

# Final report

---

## **Project AKTION „Development of novel paradigms for Social neuroscience“ No. 72p12.**

Principal Investigators: CR – prof. MUDr. Tomáš Kašpárek, Ph.D., AT – prof. dr. Claus Lamm, Ph.D.

### **Objectives of the project**

The objectives of this bilateral research project were:

O1: Development of a set of behavioral paradigms implemented for EEG/fMRI

O2: Collection of pilot data using these paradigms and establishment of data analysis methods

O3: Training of students and lab staff in electrophysiological and neuroimaging methods

O4: Organization of a meeting

### **Research team**

#### **Department of psychology and psychosomatics, Faculty of Medicine, Masaryk University, Brno**

Principal investigator: Tomáš Kašpárek

Zdeněk Krpoun – PhD student of Psychology

Martina Kolářová – MSc student of Psychology

Leoš Landa, later replaced by Marin Jáni – PhD student of Neurosciences

**No. of academics supported by the project: 2**

**No. of students supported by the project: 3 (2 PhD, 1 MSc)**

#### **SCAN Unit, Vienna University**

Principal investigator: Claus Lamm

Igor Riečanský – senior researcher, methodology of EEG experiments

Giorgia Silani – senior researcher, methodology of social neuroscience

PhD students: Jasminka Majdandzic, Markus Rütgen, Daniela M. Pfabigan, Anna Wucherer

**No. of academics supported by the project: 2**

**No. of students supported by the project: 4**

### **Results**

To fulfill specified objectives a group of young researchers from Brno visited the partner who contributed by providing expertise in electrophysiological methods and social neurosciences. During the visits the Brno team received training in electrophysiological methods, data analysis, and the principles of behavioral paradigm development and its implementation for the EEG/fMRI measurement. Gradually, the Brno team worked on a modified TAT paradigm and on an original paradigm for Theory of Mind, and after a set of pilot measurements in Brno, the experimental methods were tailored, and appropriate data analysis methods were selected.

### **Overview of scientific visits**

#### **Brno group to Vienna**

1. 4. 2015 – 10. 4. 2015 (Dr. Leoš Landa, Zdeněk Krpoun, Martina Kolářová)

Lectures in EEG acquisition software (NetStation), data analysis software (EEGLAB), and tool for behavioral paradigm development (E-Prime), practical demonstration of their usage. Overview of behavioral social-cognitive paradigms used at the SCAN unit, practical demonstration of their usage in a laboratory setting. Training in behav. paradigm programming. Consultations of correct marker setting and timing in E-Prime for EEG.

3. 6. 2015 – 12. 6. 2015 (Mgr. Martin Jáni, Zdeněk Krpoun, Martina Kolářová)

The beginning of TAT paradigm development and programming using E-Prime. Pilot measurement using TAT paradigm in the SCAN EEG laboratory. Preprocessing of the EEG data using EEGLAB. Corrections of TAT paradigm according to the first pilot measurements.

14. 12. 2015 – 18. 12. 2015 (Mgr. Martin Jání) and 18. 11. 2015 – 27. 11. 2015 (Zdeněk Krpoun a Martina Kolářová)

Literature search and consultations of potentials for behavioral paradigms and neuroimaging for social neuroscience. Implementation of the control of nuisance variables into the research project. Focus on alexithymia, overmentalizing and undermentalizing. Development of a novel Theory of Mind paradigm and pilot measures. Implementation of the paradigms for multimodal imaging (EEG-fMRI). Advanced E-Prime programming and advanced data processing in EEGLAB software.

### **SCAN unit to Brno**

29.9.-3.10.15, 21.10.-24.10.15, 2.12.-3.12.2015, 17.12.-18.12.2015

During the consecutive visits, SCAN unit partner supervised data measurement, laboratory practices, and contributed to the gradual tailoring of the two paradigms in development. Consultation of data analysis and pilot results were organised as well.

### **O1: Development of a set of behavioral paradigms implemented for EEG/fMRI**

We have developed two novel behavioral paradigms and implemented them for multimodal neuroimaging (EEG, fMRI).

#### **1) Modified TAT paradigm (Krpoun, Kolářová)**

We modified the Thematic Apperception Task (TAT) for the use in EEG and fMRI. A set of pictures depicting figures in ambiguous social situations is presented together with questions that require involvement of cognitive, Theory of Mind, and affective processes. Event-related changes related to these processes can be extracted and analyzed. The paradigm was developed in E-Prime and implemented in EEG lab and CEITEC MRI core facility in Brno.

#### **2) Novel Theory of Mind paradigm and its application in schizophrenia research (Jání)**

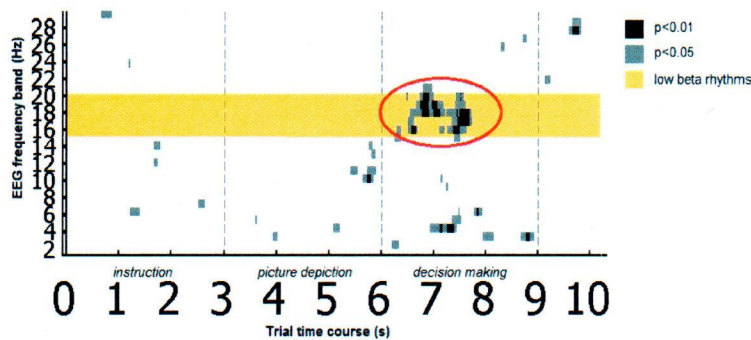
Because of inconsistent findings of the neurobiology of social cognition deficits in schizophrenia we performed a meta-analysis of 29 relevant studies using SDM mapping of two conditions – affective mentalization (empathy) and cognitive mentalization (Theory of Mind, ToM). The results suggested a complex form of deficit that cannot be captured by simple ToM task. Therefore, we started the development of a novel behavioral paradigm that enables dissociation of the two perspective taking processes (affective and cognitive). Moreover, the heterogeneity of schizophrenia patients responses could encompass both reduced, appropriate, and qualitatively inappropriate ability to perceive the mental states of others, and these types need to be implemented into the paradigm as well. The paradigm was implemented using E-Prime and was used for pilot measurements in a fMRI setting in CEITEC-MU, Brno.

### **O2: Collection of pilot data using these paradigms and establishment of data analysis methods**

#### **1) TAT paradigm**

We recorded data from 29 healthy subjects and 6 patients with anorexia nervosa in EEG and 12 healthy subjects and 6 patients with anorexia nervosa in fMRI. The paradigm enables event-related analysis of spectral perturbations related to three experimental conditions – other-focused theory of mind, other-focused non-theory of mind (cognitive), and self-focused affective questions. We implemented a time-frequency analysis of EEG that showed desynchronization in the beta frequencies over the left sensorimotor cortex related to the other-related mentalization in contrast to self-related affective processing (Fig. 1).

Figure 1.



## 2) ToM paradigm

The ToM paradigm was developed using pilot data from 12 schizophrenia patients and 40 healthy volunteers. We performed qualitative analysis of their responses and prepared a typical set of responses related to individual stimuli. Consequently, the paradigm was tested in a fMRI setting in one healthy volunteer.

## O3: Training of students and lab staff in electrophysiological and neuroimaging methods

The Brno group of young researchers (Krpoun, Landa, Kolářová, Jáni) received training in laboratory practices (EEG), in the principles of behavioral paradigm development, and data analysis. They gained skills in using EEG acquisition software (NetStation), paradigm development and presentation software (E-Prime), and EEG data analysis software (EEGLAB). The expertise they obtained led to the ability to develop a novel experimental paradigm that takes into consideration the data acquisition and analysis issues, and its implementation into the neuroimaging research of social neuroscience.

## O4: Organization of a meeting: Workshop „Social neuroscience“

According to the project plan we organized a workshop on „Social neuroscience“ in November 6, 2015. The workshop was held from 9 a.m. at the Conference room No. 300, building Komenského náměstí 2, Brno. Coordinators of the workshop were prof. MUDr. Tomáš Kašpárek, Ph.D., prof. dr. Claus Lamm, Ph.D. Speakers and their talks:

- I. Riečanský: "The effects of estradiol on action monitoring "
- J. Majdandžić: "Studying the social effects of moving in synchrony"
- M. Rütgen: "Placebo empathy analgesia: New evidence for shared representations from EEG and fMRI"
- D. M. Pfabigan: "Genetic and social impact on cognitive control"
- A. Wucherer: "The modulating role of psychopathic traits on automatic imitation and empathy for pain"
- G. Silani: "Disentangling egocentricity bias from second order ToM: a new paradigm"
- P. Zemánková: „Processing of emotionally ambiguous interpersonal stimuli in health and disease.“
- M. Jani: „Cognitive and affective perspective-taking in schizophrenia: a meta-analysis of imaging studies.“
- P. Linhartová: „Impulsivity and its measures.“
- T. Bernatová: „Emotional awareness and regulations in Eating disorders.“
- P. Sojka: „The role of interoception in dissociation.“

The workshop was opened to the neuroscientific community in Brno, and researchers from Masaryk University (Departments of Psychiatry, Psychology of the Medical Faculty, Behavioral and social neuroscience group from CEITEC-MU, Department of psychology of the Faculty of Social Sciences), and SCAN unit, University Vienna, contributed with their talks and took part in the discussion.

Prof. MUDr. Tomáš Kašpárek, Ph.D.

prof. Tomas Kasperek, MD, PhD