

Conscious Experience of Motor Intentions and its Experimental Investigation

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Introduction

The present poster overviews the conceptualization of the *Awareness of Intention (Aol)*, provides an introduction into the phenomenology of motor agency, clarifies the relation between Aol and the *Sense of Agency (SoA)* and proposes an experimental manner of investigating the phenomenon.

This work discusses some of the issues related to conscious experience of volitional agency and the experience of (motor) intentions.

Phenomenal Experience of Agency

For considering the *Conscious Experience of Motor Intentions*, two concepts are crucial - **Sense of Agency** and **Awareness of Intention**.

Sense of Agency

Sense of Agency is the sense that *I am the one who is causing or generating an action*. E.g. that I am the one who is causing something to move, or that I am the one who is generating a certain thought in my stream of consciousness. (Gallagher, 2000).

Sense of Agency (SoA) could be defined as “*the experience of being in control both of one’s own actions and, through them, of events in the external world*” (Haggard and Tsakiris, 2009) or “*the registration that we are the initiators of our actions*” (Synofzik et al., 2008). The term quickly became a generic notion for a family of topics.

Awareness of Intention

We understand the awareness of intention (Aol) in general sense as a phenomena of *conscious experience of having an intention*. In the specific context of motor agency Aol is to be considered as a *conscious awareness of one’s own intention to perform a motor action*. Hakwan Lau defines Aol as *referring to one’s conscious grasp of an action he/she is about to make* (Lau et al., 2012). Classically, awareness is considered to be an essential qualifier for intention, thought this is currently a matter of dispute in the literature on *unconscious intentions*.

According to the Haggard’s view, the **W-time** in tasks on LRP corresponds to the *awareness of intention* which is also sometimes referred to as “conscious intention” or “conscious awareness of intention”.

Relations between Aol and SoA

To our knowledge the relation of these terms was not yet explicitly discussed in literature, nor implicitly respected. Thus we propose a preliminary delimitation, pointing out some of the differerring phenomenal characteristics. In our understanding **SoA** represents a rather broad, generic term for various forms of the experience of agency and is connected with *motor agency*.

Awareness of intention is specifically about how the conscious awareness of an intention arises. It refers to intentions, which are not necessarily always about *motoric action*.

Our research program

In our research we want to focus on refining the *phenomenal aspects* of Aol, *clarifying its position to SoA* and examine the *underlying neural substrates* responsible for this specific type of experience.

Experiment:

Manipulating the awareness of intention

The behavioural design we propose aims at testing the behavioural stability of awareness of intention under several types of manipulation. Awareness of intention will be measured via a proxy – sensitivity in **agency attribution** in the task involving **voluntary action** and **passive movement** induced by experimenters. This experiment is currently developed and will be executed in coming months.

Objectives

1. To examine different ways of manipulation the Aol phenomena by psychological treatment.
2. To manifest the behavioural stability / instability of the Aol phenomena under selected means of manipulation.
3. Testing the paradigm for following neuropsychologic experiment.

Method

Aol will be assessed via proxy – **error rate in agency attribution (ERA)** acquired in an experimental test – self-paced finger extensions with occasional externally induced extensions.

Hypothesis

The experiment test possibilities of *external manipulation of intention experience* with an assumption of it prospective or parallel nature. As we are not testing SoA, we strive to minimize proprioceptive, visual and auditory clues helping subject to estimate her agency on the basis of non-intentional agency cues. Since Haggard’s *action awareness framework* explains sense of agency as a co-activation of motoric planning pathways with a center responsible for FoA, “**deafferenting**” a subject should not harm her ability to be aware of her intentions.

Experimental design

Setup

Experiment follows right after the treatment. Subject has both **left and right hands placed on the table, put into a heavy gloves placed in a occluding box**. The reason behind this is minimizing external clues and retaining only the *internal awareness of intention* (possibly) based on *movement preparation detection* taking place in a brain.

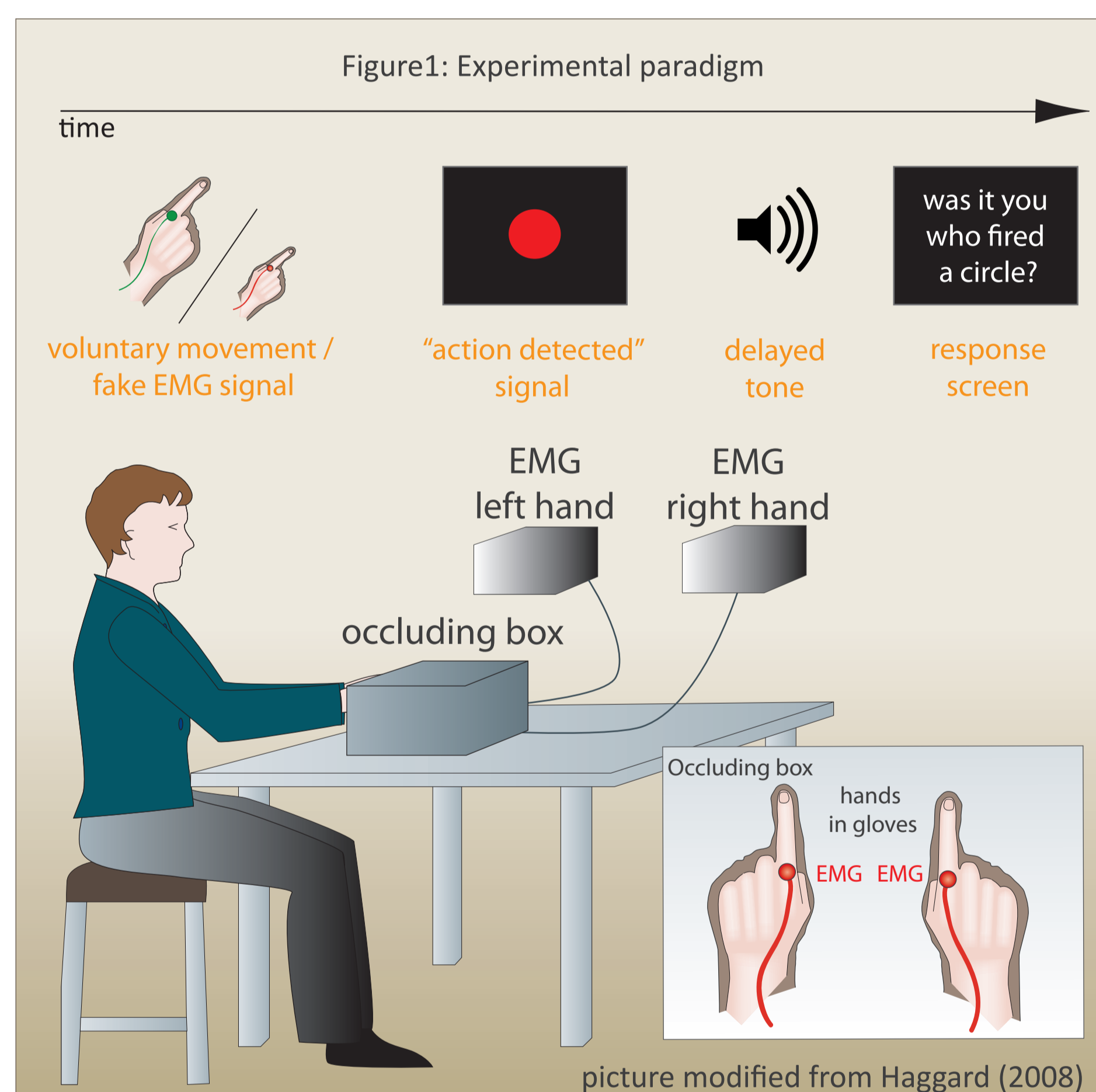
Bilateral design - it has been shown that agency attribution differs between dominant and non-dominant hands, being better for *dominant* (Daprati and Sirigu, 2002). Also Aol corresponds to ‘what’ stage of action planning (L/R hand selection) rather than ‘when’ or ‘whether’.

EMG sensors are connected to index finger extensors measuring the muscle activation.

Experimental task

During the experimental stage the **subject performs self-paced finger extensions with either L/R hand at any time when he/she decides to do so**. Subject is informed that the EMG machine is “*extremely sensitive*” and “*may sometimes indicate a movement just by itself, due to an error*”.

Subject’s task is therefore to **focus on her intentions to act and indicate which movement detections recorded by computer (red circle flashed on a display) are caused by agent and which are „errors of EMG device” (=fake signals fired by experimenter)**.



Red circle on a screen is fired

- a) each time by subject’s finger movement (*active movement*)
- b) externally by experimenter (*passive action, fake movement*).

Second parallel task is to remember timing and strength of **post-action sound beep** played at fixed delay after red circle.

Post-action sound is implemented to double-check the effect of manipulation. The measure is based on the effect of *Sensory attenuation and Intentional binding (IB)* documented as robust measures of SoA (Haggard et al., 2002). Both IB and SA effects should be congruent and also consistent with measured agency error rates and confidence ratings. The *sound intensity* and *time interval* will be the same in all conditions.

Then an experiment is stopped and a short **reporting battery** is displayed.

Reporting

Subject reports 4 ratings:

- 1) perceived **time delay** between red circle and tone (short / same / long)
- 2) **tone intensity** (weaker / same / stronger)

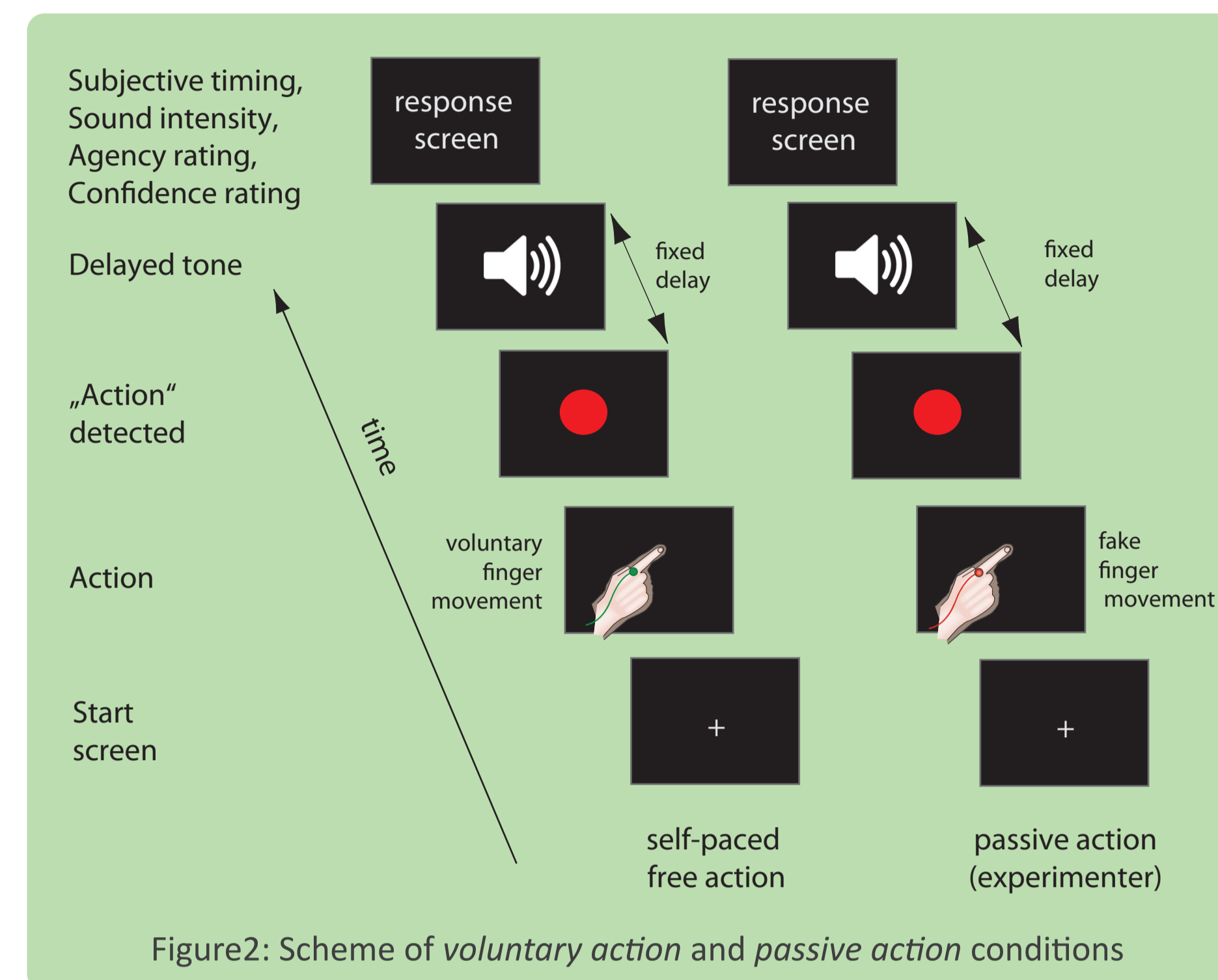


Figure 2: Scheme of voluntary action and passive action conditions

3) **autorhip** - slider indicating how much she feels she was the author of the movement.

4) **confidence rating** on a slider.

The experiment then **continues** until next self-paced movement or movement fake-detection

Subjects

Healthy subjects, meditation practitioners, schizophrenia patients.

Treatments

Treatments include *manipulation of the belief in free will* (determinism / free will / neutral texts), *manipulation of attention* (meditation, relaxation or physical activity) and *manipulating by cognitive load* (N-back task).

Experimental procedure

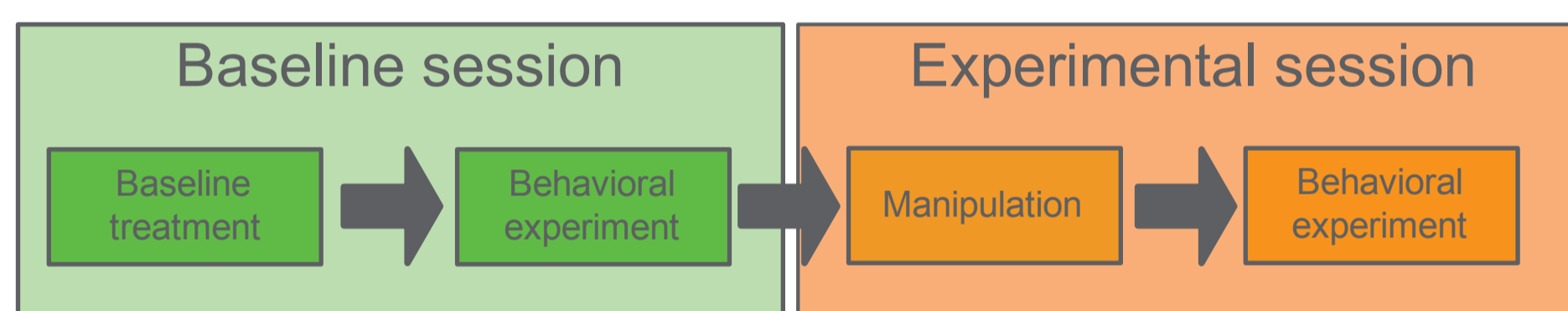


Figure 3: Experimental procedure for experimental group. ERAs are compared between experimental and baseline sessions with worse ERA in experimental.

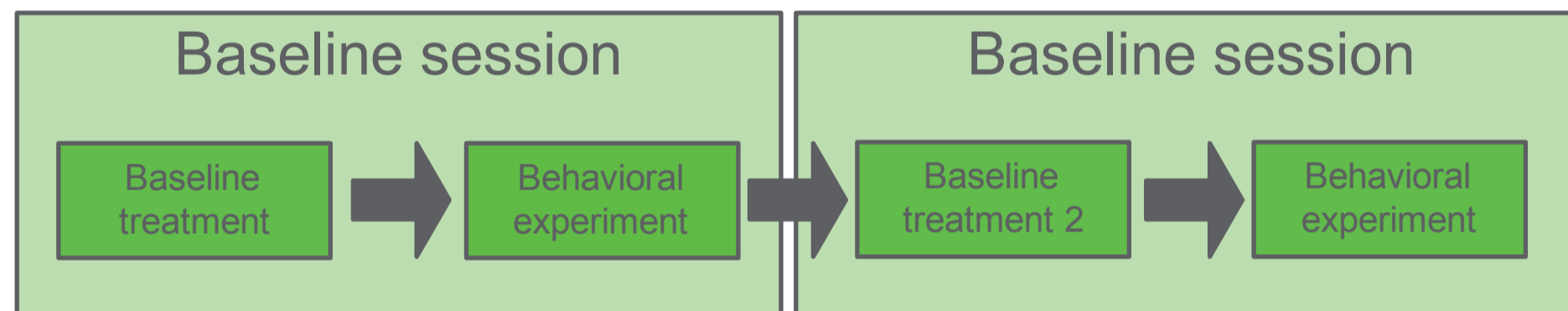


Figure 4: Experimental procedure for control group which serves as a control to effect of learning. ERAs in first and second session should be about the same.

Evaluation

We presume ERA follows the Aol and thus is a good way of its assessing, since Aol is essentially problematic to examine directly as a private phenomenal experience. Effect of manipulating each out of 3 independent variables on ERA will be analyzed.

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