12º SIMPÓSIO DA FUNDAÇÃO Bial

AQUÉM E ALÉM DO CÉREBRO

BEHIND AND BEYOND THE BRAIN

Potenciar a mente | Enhancing the mind

5 de abril - quinta-feira ***April 5 - Thursday***

Apresentações orais de posters - Investigadores apoiados pela Fundação Bial
Posters oral presentations - Bial Foundation grant holders

14:30 - 15:30 - Apresentações orais posters - Investigadores apoiados
Posters oral presentations - Grant holders
Moderator - **Mário Simões**

15:30 - 16:00 - Café, sessão de posters e contactos
Coffee, posters session and contacts with faculty

16:00 - 17:00 - Cont.
Apresentações orais posters - Investigadores apoiados
Posters oral presentations - Grant holders

128/10 - "Extending the spiritual healing paradigm to explore distant mental interaction effects with Wiccan healers"
Investigadores/*Researchers*: **Chris Roe**, Charmaine Marie Sonnex
Instituição/*Institution*: Centre for the Study of Anomalous Psychological Processes (CSAPP), University of Northampton, Psychology Division, Northampton (UK)

51/12 - "The interpretation and evaluation of meaningful coincidences suggestive of psi communication in everyday life"
Investigadores/*Researchers*: **Robin Wooffitt**, Germaine Gunther
Instituição/*Institution*: Anomalous Experiences Research Unit, Dep. of Sociology, University of York (UK)

87/12 - "Neurobiological correlates of empathy in couples: A study of central and peripheral measures"
Investigadores/*Researchers*: **Joana** Fernandes Pereira **Coutinho**, Cledna Patrícia de Oliveira Silva, Jean Decety, Kristin Perrone McGovern, Óscar Filipe Coelho Neves Gonçalves, Vânia Andrea Sousa Gonçalves Moreira de Lima
Instituição/*Institution*: Centro de Investigação em Psicologia, Escola de Psicologia, Universidade do Minho, Braga (Portugal)

130/12 - "Neural mechanisms of cognitive bias"
Investigadores/*Researchers*: **Rui** Filipe Nunes Pais de **Oliveira**, Ana Félix, Sara Cardoso
Instituição/*Institution*: ISPA, CRL, Lisbon and Instituto Gulbenkian de Ciência, Oeiras (Portugal)

157/12 - "Contributions of parent-infant psychophysiology during dyadic interactions to child development"
Investigadores/*Researchers*: **Raquel** Alexandra Gonçalves **Costa**, Iva Tendais, Ana Conde, Catarina Tojal
Instituição/*Institution*: ISLA Campus Lisboa, Laureate International Universities, Lisboa (Portugal)

178/12 - "How collaboration in psychotherapy becomes therapeutic: A study of interactive and psychophysiological processes in good and poor outcome cases"
Investigadores/*Researchers*: **Eugénia** Maria Ribeiro **Pereira**, Adriana Sampaio, Cledna Patrícia Silva, António P. Ribeiro, Adam O. Horvath, William B. Stiles, Inês Sousa, Joana Mourão, Dulce Pinto, Zita Sousa
Instituição/*Institution*: Centro de Investigação em Psicologia (CIPsi/UM), Escola de Psicologia, Universidade do Minho, Braga (Portugal)

185/12 - "Circuit mechanisms of spatial attention in the zebrafish midbrain"
Investigadores/*Researchers*: **Michael** Brian **Orger**, Sabine L. Renninger
Instituição/*Institution*: Fundação Champalimaud, Lisboa (Portugal)

192/12 - "Effects of conditional foxp2 deletion on motor-sequence learning"
Investigador/*Researcher*: **Catherine** Ann **French**
Instituição/*Institution*: Fundação Champalimaud, Lisboa (Portugal)

83/14 - "Electrophysiological correlates of the incorporation of recent memory sources into REM and non-REM dreams and of levels of insight following REM and non-REM dream interpretation"
Investigadores/*Researchers*: **Mark Blagrove**, Chris Edwards, Jean-Baptiste Eichenlaub, Perrine Ruby
Instituição/*Institution*: College of Human and Health Sciences, Department of Psychology, Swansea University (UK)

118/14 - "Recursive consciousness training: Using neurofeedback to induce altered states"
Investigadores/*Researchers*: **Amir Raz**, Niels Birbaumer, Robert T Thibault
Instituição/*Institution*: Montreal Neurological Institute, McGill University (Canada); Institute of Medical Psychology and Behavioral Neurobiology, University of Tübingen (Germany)

128/14 - "Autonomic nerve recordings applied as a novel psychophysiological tool for Consciousness Science"
Investigadores/*Researchers*: **Hugo** Dyfrig **Critchley**, Peter Taggart, Yrsa Sverrisdottir
Instituição/*Institution*: Brighton and Sussex Medical School, University of Sussex (UK); Department of Physiology, Anatomy and Genetics, University of Oxford (UK)

143/14 - "From audio-visual perception to action: The processing of spatio-temporal components"
Investigadores/*Researchers*: Sandra Mouta, Joana Vieira, **Mariana Silva**
Instituição/*Institution*: Association/ZGDV-Centro de Computação Gráfica, Guimarães (Portugal)

163/14 - "Sacred values underlying conflict proneness: A neuroimaging study of religious and nationalist radicals"
Investigadores/*Researchers*: Adolf Tobena, **Clara Petrus**, Joseph Hilferty, Oscar Vilarroya, Scott Atran
Instituição/*Institution*: Department of Psychiatry and Forensic Medicine UAB, Bellaterra Campus (Spain)

228/14 - "Pushing consciousness and selfhood towards their boundaries - An EEG neurophenomenological study"
Investigadores/*Researchers*: Joseph Glicksohn, Aviva Berkovich-Ohana, **Tal Dotan Ben-Soussan**
Instituição/*Institution*: Bar-Ilan University, Ramat Gan (Israel); Fondazione Patrizio Paoletti, Assisi (Italy)

233/14 - "Training anomalous cognition in a motor task with subliminal auditory feedback"
Investigador/*Researcher*: **John** Albert **Palmer**
Instituição/*Institution*: Rhine Research Center, Durham, NC (USA)

244/14 - "Induced brain plasticity after perinatal stroke: Structural and functional connectivity"
Investigadores/*Researchers*: **Antoni Rodriguez-Fornells**, Alfredo García-Alix, Carme Fons, Clément François, Jordi Muchart, Laura Bosch, Mónica Rebollo, Pablo Ripollés
Instituição/*Institution*: Department of Basic Psychology, University of Barcelona (Spain); Hospital Sant Joan de Deu, Esplugues de Llobregat (Spain)

246/14 - "Anomalous/paranormal experiences reported by nurses themselves and in relation with their patients in hospitals: Examining psychological, personality and phenomenological variables"
Investigador/*Researcher*: **Alejandro** Enrique **Parra**
Instituição/*Institution*: Instituto de Psicologia Paranormal, Buenos Aires (Argentina)

253/14 - "The impact of lipid signaling modulation in cognition"
Investigadores/*Researchers*: **Tiago** Gil Rodrigues **Oliveira**, Isabel Maria Sousa Castanho, Neide Marina Vieira Pereira, Rita Catarina Ribeiro da Silva, Vítor Manuel da Silva Pinto
Instituição/*Institution*: Life and Health Sciences Institute - ICVS, School of Health Sciences, University of Minho, Braga (Portugal)

279/14 - "Facial and bodily temperature maps of emotions"
Investigadores/*Researchers*: Maria **Lucia** Martins das Neves **Garrido**, Lisa Katharina Kuhn, Nicholas Pound
Instituição/*Institution*: Division of Psychology, Department of Life Sciences, Brunel University, Uxbridge (UK)

282/14 - "The mindful eye: Smooth pursuit and saccadic eye movements in meditators and non-meditators"
Investigadores/*Researchers*: **Veena Kumari**, Elena Antonova
Instituição/*Institution*: Institute of Psychiatry, King's College London (UK)

287/14 - "Cryptochrome (CRY) and Intention"
Investigadores/*Researchers*: **Yung-Jong Shiah**, Hsu-Liang Hsieh, Dean Radin
Instituição/*Institution*: Graduate Institute of Counseling Psychology and Rehabilitation Counseling of the National Kaohsiung Normal University, Kaohsiung (Taiwan); Photobiology Lab, Taipei (Taiwan)

340/14 - "A question of belief: An analysis of item content in paranormal belief questionnaires"
Investigadores/*Researchers*: **Lance Storm**, Ken Drinkwater, Tony Jinks
Instituição/*Institution*: Brain and Cognition Centre, School of Psychology, University of Adelaide (Australia); Department of Psychology, Faculty of Health, Psychology and Social Care, Manchester (UK)

344/14 - "An integrative approach to the neural basis of hypnotic suggestibility"
Investigador/*Researcher*: **Devin** Blair **Terhune**
Instituição/*Institution*: Goldsmiths, University of London (UK)

355/14 - "Cognitive and personality differences in supernatural belief"
Investigadores/*Researchers*: Ian Scott Baker, David Sheffield, **Malcolm Schofield**, Paul Staples
Instituição/*Institution*: College of Life and Natural Sciences, University of Derby (UK)

366/14 - "Changes in subjective time as indication of increased mindfulness after meditation"
Investigador/*Researcher*: **Marc** Christoph **Wittmann**
Instituição/*Institution*: Institute for Frontier Areas of Psychology and Mental Health, Freiburg (Germany); Department of Psychosomatic Medicine, University Medical Center Freiburg (Germany)

373/14 - "Multimodal mapping of visual motion perceptual decision: Dissecting the role of different motion integration areas in visual surface reconstruction"
Investigadores/*Researchers*: **Miguel** de Sá e Sousa de **Castelo Branco**, Gabriel Nascimento Ferreira da Costa, Gilberto Silva, João Valente Duarte, Ricardo Martins
Instituição/*Institution*: ICNAS - Institute for Nuclear Sciences Applied to Health, Coimbra (Portugal); IBILI - Institute for Biomedical Imaging and Life Sciences, Coimbra (Portugal)

380/14 - "Using neural stimulation to modulate paranormal beliefs"
Investigadores/*Researchers*: **Miguel Farias**, Ute Kreplin
Instituição/*Institution*: Centre for Research in Psychology, Behaviour and Achievement, Coventry University (UK)

385/14 - "Affective and cognitive modulation of pain by using real-time fMRI neurofeedback"
Investigadores/*Researchers*: **Pedro** Jose **Montoya** Jimenez, Beatriz Rey Solaz, Inmaculada Riquelme, Miguel Angel Munoz Garcia, Niels Birbaumer
Instituição/*Institution*: Research Institute on Health Sciences, University of Balearic Islands, Palma (Spain)

386/14 - "Remote meditation support - A multimodal distant intention experiment"
Investigadores/*Researchers*: Stefan Schmidt, Han-gue Jo, **Marc Wittmann**, Thilo Hinterberger, Wolfgang Ambach
Instituição/*Institution*: Department of Psychosomatic Medicine, University Medical Center Freiburg (Germany); Institut für Grenzgebiete der Psychologie und Psychohygiene, Freiburg (Germany)

400/14 - "Is the matrix-experiment really a robust and artifact free experimental model to demonstrate generalized entanglement effects?"
Investigador/*Researcher*: **Harald Walach**
Instituição/*Institution*: Institute of Transcultural Health Studies, European University Viadrina, Frankfurt Oder (Germany)

402/14 - "Skin Conductance Feedback Meditation (SCFM) – Exploring the role of skin conductance in meditative practice"
Investigador/*Researcher*: **Thilo Hinterberger**
Instituição/*Institution*: Department of Psychosomatic Medicine, Clinic of the University of Regensburg (Germany)

413/14 - "The role of dopamine in behavioral exploration and action selection"
Investigador/*Researcher*: **Aaron** Christopher **Koralek**
Instituição/*Institution*: Champalimaud Neuroscience Programme, Lisboa (Portugal)

480/14 - "The role of experimenter and participant mindset in the replication of psi experiments: Phase II of a global initiative"
Investigador/*Researcher*: Marilyn Schlitz, **Arnaud Delorme**
Instituição/*Institution*: Institute of Noetic Sciences, Petaluma, California (USA)

489/14 - "An examination of the effects of mood and emotion on a real-world computer system and networking environment"
Investigador/*Researcher*: **John** G. **Kruth**
Instituição/*Institution*: Rhine Research Center, Durham (USA)

495/14 - "Episodic memory enhancement in aging: The role of cognitive training combined with (bilateral) tDCS in the medial-temporal cortex and cerebellum on episodic memory performance in the elderly"
Investigadores/*Researchers*: Mário Manuel Rodrigues Simões, Filipe Fernandes, Jorge Evandro de Araújo Alves, Marcel Simis, Ana Rita Simões Martins, Jorge Almeida, **Lénia** Alexandra Leal **Amaral**
Instituição/*Institution*: CINEICC - Centro de Investigação do Núcleo de Estudos e Intervenção Cognitivo-Comportamental/Universidade de Coimbra (Portugal)

506/14 - "The Selfield: Optimizing precognition research"
Investigadores/*Researchers*: **Mario Varvoglis**, Peter Bancel
Instituição/*Institution*: Institut Metapsychique International, Paris (France); Institute of Noetic Sciences, Petaluma, California (USA)

"The Aging Social Brain - Neural and behavioral age-related changes in social cognition and decision-making"
Investigadores/*Researchers*: João Eduardo Marques Teixeira, Manuel Fernando Santos Barbosa, Fernando Ricardo Ferreira Santos, Pedro Manuel Rocha Almeida, Hugo Daniel Leão Sousa, **Carina Fernandes**
Instituição/*Institution*: Faculdade de Psicologia e de Ciências da Educação, Universidade do Porto (Portugal)

"Aware Mind-Brain: Bridging insights on the mechanisms and neural substrates of human awareness and meditation"
Investigadores/*Researchers*: **Antonino Raffone**, Salvatore Maria Aglioti, Henk P. Barendregt, Fabio M. Giommi, Juliana Jordanova, Peter Malinowski, Stephen Whitmarsh
Instituição/*Institution*: ECONA - Interuniversity Center for Cognitive Processing in Natural and Artificial Systems, Università degli Studi di Roma "La Sapienza" (Italy)

97/16 - "Reproductive hormonal status as a predictor of precognition"
Investigadores/Researchers: **Julia Mossbridge**, Daryl Bem
Instituição/Institution: Institute of Noetic Sciences, Petaluma, California (USA); Department of Psychology, Cornell University, Ithaca (USA)

Extending the Spiritual Healing Paradigm to Explore Distant Mental Interaction Effects with Pagan Healers

Prof. Chris A. Roe, Dr Charmaine Sonnex, Dr Elizabeth C. Roxburgh

Centre for the Study of Anomalous Psychological Processes

Sponsored by
grant no.: 128/10

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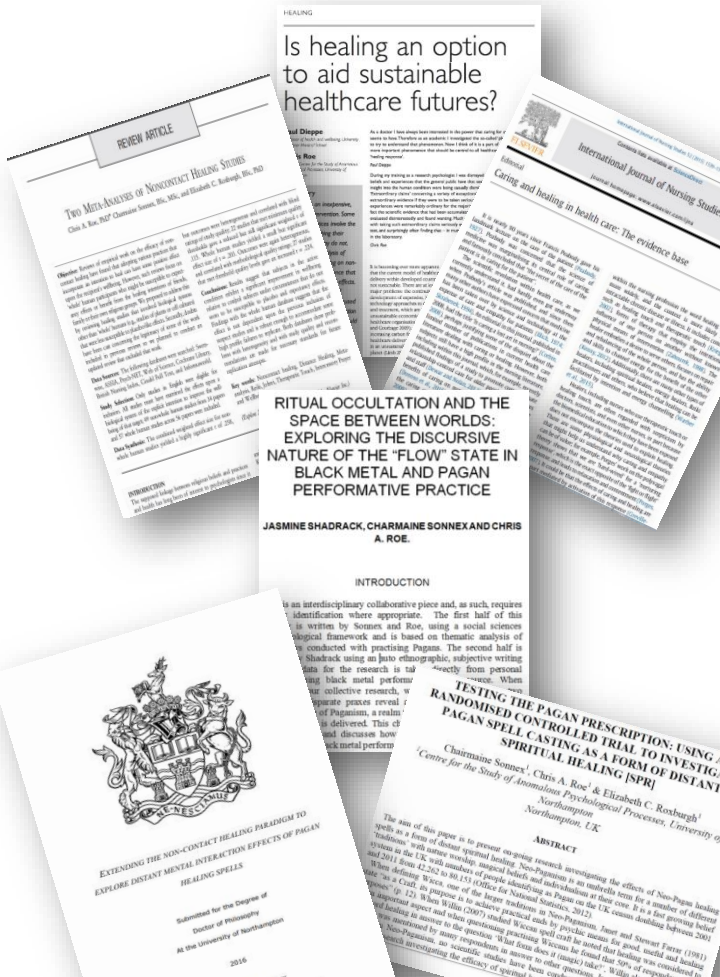
Phase 1: Meta-analysis of extant noncontact healing studies, separating 'whole human' and 'non-whole human' target systems

Phase 2: Interviews with Pagan healers in order to map their understanding of the healing process to ensure a better fit between experimental design and in situ practice

Phase 3: Randomised control trial of noncontact healing. Working with an experienced Pagan practitioner, combining the rigor of the experimental method with ecological validity informed by interview data



THE UNIVERSITY OF NORTHAMPTON

EXTENDING THE SPIRITUAL HEALING PARADIGM TO EXPLORE DISTANT MENTAL INTERACTION EFFECTS WITH WICCAN HEALERS

Chris A. Roe & Charmaine Sonnex

University of Northampton

Grant 128/10

Background: Previous research investigating the efficacy of spiritual healing practices has been sufficiently successful to warrant further study. We argue that research designs could be improved by working with participant populations that are not critically ill so that we can have greater confidence that those in a control group are not receiving healing intentions from friends and family, by ensuring that the outcome parameters that are measured reflect the nature of the healing claim made by practitioners, and most importantly that healers are drawn from a homogenous group that come from a spiritual tradition that incorporates healing as part of its belief system and set of practices. We therefore proposed a study in which Wiccan practitioners are interviewed to generate an in-depth understanding of the effects that they aim to produce so that those insights can be used to inform a double-blind randomised control study of Wiccan healing.

Aims: To review the literature on spiritual healing so as to identify best practice in conducting an appropriately controlled experimental test and to identify those outcome markers that have been found to be most sensitive to noncontact healing effects. To interview practising Wiccan healers so as to develop an authentic account of the range of healing rituals practised, their claimed benefits, strengths and limitations; also to develop an understanding of practitioners' own perceptions of the mechanism by which healing is effected. Informed by objectives 1 & 2, to conduct a double-blind randomised control study to look for evidence of healing effects as a consequence of being treated by experienced Wiccan healers as they conduct healing rituals for specified persons. Participants will not be medically ill but rather the study will focus on changes in general wellbeing in a manner not dissimilar to the DMILS paradigm.

Method: Phase 1 consisted of a meta-analytic review of extant literature on noncontact healing and complementary therapies to identify possible mechanism. Phase 2 consisted of semi-structured interviews with eight practising Pagan spellcasters that were recorded and later transcribed. Phase 3 consisted of a double-blind randomised controlled study that adheres to design quality criteria outlined by phases 1 and 2. Using an interrupted time series design, 44 participants attended a 'baseline' session at time T0 at which they completed measures of wellbeing and participated in a group meditation exercise. All participants attended further group meditation sessions at time T1, T2, and T3 (spaced a week apart). After the first meeting they were randomly allocated to one of two groups, A or B, with participants in group A being the focus of noncontact healing efforts from a Pagan practitioner in the period from T0-T1 and group B in the period T1-T2. All participants and researchers who interact with them were blind to this allocation. Participants were run in small cohorts of between 6 and 8 persons.

Results: Interview material was analysed using thematic analysis, eliciting the primary themes: balance between adhering to tradition and personalising of practice; ethical

considerations in what represents an appropriate outcome; the importance of belief and intention, and the role that ritual plays in maintaining that; and the relationship between practice and one's understanding of the nature of reality, particularly the energetic/spiritual nature of humankind and its implications for the causes of illness and wellbeing. Differences in scores on all subscales of the WHOQOL- BREF between T0 and T1 were calculated and compared between group A (the active condition) and group B (the wait list control condition) using MANOVA. No significant differences were found, suggesting no discernible healing effect in period 1. Scores were similarly compared for the period T1-T2 for which group A were the control group and group B the group receiving treatment, and again showed no evidence of a healing effect. However, participants did show an improvement across the length of the study in domains of the WHOQOL that were hypothesised *a priori* to be most directly related to their spell requests (that is, the psychological and physical rather than the social or environmental).

Conclusions: Findings suggests that there is some aspect of participating in this healing study that confers a positive effect upon wellbeing. The most likely explanation is that this represents a placebo expectancy effect, though one might argue that an effect due purely to suggestion would be reflected in all domains of the wellbeing measure. Participants' scepticism towards the efficacy of noncontact healing was measured before the study began but, contrary to the expectancy explanation, showed no relationship with changes in wellbeing scores across the duration of the study. One confounding factor was the inclusion of a meditation session to bring the group together and to provide a focal point for meetings that were primarily to allow participants to complete interim wellbeing measures; an extensive literature suggests that meditation can affect wellbeing, and in future designs an alternative activity might control this potential confound. Finally, it may be that the active period was too brief in duration to capture effects that may be slow acting but long lasting.

Keywords: Noncontact healing, Paganism, Thematic analysis, Randomized control trial

Publications:

Dieppe, P., & Roe, C., & Warber, S. (2015). Caring and healing in health care: The evidence base. *International Journal of Nursing Studies*, *52*, 1539–1541.

Dieppe, P., & Roe, C. (2015). Is healing an option to aid sustainable healthcare futures? *Journal of Holistic Healthcare*, *12*(1), 22-25. ISSN: 1743-9493

Roe, C.A., Sonnex, C., & Roxburgh, E.C. (2015). Two meta-analyses of noncontact healing studies. *Explore:The Journal of Science & Healing*, *11*(1), 11-23. ISSN: 1550-8307

Roe, C.A., Sonnex, C., & Roxburgh, E.C. (2015) Noncontact healing: What does the research tell us? *European Journal of Integral Medicine*, *7*(6), 687. ISSN: 1876-3820.

Sonnex, C.S. (2016) Psi healing research. *Psi Encyclopedia*, Society for Psychical research. Available at http://psi-encyclopedia.spr.ac.uk/articles/psi-healing-research

Sonnex, C.S. (2017). *Extending the non-contact healing paradigm to explore distant mental interaction effects of pagan healing spells*. Unpublished PhD thesis, University of Northampton.

Sonnex, C., Roe, C.A., & Roxburgh, E.C. (2015). Testing the Pagan prescription: Using a randomised controlled trial to investigate Pagan spellcasting as a form of distant spiritual healing. *Abstracts of presented papers: Parapsychological Association 58th Annual Convention, University of Greenwich, London, July 16-19, 2015*. (pp. 74-75)

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The interpretation and evaluation of meaningful coincidences suggestive of psi communication in everyday life

Bial Foundation Bursary for Scientific Research, no. 51/12
Robin Wooffitt, Department of Sociology, University of York, UK.
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- Poetic confluence: a speech event in which one participant produces a spoken turn that exhibits a poetic relationship to a co-participant's *unspoken* thoughts or *unarticulated* mental imagery.

- Poetic confluence and interpersonal social actions:

-re-engaging participants' attention to ongoing interaction;
-detoxifying sensitive or inappropriate imagery/thoughts;
-establishing alignment and affiliation.

- One example of psi mediated through mundane communication.

Outputs

Wooffitt, R. (2018) Shared subjectivities. *Subjectivity*,11(1): 40-56.
Wooffitt, R. Poetic confluence and the public formulation of others' private matters. (Under review, *Sociological Research Online*.)
Wooffitt, R. The social organization of an enigmatic moment. (Under review, *Psychoanalytic Dialogues*.)
Stockbridge, G. and Wooffitt, R. Coincidence by design. (Under review, *Qualitative Research.*)

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THE INTERPRETATION AND EVALUATION OF MEANINGFUL COINCIDENCES SUGGESTIVE OF PSI COMMUNICATION IN EVERYDAY LIFE

Robin Wooffitt & Germaine Stockbridge

Department of Sociology, University of York, Heslington, York, UK

Grant 51/12

Background: Meaningful coincidences can be strongly suggestive of psi processes. However, there has been little investigation of the ways coincidence experiencers describe their experiences. Analysis of coincidence accounts can provide understanding of the underlying tacit knowledge which people draw on in interpreting events as having a meaningful coincidental character. Similarly there has been little prior work on coincidences that occur in naturally occurring talk in social interaction.

Aims: First: to investigate the discourse of coincidence accounts to identify tacit normative and communicative practices. Second: to examine a particular class of coincidence that occurs in everyday interaction. This coincidence, called poetic confluence, takes the form of word selection that suggests telepathic communication with a co-interactant's unstated mental imagery or thoughts.

Method: For the analysis of coincidence accounts, an ethnomethodological discourse analysis was used. For the analysis of psi in word selection, we employed an interpretative method informed by the findings from Conversation Analytic studies of naturally occurring interaction.

Results: The analysis of accounts investigated: the rhetorical structure of coincidence accounts; the management of personal agency in coincidence experience; the design of coincidence account for specific audience, and the management of sceptical interpretations of coincidence claims. The analysis of poetic confluence found co-ordination of mutual attention; alignment and affiliation; and the normalisation of sensitive thoughts or imagery.

Conclusions: Coincidence accounts are rhetorically structured to manage a range of inferential issues arising from making claims of significant coincidental experiences. The phenomenon of poetic confluence suggests that psi in everyday life performs interpersonal tasks common to mundane social interaction.

Keywords: Coincidence, Accounts, Poetic confluence

Publications:

Stockbridge, G. (2017) *Crafting Coincidence: The Rhetoric of Improbable Events*. PhD, University of York.

Wooffitt, R. Relational psychoanalysis and anomalous communication: Continuities and discontinuities. *History of the Human Sciences*, *30*(1), 2017, 118-137.

E-mail contact: robin.wooffitt@york.ac.uk

"NEUROBIOLOGICAL CORRELATES OF EMPATHY IN COUPLES: A STUDY OF CENTRAL AND PERIPHERAL MEASURES" Grant 87/12

Research Team: Joana Coutinho [1], Patrícia Oliveira-Silva [2], Óscar Gonçalves [1, 5], Kristin Perrone [3] & Jean Decety [4]

[1] Neuropsychophysiology Lab, Psychology School–Minho University [2] Faculdade de Educação e Psicologia -Universidade Católica Portuguesa, [3] Department of Psychological Science, Ball State University, USA, [4] Department of Psychiatry and Behavioral Neuroscience, University of Chicago, USA, [5] Applied Psychology Bouvé College of Health Sciences Northeastern University Harvard Medical School, Boston, USA

Background

- Romantic relationships are the most central relationship for most adults with an important temporal duration in human life cycle(Robles & Kiecolt-Glaser 2003). The consequences of marital conflict for society are relevant considering the impact of negative affect for the physical and mental health of each partner (SunWoo & Marks 2016), as well as for those directly involved in marital conflict such as children (El-Sheikh et al. 2009).
- We aimed to investigate the neural basis of empathy as it occurs in real interpersonal contexts, specifically in couples' relationships in an attempt to fill a gap in the literature where most studies rely on self-report measures or tasks where subjects are asked to empathize with fictional targets.
- At the pheripheral level conflict interpersonal interactions lead to an higher increase over baseline in psychophysiological responses such as heart rate, blood pressure and cortisol (Robles & Kiecolt-Glaser 2003). More than the level of autonomic arousal *per se*, the physiological synchrony between dyad members may be more relevant for interpersonal processes (e.g. Levenson & Gottman, 1983).
- At the central nervous system experiencing another person´s feelings recruits emotional brain circuits comprised by the anterior insula, amygdala and anterior cingulate cortex (Decety et al.,2012), whereas our ability to cognitively understand other´s feelings and thoughts recruits the medial prefrontal cortex, temporal parietal junction and posterior cingulate cortex (Engen et al.,2013). These regions belong to the Default Mode Network, a resting state networks , recruited when we think about mental states both our own and others

Methods and research design

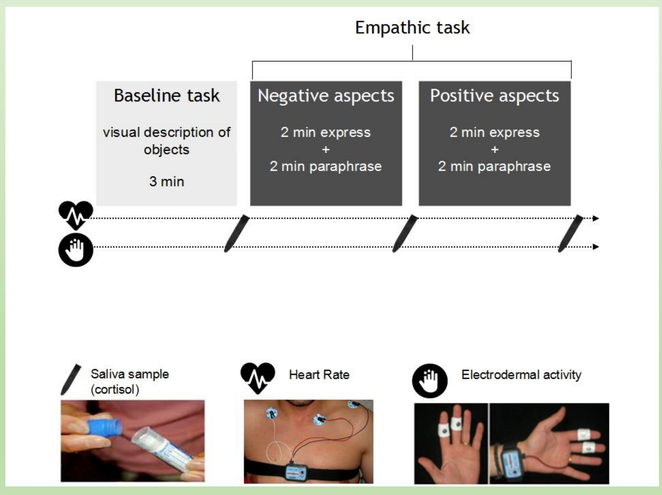
Participants

N= 72 (36 couples) in a monogamous relationship with duration > 1 year

Age	*M*=32.3 (*SD*=7.7)	Min=22, Max=62
Educational level	College education 12th grade 9th grade Basic education	68% 22% 7% 3%
Marital status	Married Living together Dating	35.7% 35.7% 28.6%
Relationship duration	*M*=9.43 (*SD*=8.05)	Min= 1, Max= 38
With children?	Yes No	12 20

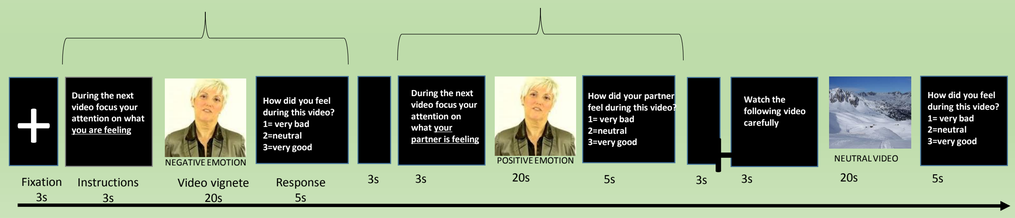
	Participants		
	Male M (SD)	Female M (SD)	All M (SD)
IRI			
PT	14.81 (2.39)	16.63 (2.98)	15.72 (2.83)
EC	13.65 (2.86)	14.1 (3.3)	13.87 (3.07)
PD	11.77 (3.21)	12.52 (2.99)	12.15 (3.1)
FS	10.35 (3.4)	12.23 (3.05)	11.29 (3.34)
Total	50.58 (6.88)	55.47 (8.27)	53.03 (7.94)
IRIC			
PT	16.35 (3.42)	16 (4)	16.18 (3.7)
EC	23.45 (2.77)	23.81 (3.67)	23.63 (3.23)
Total	39.81 (4.45)	39.9 (5.18)	39.85 (4.79)
DAS			
Consensus	24.29 (2.95)	24.55 (2)	24.42 (2.5)
Satisfaction	15.81 (2.04)	15.48 (1.73)	15.65 (1.88)
Cohesion	12.77 (4.23)	13.13 (3.88)	12.95 (4.03)
Total	52.87 (6.99)	53.16 (5.31)	53.02 (6.16)

Autonomic Nervous System and Neuroendocrin Measures



Central Nervous System – fMRI acquistion

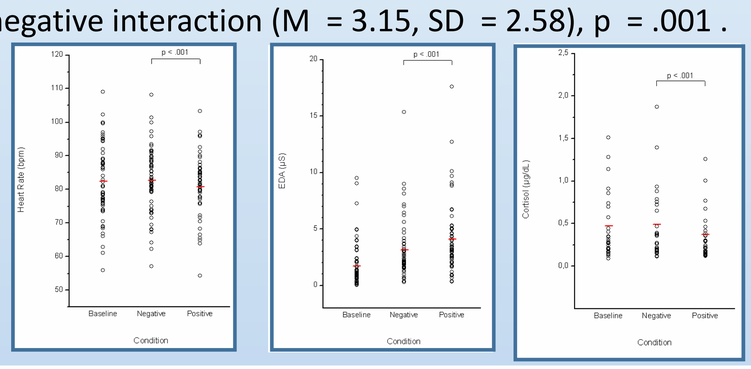
Functional images acquired in a clinical approved 3T MRI scanner (Siemens Magnetom Tim Trio, Erlangen, German)
1) Structural MPRAGE acquisition;
2) 9´m Resting state acquistion;
3) Social fMRI Task



Main Results and Conclusions

ANS Markers

- Significantly higher Heart Rate in the negative interaction (M = 82.72, SD = 10.27), than in the positive interaction (M = 80.89, SD = 9.16) (p = .001).
- Higher cortisol levels immediately after the negative interaction (M = 0.39, SD = 0.35), than after the positive interaction (M = 0.31, SD = 0.24), p = .001.
- Significantly higher eletodermal activity in the positive interaction (M = 4.10, SD = 3.02), than in the negative interaction (M = 3.15, SD = 2.58), p = .001 .



Coutinho J., Patrícia Oliveira-Silva P., Mesquita A., Barbosa M., Perrone-McGovern K. & Gonçalves O. F., (2017) "Psychophysiological reactivity in couples during a marital interaction task", Applied Psychophysiology and Biofeedback DOI 10.1007/s10484-017-9380-2

- We found evidence for EDA synchrony in the interaction task. This was significant for the negative condition ($t(30)=4.45$, $p<0.001$), as well as for the positive condition ($t(30)=2.03$, $p<0.05$). The effect size of the baseline condition was not significant ($t(29)=0.40$).
- Synchrony was significantly higher during the negative condition ($M=1.10$, $SD=0.21$) in comparison with the positive ($n=227$, $M=0.46$, $SD=0.20$) and the baseline conditions ($n=35$, $M=-0.06$, $SD=0.28$).

Joana Coutinho, Oliveira-Silva P., Fernandes E., Correia D., Gonçalves O. F. & Tschacher W. (in revision) "Psychophysiological synchrony during verbal interaction in romantic relationships", Family Process

SNC Markers

- Higher empathy scores were associated with higher functional connectivity of the DMN and an increased contribution of the medial prefrontal cortex (mPFC) to the DMN spatial mode

Esménio S., Soares J. M., Oliveira-Silva P., Zeidman P., Razi A., Gonçalves O. F, Friston K., Coutinho J. (in revision) Using resting-state functional and effective connectivity to characterise the functional anatomy of empathy

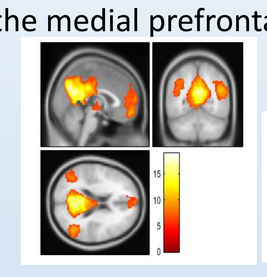
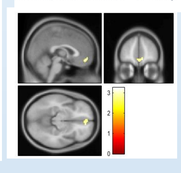
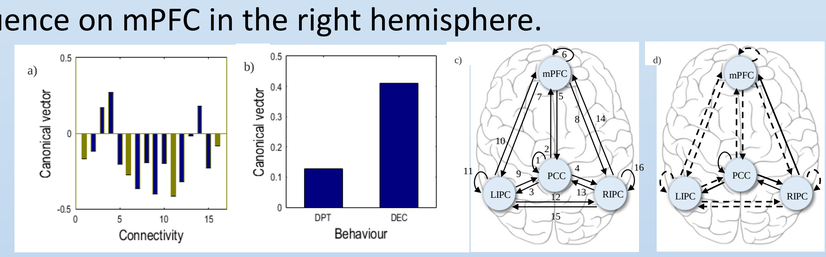


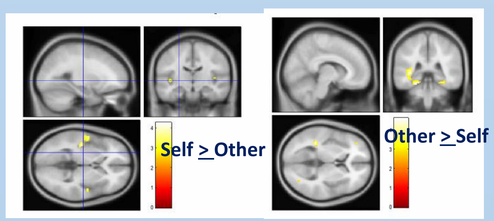
Fig. 1 DMN activations identified in the resting state condition for the entire sample (FWE<0.05 corrected, extent threshold k = 10 voxels).



- DCM revealed this association was mediated indirectly by the posterior cingulate cortex via the right inferior parietal lobule: for participants with higher scores in dyadic empathy, the PCC had a greater effect on bilateral IPL and IPL had a greater influence on mPFC in the right hemisphere.



- Areas of affective processing in left insula left superior temporal gyrus, right insula whereas more active during the self condition, whereas those involved in the cognitive representation of others like the fusiform gyrus and left supra marginal gyrus were more active during the other condition.



Esménio S., Soares J. M., Oliveira-Silva P., Gonçalves O. F, Friston K., Coutinho J. (in revision) Neural basis of Self and Other perspectives during a naturalistic fMRI dyadic empathic task.

Other publications:

NEUROBIOLOGICAL CORRELATES OF EMPATHY IN COUPLES: A STUDY OF CENTRAL AND PERIPHERAL MEASURES

Joana Coutinho[1], Patrícia Oliveira-Silva[2], Óscar Gonçalves[1,5],
Kristin Perrone[3] & Jean Decety[4]

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[2]Faculdade de Educação e Psicologia - Universidade Católica Portuguesa;
[3]Department of Psychological Science, Ball State University, USA;
[4]Department of Psychiatry and Behavioral Neuroscience, University of Chicago, USA;
[5]Applied Psychology Bouvé College of Health Sciences Northeastern University
Harvard Medical School, Boston, USA

Grant 87/12

Background: Empathy is one of the most studied constructs in psychology. An interpersonal context in which empathy appears to be critical is that of romantic relationships. Social neuroscience has clarified the neural basis of the different dimensions of empathy both at the central and pheripheral nervous system levels. For example previous evidence showed that not only the autonomic arousal per se but also the autonomic synchrony between spouses are markers of empathy. At the central level different brain areas have been linked with empathic processes.

Aims: This project aimed to explore the neural correlates of empathy in couples both at the peripheral and central nervous system level. Specific goals: 1) To characterize the autonomic (electrodermal (EDA) and cardiac activity) and neuroendocrine response (cortisol) in couples during an interactive task; 2) To test whether more empathic couples have higher levels of physiological synchrony; 3) To clarify the relationship between the patterns of connectivity of the Default Mode Network (DMN) and empathy 4) To analyse the brain areas involved in the self-other distinction during an empathy task.

Method: 32 couples (*N* = 64) in a committed relationship for at least one year performed a couple´s interaction task consisting in a structured discussion about the positive and problematic aspects of their relationship, while their cardiac and electrodermal activity was recorded using Biopac MP-150. Questionnaires of dyadic empathy and relationship satisfaction were administered to both spouses. The video-vignettes from this task were used to construct an fMRI paradigm in which each partner was asked to process his/her own feelings and those of his partner. A resting state acquisition was also performed.

Results: We found higher levels of heart rate and cortisol during the negative interaction condition whereas EDA was higher during the positive interactions. Physiological synchrony between spouses was higher in the negative interaction. At the central level we confirmed the association between both functional and effective connectivity of the DMN and dyadic empathy. Finally we found that brain areas such as insula and medial temporal regions were more active during the self condition whereas the supramarginal and fusiform gyrus were more active during the other condition.

Conclusions: Our results contributed for the understanding of the neural response during couple´s interactions and have important clinical implications.

Keywords: Empathy, Intimate relationships, Autonomic measures, Neuroimaging measures, Default Mode Network

Publications

Coutinho J., Oliveira-Silva P. & Decety J (2014) Neurosciences, Empathy, and Healthy Interpersonal Relationships: Recent Findings and Implications for Counseling Psychology". *Journal of Counseling Psychology.* doi.org/10.1037/cou0000021

Coutinho J., Beiramar A., Silva C., Calvo A., Lima V., Grace R., Oliveira-Silva P., Gonçalves O. & Sampaio A. (2015). Evidências de validade da Versão Portuguesa do Índice de Reatividade Interpessoal para Avaliação da Empatia em Casais". *Avaliação Psicológica. Vol* 14(3), pp.309-317. DOI: 10.15689/ap.2015.1403.02

Coutinho J., Patrícia Oliveira-Silva P., Mesquita A., Barbosa M., Perrone-McGovern K. & Gonçalves O. F., (2017) "Psychophysiological reactivity in couples during a marital interaction task", *Applied Psychophysiology and Biofeedback.* doi:10.1007/s10484-017-9380-2

Coutinho J., Perrone-McGovern K. M & Gonçalves O. F. (2017) "The Use of Neuroimaging in Clinical Psychological Science Research: Promises, Pitfalls and Recommendations*", Canadian Journal of Counselling and Psychotherapy*

Coutinho J, Oliveira-Silva P., Fernandes E., Correia D., Gonçalves O. F. & Tschacher W. (*in revision*) "Psychophysiological synchrony during verbal interaction in romantic relationships", *Family Process*

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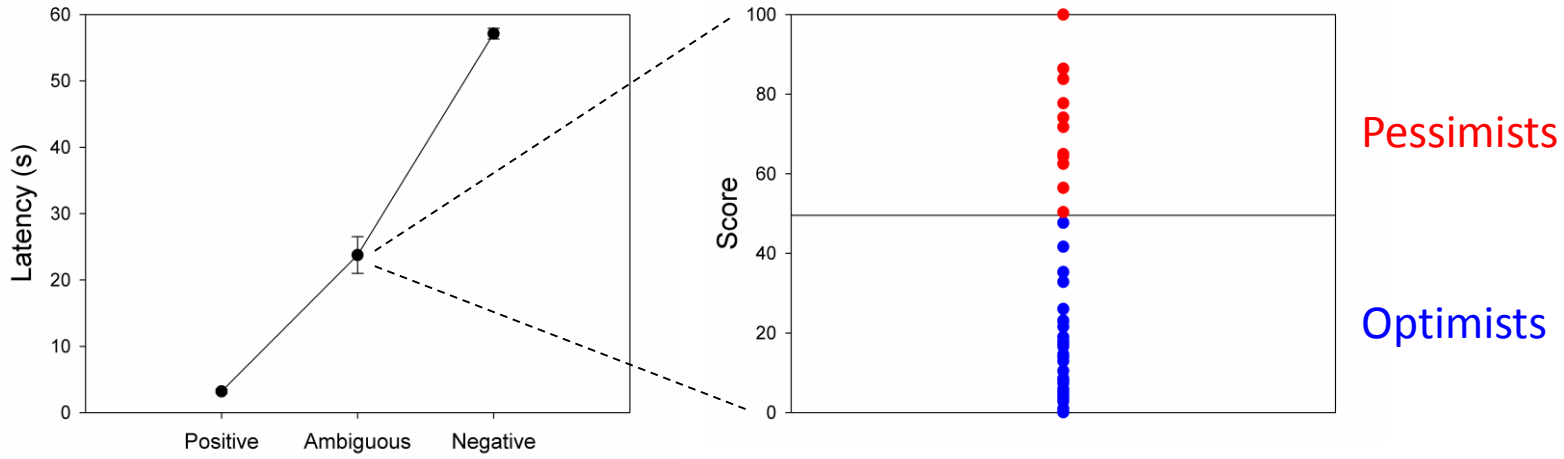
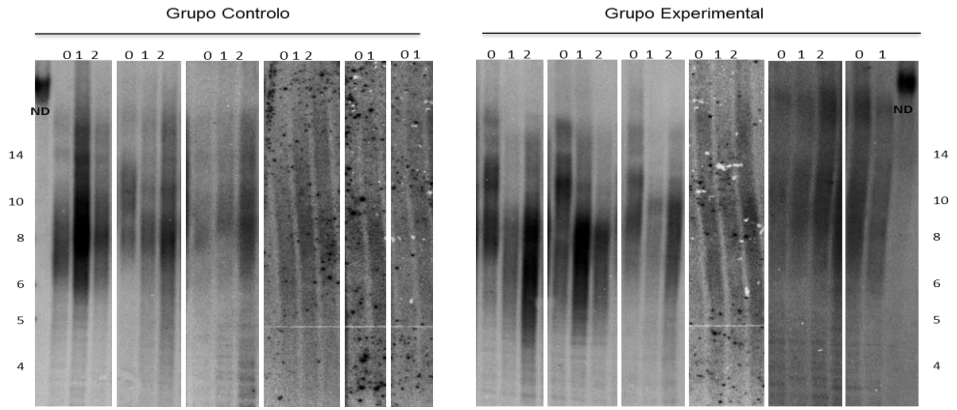
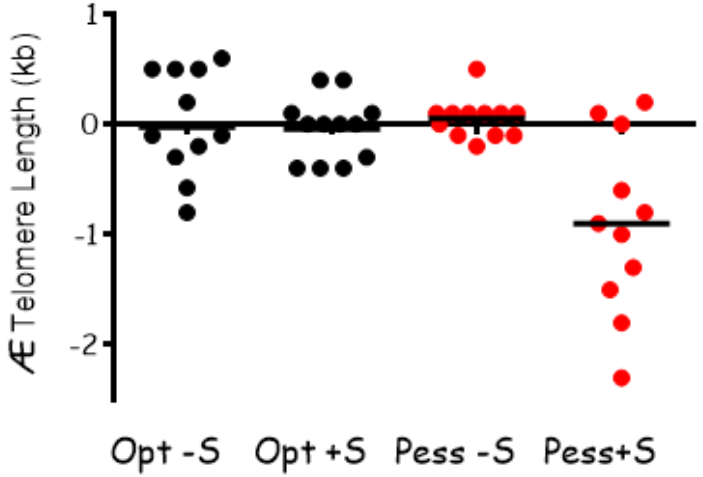
NEURAL MECHANISMS OF COGNITIVE BIAS

Rui F. Oliveira

ISPA – Instituto Universitário & Instituto Gulbenkian de Ciência







FUNDAÇÃO Bial
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Grant 130/12

COGNITIVE BIAS REGULATES SUSCEPTIBILITY TO STRESS IN ZEBRAFISH

Felipe Espigares[1], Diana Abad[1], Tânia Ferreira[1],
Miguel Godinho-Ferreira[1] & Rui F. Oliveira[1,2]

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Grant 130/12

Background: The fact that cognitive appraisal is involved in the evaluation of stimuli creates the potential for cognitive biases that produce subjective evaluations (i.e., some individuals will consistently evaluate ambiguous stimuli as negative – aka pessimists, whereas others will perceive them as positive – aka optimists). Thus, cognitive biases may explain inter-individual variation in the response to stressors and concomitantly in the susceptibility to stress-related diseases.

Aims: In the present study we aim to investigate the occurrence of cognitive bias in zebrafish and to assess if optimistic and pessimistic differ in their susceptibility to detrimental effects of exposure to chronic stress.

Method: Zebrafish were tested in a cognitive bias paradigm and classified in an optimistic/pessimistic dimension. Afterwards, we used exposed the individuals to unpredictable chronic stress during 1 month, and the consequences of chronic social stress in pessimistic and optimistic zebrafish were assessed at multiple levels (behavior, functioning of the hypothalamic-pituitary-interrenal axis and cellular aging as measured by telomere shortening).

Results: First, we analyzed the differential responsiveness to stress by measuring whole-body cortisol and expression levels of stress-related genes in the brain. Our results show that optimistic and pessimistic individuals are characterized by different basal brain states, suggesting that cognitive bias towards optimistic/pessimistic judgments differentially activates a stress response. Secondly, we studied the impact of chronic stress on cellular aging by analyzing telomere dynamics. Our results suggest that cognitive bias towards pessimistic judgments could make individuals more susceptible to the detrimental effects of chronic stress, since telomere shortening seems to be associated to pessimistic individuals exposed to chronic stress.

Conclusions: Cognitive bias seems to play a major role in the inter-individual variation in the susceptibility / resilience to stress.

Keywords: Cognitive bias, Stress, Telomere, Cortisol, Zebrafish

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Contributions of parent-infant psychophysiology during dyadic interaction to child development
Grant: 157/12

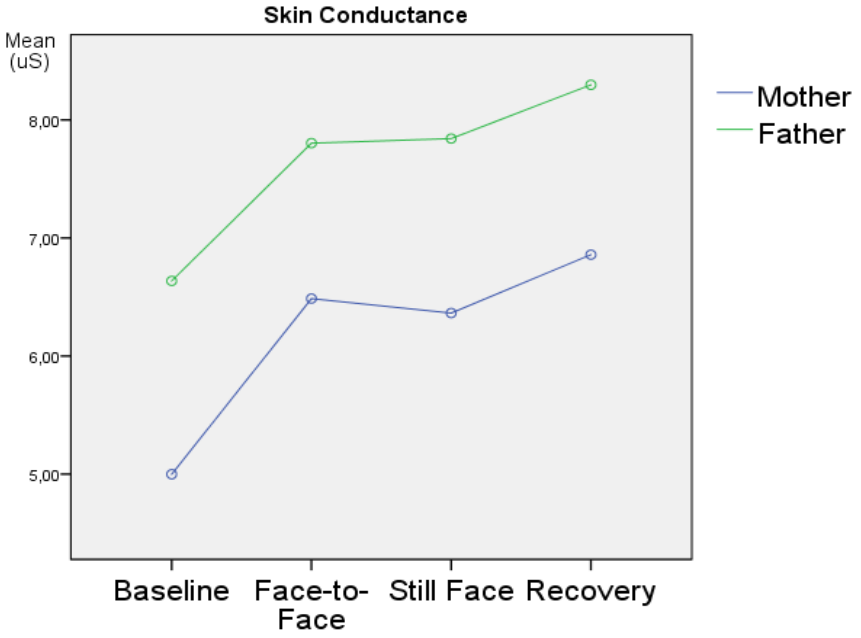
FUNDAÇÃO Bial
Institution of public utility

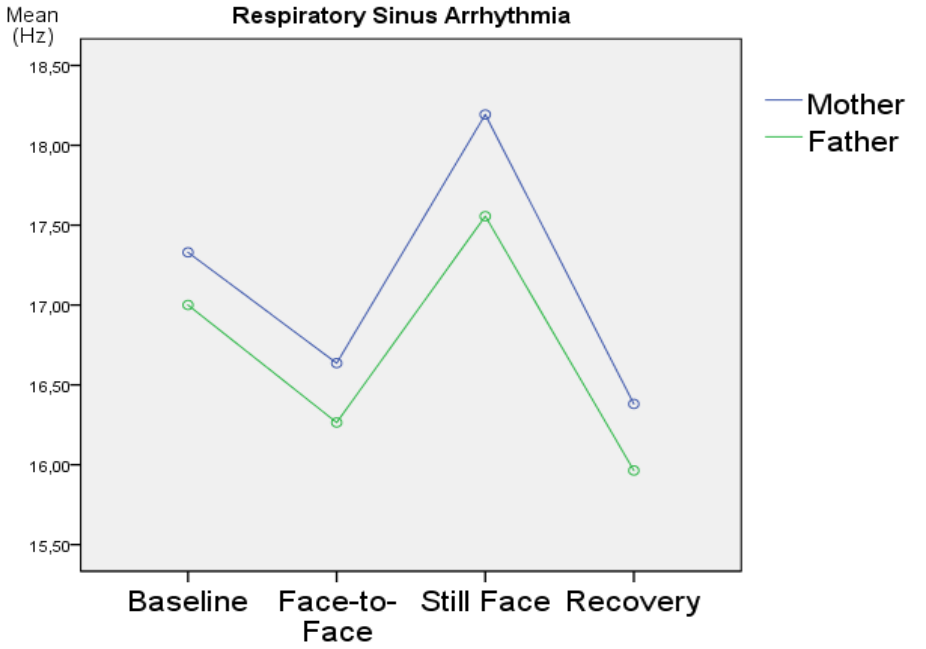
PSYCHOPSYSIOLOGY OF EARLY INTERACTIONS

Raquel Costa[1,2] & Catarina Tojal[2]

[1]Universidade Europeia |Laureate International Universities; [2]EPIUnit - Instituto de Saúde Pública, Universidade do Porto, Rua das Taipas, nº 135, 4050-600 Porto, Portugal

Objective: To examine the underlying physiological mechanisms during dyadic interaction at 6 months of age.





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Tojal, C., & Costa, R. (2016). Physiologic reactions during mother-infant and father-infant face-to-face interactions. Proceedings (S908) of the 17th ECDP, 45. Italy: Medimond – Monduzzi Editore International Proceedings Division. ISBN:978-88-7587-733-0

PSYCHOPHYSIOLOGY OF EARLY INTERACTIONS

Raquel Costa[1] & Catarina Tojal[2]

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Grant 157/12

Background: Parent-infant interactions characterized by mutual engagement difficulties and low parental sensitivity and responsiveness are associated with child developmental difficulties.

Aims: to understand what characterizes the behavioral and physiological point of view difficulties in situations of mutual engagement, low parental sensitivity and responsiveness.

Method: longitudinal study with 400 families from 6 weeks to 18 months of the child's life. At 6 weeks, a sociodemographic questionnaire will be conducted for both mothers and fathers. Parental mental health will be assessed using the World Health Organization Composite International Diagnostic Interview (CIDI) and perinatal health will also be assessed using the Optimality Index (OI). Separate face-to-face interactions between the infant and each parent will be video recorded for a 10 minute interval according to the protocol of the Global Rating Scales (GRS). This procedure will be followed by the face-to-face still-face paradigm. During these interactions parental respiratory sinus arrhythmia (RSA), heart rate (HR) and skin conductance (SC) will be monitored (VU-AMS). Measures of infant social withdrawal using the Alarm Distress Baby Scale (ADBB) were conducted.

Results: Maternal depression symptoms (DS) during pregnancy and at 2 month postpartum is associated with more rejecting behaviors toward the infant *(r* = -0,156, *p* = 0.044 and *r* = -0.211, *p* = 0.008, respectively) and less attentive infants (*r* = -0,156, *p* = 0.045 and *r* = -0.188, *p* = 0.017, respectively). Maternal DS at 2 months is associated with higher sadness in the interaction (*r* = -0.174, *p* = 0.028). Paternal antenatal DS is associated with more rejecting behaviors (*r* = -0.179, *p* = 0.032) while paternal DS at 2 months is associated with lower responsiveness and activity (*r* = -0.203, *p* = 0.18; *r* = -0.235, *p* = 0.006, respectively) and higher sadness (*r* = -.235, *p* = 0.006). Paternal DS at 2 months is also associated with infant's self-centered behavior (*r* = -.179, *p* = .039) and with less fun and enthusiastic involvement interactions (*r* = -.172, *p* = .048 and *r* = -.231, *p* = .007, respectively). Both maternal and paternal DS, before and after childbirth, are associated with lower quality of early interactions. Our findings also show that during normal interactions parental intrusive behavior is associated with lower respiratory sinus arrhythmia while parental non-remote behavior is associated with higher skin conductance during a still-face perturbation. Lower excited engagement is associated with higher skin conductance during recovery.

Conclusion: The physiological reactions during early interaction may be an important complementary tool for the psychological assessment of parental behaviors.

Keywords: Mother-infant interaction, Father-infant interaction, Depression, Respiratory sinus arrhythmia, Skin conductance

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Therapeutic collaboration and the dyad's physiological synchrony in psychotherapy

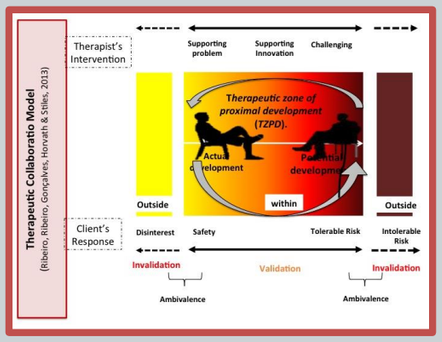
Eugénia Ribeiro, Adriana Sampaio, Patricia Oliveira-Silva[1], Adam Horvath[2], William B. Stiles[3], Inês Sousa[4], Ângela Ferreira, Dulce Pinto, Nuno Pires, Joana Senra & Joana Mourão

Grant 178/12

Center of Research in Psychology; School of Psychology, University of Minho;

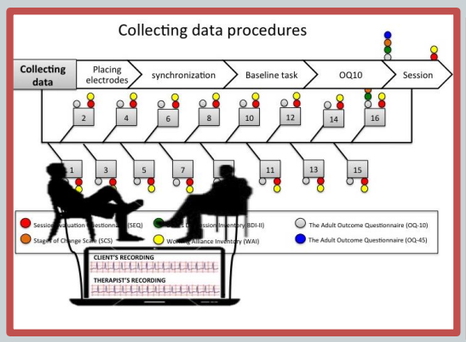
[1]Universidade Católica Portuguesa; [2]Symon Faser University, Canadá; [3]Department of Psychology, Miami University, Ohio, USA; [4]department of Math, University of Minho

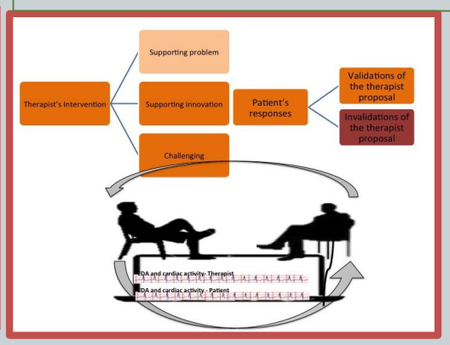
Introduction



We define ***therapeutic collaboration:*** as a **joint effort** of the dyad to maintain the therapeutic focus **within the limits** of the client's therapeutic zone of proximal development- **TZPD** (Ribeiro, Ribeiro, Gonçalves, Horvath & Stiles, 2013). When the client elaborates upon a given experience, the **therapist's response to it,** only becomes *therapeutic* if the client perceives it as attuned to his or her experience and accepts it, **that is validate the therapist intervention.** These type of **therapeutic exchanges** are defined as **collaborative**. However, some therapeutic exchanges indicate that the dyad works **at the limit or outside the clients' TZPD**, as indicated by the client's response of ambivalence or invalidation. This means that the therapist's interventions were redundant, uninteresting or too challenging, exceeding the TZPD. The **quality of the interaction** in therapy seems to be a critical factor in clients' decisions regarding the **(dis)continuation** of the therapy. (Corning, Malofeeva, & Buchianeri, 2007). Synchrony plays a key role in the formation of interpersonal bonds. Movement synchrony between client and therapist was predictive of the quality of alliance, as rated by the client at the end of each session. Synchrony also predicted symptom reduction, at the end of psychotherapy, and therapeutic outcome. (Koole, S. L., & Tschacher, W. (2016)). **In this study**, therapeutic collaboration and Physiological synchrony are both assumed as components of therapist and client interaction.

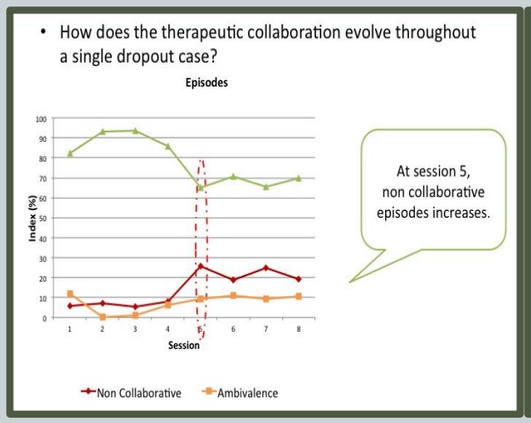
Methodology

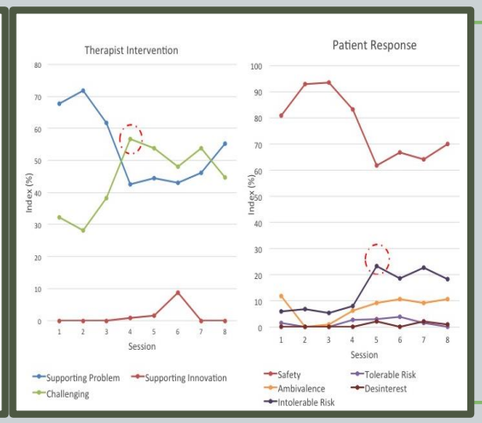




1) 1-1 Psychological process and outcome measures filled by therapist and patient over the therapy process / 1.2 Therapist and patient physiological activity was registered along each session over the therapy process.
2) Therapeutic collaboration coding system was used to analyze the dyad interaction and physiological synchrony between therapist and patient was analyzed over the therapy process

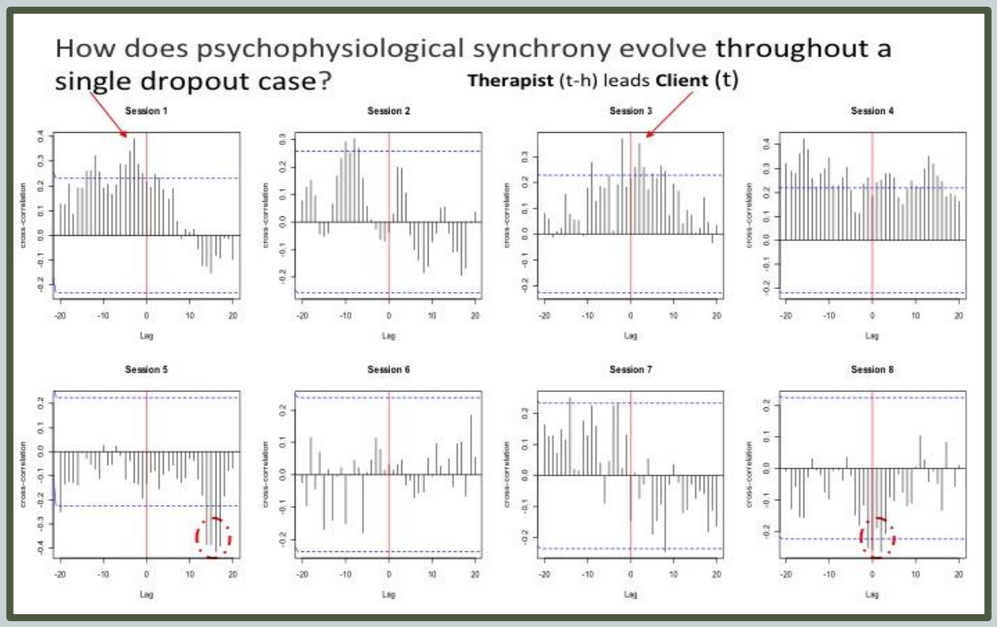
Results





1) Therapeutic collaboration decreasde at session 5

2) Therapists interventions and clients responses
If we look to therapist's intervention, we can see that challenging increase substantially at session 4.
Furthermore, if we look to client's responses, we can see that the intolerable risk index doubled **at session 5** and its frequency remains high also until the end.



Moving to the physiological analyses, to describe the relationship between two time series – client HR and therapist HR- we then plotting a cross-correlation. On y axis we have correlation values, and on x axis we have lags or delay between therapist and client heart rate.
Globally, we can observe positive and significant cross correlations for the first 4 sessions.
But, **at session 5** the cross correlations are negative. We see that an increase in the client's heart rate, later in session, is related to a decrease in the therapist's heart rate, earlier in the session, or vice-versa. The same happens at session 8, immediately before to client dropout.

Discussion

Therapeutic dialogue tends to move to **Challenging- Intolerable Risk**, i.e., there is an escalation in client's discomfort. After session 4, Challenging – Intolerable Risk indexes doubled (were the second more frequent), this means that much of therapeutic work exceed the client's therapeutic zone of proximal development.

At same time, we observed a negative lag correlation between the therapist and client heart rate, at session 5. We speculate that this can represent an overall **physiological discordance or in other words as negative synchrony.**

Miss attunement was observed at conversational and physiological level

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THERAPEUTIC COLLABORATION AND THE DYAD'S PHYSIOLOGICAL SYNCHRONY IN PSYCHOTHERAPY

Ribeiro, E.[1], Sampaio, A.[1], Oliveira-Silva. P.[2], Adam Horvath[3], William B. Stiles[4], Sousa, I.[1], Ferreira, A.[1], Pinto, D.[1], Pires, N.[1], Senra, J.[1] & Mourão, J.[1]

[1]Unidade de Investigação em Psicoterapia e Psicopatologia, CIPsi-Escola de Psicologia da Universidade do Minho; [2]Universidade Católica Portuguesa; [3]Symon Faser University, Canadá; [4]Department of Psychology, Miami University, Ohio, USA, and Appalachian State University, North Carolina, USA

Grant 178/12

Background: Therapeutic alliance the strongest predictor of therapy outcomes and one of the most important therapeutic common factors. While there is a great deal of research available on what the alliance does, much less investigation has been done on how the alliance does what it does. Looking at this question, we will describe in detail the interactive and physiologic processes through which therapeutic collaboration (TC), the core dimension of alliance, is developed. We conceptualize TC has having two main components: 1) supporting and helping the patient to feel safe. This usually involves an expression of understanding the patient's experience within his or her usual perspective; and 2) challenging the maladaptive perspective by using strategies that stimulates change. This therapeutic interaction process implies self and other observations that will be further transformed into inferential processes and allow the empathic comprehension of the self and the other internal experience. These processes are modelled by several brain regions and are translated into psychophysiological signatures. Although there are some theoretical references regarding the neural substrates of therapeutic alliance correlates, empirical studies conducting within psychotherapy process and unravelling its underlying psychophysiological signatures are still rare.

Aims: This project aimed to explore the relationship between interactive and psychophysiological processes underlying the TC. Thus, the heart rate was used for a description of psychophysiological correlates of the therapeutic collaboration.

Method: We focused on the analysis of all sessions of 23 clinical cases treated with Cognitive Behaviour Therapy. The Therapeutic Collaboration Coding System was used to analyse the dyad's therapeutic collaboration within the sessions. The heart rate of both the therapist and the patient was measured using the BIOPAC System MP150.

Results: The results showed that the therapist and patient's psychophysiological synchrony differed according to the sessions and the therapeutic exchange types. Specifically, we found that, when the therapist and the patient were being collaborative the dyad showed physiological synchrony.

Conclusions: Collaboration between the therapeutic dyad appears to be particularly tied to the mutual influence of the cardiac responsivity pattern. The results are discussed in terms of the role of physiological reactivity for the therapeutic collaboration.

Keywords: Therapeutic collaboration, Heart rate, Physiological synchrony

Publications:

Ribeiro, E.*, Cruz, S.*, Sampaio, A., Oliveira-Silva, P. Pinto, D. & Sousa, I (2017, Submitted) Therapeutic collaboration and the dyad's physiological profile in the early phase of psychotherapy. *Psychotherapy*.

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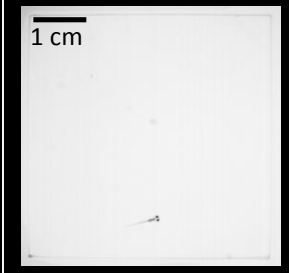
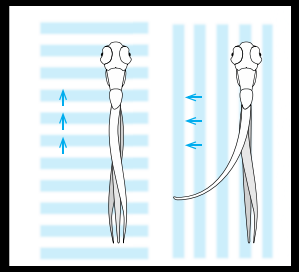
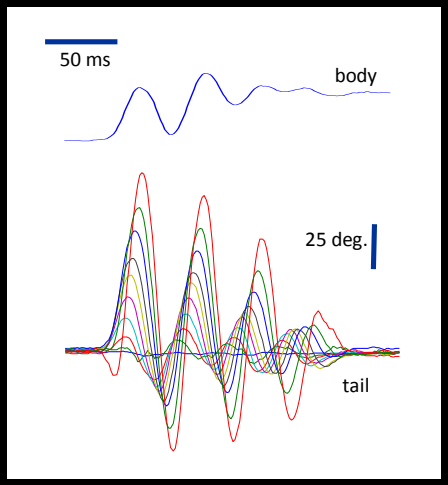
Poster Title: Imaging sensorimotor processing in visual circuits in the zebrafish midbrain (Project 185/12)

Poster authors: Michael B. Orger, João C. Marques, Claudia E. Feierstein, Sabine L. Renninger

Behavior characterization using high-speed video tracking

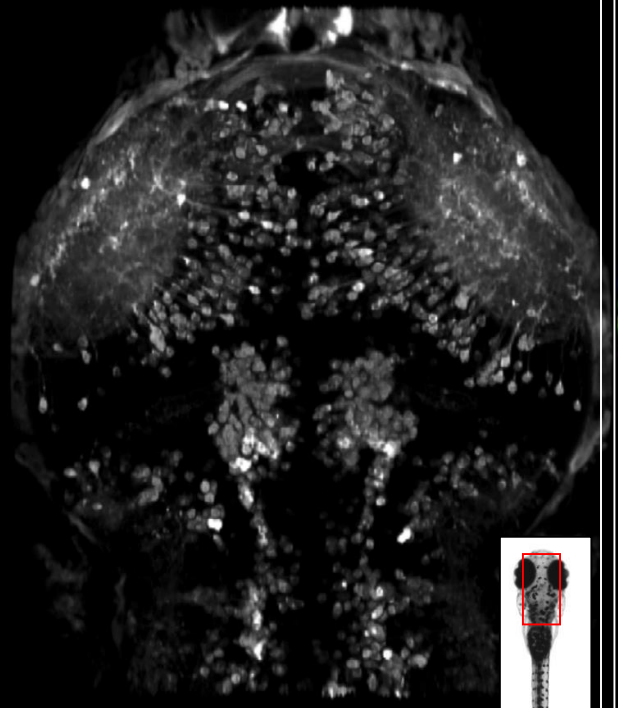


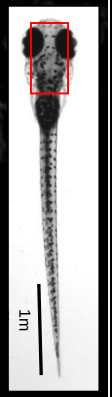




Real-time high speed video tracking was used to record swimming kinematics. Unsupervised clustering identified 13 different movement categories that are driven by distinct features of sensory stimuli.

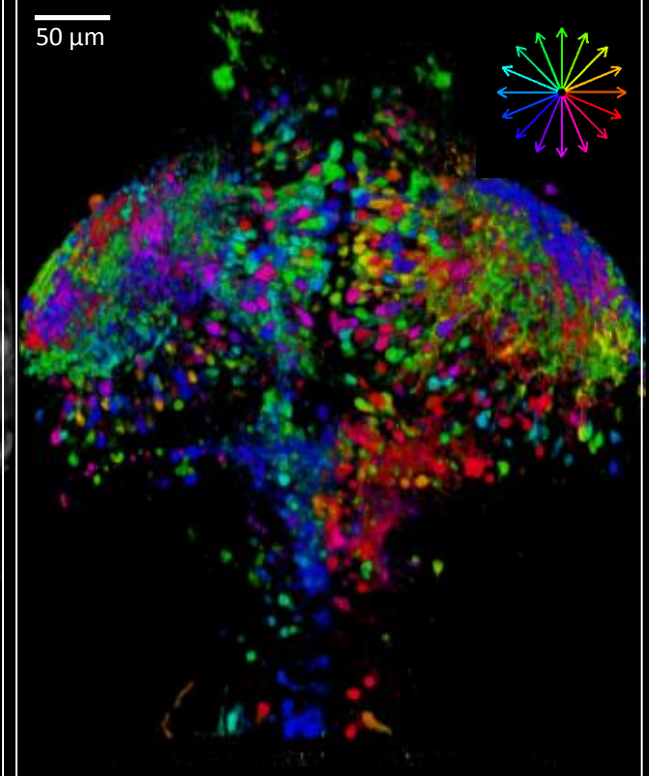
Genetic targeting of neuronal subpopulations





Fish with inhibitory neurons labelled with a genetically encoded calcium indicator by genomic integration of UAS:GCaMP6f and a recombineered BAC Gad1b:Gal4FF.

Whole brain functional maps



Projection of week-old larval zebrafish brain with voxels color-coded by preferred motion direction recording using 2-photon imaging in ChAT GCaMP6f transgenic line.

Research articles: (1) Lu, R., Sun, W., Liang, Y., Kerlin, A., Bierfeld, J., et al. (2017) *Nature Neuroscience*, 20(4), 620–628. (2) Marques, J.C., Lackner, S., Félix, R., Orger, M.B. (2018) *Current Biology. Peer-reviewed review papers: (1)* Orger, M. B., & de Polavieja, G. G. (2017) *Annual Review of Neuroscience*. *(2)* Orger MB (2016) *Current Biology* 26:R377-385. *Preprints of submitted articles:* Marques, J. and Orger MB. (2017) *www.biorxiv.org.*

IMAGING SENSORIMOTOR PROCESSING IN VISUAL CIRCUITS IN THE ZEBRAFISH MIDBRAIN

Michael B. Orger, João C. Marques, Claudia E. Feierstein & Sabine L. Renninger

Champalimaud Centre for the Unknown, Lisbon, Portugal

Grant 185/12

Background: Faced with a continuous barrage of sensory stimuli, animals are able to reliably identify salient information and select appropriate behavioural responses. A central aim of neuroscience is to understand how such processes are implemented in neural circuits in the brain. However, such circuits typically consist of interconnected networks of neurons distributed across many brain areas. The small, transparent brain of zebrafish provides a powerful model system to address these questions, since every neuron is optically accessible using non-invasive methods.

Aims: The goal of this project was to understand how the brain selects the appropriate sensory information to guide behavior, particularly in the presence of multiple conflicting stimuli. Specifically we aimed to understand how the process of stimulus selection is mediated by the midbrain optic tectum, and different nuclei with which it makes reciprocal connections.

Method: Experiments used larval zebrafish aged 6-7 days post-fertilization. Transgenic driver and reporter lines were generating using the Tol2 transposase system. Behavior was tracked using infrared high-speed cameras and visual stimuli were displayed on a diffusing screen using digital projectors. For functional imaging, larvae were immobilized in low-melting temperature agarose gel, and imaged using custom-built two-photon microscope systems. Data were analysed using custom routines in Matlab.

Results: We generated a suite of transgenic lines, including panneural calcium indicator lines, reporter lines for analyzing anatomy, neural recording and optogenetics, and driver lines targeting GABAergic and cholinergic populations. We first identified, in behavioural experiments, what features of moving visual stimuli elicit different motor responses. We then mapped responses to these features throughout the larval midbrain, using 2-photon in vivo calcium imaging. We also made comprehensive maps of stimulus tuning properties in the retinal ganglion cell inputs to the optic tectum. To dissect out the role of specific circuit elements in processing these stimuli, we imaged different transgenic lines and registered each set of data to a reference brain anatomy, allowing the comparison of gene expression patterns and functional data across different individuals. Finally we developed systems to allow reversible manipulation of activity using optogenetics.

Conclusions: The larval zebrafish provides a powerful model to dissect the role of genetically identified neurons in behavioral choices.

Keywords
Vision, Calcium imaging, Zebrafish, Behaviour, Optogenetics.

Publications:

Lu, R., Sun, W., Liang, Y., Kerlin, A., Bierfeld, J., Seelig, J. D., et al. (2017). Video-rate volumetric functional imaging of the brain at synaptic resolution. *Nature Neuroscience, 20*(4), 620–628.

Orger, M. B., & de Polavieja, G. G. (2017). Zebrafish Behavior: Opportunities and Challenges. *Annual Review of Neuroscience*.

Orger MB (2016) The cellular organization of zebrafish visuomotor circuits. *Current. Biology* 26:R377-385.

Manuscripts currently submitted:

Marques, J., Lackner, S., Felix, R. and Orger, MB. Hierarchical structure of the zebrafish locomotor repertoire revealed with unsupervised behavioural clustering. (currently in revision)

Marques, J. and Orger MB. Clustering by search of density valleys. (submitted)

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Effects of Conditional Foxp2 Deletion on Motor-Sequence Learning

Catherine A. French | Champalimaud Foundation | Bial grant 192/12

~~FOXP2~~

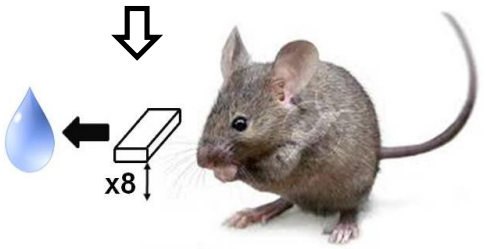
⇩

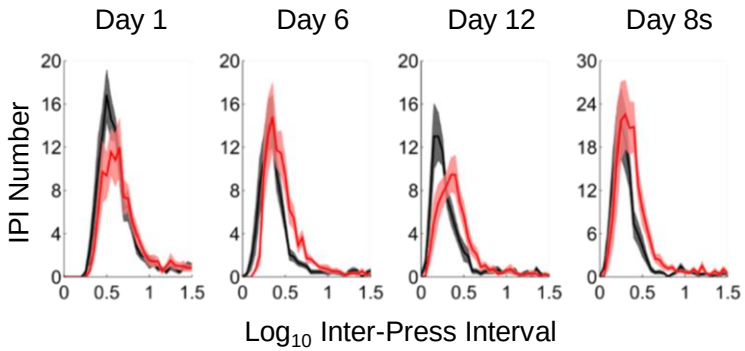
Developmental verbal dyspraxia

1. Selective Foxp2 KO

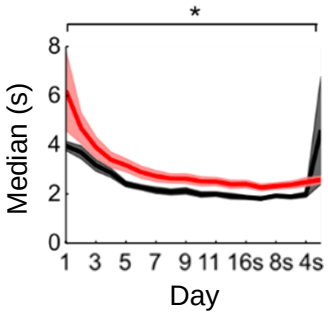
Purkinje cells
Striatum
Cortex

2. Global adult KO

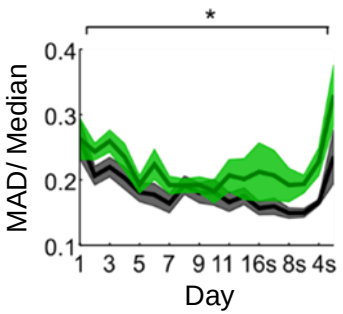




Median IPI



IPI Variability



French C.A. and Fisher S.E. (2014) What can mice tell us about Foxp2 function? *Current Opinion in Neurobiology.*

French C.A. *et al*. Differential Effects of Foxp2 Disruption in Distinct Motor Circuits. *In revision, Molecular Psychiatry*.

FUNDAÇÃO Bial
Institution of public utility

DIFFERENTIAL EFFECTS OF FOXP2 DISRUPTION IN DISTINCT MOTOR CIRCUITS

Catherine A. French[1], María F. Vinueza Veloz[2], Kuikui Zhou[2], Saša Peter[2], Mariana Correia[3], Simon E. Fisher[4,5], Chris I. De Zeeuw[2,6] & Rui M. Costa[1,3]

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Grant 192/12

Background: Disruptions of the *FOXP2* gene cause a rare speech and language disorder, a core feature of which is problems in sequencing orofacial movements. The gene encodes a transcription factor which is expressed in cortico-striatal and cortico-cerebellar circuits required for sensorimotor integration and motor-skill learning, and imaging studies have identified structural abnormalities in these same regions in affected individuals. *FOXP2* is also highly conserved in several other vertebrate species, where expression is seen both during development and in adulthood.

Aims:
i) Investigate motor function in mice with brain-region/ cell-type specific disruptions of Foxp2.
ii) Determine if Foxp2 is required for motor function in adulthood.

Method: The Cre-*loxP* system was used to disrupt Foxp2 selectively in the cortex, striatum or cerebellar Purkinje cells of mice. Global Foxp2 disruption in adulthood was achieved using a tamoxifen-inducible Cre line. These genetic approaches were combined with a behavioural task where mice learned to execute sequences of lever presses. Activity in Purkinje cells was measured using *in vivo* and slice electrophysiology techniques.

Results: Loss of Foxp2 in specific brain regions/ cell types impacted motor-skill learning and performance differently, with Foxp2 disruption in cerebellar Purkinje cells and striatum affecting the speed and variability of lever-press sequences respectively. Mice lacking Foxp2 in Purkinje cells showed a prominent phenotype involving slowed lever pressing as well as deficits in skilled locomotion. *In vivo* recordings from Purkinje cells uncovered an increased simple spike firing rate and decreased modulation of firing during limb movements. This was caused by increased intrinsic excitability rather than changes in excitatory or inhibitory inputs. Disruption of Foxp2 in adulthood resulted in the death of around one third of mice. However, surviving animals were healthy and able to perform lever-press sequences normally despite appearing to be less motivated.

Conclusions:
i) Foxp2 expression in specific brain regions affects different aspects of motor behaviour.

ii) Foxp2 modulates Purkinje cell activity, a function which is important for skilled movements.
iii) Developmental expression of Foxp2 is required motor-skill learning and performance in adulthood.

Keywords: Speech and language, Foxp2, Motor-skill learning

Publications:

French C.A. & Fisher S.E. (2014) What can mice tell us about Foxp2 function? *Current Opinion in Neurobiology* 28:72-79.

French C.A.*, Vinueza Veloz M.F.*, Zhou K.*, Peter S.*, Fisher S.E., Costa R.M. & De Zeeuw C.I. Differential Effects of Foxp2 Disruption in Distinct Motor Circuits. *Under review, Molecular Psychiatry*. *equal contribution

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Daydreams incorporate recent waking life concerns but do not show delayed ('dream-lag') incorporations

Elaine van Rijn, Alexander M. Reid, Christopher L. Edwards, Josie E. Malinowski,
Perrine M. Ruby, Jean-Baptiste Eichenlaub and Mark T. Blagrove
Swansea University Sleep Laboratory

Bial Foundation Grant 83/14

Swansea University
Prifysgol Abertawe

FUNDAÇÃO Bial
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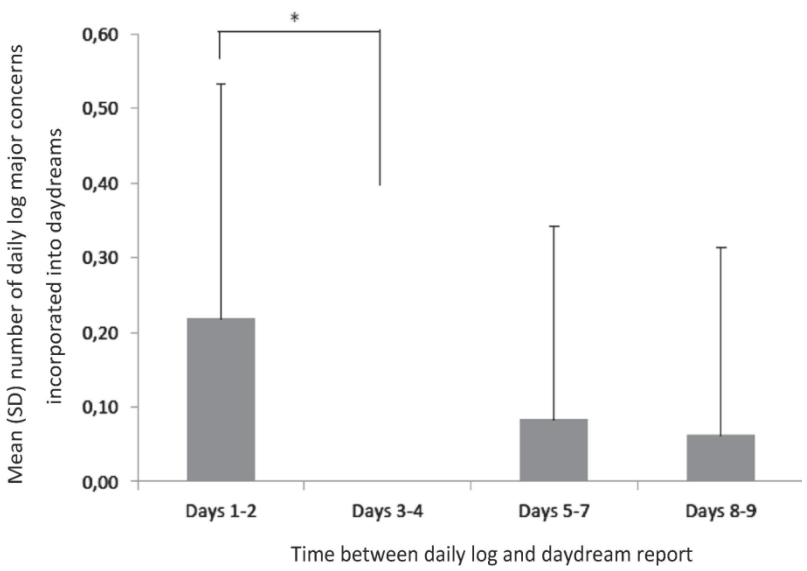
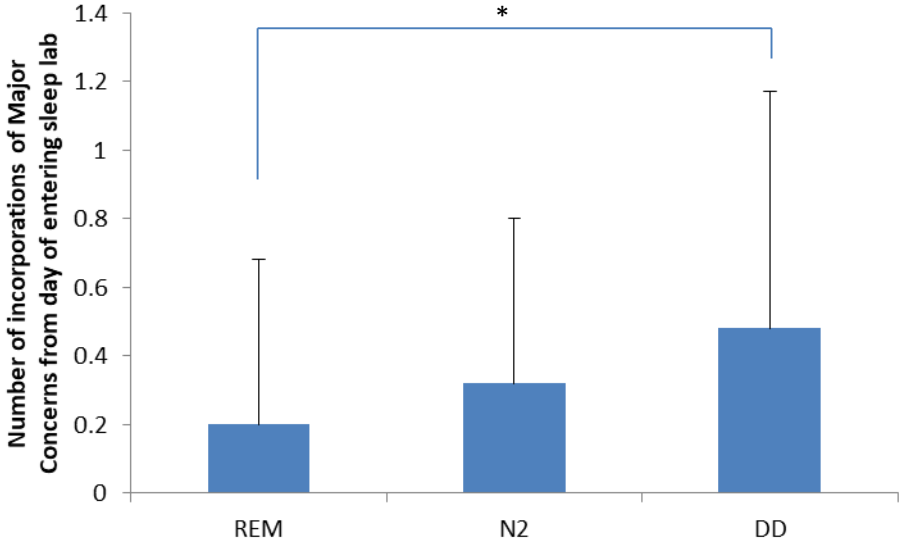
Although current concerns and recent emotional events are known to be incorporated into daydreams, the timescale of their incorporation has not yet been studied.

Thirty-one participants kept a diary for 10 days, reporting major daily activities (MDAs), personally significant events (PSEs) and major concerns (MCs). They were then cued for Daydream, Rapid Eye Movement (REM) and N2 dream reports in the sleep laboratory.

There was a higher incorporation into Daydreams of MCs from the previous two days (day-residue effect), but no day-residue effect for MDAs or PSEs. And Daydreams had significantly higher incorporation of Major Concerns from the day of entering the sleep lab than did REM dreams (both * p<.025).





DAYDREAMS INCORPORATE RECENT WAKING LIFE CONCERNS BUT DO NOT SHOW DELAYED ('DREAM-LAG') INCORPORATIONS

Elaine van Rijn, Alexander M. Reid, Christopher L. Edwards, Josie E. Malinowski, Perrine M. Ruby, Jean-Baptiste Eichenlaub & Mark T. Blagrove

Swansea University

Grant 83/14

Background: Although current concerns and recent emotional events are known to be incorporated into daydreams, the timescale of their incorporation has not yet been studied.

Aims: To investigate the time course of incorporation of waking life experiences into daydreams using methods used to study such incorporations into dreams.

Method: Thirty-one participants kept a diary for 10 days, reporting major daily activities (MDAs), personally significant events (PSEs) and major concerns (MCs). They were then cued for daydream, Rapid Eye Movement (REM) and N2 dream reports in the sleep laboratory.

Results: There was a higher incorporation into daydreams of MCs from the previous two days (day-residue effect), but no day-residue effect for MDAs or PSEs, supporting a function for daydreams of processing current concerns. A day-residue effect for PSEs and the delayed incorporation of PSEs from 5-7 days before the dream (the dream-lag effect) have previously been found for REM dreams. Delayed incorporation was not found in this study for daydreams.

Conclusions: Daydreams differ in function from REM sleep dreams. However, the REM dream-lag effect was not replicated here, possibly due to design differences from previous studies.

Keywords: Daydreaming, Mind-wandering, Dreaming, Day-residue, Memory consolidation

Publications:

Elaine van Rijn, Alexander M. Reid, Christopher L. Edwards, Josie E. Malinowski, Perrine M. Ruby, Jean-Baptiste Eichenlaub and Mark T. Blagrove (2017). Daydreams incorporate recent waking life concerns but do not show delayed ('dream-lag') incorporations. *Consciousness and Cognition* (in press). doi.org/10.1016/j.concog.2017.10.011

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fMRI and EEG Neurofeedback to Improve Behaviour

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[2] Interdisciplinary Institute for Brain and Behavioral Sciences, Chapman University, Orange, USA

Publications — Grant 118/14

Thibault, R.T., MacPherson, A., Lifshitz, M., Roth, R.R., Raz A. Neurofeedback with fMRI: A critical systematic review, NeuroImage (in press).

Thibault, R. T., Lifshitz, M., & Raz, A. (2017b). The Climate of Neurofeedback: Scientific Rigour and the Perils of Ideology. Brain, 1–3.

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Thibault, R. T., & Raz, A. (2016). When can neurofeedback join the clinical armamentarium? The Lancet Psychiatry, 3, 497–498.

Thibault, R. T., & Raz, A. (2016). Neurofeedback: The power of psychosocial therapeutics. The Lancet Psychiatry, 3(11), e18.

Thibault, R. T., Lifshitz, M., & Raz, A. (2016). The Self-Regulating Brain and Neurofeedback: Experimental Science and Clinical Vogue. Cortex, 74, 247–261.

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For Further Information

Please contact *robert.thibault@mail.mcgill.ca* or *amir.raz@mcgill.ca.* More information on this and related projects can be obtained at *www.razlab.org*

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NEUROFEEDBACK TO PROMPT EXPERT BRAIN STATES

Robert Thibault & Amir Raz

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Chapman University, Irvine, USA

Grant 118/14

Background: Since 1958, researchers and practitioners have used neurofeedback to entrain brain activity and improve human functioning in health and disease. This procedure provides individuals with real-time depictions of their ongoing brain activity. With this information, they can learn to modulate specific brain activity in connection with related behavior. In 2003, the field of neurofeedback took a leap forward with the first fMRI-based neurofeedback protocol (fMRI-nf).

Aims: We aimed to explore whether real-time brain imaging can train individuals to actively modify their neural processes and, in turn, achieve specialized states of consciousness. With the variety of available brain imaging techniques, we first identified the most effective means to train neural self-regulation. Because specialized brain states pair with particular postures (e.g., sitting upright in meditation), we also conducted experiments to identify the body-position most advantageous to successful training.

Method: To find the top imaging modality for neurofeedback, we conducted a comprehensive literature search reviewing the most oft-cited and influential papers concerning various feedback methods (Thibault, Lifshitz, & Raz, 2016) We followed this up with a comprehensive literature review on fMRI-nf (Thibault, MacPherson, Lifshitz, Roth, & Raz, *under review*).
To uncover the most ideal posture for neurofeedback, we leveraged multi-postural magnetoencephalography to measure brain activity in three positions (i.e., lying supine, reclined at 45°, and sitting upright) conducting both sensor-level (Thibault, Lifshitz, & Raz, 2015) and source-level analyses (Lifshitz, Thibault, Roth, & Raz, 2017).

Results: Our survey of the literature suggests that training outcomes associated with electroencephalography neurofeedback are likely attributable to expectations and placebo-like effects (Thibault & Raz, 2017). FMRI-nf, alternatively, appears to help guide participants toward neural self-regulation (Thibault et al., *under review*).
Sitting upright, compared to sitting reclined or lying supine, increases left-hemisphere high-frequency neural activity over common speech areas (Thibault et al., 2015) and pairs with a more alert brain state (Lifshitz et al., 2017); thus, rendering upright postures more conducive to brain training.

Conclusions: With appropriate controls, fMRI-nf may help naïve individuals achieve expert brain states.

Keywords: Self-regulation, Neurofeedback, fMRI, Real-time, Neuroimaging

Publications:

Lifshitz, M., Thibault, R. T., Roth, R., & Raz, A. (2017). Source-localization of brain states associated with canonical neuroimaging postures. *Journal of Cognitive Neuroscience*, in press.

Thibault, R. T., Lifshitz, M., & Raz, A. (2015). Body position alters human resting-state: Insights from multi-postural magnetoencephalography. *Brain Imaging and Behavior, 10*(3), 772–780.

Thibault, R. T., Lifshitz, M., & Raz, A. (2016). The Self-Regulating Brain and Neurofeedback: Experimental Science and Clinical Vogue. *Cortex, 74*, 247–261.

Thibault, R. T., MacPherson, A., Lifshitz, M., Roth, R., & Raz, A. (n.d.). Neurofeedback with fMRI: A critical systematic review. *Under Review*.

Thibault, R. T., & Raz, A. (2017). The Psychology of Neurofeedback: Clinical Intervention even if Applied Placebo. *American Psychologist, 72*(7), 679–688.

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University of Sussex
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brighton and sussex medical school

Sussex Partnership NHS
NHS Foundation Trust

128-14 Autonomic nerve recording applied as a novel psychophysiological tool for Consciousness Science

Hugo Critchley University of Sussex, UK

- Interoceptive predictive coding underpins conscious selfhood
- Autonomic efferent activity = interoceptive active inference
- Rubber hand illusion, Libet task, masked emotion
- Autonomic microneurography MSNA N = 3
- Skin Sympathetic Nerve Activity SKNA N = 20
- Findings

  Acquisition of RHI reflected in burst activity of in SKNA

  Individual differences in cardiac interoception

- Outputs: 1) data paper; 2) technical methods paper
  - Still working on MRI implementation

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AUTONOMIC NERVE RECORDINGS APPLIED AS A NOVEL PSYCHOPHYSIOLOGICAL TOOL FOR CONSCIOUSNESS SCIENCE

Hugo Critchley[1], Cass Gould van Praag, Sarah Garfinkel, Yrsa Sverrisdottir
Vanessa Botan & Peter Taggart

[1]University of Sussex, UK

Grant 128/14

Background: Recent theories in consciousness science embrace the notion of *interoceptive predictive coding* wherein the sense and integrity of 'self' depends upon control and representation of the physiological state of the body. In this model, selfhood is coupled to internal agency which arises from active inference, through the activity of efferent autonomic nerves and their predicted impact in visceral afferents. Correspondingly, change in conscious perception of the self is accompanied by autonomic responses and interoceptive signaling influences self-representation.

Aims: To test the hypothesis that peripheral autonomic (sympathetic) nerve traffic fine-grained will encode states of conscious (vs. subconscious perception, volitional action and, illusions of body ownership) consistent with interoceptive predictive coding models of conscious selfhood.

Method: We manipulated and tested conscious perceptual awareness using backward masked presentation of emotional face stimuli, sense of volitional action using Libet experiments, and the sense of body ownership using the Rubber Hand Illusion. Experiments were conducted using multiaxis autonomic recordings, including direct sympathetic nerve recordings (muscle and skin sympathetic nerve activity, recorded from common peroneal nerve) in three individuals and, in 20 individuals, a novel non-invasive measurement of skin sympathetic nerve traffic (chest SKNA, reflecting stellate ganglion activity; [Doychinova et al. Heart Rhythm. 2017]). Multiunit nerve activity was appraised using established and exploratory analytic approaches.

Results: Changes in participant's conscious state were reflected in the activity of peripheral sympathetic nerves. This was particularly observed during indication of the rubber hand illusion. Changes in sympathetic activity broadly reflected the degree to which participants adopted the illusion of body-ownership of an artificial limb. Individual differences in interoceptive ability accounted for within-group variation

Conclusions: Our findings support the hypothesis that self-representation is built in part on principles of interoceptive active inference, through the action of autonomic nerves and the precision of predicted visceral responses signalled via viscerosensory afferents.

Keywords: Active inference, Autonomic, Illusion, Interoception, Selfhood

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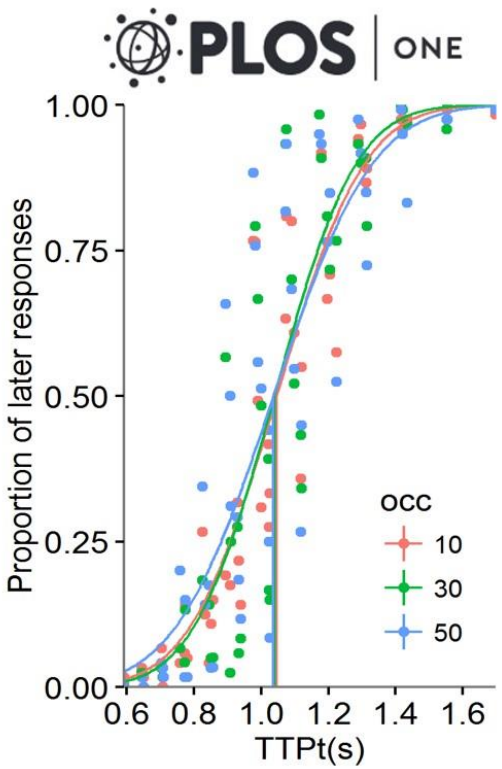
From Audiovisual Perception to Action: the processing of spatiotemporal components

R. Mariana Silva, Carlos César Silva, Rosane Sampaio, Dominic Noy, Sandra Mouta

Grant 143/14

What is the role of the auditory and visual perceptual systems in spatial and temporal tasks?
How can the perceptual system predict timing and position of an event?



FROM AUDIOVISUAL PERCEPTION TO ACTION: THE PROCESSING OF SPATIOTEMPORAL COMPONENTS

R. Mariana Silva [a], Carlos César Silva [b, c], Rosane Sampaio [b], Dominic Noy [a] & Sandra Mouta [d, e]

[a] Departamento de Psicologia Básica, Escola de Psicologia, Universidade do Minho, Braga
[b] Centro de Computação Gráfica, Guimarães
[c] Departamento de Informática, Universidade do Minho, Braga
[d] Ordem de São Francisco do Porto, Porto
[e] CINTESIS - Center for Health Technology and Services

Grant 143/14

Background: Vision is usually referred as a dominant modality in the scientific community, specifically in the context of spatial performance. On the other hand, recent investigation has shown that the auditory modality is a reliable source of information, mainly in temporal tasks. There is a gap in scientific reports that does not allow to understand the degree of expertise and adaptability of the perceptual system to dynamic events.

Aims: The aim of this project was to investigate how auditory and visual information could account for the perception of static and dynamic events. We proposed to study human perception in a continuum of judgement of unimodal events until the execution of motor actions in accordance with the displayed perceptual scenario.

Method: In a localization task, we tested how participants' could discriminate stimuli presented at various spatial positions, the effect of training and the effect of the type of audio device. In a temporal task, we measured the accuracy and precision of participants' estimation of an approaching object in a pass-by trajectory. In this experiment we manipulated the amount of information presented, the type of stimulus and the intensity level in which it was presented. The results from these experiments are compared with reference results from the visual modality. Additionally, a "when and where" cross-modal integration was tested with synchronization of biological motion, through the manipulation of auditory and/or visual cue availability.

Results: Auditory localization tasks have shown that training has a significant effect in the overall localization error, as has the equipment. Temporal tasks have demonstrated that participants can predict the approaching event regardless of the amount of information presented. Accuracy along the task was maintained through the use of different perceptual strategies. Synchronization tasks revealed no improved performance for audiovisual condition, in comparison with audio condition alone.

Conclusions: Within the scope of this project a mapping of the temporal and spatial resolution of the perceptual system was obtained. We studied several dimensions of the human action-perception system: time, space and motor action.However, some

results need to be further explored in order to have a continuum between complexity of information processing and action.

Keywords: psychophysics, human perception, looming events, biological motion

Publications:

Noy, D., Mouta, S., Lamas, J., Sousa, E., Santos, J. A. (submitted). *Side-by-Side Walkers Synchronize Global Body Motion*. PLos ONE

Silva, R.M., Lamas, J., Silva, C.C., Coello, Y., Mouta, S. & Santos, J.A. (2017). *Judging Time-to-Passage of looming sounds: evidence for the use of distance-based information*. PLoS ONE, 12, 1-17.

Silva, C., Mouta, S., Santos J. (2016) *Choosing audio devices on the basis of Listeners Spatial Perception: A case study of Headphones vs In-earphones.* IEEE-ICCE Berlin Proceedings of the International Conference on Consumer Electronics.

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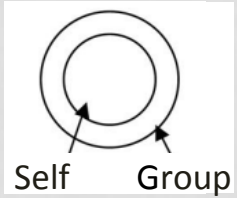
Neuroimaging will to fight and die for sacred values

Clara Pretus, Adolf Tobeña, Oscar Vilarroya, **URNC, BIAL-163/14-Sacred Values**

Background

Sacred Values

Devoted Actor Model



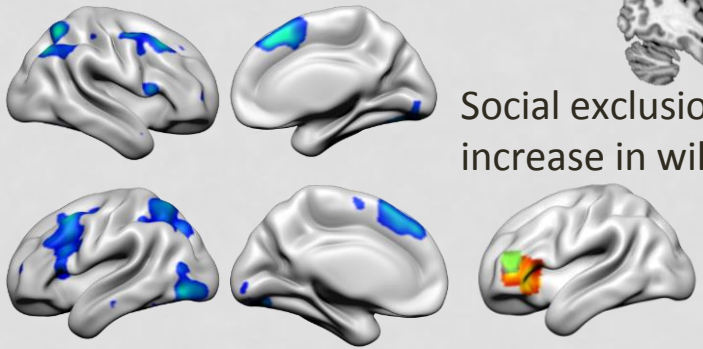
Task

Samples

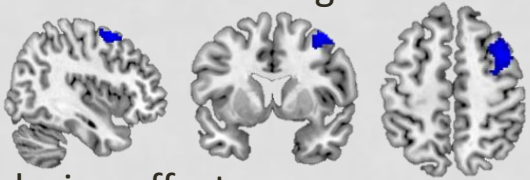
- 29 Pakistani radicalized adult men
- 38 Moroccan vulnerable young men
- 68 Catalan independentist men & women

Results & Conclusions

Hypoactivity of cognitive control areas during sacred value processing



Social conformity effects: decrease in will to fight and die



Social exclusion effects: increase in will to fight and die

Acknowledgements

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WILL TO FIGHT: NEUROIMAGING SUPPORTERS OF AN AL QAEDA AFFILIATE

Clara Pretus[1,2], Nafees Hamid[1], Oscar Vilarroya[1,2],
Richard Davis[1], Scott Atran[1] & Adolf Tobeña[1,2]

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Grant 163/14

Background: Intractable and violent intergroup conflicts are often motivated by commitments to abstract ideals such as god or nation, so-called "sacred" values that are relatively insensitive to material incentives or disincentives. There is scant knowledge of how the brain processes willingness to fight and die (WFD) for such cherished causes.

Aims: Our goal was to assess WFD for sacred compared to non-sacred values using fMRI in a within-subject study including supporters of a radical Islamist group.

Method: We selected 30 radicalized individuals out of 146 interviewed candidates from different neighborhoods in and around Barcelona, Spain. We measured their brain activity as they indicated their WFD for sacred and non-sacred values and observed peers' ratings for the same values.

Results: We observed diminished activity in dorsolateral prefrontal cortex (dlPFC), inferior frontal gyrus and parietal cortex while participants conveyed WFD for sacred relative to non-sacred values, regions that have previously been implicated in calculating costs and consequences. These differences could not be attributed to differences between sacred and non-sacred values in emotional intensity, familiarity or salience. An overlapping region of dlPFC was active when viewing conflicting ratings of sacred values from peers, to the extent participants were sensitive to peer influence, indicating that it is possible to induce flexibility in the way people defend sacred values.

Conclusions: Our results are consistent with a view that "devoted actors" motivated by a commitment to sacred values and abstract group identities rely on distinct decision mechanisms that render them insensitive to material tradeoffs. Such information may help to better policy for the common defense.

Keywords: Sacred values, Devoted actor, fMRI, Radicalization, Will to fight

Publications:

Clara Pretus, Nafees Hamid, Oscar Vilarroya, Jeremy Ginges, Hammad Sheikh, Molly J. Crockett, Adolf Tobeña, Susanna Carmona, Angel Gómez, Richard Davis and Scott Atran. Will to fight: Neuroimaging supporters of an Al Qaeda affiliate (*under review at PNAS*)

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This research was supported by a grant from the Bial Foundation

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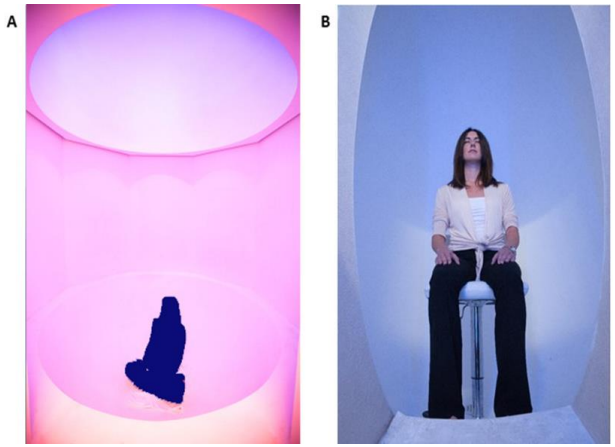
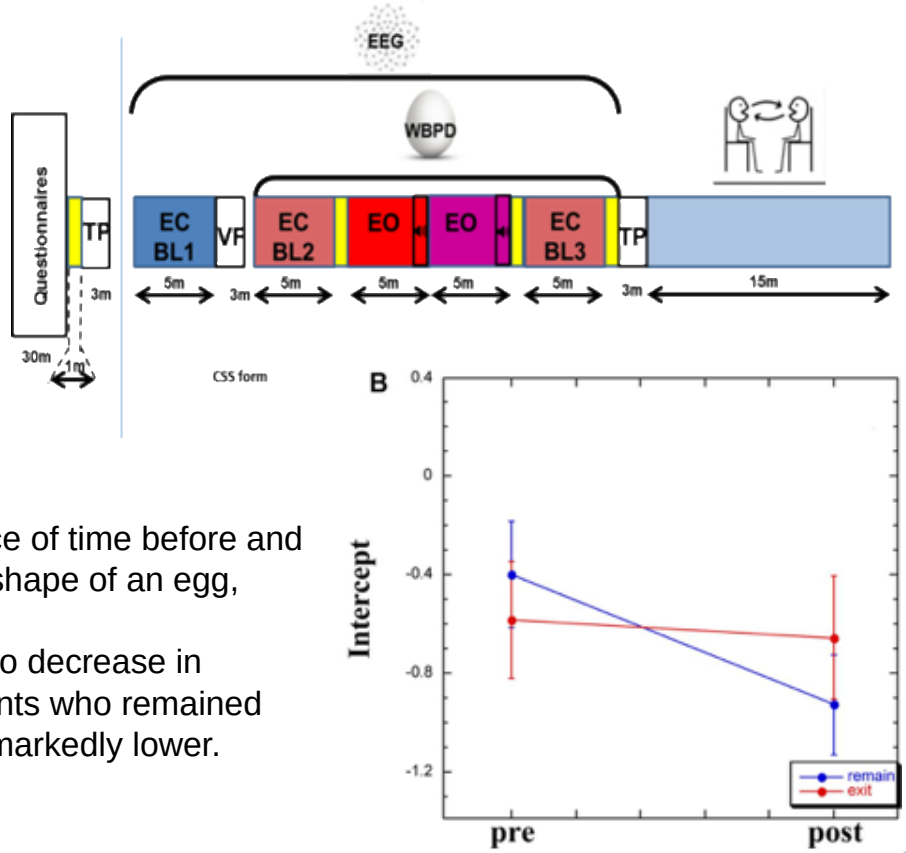
Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, Faculty of Education, University of Haifa, Israel

Research Institute for Neuroscience, Education and Didactics, Fondazione Patrizio Paoletti, Italy

What happens to time perception inside an altered sensory environment?





We examined time perception and the experience of time before and following the OVO. The OVO chamber is in the shape of an egg, created by Patrizio Paoletti.
For those participants exiting the OVO there is no decrease in intercept due to WBPD, while for those participants who remained within the chamber, their post-OVO intercept is markedly lower.

Glicksohn, J., Berkovich-Ohana, A., Mauro, F., & Ben-Soussan, T. D. (2017). Time Perception and the Experience of Time When Immersed in an Altered Sensory Environment. *Frontiers in human neuroscience*, *11*, 487.

PUSHING CONSCIOUSNESS AND SELFHOOD TOWARDS THEIR BOUNDARIES: AN EEG NEUROPHENOMENOLOGICAL STUDY

Joseph Glicksohn[1,2], Aviva Berkovich-Ohana[3] & Tal Dotan Ben-Soussan[4]

[1]The Leslie and Susan Gonda (Goldschmied), Multidisciplinary Brain Research Center; [2]Department of Criminology, Bar-Ilan University, Israel; [3]The Edmond J. Safra Brain Research Center for the Study of Learning, Disabilities, Faculty of Education, University of Haifa, Israel; [4]Research Institute for Neuroscience, Education and Didactics, Patrizio Paoletti Foundation, Assisi, Italy

Grant 228/14

Background: The *Ganzfeld* is a method of perceptual deprivation, involving reduced patterning of stimulation, in which participants may experience altered states of consciousness (SOC). We look at both phenomenology and electrophysiology (EEG) of participants immersed in Whole-Body Perceptual Deprivation (WBPD).

Aims: To investigate a WBPD-induced shift in SOC and sense of self as well as synesthesia.

Method: The WBPD chamber was first flooded with white light, followed by red light and indigo light, enabling an immersive WBPD. The complete sample of the study comprised 32 experienced practitioners of breathing meditation (182 - 7280 hours). EEG and Time Production (TP) were examined. At the end of the session, an extensive interview was conducted.

Results: Our participants reported experiences of an unusual character, including changes in the experience of time. In addition, they reported changes in bodily sensations, coupled with a feeling of immersion. We found wide individual differences in EEG alpha profile, and in TP. For those participants reporting a marked change in time experience, such as “the sensation of time disappeared”, their TP data could not be linearized using a log-log plot, hence indicating that for these individuals there might be a ‘break’ in the psychophysical function.

Conclusions: In spite of the existence of these individual differences, we can make the following tentative claims. First, when “time disappeared”, TP becomes haphazard. Second, when “time was slower” or “time was expanded”, TP is lengthened. In addition, our EEG data indicate that male and female participants should not be pooled, because their alpha asymmetry profiles are diametrically opposed.

Keywords: Alpha, EEG, *Ganzfeld*, Time perception, Self

Publications:

Glicksohn, J., Berkovich-Ohana, A., Mauro, F., & Ben-Soussan, T. D. (2017). Time perception and the experience of time when immersed in an altered sensory environment. *Frontiers in Human Neuroscience*, *11*, article 487.

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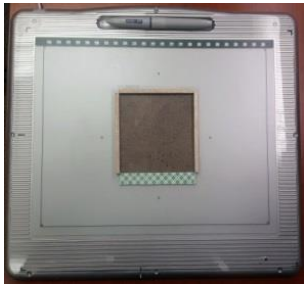
Training Anomalous Cognition in a Motor Task with Subliminal Auditory Feedback

John Palmer
Rhine Research Center, Durham, NC, USA

Gratitude to Bial Foundation (Grant 233/14)

FUNDAÇÃO Bial
Institution of public utility



- P points to which of 16 virtual squares (divided into 4 quadrants) under the grid he/she senses was randomly selected as the target. 60 trials per run/session.
- Task performed with eyes closed preceded by relaxation exerise and suggestions for success.

MAIN SELECTION CRITERIA (previous study)

- Trait dissociation: Watson Dissociative Processes Scale (Detachment subscale).
- State dissociation: "… did you feel your hand was being moved by an outside force".

FEEDBACK: After each trial, 1.5 sec subliminal (25 db) auditory stimulus masked by 40 db brown noise. Quadrant hit: "good". Square hit: "good good". 15-20 sessions per participant.

RESULTS

- Significant variability among the 5 difference scores
- No evidence of learning.

COMPOSITE Z-SCORES FOR SQUARE AND QUADRANT HITS AND CORRELATIONS WITH RUN NUMBER

	Baseline (n=120)		Test (n=120)		Difference		Training	
	z	*p*	*z*	*p*	*z*	*p*	*M(SD)*	*r*
P1	+0.40	ns	- 2.58	.045	-2.98	.082	+0.13 (1.23)	-.02
P2	- 1.63	ns	+1.35	ns	+2.98	.082	-0.10 (1.15)	-.34
P3	+0.25	ns	+0.82	ns	+0.57	ns	+0.23 (1.14)	+.20
P4	+2.49	.041	+1.08	ns	-1.41	ns	+0.06 (0.68)	-.34
P5	-2-19	.069	+2.30	.055	+4.49	.011	-0.15 (1.51)	+.12

Journal of Parapsychology (in press)

TRAINING ANOMALOUS COGNITION IN A MOTOR TASK WITH SUBLIMINAL AUDITORY FEEDBACK

John Palmer

Rhine Research Center, Durham, NC, USA

Grant 233/14

Background and aims: The purpose of the study was to train anomalous cognition (AC) in a motor- automatism task with subliminal auditory feedback in 5 participants (Ps) selected on evidence of high state dissociation (reports of hand being moved by an outside force during the AC task) and trait dissociation (high scores on the Detachment subscale of the Dissociative Processes Scale) in a previous motor automatism experiment. The formal hypothesis was significantly higher AC scoring after training than before training by the 5 Ps both individually and collectively.

Method: The motor task is administered on a computer writing tablet on top of which is affixed a 4 inch grid conceptually divided into 16 1-in. squares which are conceptually divided into 4 quadrants of 4 squares each. One of the squares is randomly assigned as the target for each of the 60 trials in a run. Participants (Ps) are instructed to explore the grid by moving the computer pen over its surface until their intuition tells them to stop. After they stop for 1 second their response is registered as the corresponding square. If they stop on the target square they get a "square hit" (P = 1/16). If they stop on any square in the correct quadrant they get a "quadrant hit" (P = 1/4). The two hit totals are converted to z-scores, the average of which represents "location zs", the dependent variable. Ps attended 2 1-run "baseline" sessions at the beginning of their participation and 2 1-run "test" sessions at the end. In between, they were to complete 15-20 1-run training sessions. The procedure for these runs differs only in that after each trial P hears 1.5 seconds of brownian (similar to pink) noise. If the trial is a quadrant hit, the noise has superimposed on it the spoken word "good". If the trial is a square hit, the words "good good" are superimposed. A threshold test prior to training assured that the words were subliminal.

Results: 1 of the 5 Ps (P5) confirmed the hypothesis. There was significant or suggestive evidence of AC in the baseline and/or test results of 4 of the 5 Ps and the five difference scores showed significant between-subjects variability.

Conclusions: There was no evidence of learning in the training sessions, and the success of P5 cannot be attributed to learning. According to the underlying theory, the conditions for learning were not met because Ps were overly attentive to the feedback, often interpreting shown-to-be imagined variations in the sound as indications of hitting.

Keywords: Anomalous cognition, Motor automatism, Dissociation, Auditory feedback, Subliminal

Publications:

Palmer, J. (2017). Training anomalous cognition in a motor task with subliminal auditory feedback. *Abstracts of presented papers. 60th Annual Convention of the Parapsychological Association,* pp. 24-25.

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Cognition and Brain Plasticity Unit

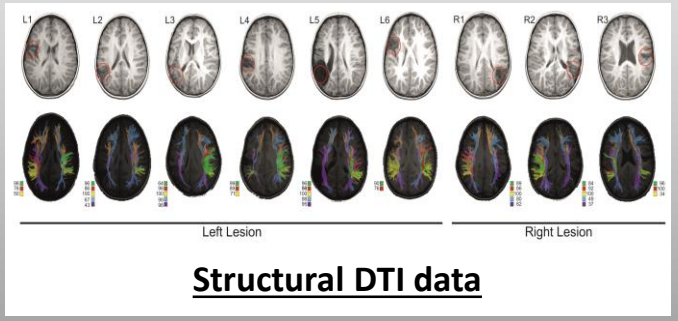
STRUCTURAL AND FUNCTIONAL REORGANIZATION OF LANGUAGE FUNCTIONS IN YOUNG CHILDREN WITH PERINATAL ISCHEMIC STROKE

Grant #244/14

Antoni Rodriguez-Fornells, Clément François, Pablo Ripollés, Laura Ferreri, Laura Bosch, Alfredo Garcia-Alix, Jordi Muchart, Joanna Sierpowska, Carme Fons, Jorgina Solé, Monica Rebollo, Robert Zatorre

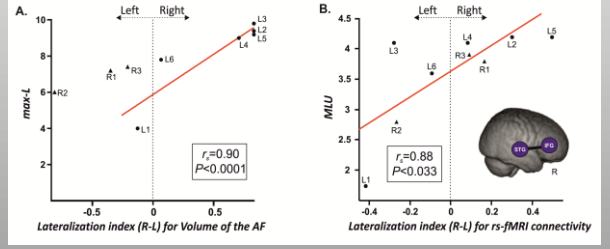
Perinatal stroke is an increasingly recognized form of neurological injury affecting newborns (incidence of 1 in 2300 to 5000 live births for ischemic injury) with approx.. 25 % of patients showing language delays.

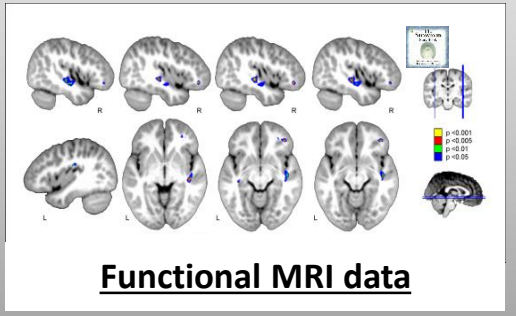
- **No previous neuroimaging study in patients below 5 years of age**
- **No studies combining structural and functional connectivity MRI measures with fine-grained language processing tasks**
- **New-Word learning was evaluated using an adapted fast-mapping task**



Structural DTI data

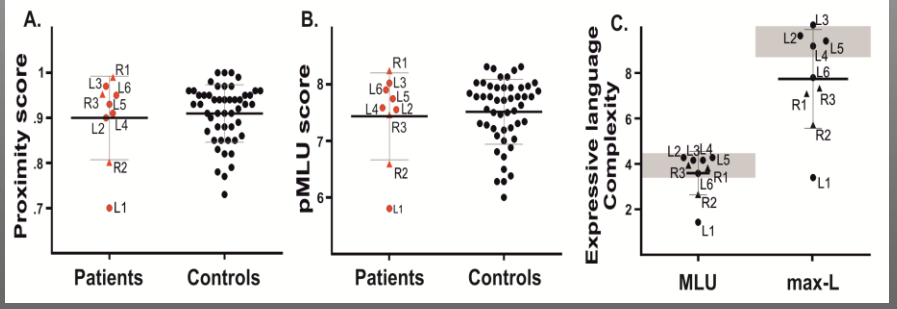
Brain-Behavior correlations



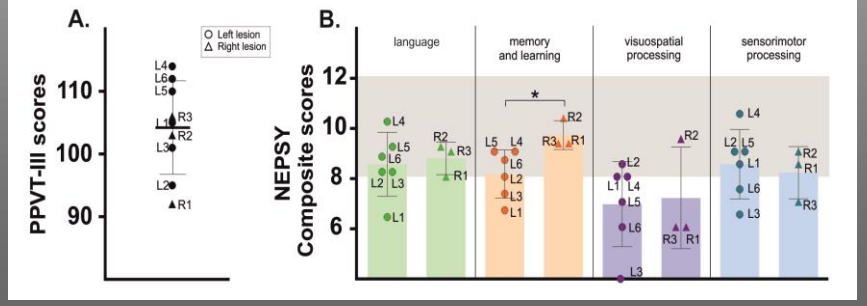


Functional MRI data

Measures of speech production



Neuropsychological data



FUNDAÇÃO Bial

François et al., *Cortex*, 2016)
François et al., Under Review)

STRUCTURAL AND FUNCTIONAL REORGANIZATION OF LANGUAGE FUNCTIONS IN YOUNG CHILDREN WITH PERINATAL ISCHEMIC STROKE

Clément François, Pablo Ripollés, Laura Ferreri, Laura Bosch, Alfredo Garcia-Alix, Jordi Muchart, Joanna Sierpowska, Carme Fons, Jorgina Solé, Monica Rebollo & Antoni Rodriguez-Fornells

University of Barcelona

Grant 244/14

Background: Despite a rather large body of literature on typically developing children, little is known on the effect of early brain lesion on the stepwise acquisition of linguistic functions in young children. Patients who have suffered from early left hemisphere injury during the perinatal period are of great interest, as they present individual differences in their degree of language recovery. Only few fMRI data collected in children with perinatal left-hemisphere brain lesions have brought evidence that the undamaged right-hemisphere is able to take over language functions as revealed by near to normal linguistic processing, thus supporting a model of recovery based on inter-hemispheric transfer of function. More recent studies have detected subtle language processing deficits on these children. As a consequence, it is still an open question to which extent the nature and extent of language reorganization and plasticity after an early brain insult is enough for normal language development.

Aims: The aims of the project were (i) to better understand how functional and structural white-matter connectivity during brain maturation is reorganized after perinatal ischemic stroke and (ii) to evaluate to which extent language functions in these children are associated with functional and structural brain changes occuring due to the large plasticity of the underlying neural networks.

Method: Nine patients with pre- or perinatal stroke (3 with lesion over the right hemisphere and 6 with lesions over the left hemisphere) took part in the present study. Neurocognitive development was assessed at 42 months of age. Language outcomes were extensively evaluated with measures on receptive vocabulary, phonological whole-word production and linguistic complexity in spontaneous speech. Word learning abilities were also assessed using a fast-mapping task designed to assess immediate and delayed recall of the mapped words.
We also acquired functional and structural imaging data as well as a measure of intrinsic connectivity.

Results:
1) We found converging functional and structural evidence for a right reorganization of the language network in the sub-group of children with a left perinatal stroke. Specifically, BOLD activations during the passive listening task were found to be clearly right lateralized with significant clusters over the right Inferior frontal and right middle temporal gyri.
2) We found converging evidence from both DTI tractography and rs-fMRI data that a greater structural-functional reorganization to the right hemisphere was related to better outcomes in several productive language related tasks.

Conclusions: To our knowledge, no previous studies have provided a 3D reconstruction of the dorsal and ventral language white-matter pathways in a homogeneous group of young 4-year old children with perinatal ischemic stroke.
Our results suggest that the amount of right lateralized reorganization induced by early left lesion is may predict productive and receptive aspects of language at this age.

Keywords: Perinatal stroke, Brain plasticity, Language development, NeuroImaging data, functional and structural connectivity

Publications:

François, C., Ripolles, P., Bosch, L., Garcia-Alix, A., Muchart, J., Sierpowska, J., Fons, C., Solé, J., Rebollo, M., Gaitán, H., Rodriguez-Fornells, A. (2016). Language learning and brain reorganization in a 3.5-year-old child with left perinatal stroke revealed using structural and functional connectivity. *Cortex, 77*: 95-118.

François, C., Ripolles, P., Ferreri, L., Bosch, L., Garcia-Alix, A., Muchart, J., Sierpowska, J., Fons, C., Solé, J., Rebollo, M., Rodriguez-Fornells, A. (in preparation). Structural and functional reorganization of language functions in young children with perinatal ischemic stroke.

E-mail contact: arfornells@gmail.com

Anomalous/Paranormal Experiences Reported by Nurses Themselves and in Relation With Theirs Patients in Hospitals: Examining Psychological, Personality and Phenomenological Variables

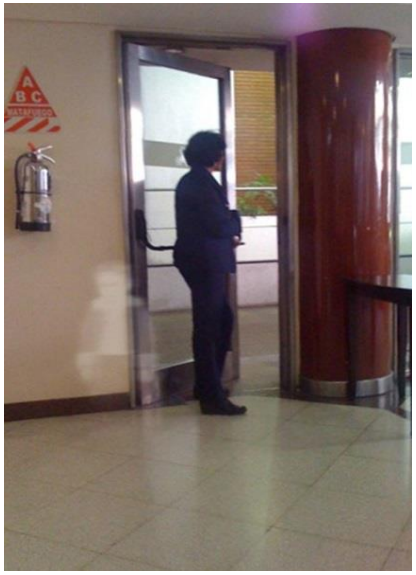
Grant # 246/14

Institution: Instituto de Psicología Paranormal, Buenos Aires, Argentina (Email: rapp@fibertel.com.ar)

Authors: Dr. Alejandro Parra & Irma Caputo, MD.

ABSTRACT. The aim of this study was to determine the degree of occurrence of certain unusual perceptual experiences in hospital settings, so called Anomalous/Paranormal Experiences, often related by nurses and carers. Three hundred forty four nurses were recruited from 36 hospitals and health centers in Buenos Aires, who were grouped 235 experiencers and 109 nonexperiencers. The most common experiences are sense of presence and/or apparitions, hearing noises, voices or dialogues, crying or complaining, intuitions and ESP experiences and as listerners of experiences of their patients, such as near death experiences, religious interventions, and many anomalous experiences in relation with children.

The rationale of the present study is confirm the early findings for work stress and absorption with a bigger sample of nurses and additionally, schizotypy proneness and empathy skills. Nurses who report APEs tended to score higher on work stress, was not confirmed, however Depersonalization scored higher than nonexperiencers. Nurses reporting these experiences tended to report greater Absorption and greater proneness to schizotypy, mainly "positive" schizotypy (Unusual experiences) and tended to report higher scores of empathy skill, mainly two factors: Cognitive empathy and Emotional comprehension, which also tended to score higher than non experiencers.



FUNDAÇÃO Bial

Institution of public utility

TABLE 1: PERCENTAGE OF NURSES WHO REPORT ANOMALOUS EXPERIENCES

Item	Type	Question	N	%
#1	1	Near-death experiences	88	25.6
#2	1	Out of the body experiences	33	9.6
#3	2	Sense of "presence", an apparition, floating lights or luminescence, or movements of objects	99	28.8
#4	2	Hearing strange noises, voices or dialogues, crying or moaning, finding no source for them.	93	27.0
#5	2	Seeing energy fields, lights or "shock" around –or coming from– a hospitalized patient	20	5.8
#6	1	Extrasensory experiences	27	7.8
#7	2	Knowing about the situation of a patient I had seen in in my clinic while being at home.	47	13.7
#8	1	Seeing medical equipment failing consistently with certain patients while not with others	28	8.1
#9	2	Religious intervention (e.g., prayer groups, laying on of hands, rites, or other objects).	69	20.1
#10	2	Knowing intuitively what is wrong with a patient just by seeing him/her.	71	20.6
#11	2	Mystical experience or special "connection" in the context of my clinic	27	7.8
#12	2	Peers who have witnessed experiences like the ones above.	104	30.2
#13	2	Anomalous events in relation with children	42	12.2

ANOMALOUS/PARANORMAL EXPERIENCES REPORTED BY NURSES THEMSELVES AND IN RELATION WITH THEIRS PATIENTS IN HOSPITALS: EXAMINING PSYCHOLOGICAL, PERSONALITY AND PHENOMENOLOGICAL VARIABLES

Alejandro Parra & Irma Caputo[1]

[1]Instituto de Psicología Paranormal

Grant 246/14

Background: There is a number of anomalous/paranormal experiences (APE) reported by nurses and carers consisting of apparitions, "coincidences," death-bed visions, and other anomalous phenomena, sometimes in relation to patients, and other by nurses, carers and doctors themselves in hospital settings

Aims: To determine the degree of occurrence of certain unusual perceptual experiences in hospital settings. We hypothesized that: (H1) nurses who report APEs will tend to score higher on work stress; (H2) higher on schizotypy proneness, (H3) higher on absorption, and (H4) higher on empathy than those who do not report such experiences.

Method: Three hundred forty-four nurses were recruited from 36 hospitals and health centers in Buenos Aires, Argentina, who were grouped 235 experiencers and 109 nonexperiencers. A self-report which has 13 yes/no items was designed. Four additional scales to measure absorption, empathy, and schizotypy proneness.

Results: The most common experiences are sense of presence and/or apparitions, hearing noises, voices or dialogues, crying or complaining, intuitions and ESP experiences and as listeners of experiences of their patients, such as near-death experiences, religious interventions, and many anomalous experiences in relation with children. Nurses reporting APEs tended higher on absorption, proneness to schizotypy, and cognitive empathy and Emotional comprehension, which also tended to score higher than non experiencers.

Conclusions: Capacity for absorption appears to be only one of a constellation of related factors. It may be that cognitive style is more important than capacity or skill, as in the case of absorption, which refers to the extent to which a person can be so engrossed in a mental experience at a given moment that reality monitoring is temporarily inhibited. However, neither of these variables (absorption or hallucination proneness) was found to be related to work stress, although it could be argued that the psychological pressure of the working conditions of nurses triggers such anomalous perceptual experiences. Nor were there indicators of psychosis proneness found, even in the experiencers with hallucinatory experiences.

Keywords: Nursing, Absorption, Anomalous experiences, Cognitive style, Schizotypy

Publications:

Parra, A. (2015). Visiones en el lecho de muerte: Enfermeras, testigos de excepción. *Más Allá, 26*(318), 22-31.

Parra, A. & Giménez Amarilla, P, (2017). Anomalous/paranormal experiences reported by nurses in relation to their patients in hospitals. *Journal of Scientific Exploration, 31*(1), 11–29.
Parra, A. (2017). Factores de personalidad, perceptuales y cognitivas asociadas con las experiencias anómalo/paranormales en personal de enfermería. *Cuidarte*, *8*(3), 78-87
Parra, A. & Giménez Amarilla, P. (2016). Relación entre estrés laboral, alucinación y experiencias anómalas entre profesionales de enfermería. *Ciencia & Cuidado, 13*(2), 22-40.

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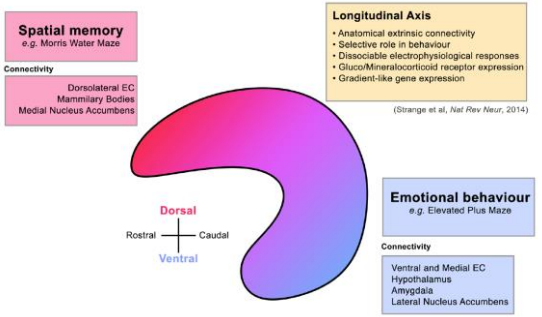
The impact of lipid signaling modulation in cognition

Luísa Santa Marinha, Isabel Castanho, Rita Silva, André Miguel Miranda, Francisca Vaz Bravo, Robin Barry Chan, Gilbert Di Paolo, Vítor Pinto, Tiago Gil Oliveira

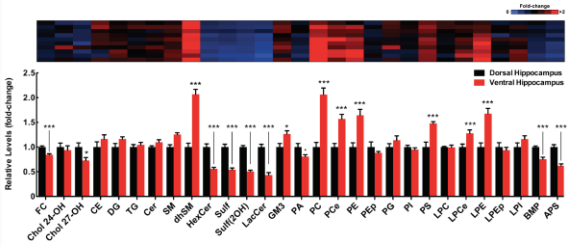
Life and Health Sciences Research Institute (ICVS), ICVS/3B's, School of Medicine, University of Minho // **BIAL Foundation 253/14**

INTRODUCTION

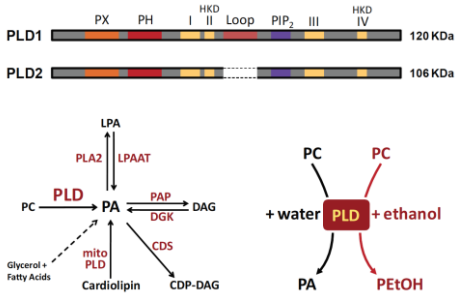
1. Hippocampus longitudinal axis



2. PC/PA gradient in the hippocampus



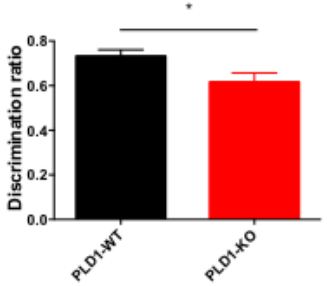
3. PLD structure and function



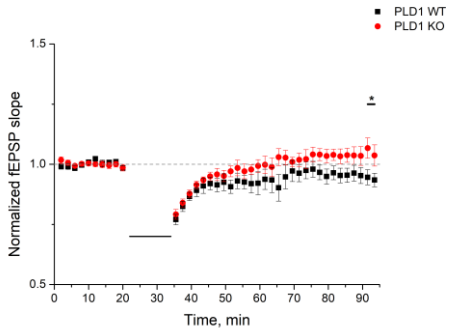
RESULTS

Behaviour, Neuron structure, Electrophysiology, Biochemistry

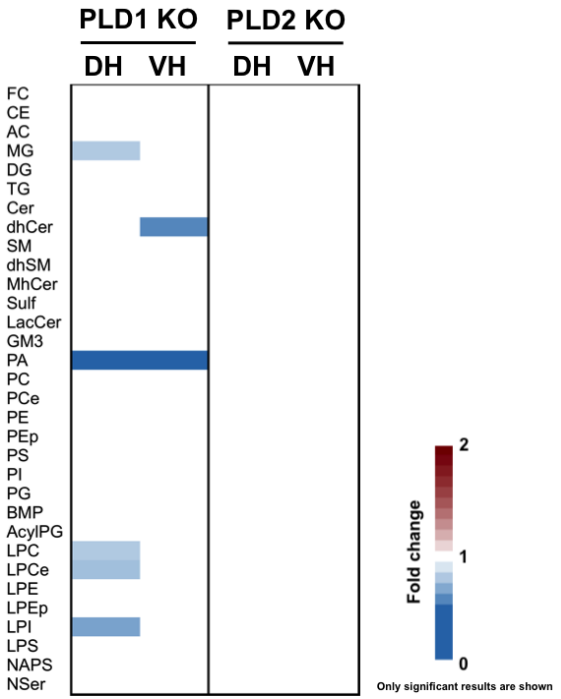
Novel Object Recognition



Long-term depression (Dorsal Hip)



Lipidomic analysis



CONCLUSION

Modulation of a key lipid signaling pathway affects specific hippocampal dependent functions.

PHOSPHOLIPASE D1 AND D2 DIFFERENTIALLY IMPACT HIPPOCAMPAL FUNCTIONING

Luísa Santa Marinha[1,2*], Isabel Castanho[1,2*], Rita Ribeiro Silva[1,2], André Miguel Miranda[1,2], Francisca Vaz Bravo[1,2], Robin Barry Chan[3], Gilbert Di Paolo[3,4], Vítor Pinto[1,2] & Tiago Gil Oliveira[1]

[1]Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Braga, Portugal; [2]ICVS/3B's—PT Government Associate Laboratory, Braga/Guimarães, Portugal; [3]Department of Pathology and Cell Biology, Taub Institute for Research on Alzheimer's Disease and the Aging Brain, Columbia University Medical Center, New York, New York 10032, USA; [4]Present address: Denali Therapeutics Inc., South San Francisco, CA 94080, USA

*These authors contributed equally to the work.

Grant 253/14

Background: Over the past years increasing amount of attention has been given to signaling lipids as well as to its modulating enzymes, such as phospholipases. Specifically, phospholipase D (PLD), that converts phosphatidylcholine to phosphatidic acid, has been shown to exhibit a role in neurological development and physiology. Several studies have been associating PLD1 and PLD2, the two main mammalian PLD isozymes, to neurological processes, including neurotransmitter release, dendritic branching, cognition, and brain development. Also, the hippocampus has been suggested as one of the brain regions showing the highest PLD activity and neurodegenerative conditions such as Alzheimer's disease associated pathways have been shown to be modulated by PLD signaling.

Aims: Thus, the aim of this project is to better understand the potential role of PLD in hippocampal function in adult mice upon *Pld1* or *Pld2* genetic ablation.

Method: We performed (1) a biochemical validation of PLD1 and PLD2 mutant mice by western blot and mass spectrometry; (2) a hippocampal related behavioral characterization of these animals by Open Field, Elevated Plus Maze, Morris Water Maze and Novel Object Recognition; (3) a structural analysis regarding dendritic morphology using dorsal and ventral hippocampal slices with Golgi staining; (4) electrophysiologic synaptic plasticity paradigms of dorsal and ventral hippocampal slices, namely long-term potentiation (LTP) and depression (LTD) protocols; and (5) a full lipidomic mass spectrometry analysis of dorsal and ventral hippocampal samples.

Results: Our results show that PLD1 is the major contributor for total PLD activity. The behavior analysis showed that while PLD1 KO mice have minor deficits in novel object recognition, PLD1 and PLD2 KO mice have no other major deficits in behaviors relying in the hippocampus. Interestingly, in the dendritic structure analysis PLD1 KO presented increased spine density in the ventral hippocampal CA1 region and PLD2 KO presented increased dendritic length in the dorsal hippocampal CA1 region. Remarkably, while PLD1 KO animals had decreased LTP both in the dorsal and ventral hippocampus, PLD2 KO had only decreased LTP only in the ventral part. Finally, the lipidomic analysis showed that PLD1 KO presented a major decrease in multiple PA

species both in the dorsal and ventral hippocampus and PLD2 KO animals presented only minor alterations in PA species in the ventral hippocampus.

Conclusions: Overall, our results show that even though PLD1 and PLD2 perform the same enzymatic reaction, they contribute in a differential manner to the function of the hippocampus. Since the PLD pathway has been implicated in disease processes that affect the hippocampus, these findings highlight not only its fundamental of role in learning and memory but also as potential therapeutical targets.

Keywords: Lipids, Cognition, Phospholipase D, Hippocampus, Memory

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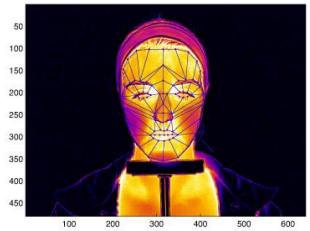
Facial and bodily temperature maps of emotions

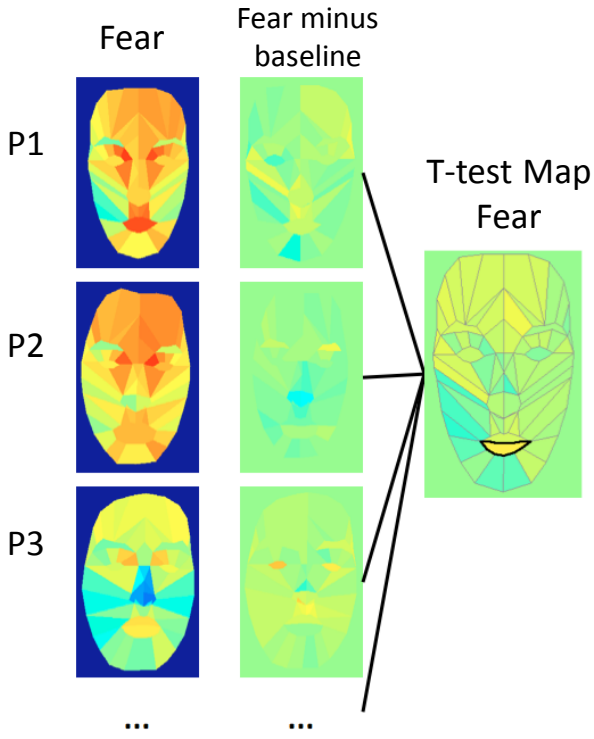
Lúcia Garrido and Nicholas Pound, Brunel University London

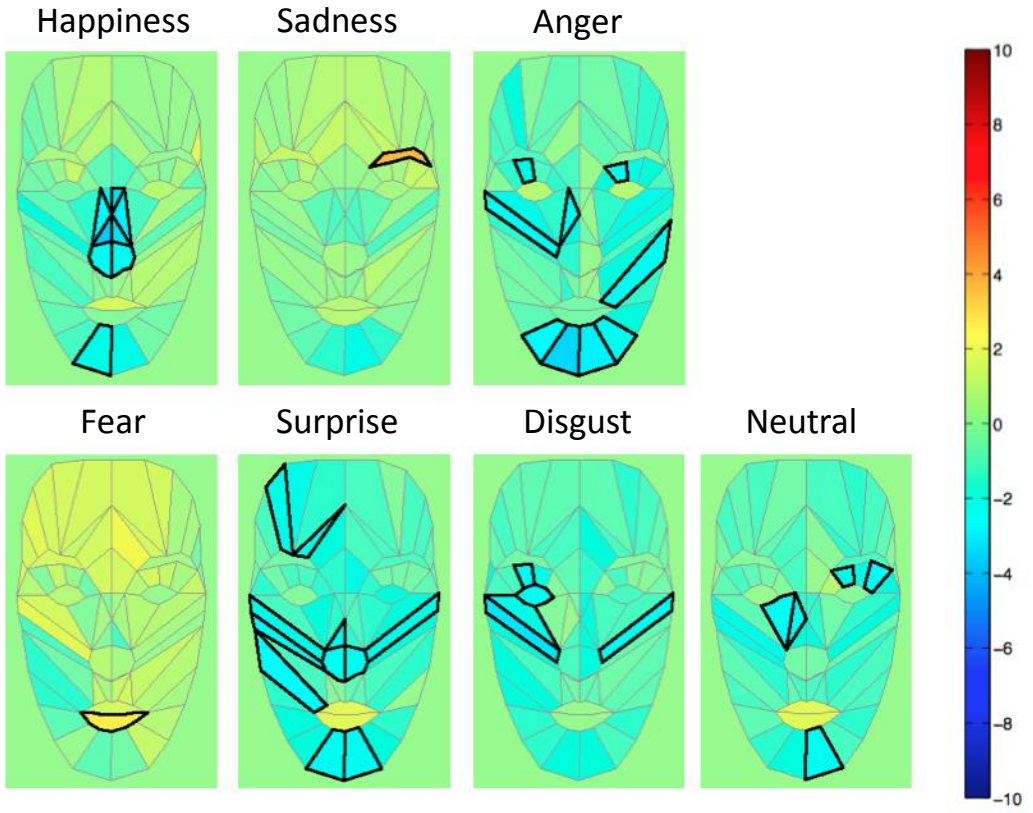
Grant 279/14

FUNDAÇÃO Bial
Institution of public utility



Experiment 1: Pictures of facial expressions of emotion
Experiment 2: Pictures that elicited emotions
Experiment 3: Videos that elicited emotions





FACIAL TEMPERATURE MAPS OF EMOTIONS

Lúcia Garrido & Nicholas Pound

Division of Psychology, Brunel University London

Grant 279/14

Background: William James (1884) argued that emotions are the subjective experience of bodily change, and thus different emotions are associated with distinct physiological responses. For the past 100 years, however, the question of whether these physiological responses are specific for each emotion or are instead generalized arousal responses has remained unsettled. A potential criticism is that most studies focused on global physiological responses (such as heart rate or respiration rate), or responses in single points in the body (such as temperature changes in a finger) and we may need richer datasets, consisting of spatial patterns of responses. Nummenmaa et al. (2014) addressed this issue by measuring subjective sensations across the whole body, permitting analysis of rich spatial patterns of responses. But these results were based on subjective reports, so an outstanding question is whether it is possible to *objectively* measure the patterns of physiological responses.

Aims: We used skin temperature maps of the whole face associated with each of six basic emotions to investigate whether those maps are distinct for different emotions.

Method: We conducted three experiments using thermal imaging (FLIR A655sc). We measured temperature in the face while participants were presented with images of facial expressions of emotion (Exp 1), images eliciting emotions (Exp 2), and videos eliciting emotions (Exp 3). In each experiment, we obtained facial temperature maps for each participant and each emotion. We used delineated landmarks to divide each facial map into 68 polygons, and tested: (1) whether there were changes in temperature in each polygon in response to each emotion compared to baseline, and (2) whether we could classify the temperature maps according to emotion.

Results: Our results showed that for each experiment, there were face regions (polygons) that consistently changed in temperature in response to perceiving or experiencing emotions. However, our results were not consistent across experiments. Moreover, our classification analyses so far have not shown clear evidence of distinct spatial temperature maps for each emotion.

Conclusions: We think that our work brings a highly innovative approach to the study of physiological changes associated with emotional states. However, more work is needed to assess the reliability of our findings and further test whether we can accurately classify specific emotions from facial temperature maps.

Keywords: Emotions, Facial temperature maps

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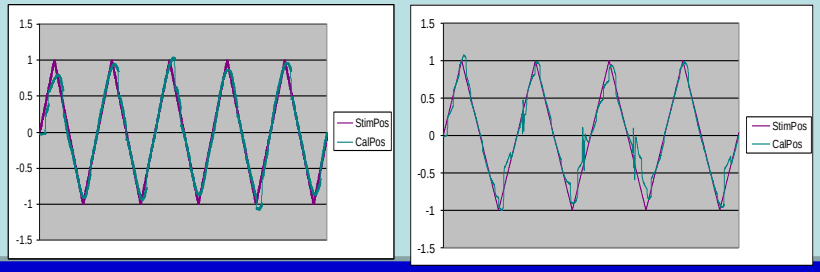
The Mindful Eye

Smooth Pursuit, Prosaccades and Antisaccades in Meditators and Non-meditators

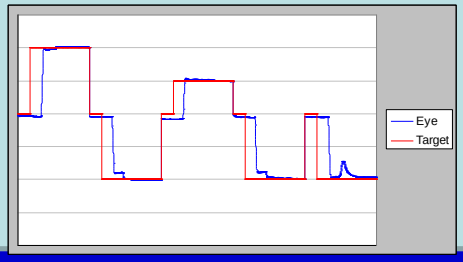
Veena Kumari [1, 2], Elena Antonova [1], Bernice Wright [1], Aseel Hamid [1], Eva Hernandez [1], Anne Schmechtig [1], Ulrich Ettinger [3]
[1] King's College London, UK; [2] Brunel University London, UK; [3] Univer1ity of Bonn, Germany

- Sample: 60 men (19-59 years), 30 mindfulness practitioners and 30 meditation-naïve
- Assessed on smooth pursuit, prosacacde and antisaccade task performance and trait mindfulness.

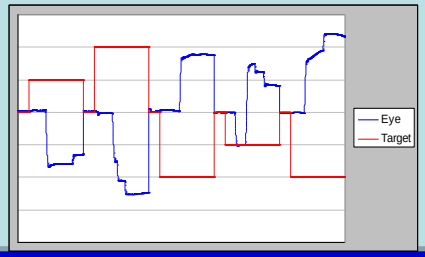
Smooth Pursuit



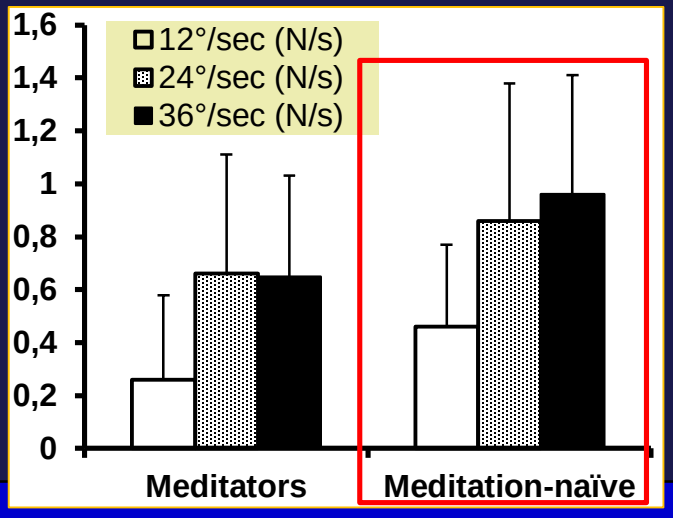
Prosaccade



Antisaccade

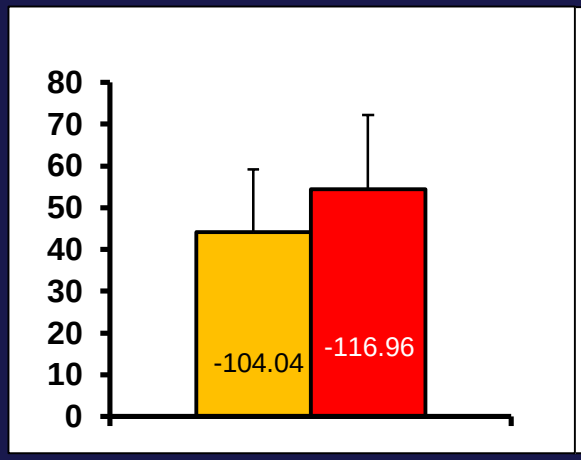


Frequency of Anticipatory Saccades

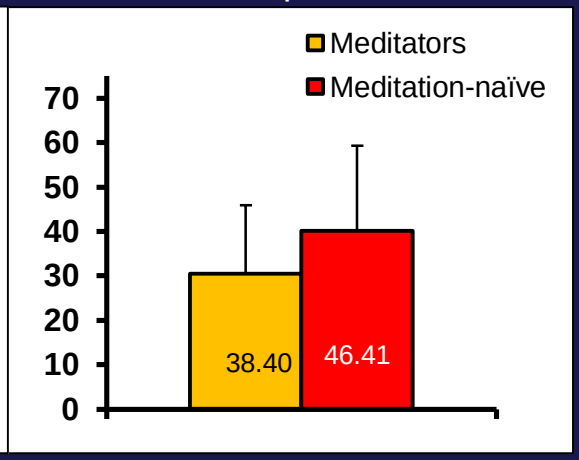


Antisaccade

SD - Gain



SD - Spatial Error



Kumari V et al. (2017) The mindful eye ….*Consciousness & Cognition*. 2017; 48: 66-75.
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Acknowledgement
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FUNDAÇÃO Bial
Institution of public utility

THE MINDFUL EYE: SMOOTH PURSUIT, PROSACCADES AND ANTISACCADES IN MEDITATORS AND NON-MEDITATORS

Veena Kumari[1], Elena Antonova[1], Bernice Wright[1], Aseel Hamid[1], Eva M Hernandez[1], Anne Schmechtig[1] & Ulrich Ettinger[2]

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Grant 282/14

Background: There is growing evidence for a positive effect of cultivated mindfulness (i.e. developed through training) on a range of cognitive functions. There are only few data at present examining the association between dispositional (trait) mindfulness, as measured in the general non-meditating population using self-report questionnaires, and cognitive function.

Aims: The aim of this study was to examine the effects of cultivated and dispositional (trait) mindfulness on smooth pursuit (SPEM) and antisaccade (AS) tasks known to engage the fronto-parietal network implicated in attentional and motion detection processes, and the fronto-striatal network implicated in cognitive control, respectively

Method: Sixty healthy men (19-59 years), of whom 30 were experienced mindfulness practitioners and 30 meditation-naïve, underwent infrared oculographic assessment of SPEM and AS performance. Trait mindfulness was assessed using the self-report Five Facet Mindfulness Questionnaire (FFMQ).

Results: Meditators, relative to meditation-naïve individuals, made significantly fewer catch-up and anticipatory saccades during the SPEM task, and had significantly lower intra-individual variability in gain and spatial error during the AS task. No SPEM or AS measure correlated significantly with FFMQ scores in meditation-naïve individuals.

Conclusions: Cultivated, but not dispositional, mindfulness is associated with improved attention and sensorimotor control as indexed by SPEM and AS tasks. Eye movement tasks which have high test-retest reliability and known brain correlates and are easy to administer hold promise as objective measures of mindfulness training.

Publications:

Kumari V, Antonova E, Wright B, Hamid A, Hernandez EM, Schmechtig A, Ettinger U. The mindful eye: Smooth pursuit and saccadic eye movements in meditators and non-meditators. *Conscious Cogn*. 2017 Feb; 48:66-75. PMID: 27842243

Keywords: Mindfulness, Antisaccade, Cgnitive control, Attention, Intra-individual variability

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Effects of intentionally treated water on growth of Arabidopsis Thaliana seeds with cryptochrome mutations Grant #287/14 2014

FUNDAÇÃO Bial
Institution of public utility

Claimed fact: Blessing travels everywhere. Intention is nonlocal and trans-living systems.

Questions: Blessing effects? This is mind and mater interaction (MMI), involving psychokinesis and existence of God (s). Is MMI and existence of God (s) real?

Theory: The Cytochrome (CRY)Theory (Shiah, 2012), a flavoprotein present in all living systems, may be a "transducer" of MMI because of its quantum biological characteristics.

Experiments and Results: The results indicate that the plant seeds, especially in gain-of-function CRY mutation, hydrated with intentionally treated vs. untreated water showed significant differences in growth.

Publication: Shiah, Y.-J*., Hsieh, H.-L., Chen, H.-J., & Radin, I. D. (2017). Effects of intentionally treated water on growth of Arabidopsis Thaliana seeds with cryptochrome mutation. *EXPLORE: The Journal of Science & Healing, 13*(6), 371-378. doi: 10.1016/j.explore.2017.05.001 (SCI)

EFFECTS OF INTENTIONALLY TREATED WATER ON GROWTH OF ARABIDOPSIS THALIANA SEEDS WITH CRYPTOCHROME MUTATIONS

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[1]Graduate Institute of Counseling Psychology and Rehabilitation Counseling, National Kaohsiung Normal University, Kaohsiung, Taiwan, ROC; [2]Institute of Plant Biology, College of Life Science, National Taiwan University, Taipei, Taiwan, ROC; [3]Institute of Noetic Sciences, Petaluma, California

Grant 287/14

Background: Cryptochromes (abbreviated CRY) are blue photoreceptors, which respond to 400 to 500 nm signals. They exist in plants, bacteria, animals, and humans, and they are involved in the organism's growth and circadian rhythms. Any protein that has a DNA sequence 25–50% similar to that of photolysis, but that lacks photolysis' ability to use blue light to repair UV-induced DNA damage, is called a CRY. CRY was originally suggested as a mind–matter interaction (MMI) target by the first author, and if further work confirms that CRY is as robust a target as our observations suggest, it could provide such a mechanism. The speculation is that CRY, a flavoprotein present in all living systems, may be a "transducer" of intention because of its quantum biological characteristics. Among other things, these quantum effects are thought to account for the exquisite sensitivity to magnetic fields and light in living organisms. Arabidopsis thaliana, a small flowering weed in the mustard family with the popular name "mouse ear cress." This is one of the most-studied plants. Arabidopsis grows quickly in the laboratory and it contains a photosensitive flavoprotein called CRY. Three variations of CRY act either as photoreceptors or as transcription regulators; they are known as CRY 1, 2 and 3. These proteins play key roles in photomorphogenesis, circadian clocks, flowering time, seed germination, etc. The potential quantum biological properties of Arabidopsis made it an interesting system for exploring intentional effects.

Aims: To investigate the CRY Theory objectively, we studied whether Arabidopsis thaliana seeds hydrated under blinded conditions with intentionally treated vs. untreated water would show differences in hypocotyl length, anthocyanin, and chlorophyll.

Method: Three Buddhist monks focused their intention on commercially bottled water with the goal of improving the growth of seeds; bottled water from the same source served as an untreated control. Seeds with three variations of CRY were used: the wild type *Arabidopsis* (Columbia-4), a gain-of-function mutation (*His-cry2*), and a loss-of function mutation (*cry1/2*), where "gain" and "loss" refer to enhanced and reduced sensitivity to blue light, respectively. Seeds were hydrated with treated or untreated water under blinded conditions, then placed in random positions in an incubator. The germination process was repeated three times in each experiment, each time using new seeds, and then the entire experiment was repeated four times.

Results: Data combined across the four experiments showed a significant decrease in hypocotyl length in the *His-cry2* seedlings (treated mean 1.31 ± 0.01 mm, untreated mean 1.43 ± 0.01 mm, $p < 10^{-13}$), a significant increase in anthocyanin with all three forms of *cry*, particularly *His-cry2* (treated mean 17.0 ± 0.31 mg, untreated mean 14.5 ± 0.31 mg, $p < 10^{-4}$), and a modest increase in chlorophyll in *His-cry2* (treated mean 247.6 ± 5.63 mg, untreated mean 230.6 ± 5.63 mg, $p = 0.05$). These outcomes conformed to the monks'

intentions because a decrease in hypocotyl length and increase in anthocyanin and chlorophyll are associated with enhanced photomorphogenic growth. These experiments suggest that the *His-cry2* mutation of *Arabidopsis* may be an especially robust “detector” of intention.

Conclusions: The present study suggests that elementary living systems with quantum-biological properties may be especially responsive targets. If future studies continue to replicate the results of the present experiments, then quantum-inspired models may be useful guides in developing hypotheses for understanding and testing the role of intention in the physical world.

Keywords: Cryptochrome, Intention, Mind–matter interaction

Publications:

Shiah, Y.-J., Hsieh, H.-L., Chen, H.-J., & Radin, I. D. (2017). Effects of intentionally treated water on growth of Arabidopsis Thaliana seeds with cryptochrome mutation. *EXPLORE: The Journal of Science & Healing, 13*(6), 371-378.

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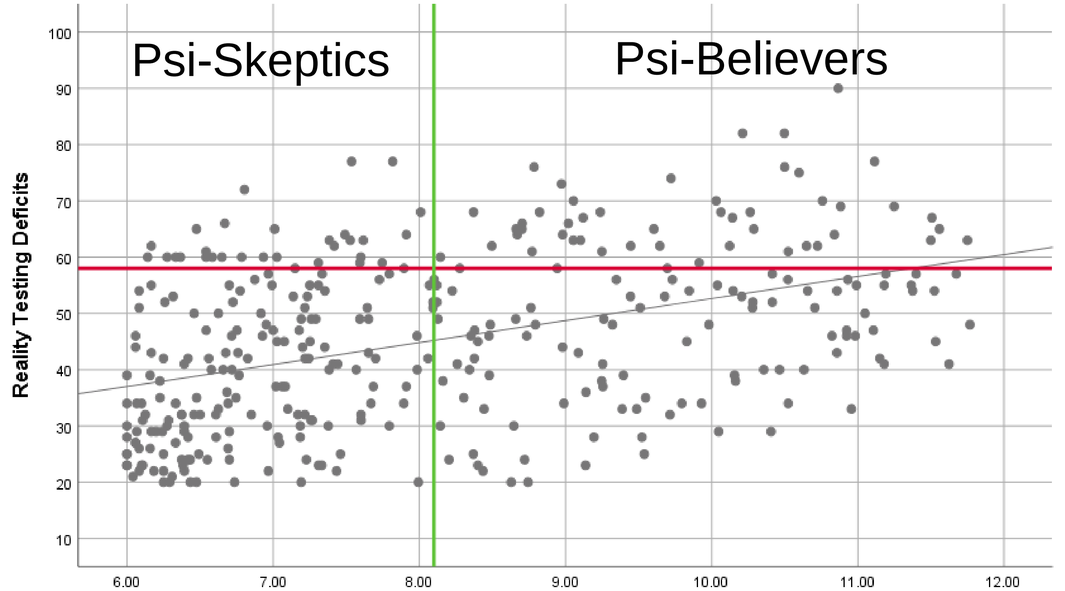
A Question of Belief: An Analysis of Item Content in Paranormal Belief Questionnaires

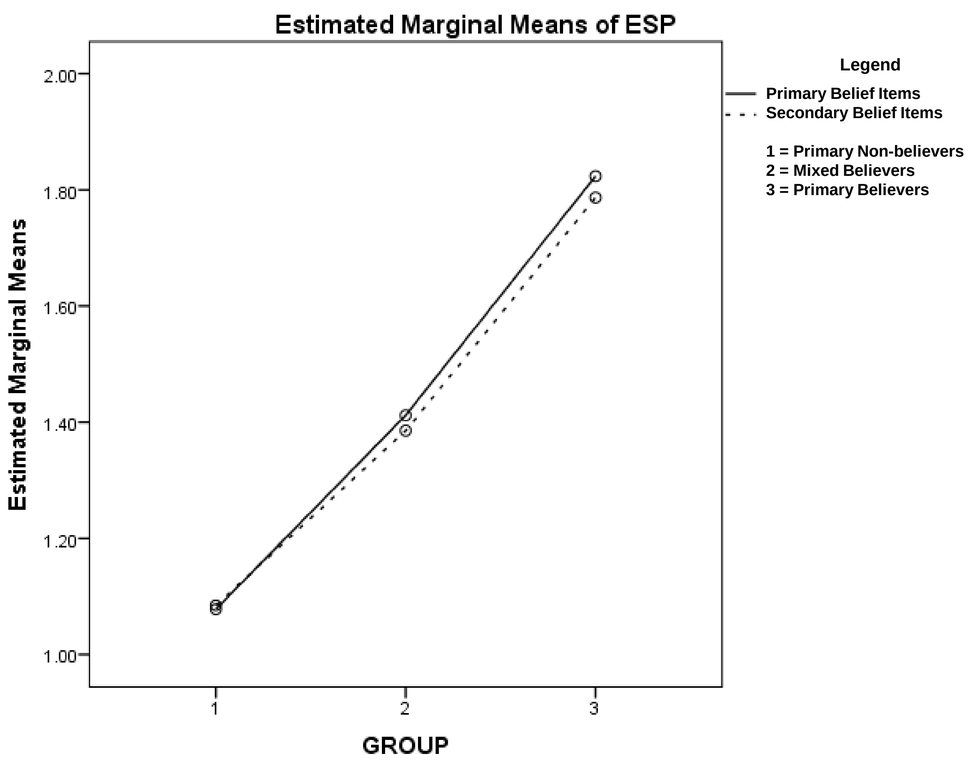
Lance Storm,* Ken Drinkwater,** and Anthony L. Jinks†
* University of Adelaide; ** Manchester Metropolitan University; † University of Western Sydney
Bial Foundation Grant # 340/14
(Storm, L., Drinkwater, K., & Jinks, A. L. (2017). A question of belief: An analysis of item content in paranormal belief questionnaires. *Journal of Scientific Exploration*, *31*(2), 187-230.)

➢ Findings from research into paranormal belief (PB), deficits, and dysfunctions, are **generalized**: if you're a psi-believer, you're placed in a 'high-risk' group.

➢ EXAMPLE: Belief plotted against reality testing deficits. The correlation is read as a **tendency** for the deficit to increase as belief increases; 34% of psi believers above red line (**clinical**). But there's also a **tendency** to ignore the fact that some skeptics (16%) are also above red line; and most believers (66%) are OK (below red line). UPSHOT: PB is misrepresented.

➢ Let's go further: Who is represented in that 34%? Perhaps the correlation is an artifact of quasi-belief (not fully informed belief; Recanati, 1997). Can we test this assumption?





➢ We evaluated 10 belief measures, and found two types of item we called: **Primary Belief Items** (PBIs) and **Secondary Belief Items** (SBIs).

➢ 'Primaries' refer directly to psi (anomalous occurrences, locations, entities, etc.) EXAMPLE: ***"There is such a thing as extrasensory perception."***

➢ 'Secondaries' use alternative wording to exclude specific reference to psi. EXAMPLE: ***"Some people have an unexplained ability to predict the future."***

➢ SBIs test quasi-belief (*strange but true*: quasi-believers tend to say 'Yes' to PBIs and 'No' to SBIs). We created a scale comprised of both items; scores used to form various believer groups.

➢ Graph shows that as primary belief increases, so does secondary belief, but more importantly, so does **quasi-belief** indicated by the gap (interaction).

➢ *What happens to the above tendency?* Reduction in number of significant correlations as we go from non-believer groups to believer groups. We concluded, deficit not predicted by certain kinds of PB. More *refined* research on PB needed.

A QUESTION OF BELIEF: AN ANALYSIS OF ITEM CONTENT IN PARANORMAL BELIEF QUESTIONNAIRES

Lance Storm[1], Kenneth Drinkwater[2] & Tony Jinks[3]

[1]University of Adelaide; [2]Manchester Metropolitan University; [3]Western Sydney University

Grant 340/14

Background: This study examined the degree to which paranormal believers, who profess 'strong' belief in the popular expression of a topic known as the primary item (e.g., There is such a thing as extrasensory perception), disagree with related items and/or the putative 'cause' of the topic, known as secondary items (e.g., Some people have an unexplained ability to predict the future). Related to this issue is that current thought in parapsychology has it that paranormal belief predicts depression and reality testing deficits. These findings may be based on a limited approach to paranormal belief.

Aims: It was theorised that scoring differences between primary and secondary items might identify certain kinds of paranormal believer, which might then allow us to conduct deeper analyses of paranormal belief (PB) and its putative relationships with depression and reality testing deficits.

Method: The Paranormal Belief Informedness Scale (PBIS) was constructed from extant PB scales—it consists of 10 primary items and 10 secondary items. PBIS subscale scores were used to identify three major PB types in the sample (*N* = 343): 'primary believers' (who believe in all 10 primary items), 'primary non-believers' (who believe in none of the 10 primary items), and 'mixed believers' (who believe in only some primary items).

Results: Significant response-rate differences were found between primary and secondary items across believer types, and across psi categories (i.e., ESP, PK, and life after death). For the full sample, it was shown that there is a significant relationship between PB and reality testing deficits (IPO-RT; Lenzenweger et al., 2001), but this relationship tended not to be significant across believer types. There was no evidence in the full sample, or in any believer type, that PB was correlated with depression as measured on the BDI-II (Beck et al., 1996).

Conclusions: We suggest that paranormal believers have differences that may be reflected in their responses to predictor variables, and/or how informed their paranormal belief is; Linear trends may be misleading when dealing with paranormal belief as a predictor of deficits and dysfunctions.

Keywords: Paranormal belief, Depression, Informed belief, Quasi-belief, Reality testing

Publications:

Storm, L., Drinkwater, K., & Jinks, A. L. (2017). A question of belief: An analysis of item content in paranormal belief questionnaires. *Journal of Scientific Exploration*, *31*(2), 187-230.

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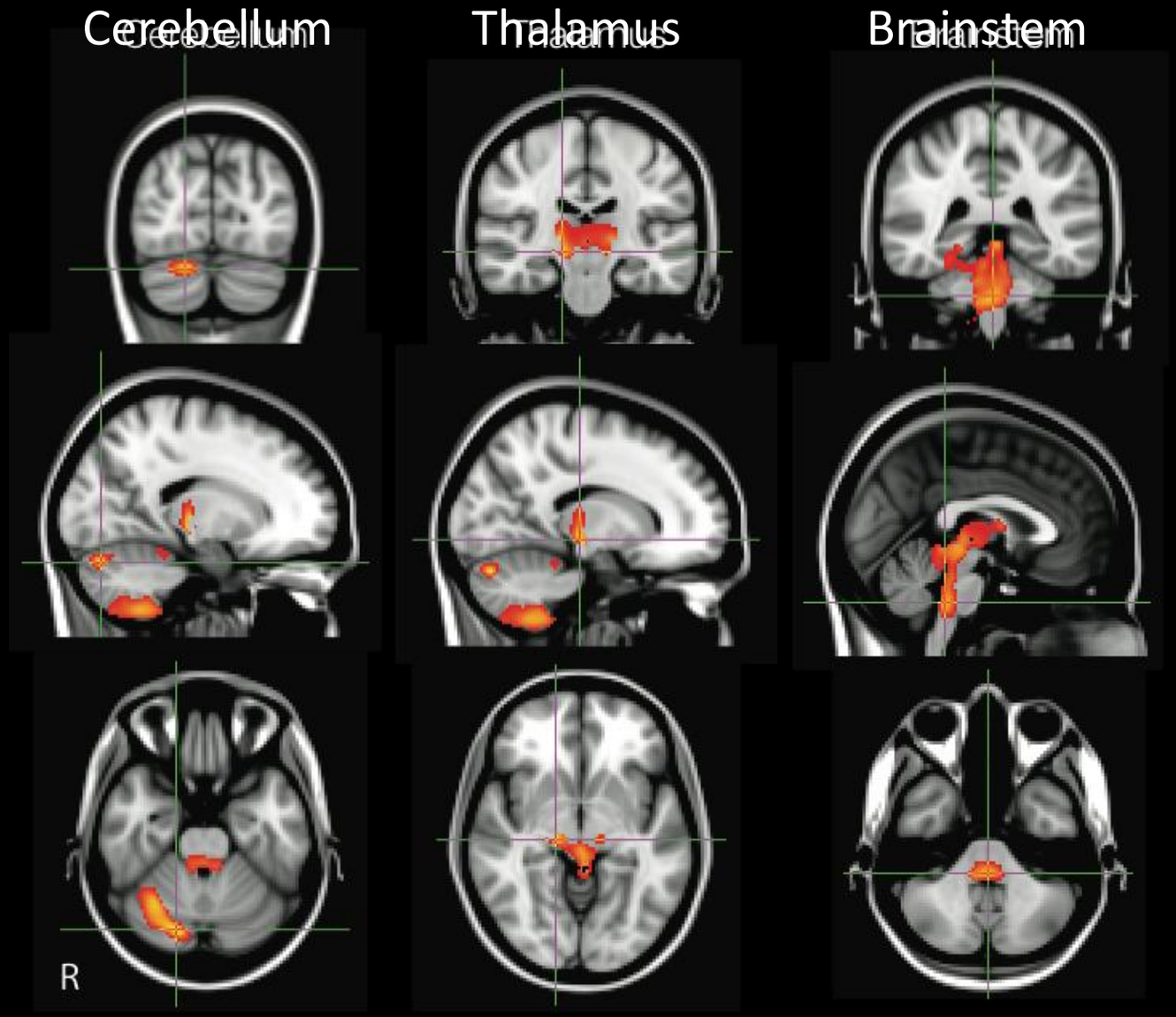
Distorted sense of agency during hypnosis is associated with gray matter volume in a cerebellar network

Devin Blair Terhune

HS individuals report reduced agency over suggested responses

The neurophysiological basis of involuntariness is unknown

- *N*=57 healthy participants
- Structural MRI
- Behavioural hypnotic suggestibility & involuntariness
- Voxel-based morphometry



FUNDAÇÃO Bial Institution of public utility

Bial bursary 344/14

Goldsmiths UNIVERSITY OF LONDON

AN INTEGRATIVE APPROACH TO THE NEURAL BASIS OF HYPNOTIC SUGGESTIBILITY

Devin B. Terhune

Goldsmiths, University of London

Grant 344/14

Background: Despite recent advances in understanding the neurophysiology of hypnosis, current knowledge of the neuroanatomical and neurochemical correlates of hypnotic suggestibility remain poorly understood.

Aims: This study sought to determine whether individual differences in hypnotic suggestibility and distortions in the sense of agency during hypnotic responding could be predicted from neurochemical concentrations and gray matter volumes in brain regions previously implicated in hypnosis and germane constructs.

Method: In two studies, participants were screened for hypnotic suggestibility using the Stanford Hypnotic Susceptibility Scale: Form C in individual sessions. In study 1 (*N*=28), participants' GABA and glutamate concentrations were recorded from primary motor and visual cortices. In study 2 (*N*=20), participants' GABA and glutamate concentrations were recorded from pre-supplementary motor area, anterior putamen, and posterior cerebellum in right hemisphere. Participants in both samples also underwent a whole-brain structural (T1) scan, for which data from 57 participants were available.

Results: In Study 1, after correction for multiple comparisons, motor cortex GABA concentrations negatively correlated with hypnotic suggestibility whereas in Study 2, no correlations between metabolite concentrations and hypnotic suggestibility achieved statistical significance. Hypnotic suggestibility did not correlate with gray matter volumes whereas involuntariness during hypnotic responding was positively associated with gray matter volumes in a broad network comprising right superior cerebellum, bilateral thalamus, and brainstem.

Conclusions: Hypnotic suggestibility can be predicted from motor cortex GABA concentrations, thereby implicating mototor inhibition in hypnotic responding. Distorted agency during hypnotic responding is associated with increaed gray matter volume in a thalamic-cerebellar network, potentially reflecting the roles of cerebellum in the experience of authorship and subcortical structures in the regulation of the information that breaches conscious awareness.

Keywords: Agency, GABA, Glutamate, Hypnosis, Hypnotic suggestibility, Neuroanatomy

Publications:

Terhune, D. B. & Cardeña, E. (2018). Nuances and uncertainties regarding hypnotic inductions: Towards a theoretically informed praxis. In V. K. Kumar & S. R. Lankton (Eds.), *Hypnotic induction: Perspectives, strategies and concerns*. New York, NY: Taylor & Francis/Routledge.

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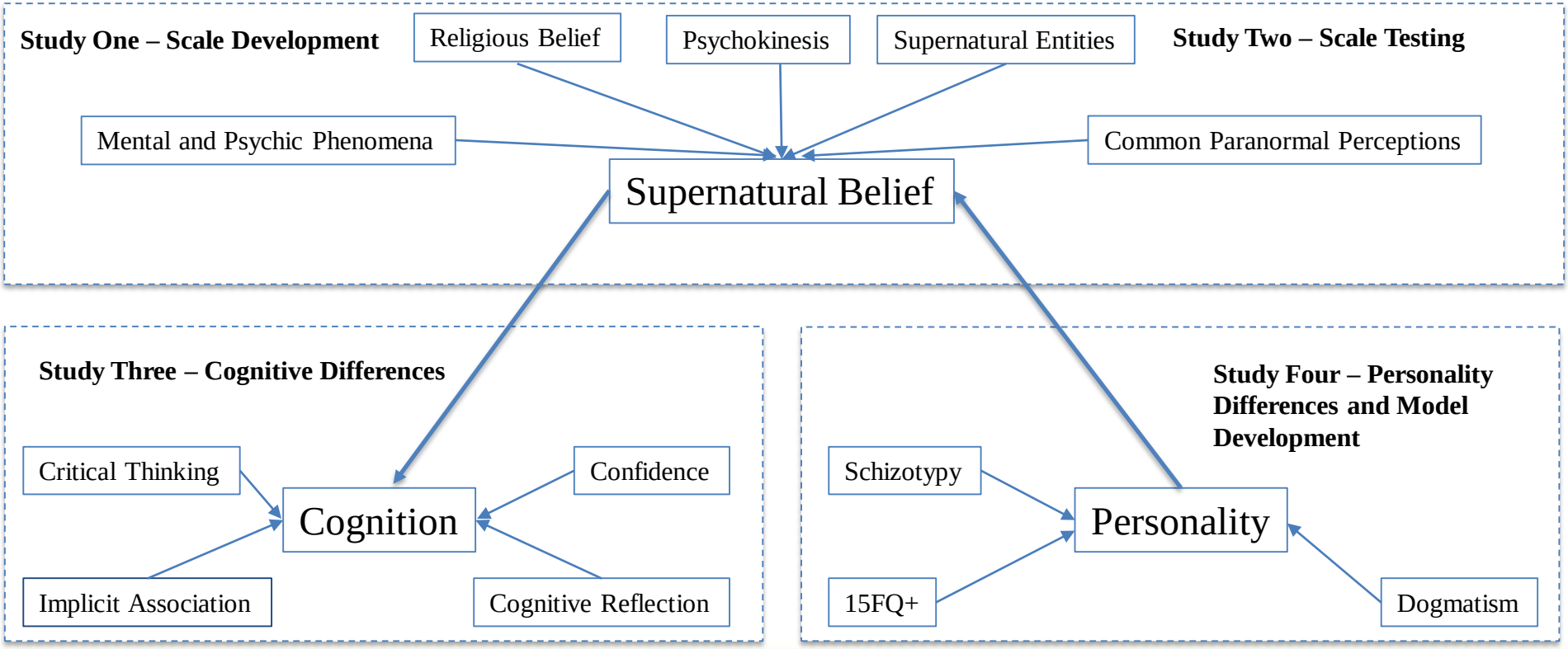
Cognitive and Personality Differences of Supernatural Belief

grant nº 355/14

FUNDAÇÃO Bial
Institution of public utility

Aim: Examine cognitive and personality differences of people who hold different types of supernatural belief

Objectives: Create and validate a new scale to measure supernatural belief; Create and test a new model of supernatural belief based on cognitive and personality differences



UNIVERSITY of DERBY
Dr Ian Baker (PI), Dr Malcolm Schofield, Paul Staples and Professor David Sheffield
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COGNITIVE AND PERSONALITY DIFFERENCES OF SUPERNATURAL BELIEF

Ian Baker, David Sheffield, Paul Staples & Malcolm Schofield

University of Derby

Grant 355/14

Background: This project examined if we believe in certain things because we think in a certain way or have certain personalities. This required the development of the scale to enable the study of cognition and personality with relation to belief, leading to the development of a model of supernatural belief, personality and cognition.

Aims: Examine cognition and personality of people who hold different types of supernatural belief.

Method: Four studies were conducted at the University of Derby and via social media, testing over 1000 participants in total. Studies one and two created and validated a new scale. Studies three and four used various measures of cognition and personality to create a new model.

Results: Studies one and two created and validated the Belief in the Supernatural Scale, a 44 item scale with five factors: 'mental and psychic phenomena', 'religious belief', 'psychokinesis', 'supernatural entities', and 'common paranormal perceptions'. The final two studies revealed subtly different profiles of cognition (study three) and personality (study four) in relation to the different beliefs. Structural Equation Modelling was then used to test different models finding that personality predicted belief, and belief predicted cognition.

Conclusions: This project indicated a clear separation of religious and paranormal belief within the new scale, that spiritual belief overlaps between these two beliefs, and 'sceptics' and 'religious believers' have remarkably similar profiles. The 'paranormal believers' did not think critically or analytically. Schizotypy was the main predictor of belief, and belief was the main predictor of cognition.

Keywords: Supernatural, Belief, Cognition, Personality, Paranormal, Religious

Publications:

Schofield, M. B., Baker, I. S., Staples, P., & Sheffield. (accepted). The creation and validation of the Belief in the Supernatural Scale. *Journal of Parapsychology.*

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Meditation-induced changes in temporal processing are mediated by heart-rate and breathing variability

Bial project number: 366/14

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[1]Institute for Frontier Areas of Psychology and Mental Health, Freiburg, Germany; [2]Department of Psychosomatic Medicine, University Medical Center Freiburg, Germany; [3]Institute of Medical Psychology, Ludwig Maximilian University Munich, Germany

Background: Study based on concepts pertaining to the embodiment of subjective time and meditation.

Aims: Assessment of meditation-induced changes of the **subjective present** with 3 timing tasks.

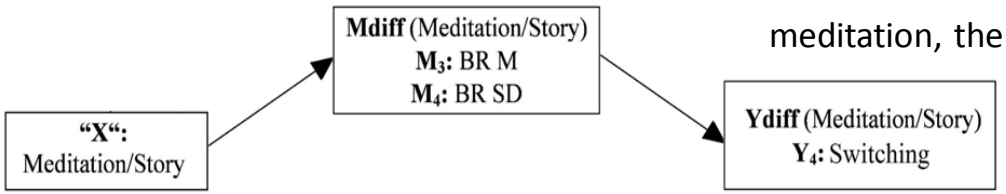
Methods: **91 experienced meditators** in either of two intervention groups: they meditated (n=44) or listened to an audio play (n=47) for 10 minutes on three separate days (3 tasks).

- **3 psychophysical tasks:** visual perception of temporal sequence; temporal integration of metronome beats; alternations of ambiguous Necker cube. Measurement **before** and **after** 10-minute intervention.

- **Psychophysiological recordings:** heart rate variability (RMSSD, HF) and breathing rate (mean, SD).

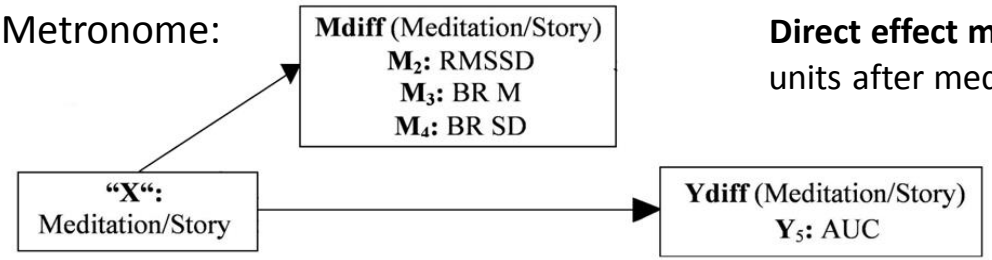
Results/Conclusions: heart rate variability and breathing rate mediate task performance

Necker cube:



Indirect effect via physiology: the slower the breathing during meditation, the slower the switching rate of the Necker cube

Metronome:



Direct effect meditation: fewer beats integrated into rhythmic units after meditation ➔ **more pronounced present-moment focus**

➔ **measure of meditation depth?**

FUNDAÇÃO Bial

Institution of public utility

MEDITATION-INDUCED CHANGES IN TEMPORAL PROCESSING ARE MEDIATED BY HEART-RATE VARIABILITY AND BREATHING RATE

Marc Wittmann[1], Karin Meissner[2,3] & Stefan Schmidt[4,5]

[1]Institute of Frontier Areas of Psychology and Mental Health, Freiburg, Germany; [2]Institute of Medical Psychology, Ludwig Maximilian University Munich, Germany; [3]Division Integrative Health Promotion, University of Applied Sciences, Coburg; [4]Department of Psychosomatic Medicine, University Medical Center Freiburg, Germany; [5]Institute for Transcultural Health Studies, European University Viadrina, Frankfurt (Oder), Germany

Grant 366/14

Background: We based our study on conceptualizations pertaining to the relationship between meditation, subjective time, and psychophysiology.

Aims: We conducted a series of experiments probing for changes in temporal-integration processes after meditation. The aim was to assess whether physiological parameter changes of heart rate and breathing rate during meditation would influence the timing of perceived events.

Methods: We employed three psychophysical tasks related to perception of sequence in the milliseconds range, the integration of metronome beats, and the perception of alternations in the ambiguous Necker cube. The tasks were administered before and after the intervention. 91 participants were experienced mindfulness meditators who in three separate 10 minute sessions either meditated by following a meditation session (n=44) or listened to an audio play (*n*=47), the three counterbalanced sessions being conducted on three separate days. During the intervention heart-rate and breathing rate were recorded and compared to a resting-state condition.

Result: Applying statistical path analyses, we found several mediating and moderating effects. Regarding subjective scales, those meditators who were less aware of the passage of time felt less emotional arousal. Regarding psychophysiology and the switching of the aspects of the Necker cube, breathing rate significantly mediated the effect of meditation across all participants. The slower the breathing during meditation, the slower the switches of the two aspects of the Necker cube. Additionally, a moderator effect showed that higher trait-mindfulness leads to slower switching times in meditators. Regarding the metronome task, and over all frequencies meditation in more experienced meditators (n > 100 hours) lead to a decrease of the duration of integration intervals. However, for the fastest (ISI = 0.3 s) and slowest (ISI = 3 s) metronome frequencies, an opposite effect occurred: the larger RMSSD, a measure of heart rate variability, during meditation. the larger the integration interval.

Conclusions: Overall, these findings add evidence to meditation-induced changes in subjective time and the general notion of the embodiment of mental functioning. Specific effects of breathing rate and heart-rate variability are indicative of physiological arousal effects on temporal processing functions after meditation.

Keywords: Mindfulness meditation, Temporal integration, Necker cube, Metronome, Sequencing

Publications:

Linares Gutierrez D, Kübel S, Giersch A, Schmidt S, Meissner K, Wittmann M (2017). *Meditation-induced changes in subjective time are mediated by heart-rate variability and breathing rate*. Poster presentation at the 1st Conference of the Timing Research Forum, Strasbourg.

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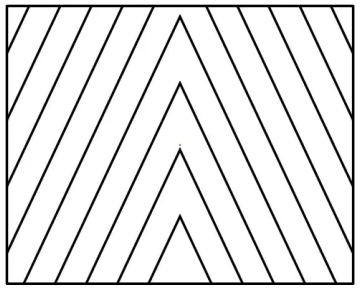
Project 373/14 – Funded by Bial Foundation

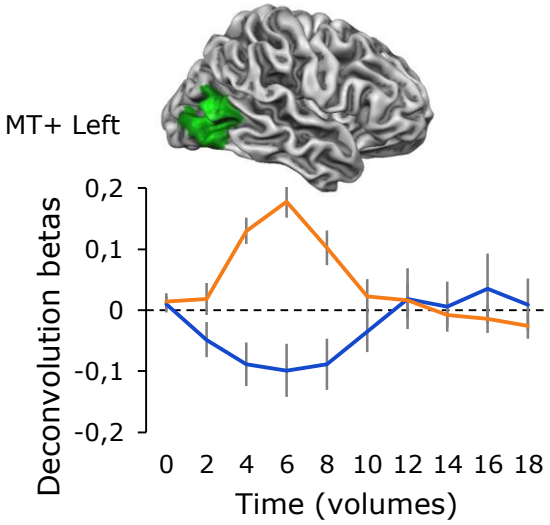
MULTIMODAL MAPPING OF VISUAL MOTION PERCEPTUAL DECISION: DISSECTING THE ROLE OF DIFFERENT MOTION INTEGRATION AREAS IN VISUAL SURFACE RECONSTRUCTION

Miguel Castelo-Branco CIBIT & ICNAS, University of Coimbra, Portugal.

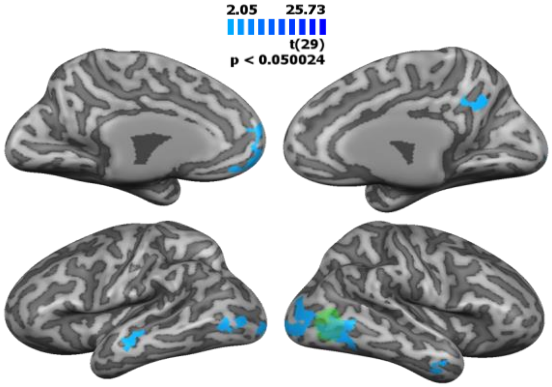
Ambiguous Motion Display



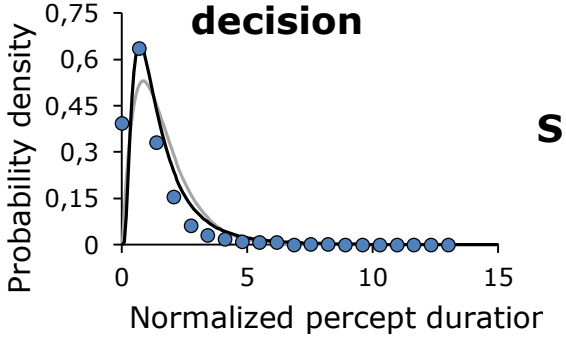
hMT+ and decision



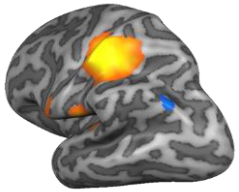
fMRI Granger Causality analysis



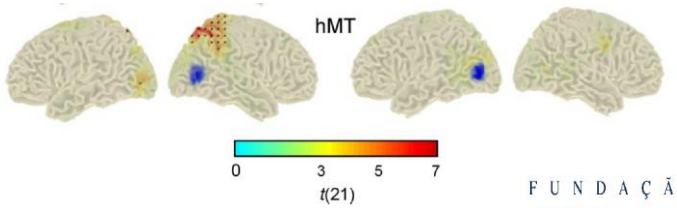
Dynamics of perceptual decision



SPL and perceptual switches



EEG Connectivity analysis (PLV) using beamformer and gray-matter sources.



Duarte et al. Hum Brain Mapp. 2017 Jun 28. doi: 10.1002/hbm.23701.
Costa GN . J Cogn Neurosci. 2017 Nov;29(11):1829-1844 doi: 10.1162/jocn_a_01158.

FUNDAÇÃO Bial
Institution of public utility

MULTIMODAL MAPPING OF VISUAL MOTION PERCEPTUAL DECISION: DISSECTING THE ROLE OF DIFFERENT MOTION INTEGRATION AREAS IN VISUAL SURFACE RECONSTRUCTION

Miguel Castelo-Branco, Gabriel Costa, Ricardo Martins, João Duarte, Teresa Sousa, Alexandre Sayal, Monika Intaite, João Castelhano, Catarina Duarte & Gilberto Silva

Institution ICNAS - P, University of Coimbra, Portugal

Grant 373/14

Background: Neural models of perceptual decision are often studied using bistable perceptual decision paradigms. Causal bottom vs top-down mechanisms remain to be elucidated.

Aims: We asked whether hMT+ is pivotal for perceptual integration of motion signals in terms of bottom-up vs top-down interactions. Moreover, if hMT+ is indeed a causal hub in the decision-making network, then it should also provide long range integration at the inter hemispheric level, which is a testable prediction. We tested whether one can find fingerprints of perception related neural coherence. Finally, we aimed to elucidate the general relation between sensory and decision modules within saliency and frontoparietal networks.

Methods: We combined EEG and fMRI methods, to understand perceptual decision mechanisms, their neural correlates and functional connectivity (with a focus on interhemispheric interactions).

Results: We found out that human hMT+ is a causal hub which contributes to maintain perceptual representations when other competing percepts are available for cognition. We further confirmed the prediction that it should also subserve long range perceptual integration, through increased interhemispheric connectivity between left/right hMT+. EEG data revealed that bound perceptual interpretations relate with parietal beta power under ambiguous conditions. Together with our findings using other decision paradigms inside and outside the visual domain, we show a modular architecture of perceptual decision-making network.

Conclusions: Our work provides a clearcut functional segregation at different time scales, between sensory representations, and the role of the general decision modules within saliency and frontoparietal networks.

Keywords: Perception, Decision-making, EEG, fMRI, Granger causality analysis, Visual motion, Bistability.

Publications:

Costa GN, Duarte JV, Martins R, Wibral M, Castelo-Branco M. Interhemispheric Binding of Ambiguous Visual Motion Is Associated with Changes in Beta OscillatoryActivity but Not with Gamma Range Synchrony. *J Cogn Neurosci*. 2017 Jun 27:1-16. doi: 10.1162/jocn_a_01158. [Epub ahead of print] PubMed PMID: 28654360.

Duarte JV, Costa GN, Martins R, Castelo-Branco M. Pivotal role of hMT+ in long-range disambiguation of interhemispheric bistable surface motion. *Hum Brain Mapp*. 2017 Jun 28. doi: 10.1002/hbm.23701. [Epub ahead of print] PubMed PMID:28660667.

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Using Neural Stimulation to Modulate Paranormal Beliefs

BIAL Foundation Grant 380/2014

Background: Dual-processing theories of belief argue that paranormal/supernatural beliefs are underpinned by a weak analytical thinking style and a strong intuitive thinking style. We call this the Intuitive Belief Hypothesis.

Aims & Methods: To test the Intuitive Belief Hypothesis we manipulated cognitive inhibition and cognitive thinking style by using neural stimulation (tDCS) and a novel cognitive training paradigm to enhance preference for intuitive or analytical thinking.

Results: By applying tDCS to the right Inferior Frontal Gyrus, we were able to increase cognitive inhibition but this had no impact on strength of paranormal belief. In study 2, training participants for two weeks had an effect on preference for intuitive or analytical thinking, but there were no changes in paranormal beliefs.

Conclusions: It is premature to explain belief in the paranormal or in the supernatural as 'intuitive'.

Published Work: Farias, M., van Mulukom, V.,... & Mottonen, R. (2017). Supernatural belief is not modulated by intuitive thinking style or cognitive inhibition. *Scientific Reports, 7*, 15100.

Acknowledgements: We are grateful to BIAL Foundation for an award to undertake this work.

Contact: Dr Miguel Farias, https://miguelfarias.co.uk

USING NEURAL STIMULATION TO MODULATE PARANORMAL BELIEFS

Miguel Farias & Valerie van Mulukom

Brain, Belief & Behaviour Lab, Coventry University, England

Grant 380/14

Background: What drives our beliefs in gods and the paranormal? The cognitive psychological literature advocates a direct link between intuitive thinking and belief in gods, by explaining that such beliefs are innate, pre-conscious, or an intuitive form of information processing. They thus suggest that paranormal and supernatural beliefs are underpinned by a weak analytical thinking style and by a strong intuitive thinking style.

Aims: To develop new experimental manipulations to causally test the role of cognitive inhibition and intuitive/analytical thinking in the modulation of paranormal and supernatural beliefs.

Method: We used a brain stimulation technique and developed a training programme to manipulate cognitive inhibition and intuitive/analytical thinking. Study 1 tested the role of cognitive inhibition in modulating paranormal beliefs. We used transcranial direct current stimulation over the right Inferior Frontal Gyrus with anodal and sham stimulation in two separate sessions. In study 2 we developed a two-week long training programme with the aim of increasing either intuitive or analytical thinking in two separate groups.

Results: For study 1, we were able to successfully increase cognitive inhibition but found no relationship between intuitive/analytical thinking and paranormal beliefs. In study 2, we found that although the training had an effect on cognitive styles, neither group experienced changes in their paranormal beliefs.

Conclusions: After experimentally manipulating cognitive inhibition, via brain stimulation, and intuitive/analytical thinking using a two-week training programme, we found no relationship between these cognitive processes and paranormal or supernatural beliefs. Supernatural and paranormal beliefs may be rooted in society and culture, rather than in some primitive gut intuition.

Keywords: Paranormal beliefs, Brain stimulation, Intuitive/analytical thinking, Cognitive inhibition

Publications:

Farias, M., van Mulukom, V., et al (under review). Cognition and Religion: Evidence Against the Supernatural Intuitive Belief Hypothesis. *Nature Scientific Reports*.

van Mulukom, V., Maraldi, E. Jong, J., & Farias, M. (under review). Does cognitive style training impact supernatural beliefs? A causal test of the Intuitive Belief hypothesis. *Psychology of Religion and Spirituality*.

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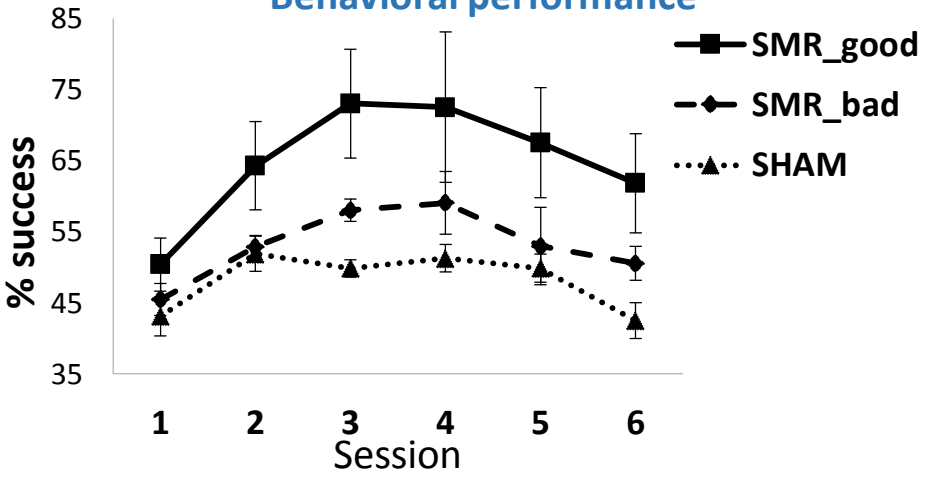
Affective and cognitive modulation of brain activity to alleviate pain by using real-time fMRI neurofeedback

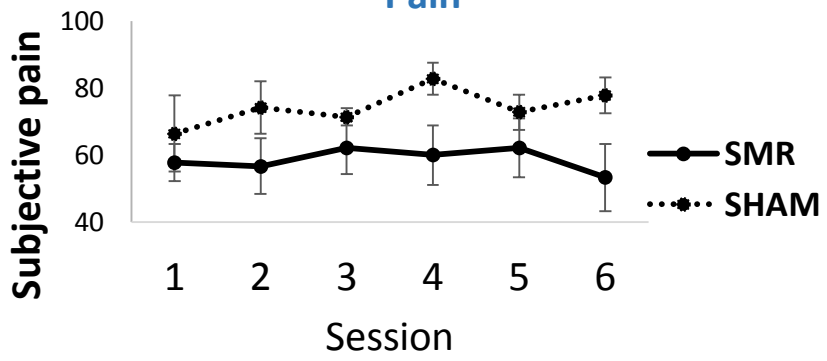
University of Balearic Islands (Spain)

Project #385/14

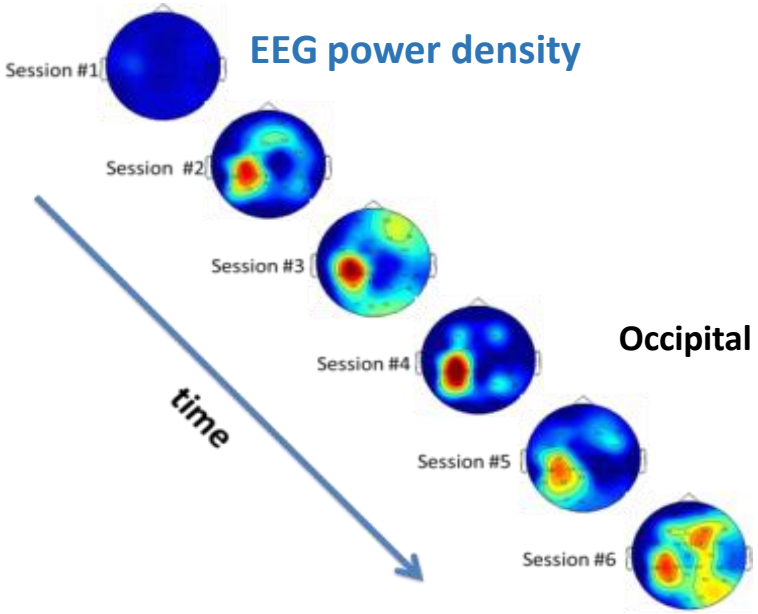
Behavioral performance



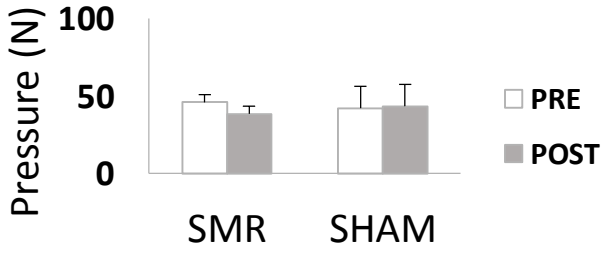
Pain



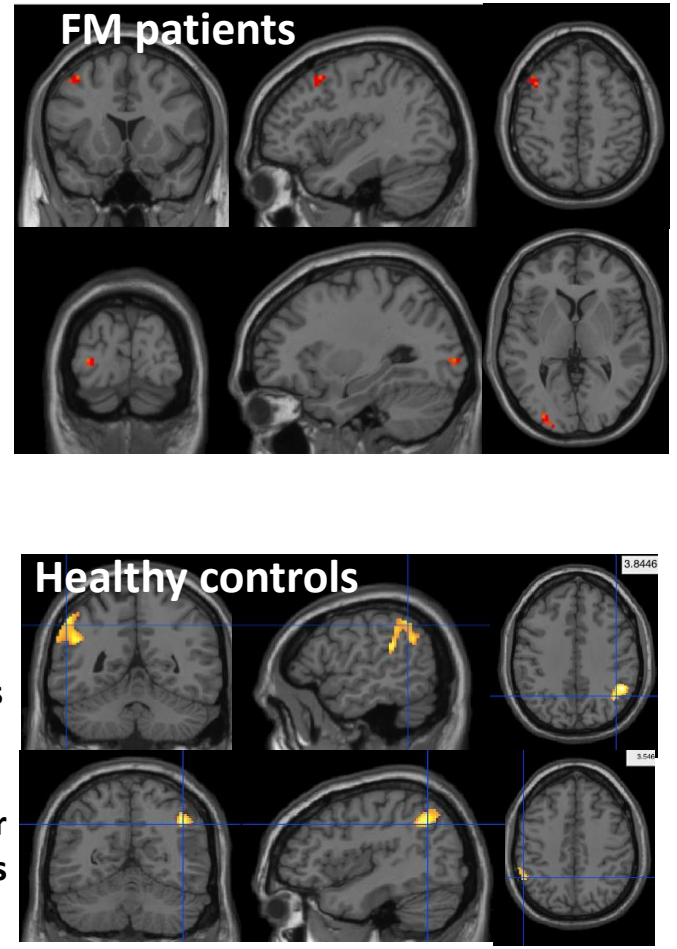
EEG power density



Wrist pain threshold



Functional connectivity of SI at rest (post>pre)



Work supported by Bial Foundation

CHANGES IN FUNCTIONAL CONNECTIVITY BETWEEN ACC AND INSULA ELICITED BY A NEUROFEEDBACK TRAINING IN CHRONIC PAIN PATIENTS

Montoya, P.[1], Terrasa, J.[1], Muñoz Garcia, M.A.[2], Cifre, I.[3] & Rey, B.[4]

[1]University of Balearic Islands (Spain); [2]University of Granada (Spain);
[3]Ramon Llull University (Spain); [4]Polytechnic University of Valencia (Spain)

Grant 385/14

Background: Humans can be trained to gain voluntary control of brain activity with high specificity by operant training using neurofeedback. It has been also demonstrated that individuals are able to induce significant and relevant behavioral changes in perception, movement, emotion, and cognition.

Aims: We focus on individuals' ability to control brain responses in order to alleviate pain. In particular, we hypothesize that chronic pain patients will be able to learn the self-regulation of brain activity (functional connectivity and power of the sensoriomotor EEG rhythm) with a neurofeedback training and, consequently, to reduce pain perception.

Method: We carried two different studies for testing our hypothesis. In the **first study**, we have trained 15 patients with chronic pain to regulate the somatosensoy EEG rhythm. In addition, activation and fucntional connectivty data obtained from fMRI were analyzed before and after five EEG training sessions (power modulation within 10-23 Hz over the centro-parietal electrode locations). Subjects were instructed to self-regulate brain activity in order to move a ball to the left or the right of a computer screen. In the **second study**, 4 chronic pain patients were trained to regulate the functional connectivity between ACC and insula. Two neurofeedback training sessions were performed to self-regulate functional connectivity. Subjects were instructed to imagine their pain experience during the presentation of a discriminative stimulus, followed by the imagery of a pleasant experience during the presentation of a second discriminative stimulus. Subjects were also asked to rate pain experience after each trial. During the neurofeedback learning task, successful trials were followed by a monetary reward.

Results: Data from the first study revealed that subjects were able to synchronize and desynchronize somatosensory EEG rhythm. These changes were followed by significant increases of functional connectivity within the somatosensory and default-mode resting-state networks. Data from the second study revealed relevant changes of brain connectivity of the pain-related network from pre- to post-training sessions. None of these neurofeedback training procedures were able to reduce pain in patients.

Conclusions: Our findings revealed that chronic pain patients are able to self-regulate several parameters of brain functioning over relevant brain regions involved in pain perception.

Keywords: Neurofeedback, Chronic pain, Functional connectivity, EEG self-regulation

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REMOTE MEDITATION SUPPORT
A MULTIMODAL DISTANT INTENTION EXPERIMENT

Stefan Schmidt[1,2], Marc Wittmann[3], Sebastian Kübel[3], Wolfgang Ambach[3], Thilo Hinterberger[4], Han-Gue Jo[1,5]

1 University Medical Center Freiburg, 2 European University Viadrina, Frankfurt (Oder), 3 Institute of Frontier Areas of Psychology and Mental Health, Freiburg, 4 University Medical Center Regensburg, 5 University Medical Center Aachen, all Germany

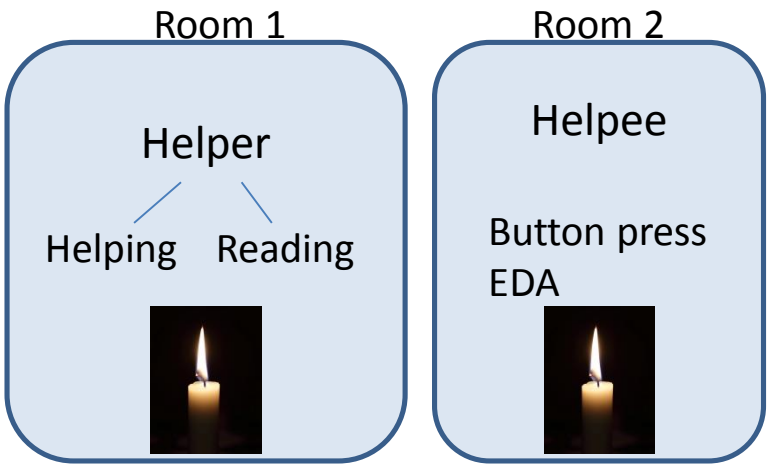
BIAL Grant 386/14

Pretest

Simple Psi Test with Meditators
N=66, 7920 Trials, 1584 hits expected
1548 hits recorded, n.s.

Main experiment (distant intention)

Goal: Maintaining focused attention



Results

N=38 participants, 30 sessions

EDA
skin conductance level
T=1.295, df=28, p=.21
non-specific responses
T=0.52, df=28, p=.61

Button Presses
Wilcox. z=0.41, p=.97

Conclusion

- No remote helping effect found
- Pre-Test and Meditation experience did not result in psi finding

REMOTE MEDITATION SUPPORT
A MULTIMODAL DISTANT INTENTION EXPERIMENT

Stefan Schmidt[1,2], Marc Wittmann[3], Sebastian Kübel[3], Wolfgang Ambach[3], Thilo Hinterberger[4] & Han-Gue Jo[1,5]

[1]Department of Psychosomatic Medicine, University Medical Center Freiburg, Germany;
[2]Faculty for Cultural Studies, European University Viadrina, Frankfurt (Oder), Germany;
[3]Institute of Frontier Areas of Psychology and Mental Health, Freiburg, Germany;
[4]Department of Psychosomatic Medicine, University Medical Center Regensburg, Germany;
[5]Department of Psychiatry, Psychotherapy and Psychosomatics, University Medical Center Aachen, Germany

Grant 386/14

Background: We assessed in our study whether one meditator can help another meditator from a distance to focus his/her attention by using the classical experimental DMILS setup from parapsychology.

Aims: We performed a distant intention experiment with a behavioral and a physiological variable. Our aim was to find a more pronounced distant intention effect by a specific selection procedure for participants. Thus, participants were selected and paired according to their performance in a simple psi experiment (ball test). All participants had at least two years of meditation experience.

Methods: We invited participants with meditation expertise for a simple psi test (ball drawing experiment). Next participants were grouped in pairs according to their hit rate and were invited for a distant intention experiment. One participant functioned as helpee and the other as helper. The helpee had the task to focus his/her attention to a candle and to indicate lapses of attention by a button press, simultaneously EDA was measured. The helper was in a different room. During helping epochs the helper also focused on a candle and tried to connect with the helpee. During control epochs the helper read a text not related to the experiment. There were 4 helping and 4 control epochs lasting 3 min each that were in a randomized order. Dependent variables were number of button presses and EDA activity.

Result: N = 38 participants performed 30 sessions, with 22 participants contributing to two sessions and 16 to only one. In one session EDA measurement failed. We found no significant differences for skin conductance level (confirmatory hypothesis, N = 29, T = 1.295, df = 28, p = .21) or number of non-specific skin conductance responses (exploratory, N = 29, T = 0.52, df = 28, p = .61). The number of button presses was not normally distributed and a non-parametric Wilcoxon test was used. No significant remote helping effect could be found (N = 30, z = 0.41, p = .97).

Conclusions: We found no distant intention effect in our study. Selecting and pairing participants as well as meditation experience did not result in finding a psi effect.

Keywords: Distant intention, Meditation, EDA, Remote helping

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Is the Matrix-Experiment Really a Robust and Artifact Free Experimental Model to Demonstrate Generalised Entanglement Effects? – *Harald Walach, Poznan Medical University, Poznan Poland*

- Aims
  - To develop a consensus protocol for an experiment based on the von Lucadou correlation matrix method to evaluate micro-PK experiments (and other PSI data)
- Method
  - Expert meeting and Delphi process to establish a consensus protocol and potential international group of researchers
- Results
  - we established a protocol
  - determined the method of evaluation (randomisation test)
  - agreed on a measure of organisational closure (OC; deviation of real time to estimated time of experiment) and various other details
  - established a protocol frame on the Open Science Framework
  - Conducted a pilot experiment (n = 40) with the new OC-measure and old REG vs. Standard RNG (TrueRNG)
  - Results of pilot: see poster
- Thanks to Thomas Filk, Jessica, Utts, Hartmann Römer, Walter von Lucadou, Ana Borges, Thilo Hinterberger, Pierre Uzan, Nikolaus von Stillfried, Hans Vogt, Majella Horan, Torkel Falkenberg, Peter Sedlmeier, Dick Bierman, Jacob Jolij, Stefan Schmidt, Patrizio Tressoldi, Thomas Rabeyron, Ian Tierney, Harmut Grote, Marc Wittmann, Ursula Flatters

Bial Grant 400/14

FUNDAÇÃO Bial
Instituição de utilidade pública
Institution of public utility

POZNAN UNIVERSITY OF MEDICAL SCIENCES POLAND

THE MATRIX EXPERIMENT REVISITED AND CONTINUED: A CONSORTIUM PROTOCOL AND EXPERIMENT

Harald Walach[1,2], Hans Vogt[3], Ana Borges Flores[4] & Thilo Hinterberger[5]

[1]Medical University Poznan, Department of Pediatric Gastroenterology, Poland; [2]University Witten-Herdecke, Department of Psychology, Germany; [3]European University Viadrina, Frankfurt (Oder), Germany; [4]University of Edinburgh, Koestler Parapsychology Unit, Department of Psychology, Edinburgh, UK; [5]University Hospital Regensburg, Department of Psychosomatic Medicine, Regensburg, Germany

Grant 400/14

Background: Parapsychology is beset with a replication problem. The matrix-experiment, first developed by Walter von Lucadou and replicated by him successfully several times (1-9), has been replicated by our group successfully as well (10). In order to establish a replicable experimental system a consensus protocol by an international group of experts was to be developed.

Aims: To establish a replicable experimental protocol on a consensus basis and pilot this experiment.

Method: First, an expert symposium was convened and an extensive round of Delphi-consultations was started. The protocol was then used by two groups to conduct new experiments. In essence, the experiment follows the logic of a micro-PK experiment, where participants try to intentionally influence a display driven by a random number generator. But in contrast to classical PK experiments, the experimental target is not a deviation from randomness. Instead, a large matrix with 2025 cells is being constructed of correlations between 45 physical variables and 45 psychological variables derived from the experiment. The number of significant correlations is predicted to be larger than expected by chance and larger than found in a control matrix.

Results: The old protocol was refined and important innovations were carried out that were also retrospectively applied to the previous study:

a) A new analysis method for the data was developed and implemented by TH: A randomization test with 10.000 iterations was run against the experimental matrix and the true p-value was decided by such a test. The p-value for the result of the permutation test was $p < 0.03$ or lower.
b) The consortium arrived at a new protocol with a few ideas, the most important of which is to use a different type of REG and a different type of analysis.
c) Using this new protocol and these ideas, two new experiments are being conducted that will be reported.

Conclusions: The original data are robust against a much more conservative analytical method. A consensus protocol has been established and an international group of researchers has been assembled that are ready to do their own experiments. First pilot experiments have been conducted.

Keywords: Parapsychology, PK, Matrix experiment, Randomization test, Delphi method, Consensus protocol

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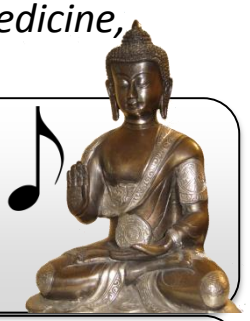
Skin Conductance Feedback Meditation (SCFM):

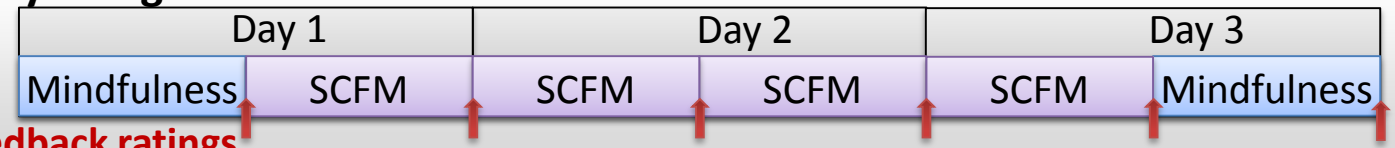
Evaluating a Method for Meditation in a State of Open Monitoring (Grant 402/14)

Thilo Hinterberger

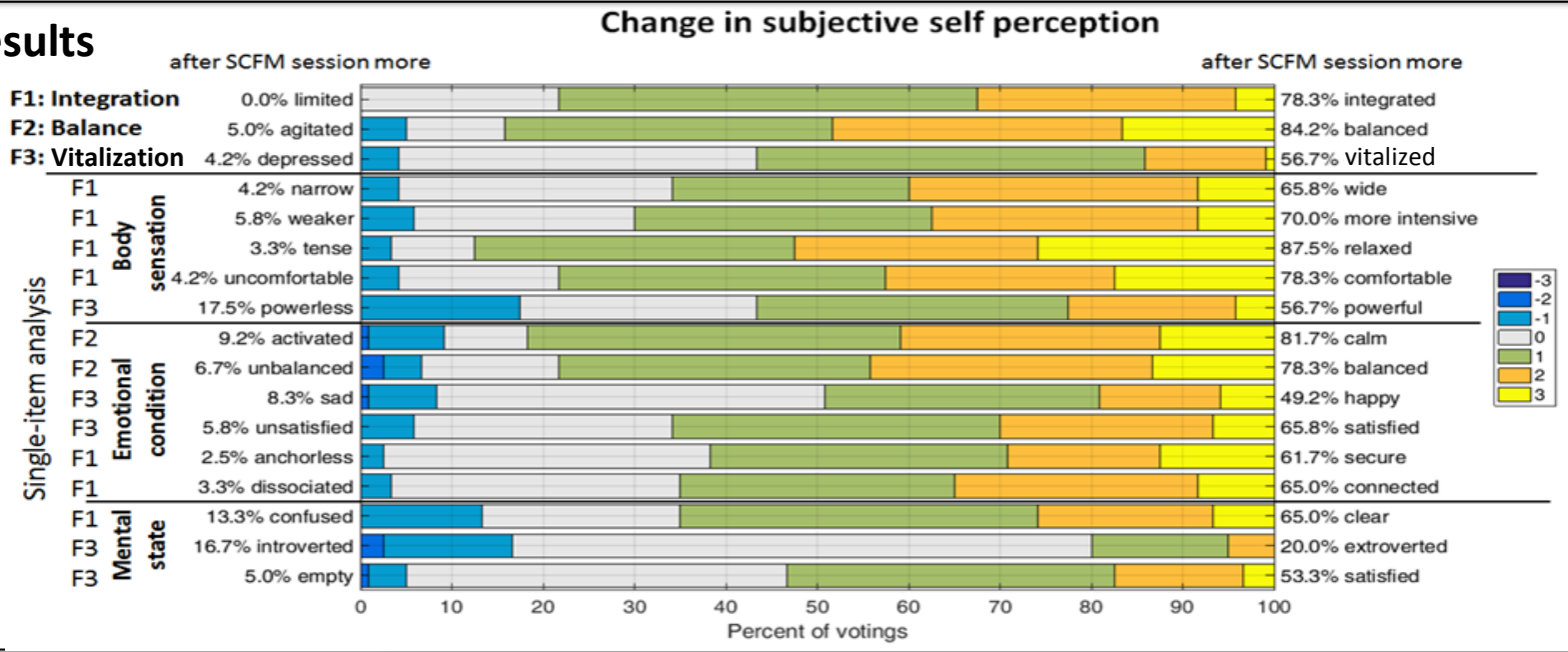
Research Section of Applied Consciousness Sciences, Department of Psychosomatic Medicine, University Clinic Regensburg, Regensburg



Study Design



Rating Results



Hinterberger, T., Baierlein, F., and Breitenbach, N. (submitted). „Skin Conductance Feedback Meditation (SCFM): Evaluation of a Novel Physiology-Assisted Meditation Style“, *Complementary and Alternative Medicine*.

We thank the BIAL Foundation for supporting this project

SKIN CONDUCTANCE FEEDBACK MEDITATION (SCFM): EVALUATING A METHOD FOR MEDITATION IN A STATE OF OPEN MONITORING

Thilo Hinterberger, Teele Tamm, Felicitas Baierlein & Natalie Breitenbach

Research Section of Applied Consciousness Sciences,
Department of Psychosomatic Medicine, University Clinic Regensburg, Regensburg

Grant 402/14

Background: Mindfulness meditation with attention to the own breathing can be regarded as a mixture of open monitoring and focused attention. The focus should help meditators maintaining a state of mindful presence. A form of pure open monitoring however should not have such a focus of attention. In order to bring meditators back to the state of presence in open monitoring an externally triggered reminder would be helpful.

Aims: Measures of skin conductance (SC) are supposed to be related to mental distractions with emotional content. Thus, feedback of SC could serve as such a reminder to return to the state of presence. We tried to measure and feedback SC in real-time during meditation sessions and evaluated physiological and psychological measures of such a novel approach for training meditation.

Method: Thirty participants, 15 of them were meditators with ongoing practice and 15 non-meditators, attended six sessions of meditation in three days. Four sessions were conducted as SC feedback meditation (SCFM) sessions and two sessions as ordinary mindfulness meditations. Each was evaluated with a feedback questionnaire and measures of skin conductance, heart rate variability, respiration and EEG which were recorded during meditation. Feedback items were assessing subjective changes in body sensation, emotional condition, and mental state.

Results: The 14 feedback items could be merged into the dimensions expansiveness and contentedness. At average, 68.3% of the participants felt more expanded and over 80% were more contented after SCFM sessions while only 3.3% felt more limited and discontented after the sessions. This result was not significantly different from the changes after ordinary mindfulness meditation. SCFM sessions were tested to be non-inferior to mindfulness meditations. Twenty participants were using a button to indicate SC reactions correlating with distracting thoughts. 52% of the button presses followed preceding SC reactions. There were no significant differences in the number of SC reactions between meditators and non-meditators and also not between ordinary mindfulness and SCFM.

Conclusions: Despite finding only few significant differences in psychological and physiological measures between mindfulness meditation and SCFM, both methods seem to be comparably good in their effects on meditators with the advantage of SCFM that no focus of attention is suggested in the meditation.

Keywords: Meditation, Skin conductance, Biofeedback, Mindfulness

Publications:

Thilo Hinterberger, Felicitas Baierlein and Natalie Breitenbach (in preparation). „Skin Conductance Feedback Meditation (SCFM): Evaluating a Method for Meditation in a State of Open Monitoring”

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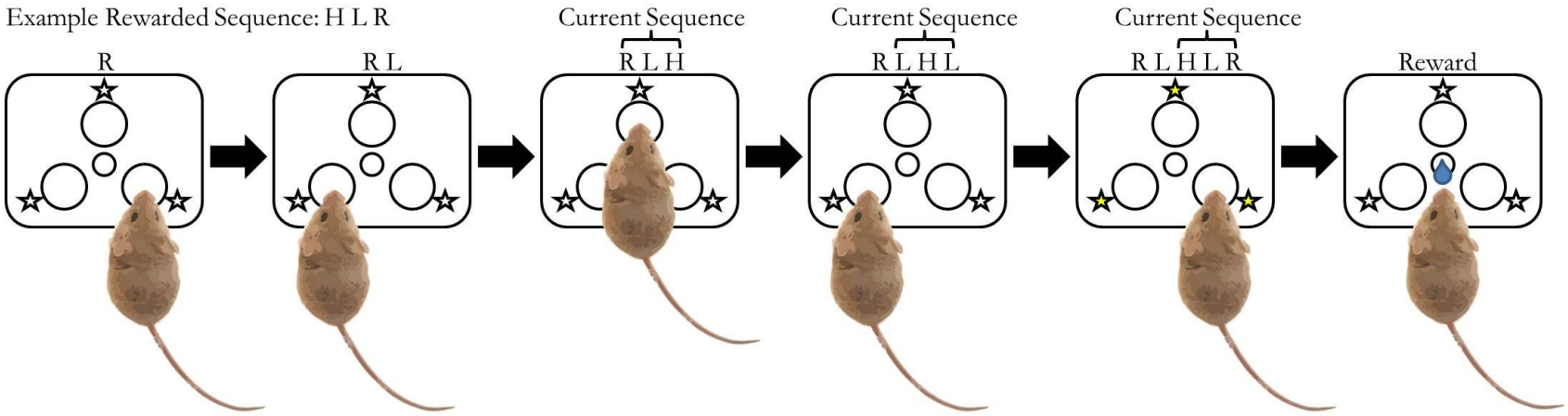
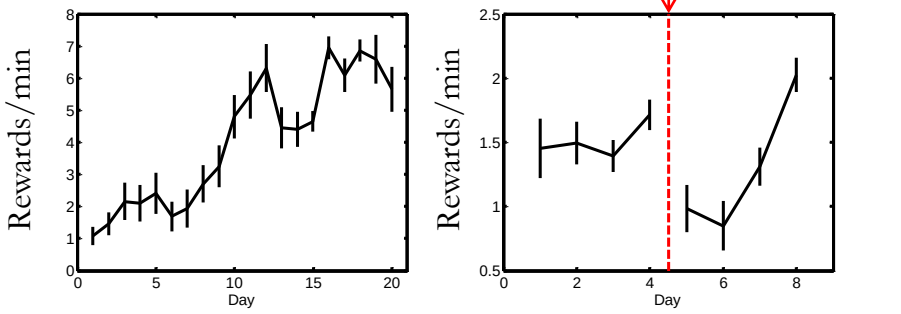
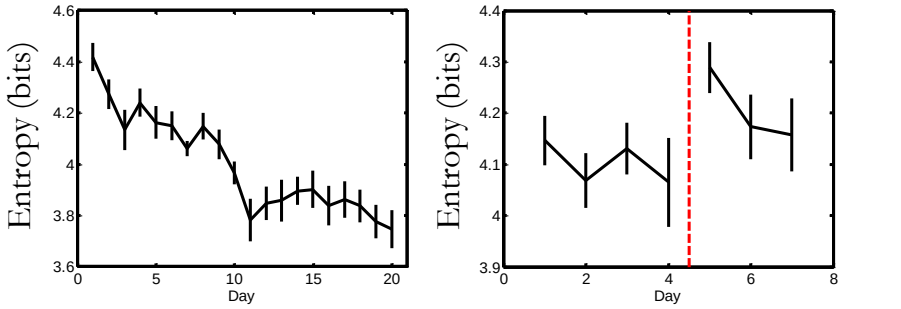
Dopaminergic and Noradrenergic Network Dynamics During Behavioral Exploration

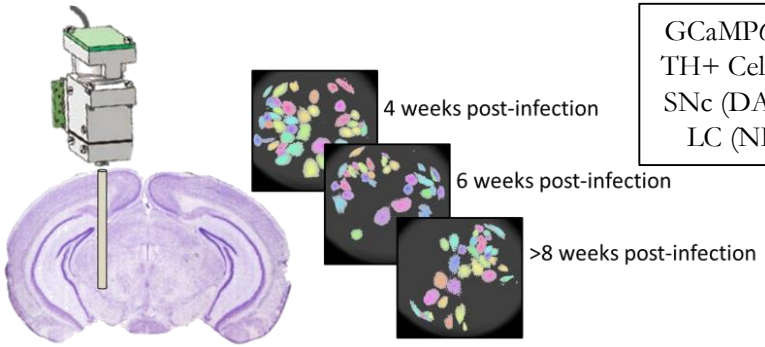
Aaron Koralek, Costa Lab, Champalimaud Neuroscience Programme, Bial Project #413/14



Change of rewarded sequence

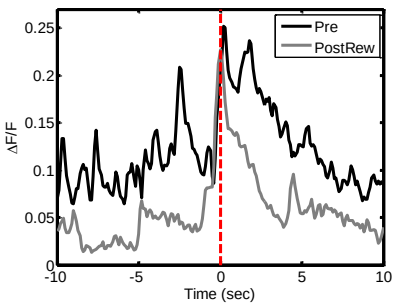




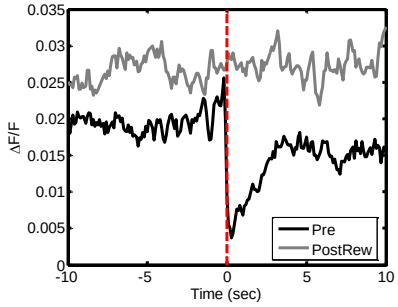


GCaMP6f in TH+ Cells of SNc (DA) or LC (NE)

SNc



LC



DOPAMINERGIC AND NORADRENERGIC NETWORK DYNAMICS DURING BEHAVIORAL EXPLORATION

Aaron C. Koralek & Rui M. Costa

Champalimaud Neuroscience Programme, Lisbon, Portugal

Grant 413/14

Background: We are constantly faced with the trade-off between exploiting past actions with known outcomes and exploring novel actions whose outcomes may be better. When environmental rewards are stable, it is preferable to perform actions known to be rewarding. However, when environmental rewards are changeable, it is adaptive to explore alternative actions and revisit previous actions whose value may have changed. This exploration-exploitation balance is thought to be strongly influenced by dopaminergic neurons of the substantia nigra pars compacta (SNc) and noradrenergic neurons of the locus coeruleus (LC). However, little is known about the ways that environmental changes impact action selection, and even less is known about SNc and LC network dynamics during exploration.

Aims: We aimed to investigate variability in action selection in response to stable and unstable environments, as well as to characterize dopaminergic and noradrenergic signaling during these distinct behavioral states.

Method: We developed a novel behavioral paradigm in mice to investigate how changes in environmental stability affect behavioral variability. Mice were placed in environments with three equidistant nose poke ports and had to explore the environment to discover which sequence of three nose pokes was rewarded. When mice began to exploit the rewarded sequence and reached a performance criterion, the rewarded sequence was changed. We then performed calcium imaging in either the SNc or LC of freely behaving mice during performance of this task, which allowed us to simultaneously record activity in large populations of genetically-identified neurons when mice were in exploratory or exploitative states.

Results: Actions were variable as mice explored to find the rewarded sequence, but became stable as they learned to exploit the rewarded sequence. When the rewarded sequence was changed, mice returned to a relatively more variable state. Dopaminergic networks expressed higher levels of sustained activity when mice were exploiting relative to exploring, and these differences could not be accounted for by low-level differences in reward occurrence. Conversely, noradrenergic networks exhibited higher levels of sustained activity when mice were exploring relative to exploiting. In addition, dopaminergic networks exhibited different correlation structures during exploitation and exploration, while noradrenergic networks exhibited a more stable network structure.

Conclusions: These experiments support a role for dopaminergic and noradrenergic networks in behavioral exploration. In particular, our data suggest that exploitation is associated with higher sustained levels of dopaminergic activity and lower sustained levels or noradrenergic activity, with potentially important consequences for downstream circuits.

Keywords: Dopamine, Exploration, Action selection, Basal ganglia

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Experimenter effect and replication in psi research

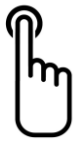
Arnaud Delorme and
Marilyn Schlitz (BIAL 480/14)

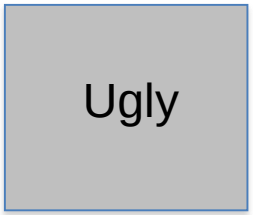
INSTITUTE OF NOETIC SCIENCES

FUNDAÇÃO Bial
Institution of public utility

1. Replication of D. Bem Feeling the future, 2010.

N=100, p<0.03; d=0.19





time

2. 640 subjects

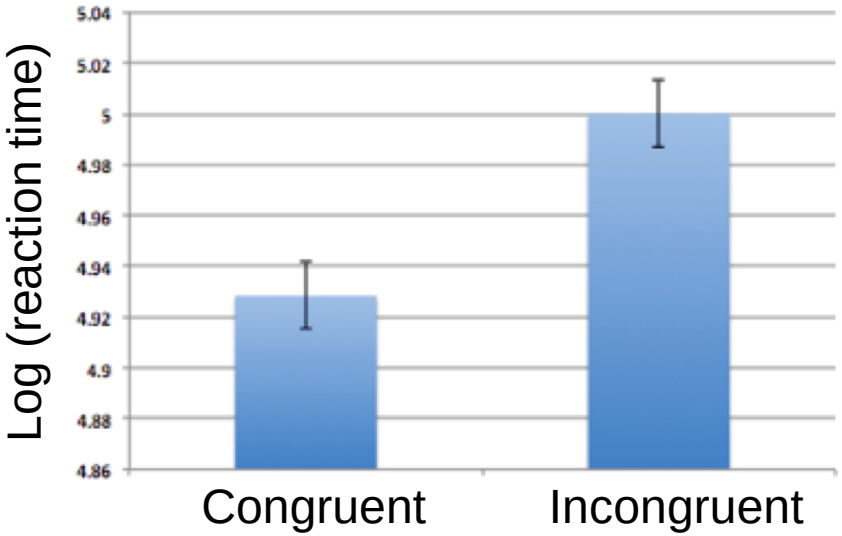
32 experimenters ⟷ Psi belief questionnaire

16 subjects each ⟷ Psi belief questionnaire

3. Results

- BIAL 233/12: original analysis ns; single-trial analysis: 0.0006
- BIAL 480/14 (explicit bias): original analysis ns; single-trial analysis: ns; no effect of bias
- BIAL 189/16 (implicit bias): data collection in progress

Single-trial results BIAL 233/12



EXPERIMENTER EFFECT AND REPLICATION IN PSI RESEARCH: ROUND II OF A GLOBAL INITIATIVE

Marilyn Schlitz, Arnaud Delorme & Daryl Bem

Institute of Noetic Sciences

Grant 480/14

Background: This study addressed the replication problem in parapsychology through the examination of experimenter and participant belief in psi and their impact on the outcome of a psi task.

Aims: This experiment involves a modified version of the previous attempt where we are influencing expectancies of experimenters and subjects. In this experiment, after showing either randomized pro or anti-psi statements (for participants) and videos (for experimenters), we are assessing the experimenters' and/or participants' expectation using questionnaires.

Method: This study made use of a standardized psi protocol developed by Daryl Bem that has been the focus of several recent replication attempts and that allows for a systematic collection of data under well-controlled conditions. The study required no instrumentation beyond a desktop computer, thirty minutes per session, and requiring statistical analyses no more complex than a t-test across sessions or participants. Specifically, the replication protocol tested the retroactive priming aspect of experiment 4 of Bem, 2011) by examining reaction time for congruent or incongruent pairing of words and pictures.

Results & Conclusions: The results of the psi task are the dependent measure for both the psi replication attempts and for the experimenters' and subjects' expectancy effects. We have completed data collection and will present our results at the BIAL conference.

Keywords: Priming, Expectancy effect, Experimenter effect, Retrocausation

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THE EFFECTS OF MOOD AND EMOTION ON A REAL-WORLD COMPUTER SYSTEM AND NETWORK ENVIRONMENT (489/14)

John G. Kruth
Rhine Research Center

Do computer users with anxiety produce unconscious errors in simulated network environments? ($p=0.038$; $d=0.45$)

Will more network errors be produced when computer users are present than when they are not? ($p>0.05$)

THE EFFECTS OF MOOD AND EMOTION ON A REAL-WORLD COMPUTER SYSTEM AND NETWORK ENVIRONMENT

John G. Kruth

Rhine Research Center, Durham, NC, USA

Grant 489/14

Background: Radin (1990) found unusual effects on a RNG embedded in a computer system. A study by the author (2015) revealed unconscious PK effects on computers and electronics was reduced using relaxation techniques.

Aims: This study explores whether the mood and emotion of a computer operator can produce errors in a network simulating a real-world working environment.

Method: 130 participants completed normal computer tasks while a separate network system was continuously monitored for errors. Experimental and control groups completed the same tasks, but the experimental group was obstructed with inoperative software designed to induce anxiety. Rewards were used to motivate participants to complete the timed tasks quickly. Participants self-rated anxiety levels.
Custom network software logged errors and avoided automatic error correction. Participants were not aware of the network and did not interact with it, but those with higher anxiety were expected to unconsciously produce more errors in the network.
Sessions were also run when no user was present. There were three categories of data: sessions with high anxiety, lower anxiety, and no users. Errors were collected from the network for each group.

Results & Conclusion: Participants who reported higher anxiety during their session produced more errors than those who reported less anxiety ($p<.038$; Effect size: $d=0.45$; power: .61). Sessions run with participants did not produce more errors than random sessions without participants ($p=0.353$).
Real-world computer networking environments and other electronics may be affected by the mood of high anxiety workers. This should be considered when designing a work environment and providing technical support to computer users.

Keywords: Psychokinesis, Technology, Emotion, Computer, Network

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Episodic memory enhancement in aging: the role of cognitive training combined with (bilateral) tDCS in the medial-temporal cortex and cerebellum on episodic memory performance in the elderly

L. Amaral, A. R. Martins, J. Alves, F. Fernandes, F. Fregni, M. Simis, A. R. Silva, J. Almeida & **M.R. Simões**

Centro de Investigação em Neuropsicologia e Intervenção Cognitivo Comportamental (**CINEICC – University of Coimbra**)

This work was supported by **BIAL Foundation project 2014/495**

Aims

General

- Investigate the neuroplasticity in older adults, combining tDCS with cognitive training.

Specifics

- Understanding whether and how tDCS combined with cognitive training facilitates verbal episodic memory in older adults, compared with sham stimulation.
- Exploit if the tDCS applied in different brain areas generates different results (left DLPFC Vs right Cerebellum).

Hypothesis

Can cognitive training (ct) and anodal tdcs (atdcs) improve episodic memory performance in healthy older adults?

Hypothesis ➡ ***anodal tdcs*** *in the* ***right cerebellar cortex*** *(rCC) or* ***left dorsolateral prefrontal cortex*** *(DLPFC) improves* ***episodic memory*** *performance, as compared to* ***sham*** *stimulation and a* ***wait list*** *control group.*

Methods

Participants

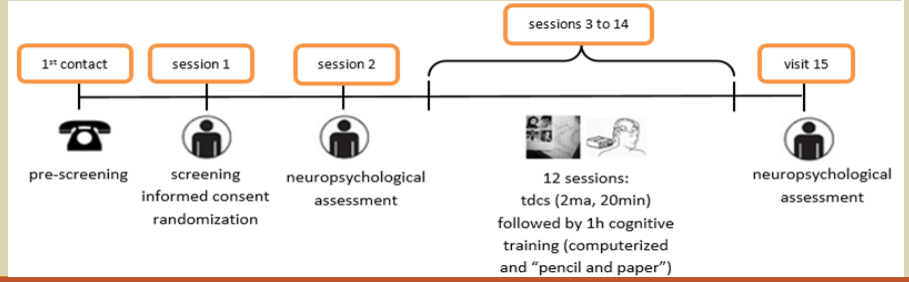
- 56 healthy elderly

Double-blinded design, sham controlled

Fixed blocks randomization

- atDCS over left DLPFC + CT
- atDCS over rCC + CT
- Sham tDCS + CT
- Wait list

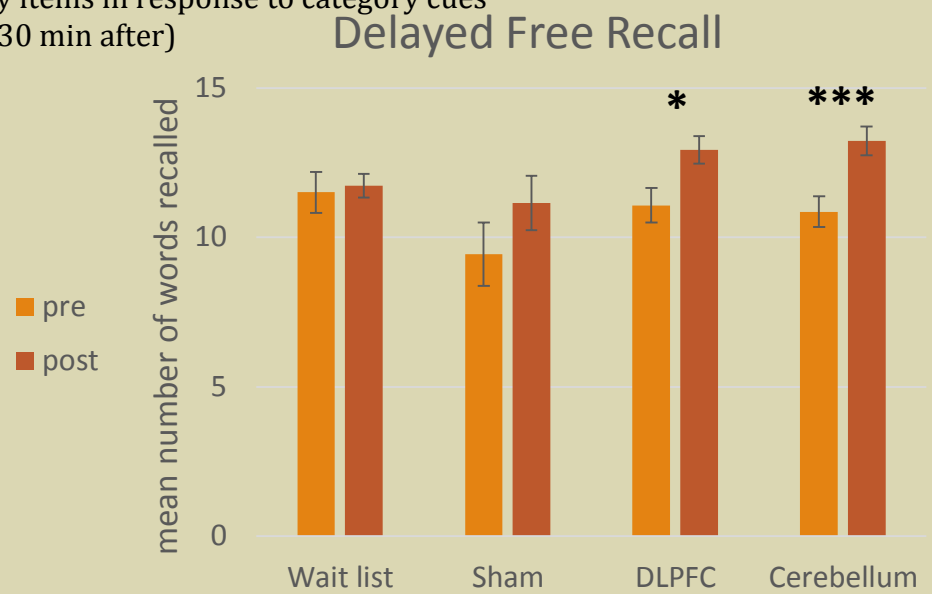
Experimental Procedure



Results

Verbal Memory: Free and Cued Selective Reminding Test (FCSRT)

- Subjects identify items in response to category cues
- Delayed recall (30 min after)



Only the groups receiving atDCS + CT show improvement in delayed recall (*$p < .05$, *** $p < .001$).

Conclusions

How does ct + tdcs affect episodic memory performance in healthy older adults?

- Our data show an overall improvement in verbal episodic memory performance in groups receiving both ct + tdcs.

Why the dlpfc and the cerebellum?

- Strong evidence in other studies that left dlpfc plays a causal role in episodic memories encoding;
- The importance of the cerebelar cortex in episodic long-term memory is being explored, namely in retrieval tasks, which is supported by our data.

Publications:

Martins, A. R., Fregni, F., Simis, M., & Almeida, J. (2017). **Neuromodulation as a cognitive enhancement strategy in healthy older adults: promises and pitfalls. Aging, Neuropsychology, and Cognition**, 24(2), 158-185.

Nogueira, J., Freitas, S., Duro, D., Tábuas-Pereira, M., Guerreiro, M., Almeida, J., & Santana, I. (in press). **Alzheimer's Disease Assessment Scale – Cognitive subscale (ADAS-Cog): Normative data for the Portuguese population**. Acta Médica Portuguesa.

MEMORY ENHANCEMENT IN AGING - THE ROLE OF COGNITIVE TRAINING COMBINED WITH TDCS: BEHAVIORAL AND NEUROIMAGING DATA

Martins, A. R.[1], Amaral, L.[1], Alves, J.[2], Fernandes, F.[3], Fregni, F.[4], Simis, M.[5], Silva, A. R.[1], Almeida, J.[1] & Simões, M. R.[1]

[1] Faculty of Psychology and Educational Sciences, University of Coimbra, Portugal
[2] Centro Cérebro, Clinica Médica e de Neurociências, Braga, Portugal
[3] Group HPA Saúde, Private Health, Algarve, Portugal
[4] Harvard Medical School, USA
[5] University of Sao Paulo Medical School General Hospital, Brazil

Grant 495/14

Background: In recent years, numerous strategies have been developed in an attempt to maintain or enhance cognitive functions in the elderly. Cognitive training (CT) has been widely implemented and it is currently accepted as the most promising method to alleviate cognitive decline. Several techniques have been combined with CT to explore the synergetic effects and, recently, a beneficial effect has been shown after the combination with transcranial direct current stimulation (tDCS).

Aims: Here we combined multiple sessions CT with tDCS to assess verbal episodic memory improvement in healthy elderly subjects, compared with sham and a wait list group.

Method: We used an innovative design to further explore the synergetic effects of CT combined with tDCS. Specifically, we tested whether CT and excitatory tDCS over the left dorsolateral prefrontal cortex (lDLPFC) or right cerebellar cortex (rCC) facilitates verbal episodic memory, compared with sham stimulation and a wait list control group. CT was applied daily for 1 hour, after 20 minutes of tDCS, over 12 sessions. Performance on memory and other cognitive tasks was evaluated at baseline and post-intervention, using behavioral and neuroimaging tools. Participants were healthy elderly, ≥ 60 years, right handed, without history of neuropsychiatric disease.

Results: 53 healthy elderly completed the study (mean age=68.4, *SD*=4.8) (ongoing recruitment). Participants received either CT and sham (*n*=13) or excitatory tDCS over the lDLPFC (*n*=14) or rCC (*n*=14), or a wait list control group (*n*=12). Data suggest an improvement in verbal episodic memory tasks in the groups receiving CT + tDCS. Interestingly, there is a greater improvement and consistency in the group receiving CT + tDCS in the rCC. Neuroimaging data supports the results from the neuropsychological assessment. Specifically, tDCS over the right cerebellum + CT increased the functional connectivity in the left hippocampus.

Conclusions: These data suggest that CT and neuromodulation hold promise as a means to enhance cognitive functions in healthy elderly. Greater light is also shed on the role of the cerebellar cortex in cognitive processing.

Keywords: Aging, Cognitive enhancement, tDCS, fMRI, Cerebellum

Publications:

Amaral, L., Martins, A. R., Alves, J., Fernandes, F., Fregni, F., Simis, S., Almeida, J., Simões, M. R. (2017). Memory enhancement in aging - the role of cognitive training combined with tDCS: preliminary results (Conference Abstract). *Brain Stimulation*, *10*, 346-540, 2017.

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THE SELFIELD: OPTIMIZING PRECOGNITION RESEARCH

Conducted at the **Institut Métapsychique International**
With the kind support of the **Bial Foundation** (Grant 506/14)

General Objective: D*evelop a useful testing system for psi-research, participant-optimization* ***&*** *efficient data-collection*

Participant optimization : immersive setting, hypnotic task
82 participants, 3000 binary-choice trials

A. Evaluate viability of approach : precognition protocol
B. Assess trial-by-trial feedback : helpful or problematic ?

Main analyses

A. Significant overall results ? p= .449 (50.1 %)
B. Feedback vs. No-Feedback trials? p= .10 (51% vs 48.6 %)

Exploratory analyses

1. Incline over course of session p= .044
2. Experienced Meditators (n=14) p= .011 (54.7%)

Next Steps

1. Explore learning possibilities (incline in scoring)
2. A More selective recruitment strategy

THE SELFIELD: A PRECOGNITION STUDY USING AN IMMERSIVE DISPLAY SYSTEM

Mario Varvoglis & Peter Bancel

Institut **M**étapsychique **I**nternational (IMI), Paris, France

Grant 506/14

Background: The Selfield is part of an ongoing effort to design protocols that are both efficient in terms of data-collection and apt to produce positive psi-scoring with unselected participants. As in our previous Bial project (190/10) we combined optimization procedures (typical of free-response studies like the Ganzfeld) with a forced-choice protocol involving multiple trials per session; the focus in this experiment was precognition.

Aims:
1. Assess whether the use of attention-focusing procedures would enhance participants' scoring in a forced-choice precognition task.
2. Assess whether trial-by-trial feedback improves scoring over no-feedback conditions.

Method: A preset total of 3000 binary choice trials were collected over a 7-week period, from 82 participants, including 26 meditation practitioners recruited from a Tibetan Buddhism center. Each participant contributed 20 or 40 binary-choice trials, whereby they had to guess the presence or absence of a hidden picture. The psi task took place in a specially constructed immersive environment, and consisted of selecting graphical spheres that emerged out of a hypnotic animated starfield and that they felt would contain an image. Following their choice, the program would randomly determine whether or not that sphere indeed contained an image, and whether or not feedback would be shown. A hit resulted in the emergence of a face (selected from a pool of possibilities) that stared directly at the participant; for misses the sphere withdrew back into the starfield, and for no-feedback trials it simply faded out with no hit-miss information.

Results: Overall results were nonsignificant. Secondary analyses showed quite encouraging trends that, if replicated in further studies, may reveal something about psi-conducive cognitive factors.
1. When examined across all 150 20-trial series, results show a significant incline in scoring (p=.04, two-tailed) over the course of the series, suggesting that participants may have progressively found a mental strategy that produced better scoring.
2. While not attaining significance (p=.12, two-tailed), scoring in feedback trials was superior to no-feedback trials; this suggests that feedback can be useful for learning if it avoids inducing a stressful, performance-oriented mindset.
3. The 26 meditators' scores were suggestively high (p=.09, 1-tailed), while the 14 most experienced amongst them (generally those with 10 or more years meditation experience), showed a significant effect (p=.012, 1-tailed).

Conclusions: Our findings contribute to the literature suggesting that sustained meditation practice may favor experimental psi results. They also suggest that, people's psi scoring may improve under the right feedback conditions. We hope to share our software with other laboratories to further explore these promising directions.

Keywords: Precognition, Forced choice, Optimization, Meditators

Publications:
Book of Abstracts, 60th Annual P.A. Convention, July 20-23, 2017, Athens.

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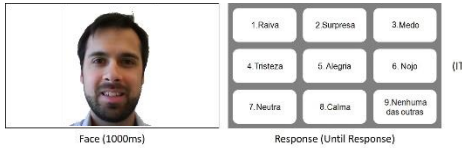
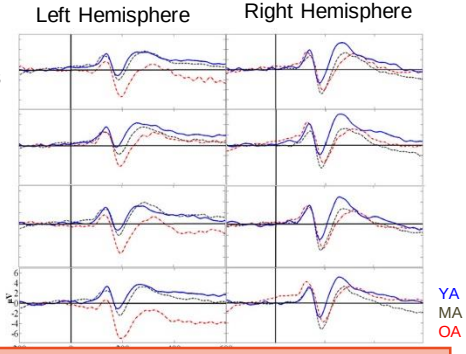
The Aging Social Brain

Aim: to analyze age-related changes in behavioral/neurophysiological correlates of social cognition.

1. EMOTIONAL PROCESSING:

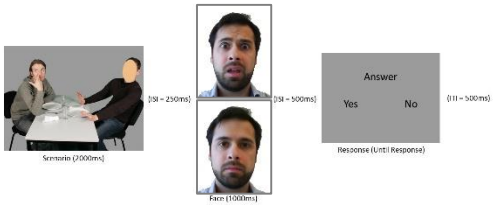


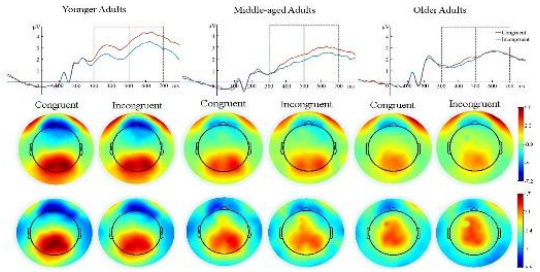
Groups had similar performance.
OA had ↓N250, but ↑ N170



Gonçalves et al. *Clin Neurophysiol* 2018

2. THEORY OF MIND:



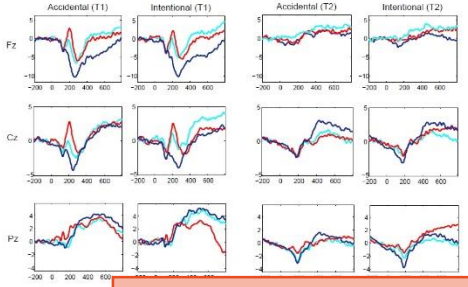


OA had ↓ performance than YA and MA. LPPs of YA and MA were ↑ incongruent than in congruent conditions, while older adults had similar amplitudes in both.

Fernandes et al. *Neurobiol Aging* 2018

3. MORAL JUDGMENT:

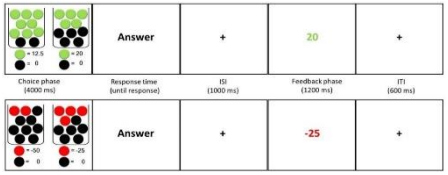
1000 ms 1000 ms 1000 ms



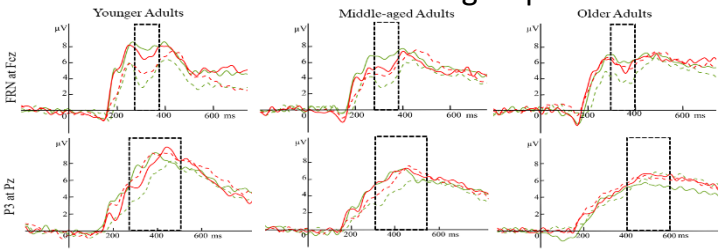
OA had ↓ accuracy than YA in identifying intentionality in moral transgressions. They also had ↓ N2 attenuation during the perception of accidental/intentional harm

Pasion et al. *Soc Neurosci* 2018

4. ECONOMIC DECISION-MAKING:



Social task: OA accepted more unfair offers than YA and MA. The MFN did not differ between groups



Risky task: OA were ↓ risk-averse than YA. In the loss domain YA had ↑ FRN for non-losses than for losses, while MA and OA had similar amplitudes in both. In the gain domain YA had ↑ P3 for gains than for non-gains, while OA had similar P3 amplitudes for both.

FUNDAÇÃO Bial Institution of public utility

Laboratory of Neuropsychophysiology

Acknowledgements:
This work was supported by a Grant of the Fundação BIAL.

THE AGING SOCIAL BRAIN: NEURAL AND BEHAVIORAL AGE-RELATED CHANGES IN SOCIAL COGNITION AND DECISION-MAKING

Fernandes, C.[1,2,3], Gonçalves, A. R.[1], Pasion, R.[1], Ferreira-Santos, F.[1], Barbosa, F. [1] & Marques-Teixeira, J.[1]

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Background: Social cognition comprises four main components: emotional recognition; theory of mind (ToM); moral judgment; and economic decision-making. Age-related changes on these components and their neurophysiological correlates are scarcely studied.

Aims: This study aims to analyze age-related changes in behavioral and neurophysiological correlates of social cognition, and the role of cognitive functioning in these changes.

Method: A sample of 30 younger (YA; *M*age=26.6, *SD*=4.05), 30 middle-aged (MA; *M*age=48.4, *SD*=5.50) and 29 older adults (OA; *M*age=64.5, *SD*=4.10) performed a set of experimental tasks targeting each social cognition components, during an EEG recording.

Results/Conclusions: Regarding emotional recognition, OA had higher N170, despite similar behavioral performances in all groups. In the ToM task, participants decided if facial expressions were congruent or incongruent with previous scenarios portraying neutral and emotional scenes. YA and MA outperformed OA, but executive functions (EF) were the main predictor of better performance. YA and MA showed higher late positive potentials (LPP) in congruent than incongruent conditions, while OA had similar amplitudes in both. This may affect OA's ability to use others' facial expressions to understand their inner states. OA were also less accurate than YA in identifying intentionality in moral transgressions, which is consistent with the N2 attenuation during the perception of accidental/intentional harm, as this component is considered a correlate of empathy for physical harm. In social economic decision-making, assessed by the Ultimatum Game, OA had the best economic strategy, accepting more unfair offers than YA and MA. As the Medial Frontal Negativity amplitude did not differ between groups, behavioral responses may be explained by different economic/social preferences, rather than different unfairness sensitivity. When making decisions under risk, OA were less risk-averse than YA. YA had higher Feedback Related Negativity for favorable than for unfavorable outcomes, while MA and OA had similar amplitudes in both. Similarly, the P3 amplitude of OA did not differ between gains and non-gains, and was correlated with poorer memory and EF performance. Our results suggest that aging is accompanied by a decline in the ability to adjust economic decisions according to feedback, which may underlie OA's preference for risk-taking.

Keywords: Aging, Social cognition, Moral judgment, Decision-making, ERPs

Publications:

Journal Articles:

Fernandes, C. (2017). Age-Related Changes in Frontal, Striatal, and Medial Temporal Activity during Expected Value Evaluation. *Journal of Neuroscience, 37*, 3442-3444. doi:10.1523/JNEUROSCI.0033-17.2017.

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Fernandes, C., Gonçalves, A., Pasion, R., Ferreira-Santos, F., Barbosa, F., Martins, I. P. & Marques-Teixeira, J. (2017). Age-related changes in social decision-making: An electrophysiological analysis of unfairness evaluation in the Ultimatum Game (under review at *Biological Psychology*).

Pasion, R., Fernandes, C., Gonçalves, A., Ferreira-Santos, F., Barbosa, F. & Marques-Teixeira, J. (2017). Aging effect on the intentionality misperception: an ERP study (under review at Social Neuroscience).

Fernandes, C., Pasion, R., Gonçalves, A. R., Ferreira-Santos, F., Barbosa, F., Martins, I. P. & Marques-Teixeira, J. (2017). Age differences in neural correlates of feedback processing after economic decisions under risk (under review at *Neurobiology of Aging*).

Conference activity:

Fernandes, C., Gonçalves, A. R., Ferreira-Santos, F., Barbosa, F. & Marques-Teixeira, J. (2015, July). *The aging brain and social cognition: a systematic review*. Poster presented at the 1st International Congress of Psychobiology, Oviedo, Spain.

Fernandes, C., Gonçalves, A. R., Ferreira-Santos, F., Sousa, H., Barbosa, F. & Marques-Teixeira, J. (2016, March). *Neural and behavioral age-related changes in social cognition: a systematic review*. Abstract presented at the 11th Symposium of The Bial Foundation Behind And Beyond The Brain, Porto, Portugal.

Fernandes, C., Gonçalves, A., Ferreira-Santos, F., Barbosa, F., Martins, I. P. & Marques-Teixeira, J. (2016, April). *The aging brain and social and economic decision-making: a systematic review*. Poster presented at the Social & Affective Neuroscience Society Annual Meeting 2016, New York, USA.

Fernandes, C., Gonçalves, A., Ferreira-Santos, F., Barbosa, F., Martins, I. P. & Marques-Teixeira, J. (2016, June). *The aging brain and social and economic decision-making: a systematic review*. Comunicação apresentada na 30ª Reunião do Grupo de Estudos de Envelhecimento Cerebral e Demência, Lisboa, Portugal.

Fernandes, C., Gonçalves, A., Ferreira-Santos, F., Melo e Castro, J., Paiva, T. O., Barbosa, F., Barbosa, F. & Marques-Teixeira, J. (2016, June). *Stimuli in moral judgment and theory of mind tasks: a validation study for the Portuguese population*. Poster presented at the 3rd International Conference of the European Society for Cognitive and Affective Neuroscience, Porto, Portugal.

Fernandes, C., Gonçalves, A., Pasion, R., Ferreira-Santos, F., Barbosa, F., Martins, I. P. & Marques-Teixeira, J. (2017). *Outcome processing in the context of gains versus losses: the influence of feedback valence in Feedback-P3* (poster to present at the congress of Society for Psychophysiological Research, Viena).

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Aware Mind-Brain:
bridging insights on the mechanisms and neural substrates of human awareness and meditation

Funded by BIAL Foundation

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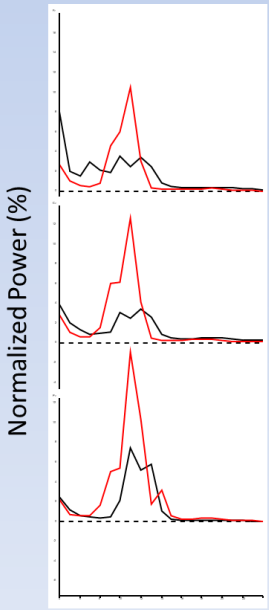
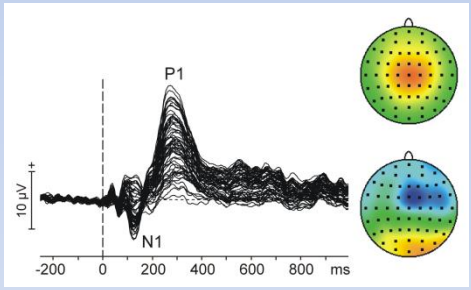
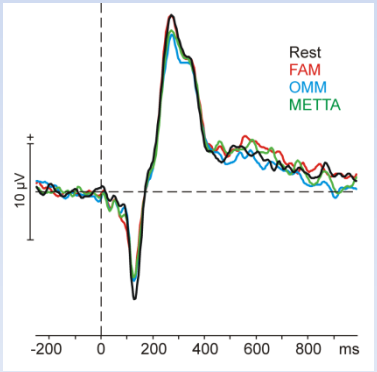
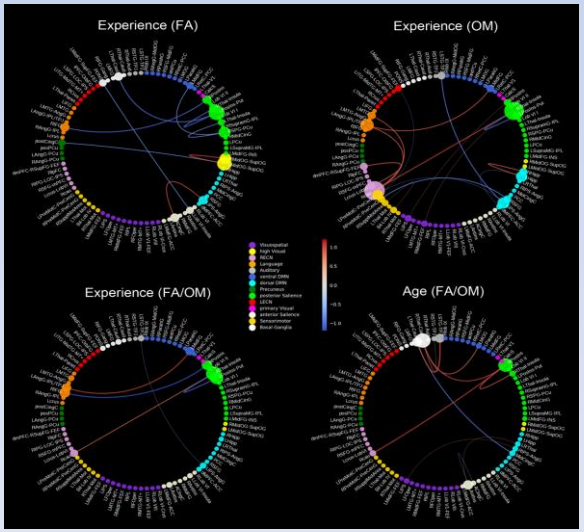
Keywords: *consciousness, meditation, mindfulness, EEG, MEG, fMRI, neuroplasticity, brain networks, pain, emotion, attention, neurophenomenology, Buddhist monks, introspection*









AWARE MIND-BRAIN: BRIDGING INSIGHTS ON THE MECHANISMS AND NEURAL SUBSTRATES OF HUMAN AWARENESS AND MEDITATION

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Background: Understanding consciousness and its neural substrates is one of the greatest scientific challenges of our time. Consciousness research crucially involves subjective (or first-person) reports. However, in most consciousness studies related to perception and emotion participants are not trained in attention and introspective awareness.

Aims: The *Aware Mind-Brain* project bridges research on the mechanisms of visual and emotional awareness with research on meditation, with a particular involvement of long-term ('virtuoso') mindfulness or insight meditators, i.e. Theravada Buddhist monks. The project has also included theoretical and modelling investigations about the mechanisms of consciousness and meditation as well as investigations of neurocognitive and neurocognitive effects of intensive insight meditation retreats and mindfulness programmes enhancing attention and emotion regulation.

Method: In this report we focus on five experiments with Theravada Buddhist monks and a control group in which we have used electroencephalographic (EEG), magnetoencephalographic (MEG) and functional Magnetic Resonance Imaging (fMRI) methods the neural correlates (bases) of different forms of meditation (Focused Attention Meditation; Open Monitoring Meditation; Loving Kindness Meditation), also contrasted with a non-meditative Rest condition. These forms of meditation involve different attentional, awareness and emotional processes. In three of the experiments (using EEG, MEG and fMRI) we have investigated the neural correlates of the forms of meditation and the effects of meditation expertise on brain activity patterns. In the last two (EEG) experiments we have investigated dimensions of phenomenological (subjective) experience associated to pain and visual emotional stimuli, and their modulation by different forms of meditation and meditation expertise.

Results: Taken together the findings in these experiments show that the investigated forms of meditation involve differential brain activity patterns in terms of oscillatory frequencies, coherence patterns and brain networks, with a deep modulation of these patterns in the Buddhist monks. Furthermore, dimensions of phenomenological experience associated to pain and emotional stimuli as well as their electrophysiological correlates are modulated by different forms of meditation as well as by meditation expertise.

Conclusions: The findings in our investigations have relevant implications for an enhanced understanding of the consciousness processes and the brain mechanisms implicated in meditation and mindfulness. They also lead to an increased understanding about how long-term mental training based on meditation leads to functional neuroplasticity associated to enhanced regulation of pain and emotion.

Keywords: Consciousness, Meditation, Pain, Emotion, Brain networks.

Publications:

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Mauro, F. et al. (in preparation). Bridging subjective experiences and event-related potentials in response to visual emotional stimuli in long-term meditators.

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Reproductive Hormonal Status as a Predictor of Precognition

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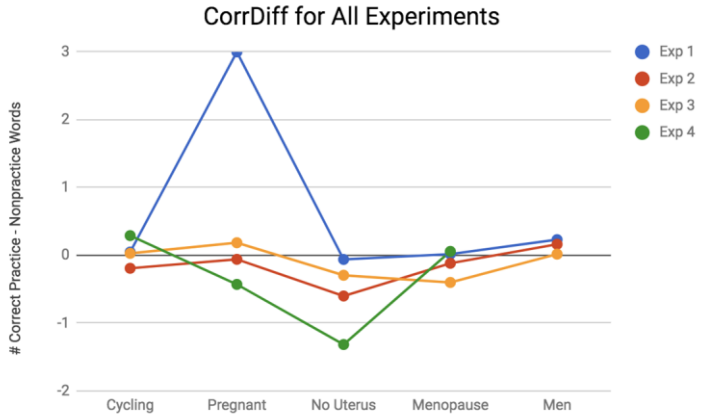
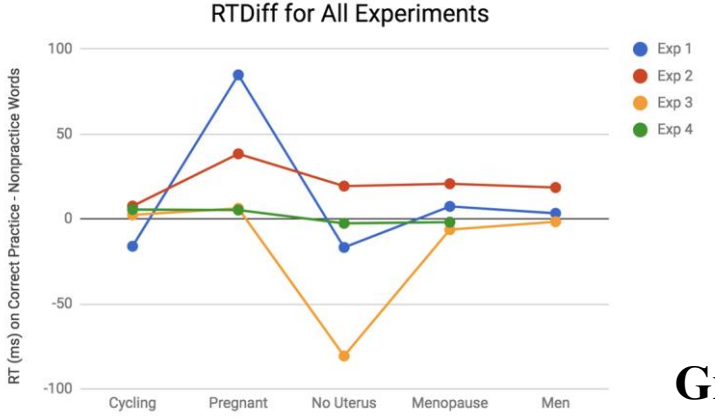
Task: Retroactive facilitation of recall (fast-thinking version)
Participants: 2469 online participants in 4 experiments; 5 hormonal groups
Dependent Variables: CorrDiff (# correct practice words minus # correct nonpractice words) and RTDiff (response time for correct practice minus correct nonpractice words)
Results: Pregnant women have higher values of both DVs than no-uterus women
Conclusions: Extremes in reproductive hormonal state may influence implicit precognition





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REPRODUCTIVE HORMONAL STATUS AS A PREDICTOR OF PRECOGNITION

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Background*:* Certain measures of precognition are dependent on both gender and age. Here we test the hypothesis that reproductive hormone levels could be related to precognitive ability.

Aims*:* In four experiments, we examined how markers of reproductive hormonal status in women are related to implicit precognition. Specifically, we originally aimed to test the hypothesis that women of reproductive age will show opposing effects to those of men and women showing menopausal or post-menopausal symptoms. However, our test of menopausal symptoms was not correlated with actual menopause, as had been previously claimed by the authors of the test. Thus, to allow us to gain insight into the currently unknown physiological mechanisms correlated with precognitive effects, we instead compared five populations, differing from each other in hormonal state, performed on an implicit precognition task.

Method: Eventually we aim to correlate measured hormonal levels with precognitive performance, but as a first step we correlated performance on an online precognition task with presumed hormonal status given self-reported information on gender, date of last menstrual period, pregnancy, and the presence or absence of a uterus. Our task was a quick-thinking version of the retroactive-facilitation-of-recall experiment. We performed the experiment four times, recruiting a total of 2479 participants, the third and fourth experiments were pre-registered with the Koestler Parapsychology Registry. In addition to the principle aim, we examined the Big-5 personality traits and their relationship to performance across all participants

Results: The general trend that emerged is that precognitive effects on this task are not apparent for cycling women, men, and menopausal women, while they are more regularly apparent for pregnant women and women without uteruses who do not take replacement hormones. Although this general trend was consistent across all four experiments, it was rarely statistically significant, likely due to the limited number of participants we were able to recruit in these two relatively unusual physiological states. We found weak correlations between extraversion, agreeableness and openness and measures of implicit precognition.

Conclusions: Because both pregnancy and not having a uterus are extreme hormonal states for women, the results suggest that taking into account reproductive hormone status, at least in women, can further reduce the signal-to-noise ratio of implicit precognition experiments. These results warrant follow-up with a larger participant pool in the two targeted populations (pregnant women and women who have had hysterectomies and are not taking replacement hormones)

Keywords: precognition, presentiment, PAA, prediction, hormones

Publications:

Mossbridge, J. A. and Radin, D. A. (March 2018 [in press]) Precognition as a Form of Prospection: A Review of the Evidence in *Psychology of Consciousness Theory, Research, and Practice*

Mossbridge, J. A. and Radin, D. A. (March 2018 [in press]) Plausibility, Statistical Interpretations, Physical Mechanisms and a New Outlook: Response to commentaries on a Precognition Review in *Psychology of Consciousness Theory, Research, and Practice*

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