neural representations during visual imagery in human participants using magnetoencephalography and multivariate pattern analysis. We show that, contrary to perception, the onset of imagery is characterized by patterns that generalize over extended time windows, indicating stable representations.

Furthermore, there is stable overlap between imagery and perceptual processing around 150 ms and from 300 ms after stimulus onset; times that presumably reflect completion of the feedforward sweep and perceptual stabilization respectively. These results indicate that during imagery either the complete representation is activated at once and does not include low-level visual areas, or the order in which visual features are activated during imagery is less fixed and more flexible than during perception. These findings extend previous fMRI work by adding the temporal dimension and have important implications for our understanding of the neural mechanisms of visual imagery.

16:40 - 16:50

Phenomenological evaluation of false memory production in younger and elderly via a virtual reality task

K. Abichou[1, 2], V. La Corte[1,2], P. Piolino[1, 2]

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Recall of episodic memory requires to piece together spatio-temporal context and details of specific events and it declines with age. Moreover, whatever the age, false memory (FM) can occur. It refers to events that feel like memories, but that were never experienced (Roediger & McDermott, 2000). However, most of research that investigated FM used classic laboratory materials (i.e., word or image lists), thus far from daily life conditions. In order to thoroughly assess similarities and difference in FM between young and older adults, we have focused on intrusions using a more ecological context via a virtual environment.

We therefore implemented a new virtual variant of the Deese/Roediger-McDermott (DRM) paradigm, a widely employed experimental procedure to induce FM. Young and older participants (n= 76) were asked to walk in a virtual town to memorize as much details as possible of elements (e.g., musical instruments in a store, vegetables on a display in the market, the clothes in a shop). Then, they performed a free recall task in which they were requested to recall as much as possible of elements with their spatio-temporal context and details associated.

Main findings show that older adults compared to younger exhibited a decline in correct free recall of factual and contextual information of studied items, but an increase of FM including both erroneous factual and spatiotemporal information. This pattern of data is in line with previous studies suggesting the reliance of FM on recollection processes (Roediger et al., 1996; Brainerd et al., 2003) and it is the first demonstration of the production of rich erroneous contextual information associated with FM in an ecological experimental task.

16:50 - 17:00

The dark side of personality: Individual differences in personality and their impact on emotional false memories for pictorial scripted events

C. Mirandola[1], E. Toffalini[1], E. Ferruzza[1], C. Cornoldi[1], F. Pazzaglia[1]

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Event memory impacts our daily life, in particular when to-be-remembered events are emotionally charged. Typically, emotion enhances memory accuracy, so that negative and positive events are better remembered than neutral ones. Concerning false memories, evidence is mixed, depending on the paradigm used and on the underlying mechanisms (spontaneous vs. induced false memories). When a paradigm eliciting inferential false memories for scripted events is employed, emotional events decrease the proneness to incur false memories. However, this holds true provided that certain circumstances do not occur, including the presence of depressive/ anxious symptoms which favor an increase in emotional false memories, specifically the negative ones and the request of post-encoding elaboration, which boosts overall false memories.

Whether individual differences in personality traits – especially the "dark" ones such as Narcissism, Neuroticism and Psychoticism – influence inferential false memories for emotional events has been neglected thus far. In the current study we investigated the relation between personality and false memories administering a memory task for pictorial scripted events (Mirandola et al., 2017) and three personality questionnaires (Triarchic Psychopathy Measure; Narcissistic Personality Inventory; Eysenck Personality Questionnaire) to college students (N = 157).

Results showed that the Extraversion trait interacted with valence, such that at increasing scores in Extraversion corresponded decreasing probability to commit positive false memories. This result might show that extravert individuals tend to focus more on positive events and thus rely on detailed-based memory traces. The "dark" traits did not interact with valence but predicted overall diminished false memories, showing that individuals with higher "dark" personality traits might elaborate the to-be-remembered events to a lower extent. Although these findings might seem contradictory, it has been previously suggested that decreased false memories might be explained by different mechanisms: 1) detailed-based encoding and 2) limited elaboration. Results will be discussed in light of these theories.

JUNE 8 12:30 - 13:00

Poster Spotlight presentation – Session 2

P2-1 Retrieval-Induced Forgetting Effects in Retrospective and Prospective Memory in Normal Aging: An Experimental Study.

M. Akca[1]

[1]Oslo University, Norway

Retrieval-induced forgetting (RIF) refers to the phenomenon that selective retrieval of some information impairs memory for related, but not previously retrieved information. Despite age differences in retrieval-induced forgetting regarding retrospective memory being documented, this research aimed to highlight age differences in RIF of the prospective memory tasks for the first time.

By using retrieval-practice paradigm, this study comparatively examined RIF effects in retrospective memory and event-based prospective memory in young and old adults. In this experimental study, a mixed factorial design with age group (Young, Old) as a between-subject variable, and memory type (Prospective, Retrospective) and item type (Practiced, Non-practiced) as within-subject variables was employed. Retrieval-induced forgetting was observed in the retrospective but not in the prospective memory task.

Therefore, the results indicated that selective retrieval of past events led to suppression of other related past events in both age groups but not the suppression of memory for future intentions.

P2-2 Visuo-constructive abilities and visuospatial working memory in Nonverbal Learning Disabilities and Autism Spectrum Disorders

R. Cardillo[1], I.C. Mammarella[1]

[1]Department of Developmental and Social Psychology, University of Padova, Italy

Visuospatial abilities are not only involved in many everyday activities, but can also be useful for studying similarities and differences in neurodevelopmental disorders. The main aim of the present study was to better understand the distinction between the neuropsychological profile of children with Nonverbal learning disabilities (NLD) and with Autism spectrum disorders without intellectual disability (ASD without ID), by comparing their visuo-constructive abilities and visuospatial working memory (VSWM) performances.

Participants with ASD without ID (n = 17) or with NLD (n = 17) were compared with a control group (n = 17), with the aim to analyze whether these groups shared any characteristics. Participants, aged from 8 to 18 years, performed a modified BDT task (Caron et al., 2006) assessing visuoconstructive skills and a task specifically devised for this study measuring VSWM at various levels of Perceptual Cohesiveness (PC).

Our results enabled us to differentiate the visuospatial profile of children with NLD from that of children with ASD. The former group showed an impaired performance in all the domains examined across all the levels of coherence. Differently, the ASD group had a more heterogeneous visuospatial profile, with strengths and weaknesses, and a variable effect of local bias. These participants performed normally in VSWM, taking advantage of the presentation of global rather than local stimuli. Differently, a local bias affected their performance in the visuo-constructive task.

In conclusion, examining different visuospatial domains and manipulating the coherence of the stimuli might be considered useful tools to better discriminate between these disorders.

P2-3 Age-related differences in updating emotional faces

C. Artuso[1], P. Palladino[1], P. Ricciardelli[2]

[1]University of Pavia, Italy

[2]University of Milano - Bicocca, Italy

Updating information is a crucial mechanism through which working memory operates and may adapt rapidly to environmental change. In fact, it consists of selecting and maintaining available relevant information and removing it from memory once no-longer relevant. Empirical evidence has shown clear age-related differences in the updating process with verbal material (e.g., Hartman, Dumas & Nielsen, 2001; Van der Linden, Bredart & Beerten, 1994). To our knowledge, no specific studies investigated age-related differences in the updating process for material other than verbal, that is socially meaningful material such as human faces. In particular, studies show the importance of the combinatorial nature of faces perception and memorization: the combination between gaze direction and facial expression within a face seems to convey the most relevant and crucial information in determining the social meaning and value of a seen face (Adams & Kleck, 2003; 2005).

Our aim was to test possible age-related differences in memory updating in young adults (aged 20-35 years) and old adults (aged 60-75 years). To this end, we administered to our sample both an updating task with socially relevant material (i.e., human faces; see Artuso, Palladino & Ricciardelli, 2012; 2015) and an updating task with non socially relevant material (i.e., letters; see Artuso, Cavallini, Bottiroli & Palladino, 2018). Interestingly, in the face updating task we manipulated the associations between gaze direction and emotion: strong observer self-meaningful associations (e.g., joy-direct gaze) were compared to weak ones (e.g., joy-averted gaze; see Adams & Kleck, 2005).

In both tasks we considered updating efficieny (accuracy) as well as updating speed (RT at different task phases such as encoding, updating). Overall, we found longer RTs for the old group in both tasks; interestingly, we found that age-related decline in the face updating task was more pronounced when emotion and gaze were weakly associated.

P2-4 Mental space representation deficits in schizophrenic patients are related to a binding deficit

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Schizophrenic patients are known to display impairments to memorize a representation of the route during navigation. However, the mechanisms of these deficits are still a matter of debate. The aim of this study was to investigate this issue based on a navigation in complex urban environments.

Nineteen schizophrenic patients and 28 control healthy participants were invited to learn a route in the area of Salpetrière hospital located in Paris city. Following the navigation task, participants were tested on their representations of the environment through their verbal description and a sketch map of the route. We analyzed in both tasks the number of indications of direction and of landmarks with their position.

Compared to controls, patients showed some deficits for the verbal description and the sketch map of the route. First, they indicated less landmarks than controls. All the landmarks produced by the patients were nevertheless correct, and they tended to favor permanent and critical landmarks relative to more casual or non critical landmarks. Moreover, the patients showed difficulties to locate landmarks in their spatial context. Second, patients produced less directions than control. They did not make more errors than controls, but made more omissions.

In conclusion, our findings indicate that schizophrenic patients have difficulties in manipulating spatial information in order to indicate the direction to take. They consider the importance of critical landmarks to navigate in an urban environment, but they fail to bind these landmarks with actions and localisations (egocentric and allocentric knowledge). Difficulties observed in building a mental representation of complex urban environments is compatible with hippocampal and frontal abnormalities.

P2-5 The role of the cerebellum in space representation: a TMS study

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[3]University of Milano-Bicocca, Italy

Prior neuroimaging and brain stimulation evidence has suggested a possible role of cerebellar regions in mediating spatial attention orienting (in the physical and/or representational space). However, evidence is not consistent and the extent and significance of cerebellar contribution to attentional mechanisms is not clear. Here, we aimed to shed light on this issue by using TMS to interfere with cerebellar activity during the execution of the Landmark task. Specifically, participants completed the landmark task in two different orientations (horizontal and vertical), while receiving single-pulse TMS at stimulus onset over the cerebellar vermis, the primary visual cortex and the vertex (control site).

Overall, TMS over V1 interfered with performance, significantly delaying response times compared to the other two conditions. In turn, TMS over vermis did not affect response latencies. In the control condition (vertex) participants showed a leftward/upper bias (i.e., they were better at recognizing left/top side of the lines as longer when they were actually longer), in line with prior literature. TMS over V1 or over vermis did not affect this bias nor it modulated accuracy overall. In sum, our findings suggest that the vermis is not critically implied in spatial attentional mechanisms as measured by the Landmark task.

P2-6 Can meditation change brain connectivity? A magnetoencephalography study.

A. Lardone[1], M. Liparoti[2], F. Jacini[2], L. Mandolesi[2,3], G. Sorrentino[2], P. Sorrentino[4], F. Baselice[4], A. Sorriso[4], R. Rucco[2]

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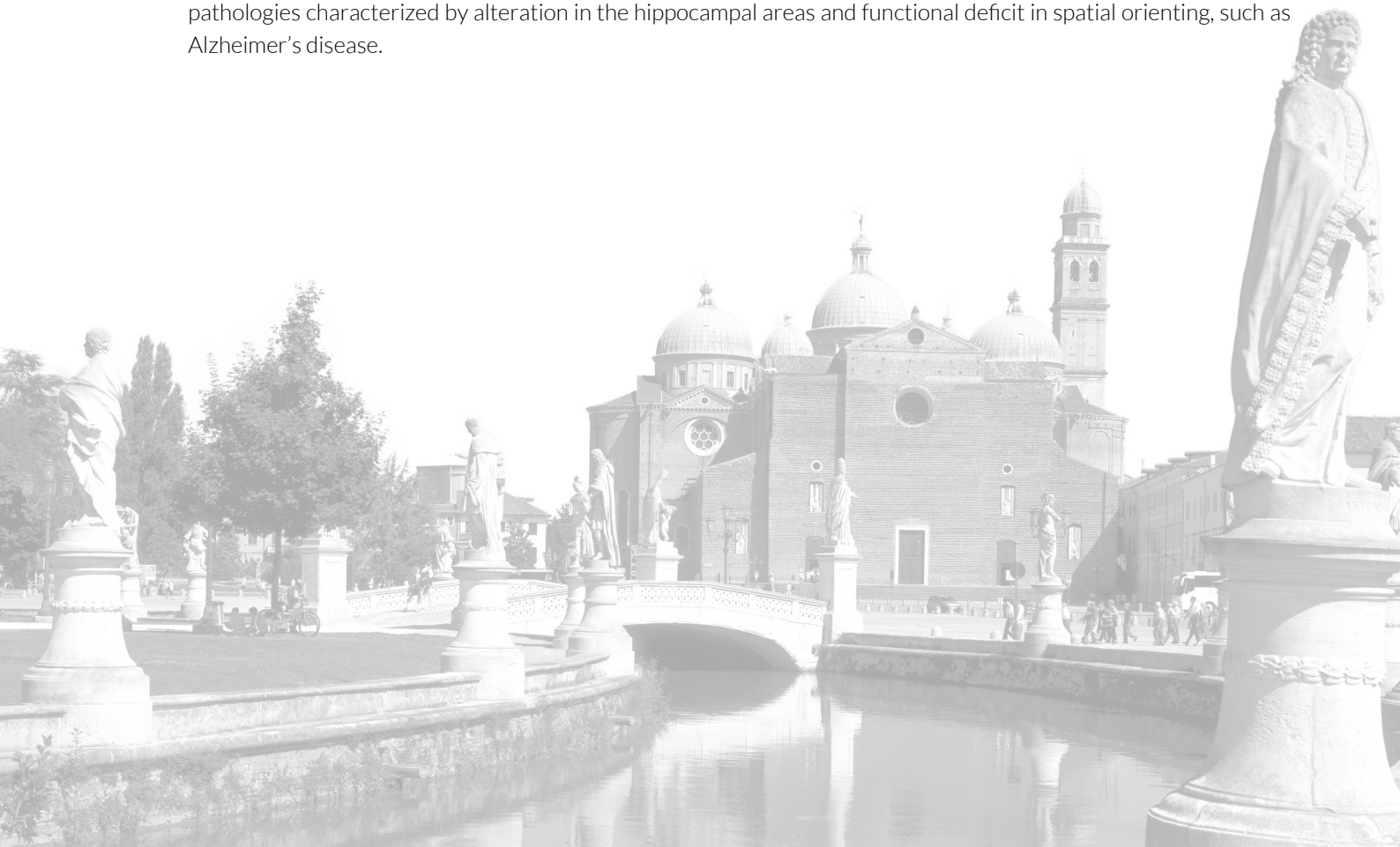
In recent decades there has been an increasing number of evidences showing differences in functional connectivity of meditators with respect to controls. The aim of our study is to compare the resting-state brain activity between meditators and meditation-naïve controls. The signals have been recorded using a magnetoencephalography (MEG) in order to clarify if there are any differences in frequency bands and in connectivity among brain areas between these two groups.

Twenty-seven meditation practitioners, and twenty-nine controls were recruited. Meditators were trained to Vipassana Meditation and had an average of 6,41 (SE = 1,489) years of meditation experience. Both groups underwent five minutes of closed eyes resting-state MEG acquisition. The data were cleaned from environmental noise, physiological and system related artifacts. The time series of neuronal activity were reconstructed in ninety regions of interests using the beamformer based on a template MRI and filtered in the classical frequency bands (delta, theta, alpha, beta, gamma). We compared topological metrics in meditators and non-meditators using permutation testing corrected for multiple comparisons.

Our findings reveal differences between the two groups in the resting-state condition. Compared to the non-meditator group, meditators show a higher degree ($p = 0.009$) in the right hippocampus in the theta band. Previous studies have suggested that the right hippocampus is engaged during the creation of future events and in spatial memory processes. Furthermore, navigation abilities rely on the metric of theta oscillation. Our result supports the possibility that meditation changes brain networks and may improve specific cognitive functions, as spatial abilities and prospective memory. The present study suggests that meditation could be used as training to enhance cognitive abilities related to perspective memory and spatial and navigation processes or supportive treatment in pathologies characterized by alteration in the hippocampal areas and functional deficit in spatial orienting, such as Alzheimer's disease.



P2-7 Dopamine transporter (DAT1) gene modulates individual differences in visual working memory capacity

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Visual working memory (VWM) capacity, the ability to retain visual information in mind for a short period of time, is highly limited. Given that VWM is used as a mental workspace to other cognitive functions and it is essential for successful everyday performance, it is important to understand the nature of its limitations. In this study, we examined the effect of a common polymorphism of the dopamine transporter gene DAT1 (also known as SLC6A3), which has dopaminergic projections on the striatum, on VWM. Specifically, we examined whether the genetic variation in DAT1 is associated with individual differences in VWM capacity.

One hundred and fifty participants were administered a visual working memory task, in which they were asked to encode four visually-presented items in working memory and subsequently report whether a probe item was part of the previously presented memory array. DNA samples were also obtained and participants were genotyped for the DAT1 3' 40bp variable number of tandem repeats (VNTR) polymorphism; therefore, participants were divided into 3 groups according to their genotype: 9-repeat carriers (9/9), 9-repeat/10-repeat carriers (9/10), and 10-repeat carriers (10/10). Results showed that the 9/9 carriers had lower accuracy scores in the VWM task than the 9/10 carriers, whereas no differences were observed between 9/10 and 10/10 carriers. In sum, these findings showed a significant association of DAT1 with VWM performance and thus demonstrate that allelic variation in DAT1 modulates individual differences in VWM capacity in healthy young adults.

P2-8 Spatial memory reasoning at familiar vs. unfamiliar environments

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Recent findings in spatial cognition suggest that people store information about unfamiliar environments with a preferred orientation, based on factors such as the intrinsic structure of layout, the environmental structure, one's learning viewpoint, the experimental instructions and the conversational partner's viewpoint. However, what is still unknown is the preferred orientation of familiar environments. This study employed the University Halls' rooms, to investigate the spatial reasoning about familiar and unfamiliar environments.

Specifically, we asked participants to make a pointing task for objects located in their own rooms; and participants who didn't own a room, to study one in VR and make the same task. We attempted to predict if participants in the familiar environment would demonstrate an orientation-free memory and if participants in the unfamiliar environment would demonstrate an orientation-dependent memory. Findings revealed reasoning about both familiar and unfamiliar environments is orientation-dependent. Reasoning for unfamiliar environments determines the preferred orientation by the starting orientation while for familiar environments by environmental cues, which can override the performance advantage of the preferred orientation.

P2-9 Do people go out less as they get older? A self-report lifespan study on orientation experiences and emotions

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Spatial orientation and navigation abilities in familiar and unfamiliar environments are essential for individuals to remain independent in their daily lives. A growing body of research has demonstrated that navigation abilities deteriorate with aging. Spatial preferences, attitudes and emotions can relate to spatial behavior, but the role of orientation experiences and emotions has yet to be investigated from the adult lifespan perspective. The aim of the present study was thus to investigate whether people's self-reported behavior as regards going out of their homes is related to their age, and to their orientation experiences of reaching places or getting lost, and to the emotions they experienced in such situations.

A large sample of people between 25 and 84 years old answered a questionnaire in which they used Likert scales to rate how much they went out, how often they had reached familiar and unfamiliar destinations, or lost their way, and the positive and negative emotions they felt in doing so.

The results of path models showed that increasing age has negative repercussions on people's tendency to go out. For familiar places, their experience of getting lost, and the negative emotions associated with this experience limited their tendency to go out. For unfamiliar places, on the other hand, their experience of reaching a destination, and the associated positive emotions increased their tendency to go out.

Overall, our results newly show that not only age, but also experience of reaching familiar and unfamiliar destinations, or getting lost, and the associated emotions have an important effect on people's tendency to go out.

P2-10 Dancing: A spatial activity that enhances visuospatial skills?

C. Meneghetti[1], E.M. Doerr[2], B. Carretti[2], T. Feraco[2]

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[2]Padova, Italy

Current literature has examined the importance of visuospatial abilities in sports, given that some sports improve the development of visuospatial skills (Ozel, Larue &Molinaro, 2008). Dancing has proven to be an interesting activity for training spatial skills, especially those related to egocentric rotation (Cortese, & Rossi-Arnaud, 2010). It is possible that dancing enhances visuospatial abilities also in a broader sense as an environmental ability compared to other sports that require less spatial rotation. The aim of the present study was to examine spatial and navigation abilities, and self-perception of movement imagery in dancing.

The sample was composed by two groups: 14 modern group dancers aged 16-21 (M = 18.47; SD = 2.03) and 15 volleyball players aged 17-21 (M= 19.73; SD = 1.79) with 10 to 14 years of experience. A series of tasks, such as visuospatial working memory (VSWM), rotation and questionnaires for spatial preferences (De Beni et al., 2014) and movement self–perception (Roberts et al., 2008) were administered; furthermore participants had to learn a route within a maze, reproduce it and then find a shortcut.

The results showed that dancers had more movement self-perception, a higher performance in the VSWM task, and found better shortcuts after route learning, while the groups did not differ in rotation tasks and route navigation. Overall the results showed that in certain spatial activities, such as dancing, experiencing egocentric rotation is related to elevated levels of visuospatial resources and the formation of environmental representations.

P2-11 Mental rotation and perspective taking skills of professional dancers

F. Pazzaglia[1], A. Moè[1]

[1]University of Padua, Italy

Previous research found that some sport activities improve mental rotation abilities s (e.g. Moreau et al., 2011; Pietsh & Jansen, 2013). This study aimed at extending the investigation to dance activity, considering also perspective taking skills. In three studies, groups of women and men expert dancers were compared to beginners and naïve in a perspective taking task (Study 1), and two different mental rotation tasks (Study 2 and 3, respectively).

The results supported the existence of a relationship between dancing practice and performance in perspective taking and mental rotation tasks. The expert dancers performed better in mental rotation and perspective taking tasks than beginners and naïve (who did not differ each other). The gender gap narrowed with increasing expertise. Our results will be discussed in light of the theories on the implication of motor activity and spatial representation in mental rotation and perspective taking performance and considering the gender issue.

P2-12 Young and older adults walk in the Corsi test: the role of age and visuo-spatial factors.

E. Carbone[1], C. Meneghetti[1], E. Borella[1]

[1]University of Padova, Italy

Memorizing routes is a large-scale ability important in daily life and affected by aging. Age-related and individual differences in both objective --working memory (VSWM) and small-scale visuo-spatial abilities-- and subjective --visuo-spatial self-assessments-- visuo-spatial factors have been shown to influence route learning. Few studies have, however, assessed pathways memory performance and its relationship with visuo-spatial factors using ecological tasks in older adults.

The study aimed at further investigating age-related differences between young and older adults' route memory performance by using a new measure reproducing a large-scale environment: the Walking Corsi Test (WalCT).

A corollary aim was to explore to what extent age and individual differences in both objective and subjective visuo-spatial factors are related with WalCT performance. Seventy young adults (18-35 years old) and fifty-six older adults (65-75 years old) performed the following in two individual sessions: (i) the backward WalCT, requiring participants to recall in reverse order pathways of increasing lenght by walking in the scaled-up configuration arranged on the floor of the classical Corsi blocks task; (ii) three VSWM tasks: the backward Corsi blocks task, the Puzzle test, the Pathways Span task; (iii) two rotation tasks (short Mental Rotation task -sMRT-; short Object Perspective test –sOPT-); (iv) two visuo-spatial self-assessments questionnaires (Attitudes to Orientation Tasks; Spatial Anxiety).

Results showed that young adults outperformed older adults in the WalCT. Regression analyses showed that the 52%of variance in the WalCT performance was explained –negatively-- by age and sOPT, and –positively-- by VSWM and sMRT. These findings confirm that older adults encounter greater difficulty than young adults in memorizing routes also when assessed with an ecological task as the WalCT. They also suggest that not only age per se, but also individual differences in terms of VSWM and visuo-spatial abilities underpin WalCT performance and should thus be considered.

P2-13 Gendered effects of material and strategy in a chronometric mental-rotation test with male- or female-stereotyped objects

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[1]University of Koblenz-Landau, Germany

Males often outperform females in mental-rotation tests. One of the reasons could be the rotational objects used as test-stimuli. In this study, 100 fourth-grade children solved a chronometric mental-rotation test with male- (M-MRT, e.g. train) or female- (F-MRT, e.g. doll) stereotyped objects on a tablet-PC and answered a questionnaire about their familiarity with the objects as well as a free text about their rotation strategy. For reaction time, significant interaction effects of gender and material and of gender and strategy were found, while there were no main effects of gender, material, or strategy. Participants were faster when solving the test using objects stereotyped to their own gender.

Overall, boys reacted faster when rotating holistically, while girls had advantages when they reported to rotate analytically. For familiarity, main effects of gender and material as well as an interaction of both were found. For all objects, girls reported a higher familiarity with the material than boys. Objects of the F-MRT were rated as more familiar than objects of the M-MRT and both genders rated their own stereotyped objects as more familiar. A Chi-Square-test revealed that significantly more children rotated holistically in the M-MRT and analytically in the F-MRT.

For both boys and girls, it seems to be easier to rotate objects that are stereotyped to one's own gender. This effect could be due to a higher familiarity with the respective material. For boys, it seems to be easier or more successful to rotate holistically, while girls are faster when rotating analytically. In this study, this effect was independent of the used material. As children rate cube figures as more male-stereotyped (Ruthsatz et al., 2014) and as the holistic strategy was used more often for the male-stereotyped objects, this could partly explain the male advantage in mental-rotation tests with cube figures.

P2-14 The effect of walking on spatial updating within described environments

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Spatial updating allows people to keep track of the self-to-object relations during movement. Physical movement has been demonstrated to enhance spatial updating in remote environments, but not in described environments. However, the studies mainly considered rotation as a physical movement, without examining other types of movement, such as walking. In Study 1, we investigated how walking affects spatial updating within described environments. Using the judgement of relative directions task, we compared the effects of imagination of rotation, physical rotation, and walking on spatial updating, which was evaluated in terms of accuracy and response times in different perspectives; then we calculated the encoding and sensorimotor alignment effects.

As regards response times, we found that in the imagination of rotation and physical rotation conditions the encoding alignment effect was higher than the sensorimotor alignment effect, while in the walking condition this gap disappeared. We interpreted these results in terms of an enhanced link between allocentric and sensorimotor representations, due to the information acquired through walking.

However, the movements were executed only after the encoding of the environment, minimally affecting the development of the spatial representation. Thus, in study 2 we investigated whether and how participants could benefit from the execution of physical movement during the encoding of described environments. Using the same task, we compared the effects of walking both during and after the description of the environment, and walking only after the description on spatial updating. We found that the distribution of accuracy scores seemed to significantly change with the action executed. Indeed, the preference for the learning perspective did not emerge when walking during encoding occurred. The results suggest that physical movement during encoding supports the development of a perspective-independent representation of described environments, reducing the anchoring for a preferred perspective in favor of a global representation.

P2-15 Mental rotation from childhood to elderly age: the effect of body-related stimuli

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Several studies show that our ability to transform mental images by rotating them declines with ageing. However, mental rotation is not a unitary process and may imply various components working in concert. It is possible that the developmental course of these components is differently affected by ageing. To assess this possibility, we focused on body-related stimuli (human hands and faces) and we compared them with 2D lines and animal faces. While most studies investigate separately rotational abilities during childhood and elderly age, we instead looked at the development of mental rotation from six to 82 years of age.

The sample included three age groups: 50 children (X= 7.940, range= 6-10 years), 30 young persons (X= 22.133, range= 20-28 years), 31 old persons (X= 67.290, range= 60-82 years). Six categories of rotational stimuli were used. Left-right hands, front-back human faces and dog/cat faces with ears clearly visible. Participants had to give laterality judgments for hands (right or left hand?) and ears of faces (was a dot on the right or left ear?) presented under four rotational degrees (0°, 90°, 180°, 270°). Same-different judgments for L-shaped lines were asked.

Results showed that young people performed better than children and elderly people with L-shaped stimuli, hands and female faces. Children performed worse that young and elderly people with animal faces and male faces. A difficulty emerged when stimuli were rotated by 180°. Performance was worse with L-shaped stimuli than all other stimuli in young and elderly people. Children performed worse with L-shaped stimuli than human hands/faces but not animal faces. Moreover, they were less accurate with animal faces than hands. In line with an Embodied Cognition approach, the findings support a “concreteness” vantage in mental rotation of images. Most interestingly, during development a facilitation linked to the human body emerged.

P2-16 The identification of solution strategies in a mental-rotation test - An exploratory eye-tracking approach

M. Saunders[1], C. Quaiser-Pohl[1], M. Rahe[1]

[1]University of Koblenz - Landau, Germany

Different strategies in mental-rotation tests are an explanation for gender differences. Nevertheless, the strategy used when solving a mental-rotation task (e.g. holistic vs. analytic) appears to depend on the complexity of the items (Heil & Jansen-Osmann, 2008). Besides using strategy questionnaires, eye-tracking methods are useful for identifying the solution strategy. An earlier study by Rahe et al. (2016) examined the influence of distinct strategies on mental-rotation performance in a computer based mental-rotation test. In this eye-tracking study we tried to identify strategies when solving a chronometric mental-rotation task with gender-stereotyped objects by identifying typical fixation patterns per item and angle. The MR-test consists of 3 male-stereotyped objects (locomotive, hammer, wrench) and 3 female-stereotyped objects (pram, hand mirror, brush) which rotated in 8 different angles (0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°), as well as a questionnaire measuring the self-perceived solution strategy (holistic/analytic) and the familiarity.

The sample was composed of 16 women and 10 men (age: M=21.58; SD=4.21). Results of our qualitative analysis with two single items on the basis of a cluster analysis revealed characteristic fixation patterns for different groups of subjects. To exemplify, subjects describing their strategy as holistic showed more fixations on particular clusters than subjects who described their strategy as analytic. Similarly, the familiarity with the object influenced the fixation pattern. In mental-rotation tests with concrete objects, the identification of the object's most characteristic and salient features seems to be fundamental for solving the item successfully. Thus, the solution strategy does not appear to depend only on the subject's ability but also on the visual characteristics of the object and the angle in which it is rotated. Therefore, the selection of the stimulus objects according to their visual features seems to be an important issue for future mental-rotation research.

P2-17 Visuospatial perspective taking through language across the adult lifespan

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Mental representations of space can be generated and communicated with respect to different references frames and perspectives. Yet, little is known about the effects of ageing on spatial perspective taking, especially when based on verbal inputs. The present study is aimed at investigating how individuals process descriptions of locative spatial relations under different spatial reference frames, including self-, third-person-, object-, and environment-centred frames, from an adult-lifespan perspective. Results reveal that individuals are substantially less accurate and slower in processing spatial descriptions within an environment-centred frame compared to the other frames, regardless their age.

Moreover, the lifespan trajectories vary depending on the spatial frame involved; processing from a self-centred perspective or within an object-centred frame remains intact throughout the adult-lifespan. By contrast, older adults exhibit a mild but significant impairment in processing spatial descriptions from a third-person perspective and a steep decline in processing spatial descriptions within an environment-centred frame. Mediation regression analyses show that mental flexibility and visuospatial working memory capacity, but not inhibition, account for a significant part of the age-related variance in processing under different spatial frames. These findings suggest that at least partially distinct operations are involved in mentally representing space under different frames, which are differentially affected by typical ageing.

P2-18 Visual Spatial Perspective Switching

A. Henik[1], D. Geva[1]

[1]Ben Gurion University of the Negev, Israel

Visual-spatial perspective taking (VSPT) is defined as the ability to imagine the appearance of objects from different orientations (perspectives) of the observer and was commonly studied in light of the mental transformation hypothesis. The most common tools in the VSPT literature are the pointing tasks. In these tasks, participants are required to imagine themselves standing in a novel perspective in space, looking at a stationary object in space, and imagine pointing to a target object.

Usually, participants are required to enter the direction pointing to the target on a response board (i.e., angles on a 'clock') that is upright, and incongruent to the perspective that is mentally taken in the task. Thus, in a pointing task, participants are required to switch from one perspective to another in the response phase. The current work will examine a new pointing task, called the dots perspective test (i.e., DPT). In the first study, we explored VSPT in the DPT, while manipulating the congruency between the perspective taken in the dots configuration and the perspective taken by the angles of the clock. This way, perspective switching in VSPT was examined within a single trial of the task.

In the second study, perspective switching was explored between trials (i.e., sequential effects) by manipulating repeating and switching from the sensorimotor perspective to the cognitive perspective. Results indicated that perspective switching costs bigger errors and longer RTs - both in the first (i.e. within trial) and the second (i.e. sequential effects) study.

JUNE 9 08:30 - 09:50

ROUND TABLE - COGNITION AND IMAGERY: WHAT APPLICATIONS?

Visual imagery in different professions

O. Blazhenkova[1]

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In contrast to the view that imagery is a unitary undifferentiated construct, there is growing cognitive and neuroscience evidence that distinct imagery subsystems process visual information in different ways. Research by Kozhevnikov, Blazhenkova and colleagues demonstrated the dissociation between individual differences in object imagery (processing of literal appearances of objects in terms of their pictorial properties such as shape, color, and texture) and spatial imagery (processing of spatial relations, locations of objects in space, and spatial transformations). Members of different professions were found excel in different types of visual imagery skills. In particular, visual-object ability distinctively related to educational and professional specialization in visual arts, while visual-spatial ability was distinctively related to specialization in natural sciences.

Visual artists showed above average object imagery abilities but below average spatial imagery abilities, while scientists showed above average spatial imagery abilities but below average object imagery abilities. Visual artists and natural scientists also exhibited qualitative differences in their subjective imagery experiences and visual information processing strategies. Professionals, whose work involved the extensive use of visual imagery, tended to generate, transform, inspect different types of visual images, and manipulate them in different ways. Furthermore, we found that egocentric spatial ability (that involves spatial transformations from a stationary point of reference) and allocentric spatial ability (that involves changing one's imagined perspective in space) played different roles for different dental specializations.

Only egocentric spatial ability significantly predicted success in tooth preparation. It also uniquely predicted performance in a specific complex task that required indirect vision during haptic virtual reality training. Overall, these findings suggest that diverse imagery abilities can be suited for effective processing of visual information during different professional tasks. Identifying specific imagery skills that underlie successful performance in different specialization domains would lead to improving the efficiency of professional education, training, and personnel selection.

Imagery and sport activity

P. Jansen[1]

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The embodiment approach describes the process that simple sensory motor interaction with the environment plays an important role in the development of higher cognitive skills. In this context, mental rotation as the ability to discriminate stimuli presented at different orientation (Shepard & Metzler, 1971) has received much attention: Mental rotation performance is facilitated when human bodies are used as stimuli (e.g. Jansen, Lehmann, & van Doren, 2012).

In a meta-analysis (Voyer & Jansen, 2017), we showed an overall advantage of motor experts compared to non-experts in spatial tasks (d = 0.38). This effect size was influenced by expert type (e.g. runners, dancers, musicians), test category (e.g. mental rotation tests, disembedding tests, rod- and frame test), publication status and stimuli category in mental rotation tests (e.g. block, bodies). Furthermore, several studies have shown that spatial performance, especially mental rotation performance, can be trained (e.g. Pietsch, Böttcher, & Jansen, 2017). It is assumed that those trainings should content coordinative elements.

To improve this type of research, more theoretical assumptions of the type of sport (e.g. co-ordinative abilities, endurance training) and the type of visual-spatial abilities (see the differentiation of Uttal et al. (2013) in two dimensions of intrinsic/extrinsic and static/dynamic skills) are necessary.

Neurodevelopmental visuospatial syndrome: Phenotypic outcomes for visual-spatial impairment

J. Goldenring Fine[1]

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Nonverbal learning disorder was initially conceptualized in phenotypic opposition to language-based reading problems. Researchers have struggled to define a population of children known to have learning challenges in the presence of relatively well-developed verbal skills. These are children who often demonstrate mathematical, and sometimes social perceptual, deficits. Research accomplished within the past decade has begun to define the phenotype as specifically related to visual-spatial functioning and the neural substrates serving the visual-spatial networks of the brain.

This talk will briefly review the history, recent data, and current attempts at creating an externally and internally valid definition for this disorder. There will be special emphasis on presenting the neuropsychological, academic, and biological data supporting the relation between visuospatial processing and phenotypic outcomes of children with nonverbal learning disorder. The limitations of the work, including the difficulty encountered establishing a formal diagnosis, and future directions for research will be discussed.

ROUND TABLE - COGNITION AND IMAGERY: WHAT APPLICATIONS?

Spatial navigation impairment after stroke

I.J.M. van der Ham[1]
[1]Department of Health, Medical, and Neuropsychology, Leiden University, the Netherlands

The ability to navigate relies on a range of cognitive qualities, with an important role for mental representation of space. Over the years, we have observed that impaired navigation ability occurs in a substantial number of patients suffering from stroke; around 30% reports problems with finding their way around. Such impairment results in a loss of autonomy and mobility, which is reflected by a lower quality of life.

As standardized diagnostic and treatment materials are still lacking for this problem, we have developed the Wayfinding Questionnaire, to screen for navigation impairment in stroke patients. Furthermore, we have developed a training program in which patients can perform cognitive exercises to improve their navigation ability with a compensatory approach. Patients typically suffer from impaired egocentric processing, combined with intact allocentric processing, or vice versa. Therefore patients are encouraged to use the intact spatial perspective to compensate for the impaired spatial perspective. Depending on the nature of impairment, specific exercises are selected, addressing skills such as sense of direction and the use of maps as representations of an environment. A pilot study with 6 stroke patients showed that such an approach is can be beneficial for these target users. A study with university students showed that the compensatory approach also results in strategy changes in healthy individuals, Data collection with patients suffering from acquired brain injury is ongoing.

As the training involves interaction with virtual environments and serious gaming techniques, end users and clinical professionals were consulted throughout the development of the training. Furthermore, a usability study was performed with 30 patients to study which means of response, feedback and instructions are most suitable for these users. Future development in this domain lies with the optimization of the use of these techniques to study and improve these spatial abilities.

Keynote Speaker

Yann Coello
Lille University

JUNE 9 09:50 - 10:50

Keynote Title:
Object and space perception in social contexts

Our ability to perceptually encode visual objects in motor terms contributes to a functional represen-tation of the external world leading to distinct neural processing of objects close to the body (i.e., in the peripersonal space) and away from the body (i.e., in the extrapersonal space). A widely held view is that peripersonal space refers to a dynamic multimodal interface between the individual and the environment, which depends on body properties as well as objects characteristics and value. As such, the representation of peripersonal space contributes to the organization of physical interactions with the external world but also the acquisition of conceptual knowledge in agreement with the embod-ied-cognition framework. It also constitutes a space of safety for our organism, which broadly influ-ences social interactions. On the basis of recent experimental, brain imaging and neuropsychological data, I will discuss the sensory-motor foundations of object and space representations and their role in our cognitive and social life.

JUNE 9 11:20 - 13:00

SESSION 8 - EMBODIED COGNITION AND MOTOR IMAGERY

11:20 - 11:40

Embodied Music Cognition and Visual Representation

S. Fortuna[1], L. Nijs[1]

[1]IPEM Ghent University, Belgium

Recent findings in music research are increasingly confirming the embodied nature of music cognition (Lesaffre, Maes and Leman, 2017). One core aspect of the theory of embodied music cognition is the multimodality of musical imagery, another is the importance of the body and body movement in musical meaning formation.

Different music educational approaches embrace the embodied nature of musical experience and integrate bodily responses to music in the learning process (e.g. Dalcroze, 1919; Nijs, forthcoming). Next to addressing bodily responses to music, educators and scholars have explored the possible role of graphical response as a visual representation of the music perception. However, the combination of both approaches has been considered only recently (Nijs, 2017).

Hypothesizing that a bodily engagement with music may influence pattern perception and thereby the structural/ formal understanding of the music, we conducted a comparative study in which primary school children (n= 52; age = 9-10) without any formal music education participated in a verbal-based vs. movement-based intervention. Before and after the intervention, children were asked to create a graphical representation of the music according their own mental image of the piece.

Data have been collected, analysed and compared partially according the categories suggested by previous literature on musical graphical representation such as global or versus differentiated notations in which one or more sonic musical parameters are described.

Different representational strategies closely connected to the body articulation have been found giving relevant insights on the role of body articulation on children's music mental image.

Dalcroze, È. J. (1919). Le rythme, la musique et l'éducation. Paris: Fischbacher.

Lesaffre, M. Maes, P.J. & Leman, M. (Eds.). (2017). The Routledge companion to embodied music interaction. London: Routledge

Nijs, L. (2017). Dalcroze meets technology : integrating music, movement and visuals with the Music Paint Machine. Music Education Research.

11:40 - 12:00

Effects of different ratios of physical and mental practice on performance in a complex postural task in young adults

A. Saimpont[1], E. Saruco[1], L. Multari[1], A. Guillot[1]

[1]Université Lyon 1, France

Mental practice (MP) consists in repeating imagined movements to improve motor performance. Few studies investigated the selective effects of MP on postural control (Saruco et al., 2017). Furthermore, the optimal ratio of physical practice (PP) and MP received little attention (Malouin et al. 2009). The present study was therefore designed to explore the effects of different ratios of PP and MP on performance in a complex postural task. Forty young adults (mean age 22.8±1.6 years; 13 women) participated in a test-retest protocol (pretest, immediate posttest, and 24h posttest).

Participants stood on a Wii Board and watched the representation of the displacement of their center of pressure (CoP) on a computer screen. Targets randomly appeared with two levels of difficulty: easy (20% of the theoretical maximum stability limitation of the participant) and hard (50% of this stability limitation). Participants were requested to validate the targets by displacing and maintaining their CoP within the targets for two seconds. Displacement and validation times were registered. Between the pretest and immediate posttest, participants practiced the task for four blocks of 32 targets. The 100PP group practiced physically only, the 50PP_50MP group combined 50% of PP and 50% of MP, the 25PP_75MP group practiced 25% physically and 75% mentally, and the 100MP group performed only MP.

In line with Saruco et al. (2017), we found no significant decrease in validation and displacement times for the easy targets in all groups. For the hard targets, validation times significantly decreased between pretest and posttests, while displacement times significantly decreased only in the 100PP and 50PP_50MP groups. These results support that MP is a relevant alternative to PP to improve performance in a complex postural task. Similar studies should be conducted with older adults since the improvement of postural control is critical for reducing the risk of falling.

12:00 - 12:20

Sensorimotor simulation during route learning: mental imagery and spatial cognition in a grounded framework

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[1]University Paris Descartes, France
[2]IFSTTAR, France

Grounded theories of cognition have proposed that cognitive mechanisms are dependent of modal systems linked with perception and action (Barsalou, 2008). This view emphasizes the prominent role of sensorimotor processes during spatial imagery tasks: some studies have shown that imagined movement share the same biomechanical constraints as real movements (Jeannerod, 1999; Kosslyn & Koenig, 1992). In the field of spatial cognition, it has been proposed that we mentally simulate the activity of walking during the recall of spatial information (Brunyé, Mahoney & Taylor, 2010). Furthermore, studies have shown that the increase of physical walking effort led to overestimate distances (Lessard, Linkenauger & Proffitt, 2009).

Little is still however known about the actual effect of effort perception on motor simulation considering complex spatial learning. In a series of empirical studies, we have asked the following question: how effort perception and body-based information can be used through motor simulation in order to learn and recall spatial representations? An ecological approach was adopted including the use of realistic virtual reality and complex spatial activities experienced in real-life situations, such as route planning problems. In a first study, we used motor active learning on a treadmill, to show that body-based information improved spatial recall of landmark positions on a map during encoding but not retrieval.

In a second study, we used ankle weights to recalibrate physical walking effort, decreasing recall of landmarks positions on a map and slowing down the implicit estimation of walking speed. In a third study, we suggested that anticipated effort was implicitly used to encode metric properties of the spatial representation through comparing spatial performance in the retrieval of more or less sloping itineraries. These results provide new elements in both spatial learning and motor imagery frameworks.

12:20 - 12:40

The role of imagery in the pantomime production of objects used toward and away from the body

F. Ruotolo[1], G. Ruggiero[2], T.P. Arabia[2], G. Scotto di Tella[2], W. Elmardi[3], L. Ott[1], T. Iachini[2], A. Bartolo[1]

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Patients with ideomotor apraxia have difficulties in producing pantomimes (i.e. the mime of object use) while their performance improves when the object is held in hand (i.e. object tool use). Furthermore, pantomimes are more difficult when executed toward the body (TB) than away from the body (AB) (Halsband et al., 2001). According to Buxbaum et al. (2005), deficits in pantomime production may reflect a specific mental imagery deficit. This study aims at identifying the type of mental imagery (visuo-spatial, motor, or visuo-motor) implicated in pantomime production with TB (toothbrush) and AB (pencil) objects.

29 healthy participants had to: i) use pencil and toothbrush and, respectively, draw 3, 6, 9 circles on a table (AB condition) or perform 3, 6, 9 circles toward the face (TB condition) (actual tool use task: AUt); ii) mime the same actions (pantomime task: Pt); iii) imagine executing the same actions (visuo-motor imagery task: VMIt); iv) imagine beating their right hand on the table (pure-motor task: PMt); v) imagine a dot moving from a starting point to an end point (visual-spatial task: VSt). Mental rotation tasks (MRt) of lines, hands and faces were also included. Execution times for AU, VMI, PM, VS, P and MR tasks were measured along with accuracy of the pantomimes and MR tasks.

Results showed that pantomimes execution time was more similar ($F<1$) and related ($r=.80$) to the visuo-motor imagery task in the AB condition than in the TB one ($F=15$, $p<.001$; $r= .60$). Pantomimes of both AB/TB conditions correlated with MRt of faces, while visuo-spatial and MR (lines and hands) tasks positively correlated only with the pantomimes in the AB condition.

These results suggest that the pantomimes in the AB and TB condition imply different imagery processes: more body-centred motor with pantomimes TB and more environment-centred visuo-spatial with pantomimes AB.

12:40 - 13:00

Experiencing robot embodiment facilitates self-other proximity

J. Ventre-Dominey[1], G. Gibert[2], M. Bosse-Platiere[3], A. Farne[4], P.F. Dominey[1], F. Pavani[4,5]

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[2]CAPsiX, France
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[5]University of Trento, Italy

Recent studies have shown how embodiment (ownership or enfacement) induced by multisensory bodily interactions between individuals can positively change social attitudes (closeness, empathy, racial biases) (see Maister et al, 2015). Here we show that a simple neuroscience-inspired procedure for beaming a human subject into a robot can immediately increase acceptability, sympathy and social closeness to that robot.

Participants wore a Head Mounted Display (HMD) tracking their head movements and displaying the 3D visual scene taken from the eyes of either the iCub or Reeti robot, which were positioned in front of a mirror. As a result, participants saw themselves as robots. When we made participants' and robots' head movements synchronous, participants felt that they were incorporated into the robot with a significant sense of agency. Critically, the robot they beamed into was judged to be significantly more sympathetic and socially closer. Control conditions whereby participants' head movements did not induce any movement in the robot's head (static), or produced unmatched movements (uncorrelated), produced instead a reduction of the sensation of embodiment and of the robots'social attraction.

Remarkably, we further found that the beaming experience (synchronous head movements) and corresponding sensation of embodiment and social proximity, was unconstrained by robots' human appearance, which was fulfilled by the iCub, but violated by Reeti. In some participants, the beaming experience was strong enough to produce a sympathy score reversal, with respect to their initial preference. These findings not only reveal the ease of body-swapping, via visual-motor synchrony, into robots that do not share any clear human resemblance, but they may also pave a new way to make our future robotic helpers socially acceptable.

JUNE 9 14:00 - 15:20

SESSION 9 - VISUO-SPATIAL WORKING MEMORY

14:00 - 14:20

Single versus multiple item visual short term memory task performance: the interesting case of individual differences associated with autistic-like characteristics.

K. Linden[1], C. Hamilton[1]

[1]Northumbria University, United Kingdom

Within a continuous resource account of visual short term memory, prior research has examined performance in qualitative task procedures where high fidelity representation of orientation was demanded. This has been in the context of single item maintenance versus three items with sequential presentation. Of particular interest in this context is the comparison of the recency item in the three item protocol with the single item task performance. One way in which to investigate this relationship is to consider how individual differences associated with autistic-like characteristics (ALC) may map onto these two protocols.

Research has indicated that individuals with extensive possession of ALC characteristics perform relatively well on qualitative visual memory tasks. There has not however been any research which has assessed these characteristics across one item and three item protocols. The aim of this research was to identify whether there would be a consistent advantage associated with ALC characteristics across the two protocols. Undergraduate and postgraduates students were recruited opportunistically and carried out the Autism-Spectrum Quotient (Baron-Cohen et al., 2001) and a single and three item orientation memory task derived from Burnett-Heyes et al. (2012, 2016).

Participants were exposed to single and multiple item arrays and had to adjust the probe stimulus until it matched either single bar orientation or a colour matched bar from the three item protocol. Data analysis was carried out by multilevel modelling, with participant accuracy for orientation corrected for individual differences in perceptual sensitivity, misbinding errors and random guessing, before regressing one- and recency three-item accuracy against AQ score. The findings will be discussed within the context of a continuous resource account versus fixed slot account of visual working memory. In addition there will be an emphasis on identifying the extent to which the typical ALC advantage is found across both of the task protocols.

14:20 - 14:40

Impaired Visuospatial Short-Term Memory in Children with ADHD

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[2]Mie University, Japan

[3]Hiratani Pediatric Clinic for Disabled Children, Japan

Previous studies provide clear evidence that visuospatial memory performance in children with attention-deficit/hyperactivity disorder (ADHD) is significantly lower than in typically developing children. In the present study, we investigated a major cause of their low performance using a spatial span test. Possibly, inattention resulting from lack of motivation or interest causes their low performance so that they do not correctly encode targets to be remembered.

On the other hand, a deficit in temporary maintenance per se may cause their low performance; that is, their inefficient use of rehearsal during a retention interval may lead to memory traces' fast decay. Results in this study indicated that children with ADHD could sustain attention during the encoding phase. Furthermore, their performance at delayed recall was significantly lower than immediate recall, but delayed recall did not affect typically developing children's performance.

These results provide evidence for the likelihood that a factor causing children with ADHD difficulty in temporarily maintaining visuospatial information is fast decay of memory traces as a result of inefficient use of rehearsal, not inattention in the encoding phase.

14:40 - 15:00

The relation between different working memory domains and processes and different math tasks: a cross-sectional study

M.C. Passolunghi[1], H.M. Costa[2], C. De Vita[1]

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Children's mathematics achievement is influenced by a number of contributing cognitive factors. In particular, Working Memory (WM) has been found to play a central role in mathematical development, since it entails the ability to retain and process relevant information during cognitive activities. However, the relative contribution of different WM domains and processes to mathematical performance is still rather unclear, since it seems to change according to children's age, developmental stages, experience, and type of math task. In particular, several studies showed that visuo-spatial WM skills are strongly related to mathematics achievement in preschool years, with an increasing involvement of verbal WM as children grow older (De Smedt et al., 2009; McKenzie et al., 2003). As far as different WM processes are concerned, most research found a strong association between high-control WM processes and complex mathematical abilities, while the relation between low-control WM processes and mathematics is still not conclusive (Friso-van den Bos et al., 2013;Passolunghi & Lanfranchi, 2012).

Based on these findings, the present study aims to investigate the role played by verbal and visuo-spatial WM domains and high-control and low-control WM processes in the prediction of specific cardinality proficiency and general mathematical achievement before and after the onset of formal education. We measured verbal intelligence, verbal and visuo-spatial WM, and mathematical abilities in 66 preschool and 110 first grade children, in a cross-sectional perspective. To examine the unique relative contribution of different WM domains and processes to cardinality and mathematics achievement, hierarchical multiple regression analyses were computed.

As expected, our findings showed a different contribution of WM domains and processes to mathematical abilities depending on age, development, and math task. These results have important implications for both early screening of children at risk for low mathematics achievement and development of age-appropriate intervention trainings.

15:00 - 15:20

Visual search impairs retro-cue's effect in visuospatial working memory task

L. Superbia-Guimarães[1], C. Galera[1], F.H. Santos[2], P.B. Albuquerque[2]

[1]Universidade de São Paulo, Brazil

[2]University of Minho, Portugal

Spatial retro-cues enhance performance in visuospatial recognition tasks. This enhancement is attributed to the retrieval of information from working memory to an active state before decision making, but few studies assured that the stored information was not already maintained active by visual rehearsal during the retention interval. In this study, we induced memory storage into a passive store using a secondary task to prevent visual rehearsal during the retention interval of a recognition task. In Experiment 1, we evaluated the retro-cue effect when participants performed a visual search during the retention interval (experimental group) and when it was blank (control group).

There were significant effects of cue validity, group and their interaction. The retro-cue effect was significant at the control group, but not at the experimental group. We consider that the visual search prevented visual rehearsal and induced storage into a passive store, conceivably corresponding to the visual cache, from where the stimuli cannot be retrieved by the retro-cues. We argue that retro-cues allow access to the information kept in an active state, but not in a passive one. In the latter case, information must be somehow reactivated. In Experiment 2 we estimated the temporal cost of this reactivation of information by manipulating the set size and the presence of the visual search in the retention interval.

The visual search increased the intercept of the reaction time linear function in 413 ms, but the slope remained equal in both conditions (260 ms). An ongoing experiment measures such temporal cost in the presence of retro-cues. For now, we suggest that the cue's effectiveness relies on a memory store that keeps the information in an activated state – possibly involving a continual generation of mental images within the visual buffer.

JUNE 9 15:20 - 16:20

SESSION 10 - IMAGERY AND NEURODEGENERATIVE DISORDERS

15:20 - 15:40

Reduced mindreading capability as early indicator of the Huntington Disease

M. Olivetti Belardinelli[1], T. Huenefeldt[1], C. Esposito[1], S. Migliore[2], S. Maffi[2], F. Squitieri[2]

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Research on the cognitive manifestations of Huntington Disease (HD) provides evidence of impaired others' mental state recognition in patients with HD. In this exploratory study, we investigated the hypothesis that difficulties in mental state recognition might be an early symptom of HD when motor symptoms are still absent, and that these difficulties might be moderated by features concerning the mental states that are to be recognized, in particular by their valence (positive, negative, neutral).

Other features such as participant gender, stimulus gender and stimulus recognition difficulty were also taken into account. 40 participants with manifest HD, 20 participants with pre-manifest HD, and 80 age-matched healthy controls performed the revised "Reading the Mind in the Eyes Test". Results showed that participants with pre-manifest HD performed significantly better than participants with manifest HD, but significantly worse than their age-matched controls. These effects were particularly evident for mental states with negative valence. Taken together, these results suggest that difficulties in the cue-based recognition of complex mental states are an early symptom of HD.

15:40 - 16:00

Episodic future thinking as a function of temporal distances : evidence from Alzheimer's disease and semantic dementia

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The ability to project the self forward in time to pre-experience personal events is referred to as episodic future thinking (EFT) (Atance & O'Neill, 2001). In the last decade a consistent number of studies has shown episodic prospection deficits in neurodegenerative diseases in particular in Alzheimer's disease (AD) and in Semantic dementia (SD), which represent excellent pathological models to enlarge the study of the episodic/semantic dissociation to the future dimension. (Duval et al. 2012). However, within the framework of this literature, there is a notable variability in temporal distances used to value personal prospection abilities. Indeed, the great majority of studies employ a temporal dimension of one year to study EFT (Irish et al., 2012; Viard et al., 2014), on the other hand some studies have investigated the future thinking ability regardless of when the event will occur (El Hay et al., 2015).

In this line the principal aim of the present study was to disentangle cognitive processes underlying subjective time travel in different temporal contexts (past vs. future) as a function of different temporal distances (nears vs. distant) in early AD and in SD. Accordingly we used the Temporally Extended Episodic autobiographical memory task (TEEAM task), in which participants they had to retrieve personal events from the past and to foresee personal specific events in episodic future (Abram et al., 2014). Results showed a double dissociation as a function of the temporal distance: AD patients were impaired in near temporal contexts whereas SD patients were mostly impaired in distant future thoughts. Interestingly the same temporal gradient was observed for the retrieval of personal memories. These findings are discussed in the light of a new theoretical account that predicts the increasing role of semantic memory as a function of temporal distance in prospection (La Corte & Piolino, 2016).

16:00 - 16:20

Investigating mental time travel in young and older adults: Imaging the past and the future

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A major aspect of the human mind is the ability to "project" the self in the mental time (Mental Time Travel) in order to remember the past and to predict the future. This study aims to investigate the difference between young and older adults in self-projecting in time. Moreover, we will investigate if the ability to self-project themselves in time vary in young-old and old-old participants as well as in clinical populations. Study 1 includes 90 participants divided into three groups: 30 young, 30 young-old and 30 old-old adults. Participants performed the mental time travel task; they were asked to project themselves in "past", "present" and "future" and to locate in time each event presented. Events included "Autobiographical" and "Social" events. We also manipulated the temporal gradient for past and future events asking participants to project themselves in 10, 5 or 1 year in the part of future.

Moreover, each participant performed the Zimbardo Time Perspective Inventory, the Retrospective Memory questionnaire and the Autobiographical questionnaire. Results showed that younger participants were more accurate than older participants in performing the mental time travel task. Participants were more accurate when judging autobiographical events compared to social events. Study 2 includes 13 Alzheimer patients and 13 controls matched for age and level of education. Participants performed the same tasks included in Experiment 1.

Results showed a generalised impairment in Alzheimer patients compared to controls, moreover, all participants were less accurate judging past and future events compared to present.

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