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Neurophenomenology in Action: Integrating the First-Person Perspective into the Libet Experiment

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Abstract

In this conceptual contribution, we argue that experimental investigations of phenomena in the cognitive sciences and consciousness research may benefit from a thorough integration of data acquired from the first-person perspective. We present a line of research from our lab applying this approach to the Libet task on voluntary action. In this well-known experimental paradigm, participants perform a movement at a moment of their own choice. Previous research has shown that this voluntary decision to perform the action is preceded by a specific pattern in the electroencephalogram, the so-called readiness potential. This finding that the decision is preceded (and presumably determined) by an action-related brain processes puts the neuroscientific account at odds with our subjective intuition and challenges the notion of free will. This discrepancy exemplifies the gap between neuro-cognitive models of the mind and the accounts of our conscious experience. The aim of our theoretical proposal is to enrich the study of volitional action by integrating reports from the first-person perspective with the Libet paradigm to develop a more coherent account. This provides an example of implementing the research program of neurophenomenology developed by Francisco Varela to overcome the gap between scientific accounts of the mind and subjective experience. Specifically, we show how this can be achieved by interweaving three methodological approaches: (i) adapting common neuro-cognitive paradigms (i.e., the Libet task); (ii) employing refined first-person methods such as the micro-phenomenological interview; and (iii) collaborating with experienced meditators as research participants. Our contribution demonstrates how the neurophenomenological framework can be used to shed new light on long-standing and fundamental debates in consciousness research. We show that this approach not only addresses questions of intellectual curiosity but also has concrete ethical implications for the practice of science itself, self-determination, and the accountability of the conscious subject. On the basis of our approach, meditation can be seen as a method for enhancing self-regulation and self-determination, which allows for more deliberate decisions and thus more ethical behavior.

Keywords Neurophenomenology · Free will · Libet task · Ethics · Mirco-phenomenology · Volition · EEG · Slow cortical potentials

Introduction

Empirical paradigms in psychology, cognitive science, and neuroscience research are dominated by behavioral and physiological outcome measures. Even when a person's *experience* is addressed, for example the experience of anxiety in a threat task, then this is usually done by self-report questionnaires that already specify the answer in the respective item. This kind of self-report is closer to a behavioral measure than to the assessment of a specific experience of a specific person in a specific situation. In other words, how people really experience a specific event is mostly neglected in such empirical paradigms.

When it comes to the study of consciousness, this paradigm falls short because consciousness cannot be grasped or defined without reference to experience (Nagel, 1974). Thus, it is not possible to study consciousness while ignoring phenomenal experience. We all know about the richness of our experience, especially when we pay attention to our present-moment experience and embeddedness in our world. There is a rich sensory apprehension of light, color, smell, sound, and touch to name a few. When we focus on

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any one of these aspects, our experience seems to unfold and open up to more subtle layers, such as fine tastes or unusual sounds. More importantly, these sensations or thoughts come into conscious experience in various ways: They implicitly involve a certain sense of subjectivity and embodiment, mood, affective tone, temporality, and attentional disposition (for phenomenological analyses of these themes, see Colombetti, 2017; Varela, 1999; Zahavi, 2007). If we want to integrate these rich experiences into cognitive neuroscientific research, then we face several barriers (for in-depth discussions, see Hurlburt & Schwitzgebel, 2007). Personal experience is private and cannot be observed and accessed directly. It is only available through intersubjective dialogue. To make things worse, personal experience cannot be fully expressed by language. There will always be more shades of green or tastes of wine than words to describe them. In addition, our personal experience seems to be unique: being in the same situation will not result in having the same experiences.

In this conceptual article, we demonstrate how science can, despite these obstacles, deal with phenomenal experience in a systematic and structured way, as originally proposed by Francisco Varela (1946–2001) in his proposal of *neurophenomenology* (Varela, 1996). Our goal is to explicate this research program by showing how first-person methods can be integrated into a standard experimental paradigm (note that in-depth methodological, epistemological, and metaphysical discussions of first-person approaches within this context can be found elsewhere Berkovich-Ohana et al., 2020; Bitbol, 2021; Froese & Sykes, 2023; Khachouf et al., 2013; Shutaleva, 2023; Valenzuela-Moguillansky et al., 2021; Valenzuela-Moguillansky & Demšar, 2023; Weger & Wagemann, 2015). This paradigm is the Libet task, named after the American neuroscientist Benjamin Libet (1916–2007). It investigates the phenomenon of *action initiation*, or more specifically, how does a person come to initiate a particular action, such as raising an arm at a particular time? We demonstrate here that the investigation of action initiation benefits from integrating phenomenal accounts from the first-person perspective of the participants. In this way, we show how neurophenomenology can be put into action, yielding novel perspectives and insights onto action.

The protocol we present here is based on our own research from the last 10 years on the Libet paradigm with experienced meditators. We developed procedures step-by-step to integrate participants' accounts into the research process in a reliable fashion. The resulting protocol is targeted at the Libet paradigm but it can serve as a blueprint for many other experimental paradigms within consciousness research and the cognitive sciences. Thus, another objective of this contribution is to stimulate more researchers to incorporate first-person accounts into their protocols.

Since the advent of behaviorism, introspective approaches were often criticized as unreliable and were therefore excluded from, or at least minimized in, empirical research (Danziger, 1980; Nisbett & Wilson, 1977; Skinner, 1960). However, the early introspectionist approaches in psychology have been critically reflected and reconsidered in recent decades (cf. Bitbol et al., 2013; Froese et al., 2011; Hurlburt & Heavey, 2001; Varela & Shear, 1999), in particular inspired by a renewed interest in the philosophical tradition of phenomenology (Thompson & Zahavi, 2006). Here, we will refer to these as first-person methods, and argue that, in the context of neuroscienctific and cognitive experiments, they bear and reveal fruitful information that can advance science once certain methodological constraints are met. In particular, we suggest three specific methodological avenues to integrate first-person accounts. These are (i) the adaptation of experimental designs so that first-person reports do not stand on their own but are triangulated with third-person measures; (ii) the use of refined first-person measures such as the *micro-phenomenological interview* (a methodological approach to make first-person experience intersubjectively accessible developed by Claire Petitmengin); and (iii) the employment of *experienced meditators* as research participants. While these empirical approaches to experience all have roots in the works of Varela (Varela, 1996; Varela & Shear, 1999), to the best of our knowledge, they have not yet been integrated within a single neuroscientific experiment. Our contribution demonstrates that this can be accomplished in a fruitful way, yielding novel insights for understanding volitional action. Moreover, it presents concrete methodological advances, such as a solution of how (micro-)phenomenological reports can be linked with neurophysiological data in a strictly time-locked fashion.

In the next section, we describe the Libet task and address some interpretations of this experiment regarding free will. We will also address the phenomenology of volitional action and argue that the study of action initiation will benefit from the application of the neurophenomenology framework. In the subsequent section, we will introduce neurophenomenology in more detail and will present our research group's previous Libet studies with meditators. Based on the integration of the behavioral, neurophysiological, and first-person data in our research, we have developed a specific three-stage model of voluntary action initiation and a hypothesis to explain Libet's findings without a free will paradox, i.e., the *Slow Cortical Potential Sampling Hypothesis*. In the following section, we will describe the protocol of a recently conducted refined neurophenomenological Libet experiment that employs experienced meditators as subjects and makes use of the micro-phenomenology interview technique and analysis. Finally, we address ethical issues with respect to free will, Buddhist meditation, and the scientific approach of integrating first- and third-person data.

Free Will and the Libet Task

There is a centuries-old debate in philosophy about whether humans have free will. In this debate, two positions are often considered irreconcilable. On the one hand, our understanding of biological organisms is based on causality. The respective models of physical, chemical, and biological functioning (e.g., in the brain) are causally closed systems. Within this framework, nothing happens without an antecedent cause, and a *free will*, however it is defined, seems logically impossible. On the other hand, there is our daily life experience of having the possibility to act freely and to make decisions based on our own *will*. Moreover, this experience of freedom seems to be a necessary condition for our personal well-being as well as for the social organization of our society. Isaac B. Singer summed up this insight with his quote "We must believe in free will — we have no choice" (cited in Kanfer, 1997). This debate took a decisive turn when Libet published his famous experiment in 1983.

The Libet task is a simple experiment designed to study the electrophysiological correlates of a self-initiated voluntary action. Libet's experimental design (Dominik et al., 2024; Libet et al., 1983b) makes use of the *readiness potential* (RP). The RP is an electroencephalogram (EEG) phenomenon that was discovered by Kornhuber and Deecke in 1964 (Kornhuber & Deecke, 1965). They asked participants to lift a finger at a time-point of their choice while simultaneously recording the electroencephalogram (EEG). In a control condition, the same finger was passively lifted by a string. By averaging many trials and by time locking them to the onset of the movement, they found a steadily rising negative electrical potential over the central area of the scalp preceding the voluntary action (Fig. 1). This potential was only present in self-initiated movements and started approximately 1.5 s before the movement onset. Kornhuber and Deecke interpreted this potential as being related to the upcoming movement and called it *Bereitschaftspotential* or in English *readiness potential*.

Benjamin Libet added one more feature to the design of Kornhuber and Deecke. This feature was the so-called Wundt Clock. Participants now sat in front of an oscilloscope where a dot on a clock face rotated at a speed of 2.5 s per revolution. The task for the participants was the same, i.e., to lift a finger at a time of their choice. This was to be done spontaneous and without prior planning. In addition, they were asked to note the position of the dot on the clock face in the very moment they decided to initiate this voluntary action and to report the respective position after the completion of the trial. This moment of decision was also described as an *inner urge to act*. Libet et al. (1983b) spoke of the "conscious awareness of 'wanting' to perform" (Libet et al., 1983b, p. 627). and called this moment *w-time*.

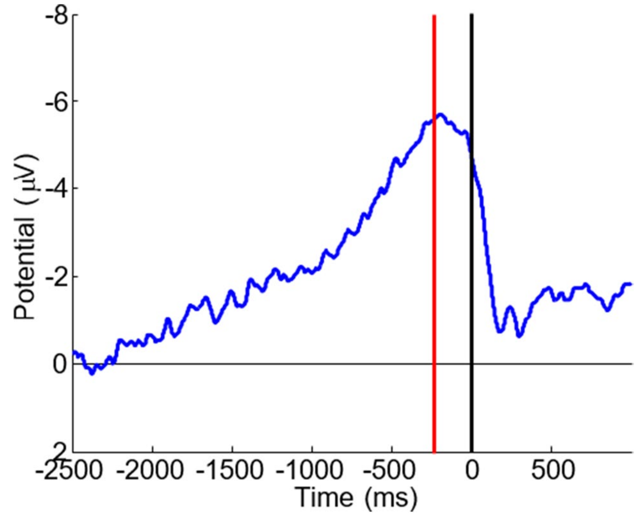

Fig. 1 The RP and the timing in the Libet task. The black line at time 0 ms indicates the moment in which the participants starts to move. The blue line indicates the RP after averaging 40 trials. It shows a steady rise in negativity starting about 2.5 to 1.5 s before movement onset. The red line shows the mean time of the participants' report of their decision/urge to move. It is 240 ms before the movement. The displayed RP is a grand average of several Libet studies conducted in our laboratory (Jo et al., 2013, 2014a, b, 2015)

What made this experiment famous was the fact that the RP started about 2.000 to 1.500 ms *before* the movement but the urge and decision to move (w-time) were only about 200 ms before to the movement (Fig. 1). In other words, the electrophysiological signal associated with the movement precedes the conscious urge or decision to move by more than 1 s. A recent meta-analysis of Libet-type experiments found an average onset of the RP 698 ms prior to movement and a w-time of 122 ms (Braun et al., 2021). These are shorter time intervals than previously reported but even in this meta-analysis the onset of the electrophysiological signal precedes the urge by 479 ms.

If there is a brain signal preparing an action about half a second before one feels the decision that one is going to initiate that action, then there seems to be a problem. Obviously, that brain signal is much more informed about what I am going to do than my conscious experience. Thus, this timing paradox in the Libet task challenges the subjective experience of free will and the veracity of subjective intuition about action initiation. Libet's empirical evidence radically challenged the existence of free will. In 2008, another experimental paradigm provided evidence that an upcoming decision is already encoded in the brain more than 7 s before it enters awareness (Soon et al., 2008). Based on this experiment and Libet's findings, some scholars argue that our experience of free will is an illusion (e.g., Wegner & Wheatley, 1999; see also Klemm, 2010; Smith, 2011). Such a radical position also has implications for legal issues since the denial of free will challenges the concept of responsibility as the backbone of our legal systems (e.g., Schleim, 2012).

However, there are many arguments that challenge such a straightforward interpretation of the empirical evidence in the direction of denying free will. These are logical as well as methodological arguments (Baumeister et al., 2010; Dominik et al., 2024; see, e.g., Klemm, 2010; Schmidt, 2023; Schmidt et al., 2016). It is not the purpose of this paper to summarize and review this controversy. However, to contextualize our own empirical approach, two strands of this debate will be explicated in this paper. One is the *Free Won't* issue and the other one is our own model, i.e., the *Slow Cortical Potential Sampling Hypothesis*, which will be presented further below.

Free Won't

In 1983, Libet et al. conducted another series of experiments (Libet, Wright et al., 1983a) in which they again asked the participants to prepare a movement, but then to "veto" this intention just before execution. Although the participants did not move, the RP could still be found. Libet argued that the initiation of voluntary acts begins in the brain *unconsciously*. However, in the progress of bringing this volitional process into physical action, it can be inhibited by a *conscious* process (Libet, 1999). Thus, there is a conscious control regarding action and the notion of free will can be saved even if the first preparations of "voluntary" acts are not consciously perceived. Libet's interpretation replaces a free will with a "free won't" (Obhi & Haggard, 2004).

This fits well with an evolutionary perspective. The complex brains of mammals evolved from simpler nervous systems. The less complex the neural wiring between sensory and motor neurons, the more direct the relationship between input and output. It is assumed that the first neuron linked a rather nonspecific stimulus to a simple action in a hardwired fashion (Stewart, 2014). Thus, in evolutionary terms, action began with a reactive system, not with the conscious initiation of action. In more complex systems, the relationship between input and output is modified by internal processes. But such modifications always address initial hardwired connections. This is also evident in human beings: There are "hardwired" reflexes that are beyond conscious control. There are autonomous processes (e.g., breathing) that can be consciously inhibited, but only within a certain range. Libet's suggestion that freedom is based on inhibition of pre-existent tendencies to act rather than on the initiation of movement fits well with a model that sees the role of cognition and decision-making in changing and governing existing behavioral patterns rather than in the initiation of new actions (from a situation of inaction).

The Relevance of Experience in Volitional Action

Many experimental researchers have attempted to resolve and explain Libet's paradox with new experimental designs. Libet's setup has been scrutinized from every possible angle. One weakness seems to be that one has to rely on the subjective reports of the participants about w-time. How do we know that these reports are accurate? Could it be that people have an internal "delay" in consciously experiencing the inner urge or in reading the clock? In other words, can we trust these statements? In psychology and neuroscience, reports of subjective experience and introspective accounts have often been dismissed as being unreliable, and researchers have therefore in many cases tried to replace subjective reports with objective measures that can be observed and controlled. This tendency can also be seen in the study of the Libet task. Logically however, there is no escape from subjective reports. The "felt inner urge to act" is by definition a subjective experience as is the experience of free will. One cannot study a paradox that is in part based on reports about experience by turning away from experience. But if this path is blocked, then the consequence is that one must turn to the phenomenon of subjective experience with scientific thoroughness. This calls for a systematic approach to *the experience and phenomenology of volitional action* which is at the basis of our experience of having a free will.

The Phenomenology of Volitional Action

The phenomenology of volitional action is complex and can be broken down into many components (Bayne & Levy, 2006; Pacherie, 2008). These include aspects such as the sense of agency, the experience of mental causation, the awareness of movement, or the awareness of self-control, to name but a few. In the present case, i.e., the Libet task, participants are asked to perform a very specific form of volitional action. Thus, the respective frame for such a phenomenological approach is also restricted to a large degree.

First of all, the Libet task is not about decision making in the sense of choosing between alternatives, e.g., coffee or tea. The action to be performed, i.e., lifting a finger, is already determined by the setup of the experiment. This is a major limitation of an experimental paradigm that is considered the most important empirical approach to free will (e.g., Klemm, 2010). Moreover, the Libet task is not about whether or not to perform an action. This decision to perform the action was already made when starting a Libet trial. The participant *must* lift the finger once in each trial. What remains as a free and volitional element in the Libet task is the *timing* of a predefined action. The participant is asked to lift a finger within a given time frame. Typically, there is an initial interval of about 2.5 s, i.e., one revolution of the clock hand that the participant must wait for before the participant enters into the freedom to decide on the timing of her action. Brass and Haggard (2008) introduce here the differentiation between a *whether* decision, a *what* decision, and a *when* decision. Only the latter one is addressed in the Libet task.

When decisions are not the most common volitional acts in our daily lives. There are hardly any situations in which the act to be performed is already decided, while the timing of the action has to be determined. We usually perform volitional acts as choices (coffee or tea, right or left) in response to a specific prompt. However, this does not mean that such a case does not exist. Lying in bed on a lazy Sunday morning and looking for the right moment to get up might be an example; deciding when to leave one's seat in the cinema after the movie is over might be another.

From a phenomenological point of view, the Libet task is a matter of "finding the right moment." Additionally, Benjamin Libet asked his participants to note the time at which an "urge" or "wanting" to move occurred. This additional instruction has the effect of directing attention not only to the precise act of initiating the requested movement but also to an alleged preceding urge or impulse to do so. This division of attention makes the Libet task quite challenging. Most participants require several training trials to perform the task as requested.

Neurophenomenology

A thorough investigation of subjective experience of volition requires a sound methodological framework. In the case of the Libet task, the specific challenge is to align the unfolding subjective experience with the EEG data, which is recorded in parallel. Neurophenomenology may be a suitable approach, as it was introduced as a pragmatic approach in cognitive science to address the so-called hard problem of consciousness (Varela, 1996). In contrast to "easy problems" of how the brain implements different cognitive functions (e.g., encoding of visual features), this "hard problem" describes the unresolved explanatory gap between functional theories of brain and cognition and the nature of conscious experience (Chalmers, 1995). While scientific approaches to consciousness usually try to find a theoretical solution to overcome this gap (explaining how consciousness emerges from matter and brain), Varela proposed an open-ended methodological approach to "remedy" the problem: He suggested to merge modern cognitive science with an in-depth first-person methodology. According to Varela, this would require building a community of practice and new pragmatical tools of phenomenological examination to be woven into the scientific process. The basic assumption of his approach is that externally observable phenomena from cognitive science (e.g., EEG data) and subjective experience are two irreducible phenomenal domains, deserving careful attention in their own right and providing mutually informative perspectives. Varela proposed concrete methodological pathways by drawing on two traditions that have developed systematic ways of investigating experience: phenomenology in continental philosophy and the contemplative tradition of Buddhism. The assumption was that the practices and insights of these traditions can be brought into a fruitful dialogue with the methods and theories of cognitive science.

The philosophical tradition of phenomenology originates in the works of Edmund Husserl (1859–1938) and aims to systematically scrutinize and reflect on the structures of conscious experience (Thompson & Zahavi, 2006). It is a response to modern scientific ways of thinking (Moran, 2010). According to phenomenology, science is an abstraction from our encounters with the lived world, and we must therefore examine how these lived encounters come to constitute the intersubjectively observable world. This idea becomes even more relevant once cognitive science attempts to explain experience based on this external world (e.g., brains and neurons) (Varela et al., 1991). Neurophenomenology urges cognitive science to embrace this mutual dependency, and to resist the temptation to declare a firm ground by adopting materialist or idealist viewpoints. This echoes a central tenet of phenomenology to suspend habitual beliefs about experience and engage in a fresh examination of it. Such an examination is referred to as "phenomenological reduction." While for Husserl phenomenological reduction was the private task of the philosopher (Depraz, 1999), neurophenomenology and related current developments aim to implement it as a social practice into the research process (Varela & Shear, 1999). Here the micro-phenomenological interview method, which we introduce later on, provides a concrete example.

Another inspiration for disciplined approaches that support the phenomenological attitude was taken from Buddhist contemplative practices (Thompson et al., 2005; Varela, 2000), since these traditions have developed a rich and detailed repertoire of examining the mind. In particular, similarities between phenomenological reduction and mindfulness practices have been postulated, as the latter cultivate a suspension of habitual thought as well as modes of sustained attention to pre-reflective and embodied experience (Bitbol, 2019; Depraz, 2019). Nowadays, mindfulness meditation has become a common object of research in cognitive neuroscience—to some extent validating the postulated benefits in terms of attention and awareness of experience (Fox et al., 2012; Shi & He, 2022; Sumantry & Stewart, 2021; Verhaeghen, 2021). In a few studies, scientists have collaborated with trained meditators based on the premise that they might provide more refined accounts of experience. These studies have targeted the embodied or minimal sense of self (Berkovich-Ohana et al., 2020; Nave et al., 2021) as well as volitional action (reviewed below).

From a methodological cognitive science perspective, neurophenomenology involves two steps. The first step consists in the generation of first-person accounts through disciplined explorations of experience, and the second step consists in reciprocally relating these accounts to third-person observations (e.g., neurophysiological or behavioral data) in an iterative way (Thompson et al., 2005). Thereby, first- and third-person perspectives provide mutual constraints for each other, which can result in ontologically neutral accounts of the mind that are embedded in both first-person experience and third-person observations. The various ways in which this dialogue has already been implemented in scientific studies have recently been reviewed and organized as a typology of bridges (Berkovich-Ohana et al., 2020). These bridges can be unfolded sequentially, thereby building an increasingly differentiated and reliable understanding of the phenomenon at stake. Below, we will describe this process based on our own research on voluntary action.

Applying Neurophenomenology to the Libet Task: Our Previous Work

Experienced Meditators in the Libet Task

Based on our previous research on meditation as well as the above methodological consideration, we decided to perform the Libet task with experienced meditators. Our aim was to use the introspective capacities meditators have developed in long-term practice for research. Thus, we did not study meditation per se but used the meditators' abilities as a methodological tool to refine our analysis. Lutz et al. (2007) argue that experienced meditators are interesting for neuroscientific research for several reasons. One is that advanced practitioners can provide data that are only accessible and obtainable after sustained mental training (see Winter et al., 2020 for an example). Another is that these participants can reliably reproduce certain mental states and thus make them accessible for science. The third advantage according to Lutz et al. (2007) is that advanced meditators are able to provide more refined first-person accounts of a certain experience compared to naïve participants.

This raises the question of which types of meditation are suitable for this approach and how we can be sure that long-term meditators have actually developed the desired skills (Davidson & Kaszniak, 2015). Different types of meditation can be distinguished on the basis of their spiritual and religious background (Sedlmeier, 2022). However, such classifications may not be suitable for empirical research, as different traditions may share similar practices while within the same tradition distinctively different types of meditation are practiced (Schmidt, 2011). Classification systems for science should therefore be based more on the factual practice than on the contextual background. Several such systems have been proposed (e.g., Dahl et al., 2015; Lutz et al., 2015; Matko & Sedlmeier, 2019; Schmidt, 2014). While these systems have several conceptual differences, they all share the idea that the most crucial feature of meditation is to regulate and sustain attention (Shapiro, 1982). Consequently, it has been repeatedly shown that long-term meditation experience leads to an improved performance on different kinds of attentions tests (Jha et al., 2007; Lutz et al., 2008, 2009; Sumantry & Stewart, 2021; van Leeuwen et al., 2009). Thus, while the more subtle effects of different types of mediation still need to be studied in greater detail, it can be assumed with some certainty that experienced meditators have attentional capacities, especially with regard to sustained attention, that benefit first-person approaches. Thus, in the context of the Libet task, it can be hypothesized (i) that due to their trained attentional skills experienced meditators have a better awareness of their *urges* or their *"wanting" to perform* in the Libet task. This may lead to an earlier w-time. (ii) Advanced practitioners may show more reliable performance when carrying out a set of 40 trials in the Libet task. This may result in smaller variances in the w-time of the trials. (iii) Experienced meditators may give refined descriptions of the various steps that lead from sensing the urge to executing the action in the Libet task.

We have tested all three hypotheses in several studies in our EEG lab (Jo et al., 2013, 2014a, 2015; Schmidt et al., 2016). We have shown that meditators do indeed perform differently in the Libet task, although their w-times were not earlier than in controls (Jo et al., 2015). We have also shown that a highly experienced meditator has a comparatively strong RP and small variances in w-time in a single case study (Jo et al., 2014a).

However, our research has so far benefitted most from the integration of the first-person reports of a very advanced Buddhist practitioner and teacher named Tilmann Borghardt. He has more than 40 years of experience with meditation, is a former Lama in a Tibetan tradition (Lama Lhündrup), and has lived in retreat centers for more than 25 years. In earlier encounters with him, we realized that he had a remarkable aptitude for speaking and describing his inner experiences. With Tilmann repeatedly performing the Libet task in our lab, we developed a specific neurophenomenological approach. His first-person data (i.e., his reports of what is it like to sense the urge and to initiate the action in the Libet task) and his third-person data (i.e., EEG recordings of the individual trials and the resulting RP, assessment of the w-time) were aligned by a mutual and iterative process involving the generation of new hypotheses, the performance of slightly modified experimental trials, the analysis and discussion of the first-person reports, and the assessment of the quantitative data (Jo et al., 2014a). This approach can be regarded as an example of the iterative process of bridging the neural and experiential domains described above. This process aims to refine and integrate the understanding on both sides.

Based on this line of research, we developed two theoretical accounts with respect to volitional action initiation and the Libet task. The first one is the *three-stage model of voluntary action initiation*, a theoretical framework of the various mental processes of initiating a voluntary action (Jo et al., 2015). It can be regarded as a first step of a phenomenological model of self-initiated action. The second one is the *slow cortical potentials* (*SCP) sampling hypothesis* (see below), which explains why the RP starts before w-time without creating a paradox regarding free will (Schmidt et al., 2016). This hypothesis received initial empirical support in experiments with Tilmann Borghardt (Jo et al., 2014a). We discuss both below.

Three-Stage Model of Voluntary Action Initiation

The model consists of three stages. The first stage involves directing attention and observing whether there is an inner impulse or urge. In terms of agency, Tilmann Borghardt did not attribute agency to the appearance of such an impulse. The second stage is the process of taking up an experienced impulse and initiating the requested action. Thereby, the pregiven task or goal and the experienced impulse merge into a specific intention to act. Here, the goal is a top-down process while the impulse is a bottom-up process. Finally, in the third stage, a final decision is made as to whether the movement will actually be executed. Tilmann Borghardt ascribes agency to his act, but he also emphasizes that most of the decision is made earlier. He speaks of "giving full permission to the organism to follow that first inner impulse…" (Jo et al., 2014a, p. 114). Both Libet, Wright, et al. (1983a) and Schultze-Kraft et al. (2016) have demonstrated that the motor action in the Libet task can be vetoed at the very last moment. Schultze-Kraft et al. (2016) estimated this point of no return to be about 200 ms before movement onset. Thus, such a veto occurs within this third stage. Based on the SCP sampling hypothesis, such a veto with no subsequent movement is consistent with the existence of a RP at the same time. This reasoning also received additional empirical support in one of the modified Libet tasks performed by Tilmann Borghardt (Jo et al., 2014a).

Slow Cortical Potential Sampling Hypothesis

The SCP sampling hypothesis proposes a different interpretation of Libet's findings. It questions one of the basic assumptions of this experimental paradigm, that is that the RP that precedes voluntary action is the *cause* of the upcoming action. This interpretation was first proposed by Kornhuber and Deecke (1965). They found an RP before a voluntary action but not before an involuntary action.

Yet, this causal argument is incomplete. If the RP is taken to be the cause of the action, it must also demonstrate that there is no RP if there is no action. Only then is the causal inference complete. The problem here is that the assessment of the RP is based on *backward sampling*. Only when an action occurs is the EEG preceding that action evaluated. This procedure does not allow to test if there is *no RP* when there is *no action*. Alexander et al. (2016) conducted a study in which they were able to elicit an RP in participants without any action. This finding already challenges a strict causal interpretation. Another challenge to a causal interpretation of the RP is that it can only be seen in the data after averaging many individual trials, typically 40. This is because it is a weak signal in a noisy environment. Therefore, it is impossible to see a RP per se and to be sure that the RP is present in every single trial (Dominik et al., 2024; Schmidt et al., 2016).

The fact that the RP is based on averaging and backward sampling allows for another hypothesis, first proposed by John Eccles already in 1985 (Eccles, 1985). He argued that there might be a continuous background fluctuation of electrical potentials in the brain. These fluctuations could be related to action initiation in the sense that negative fluctuations have an excitatory effect and positive fluctuations have an inhibitory effect on brain processes. If this was the case, an action would be initiated more often during a negative background fluctuation than during a positive one. The resulting average of many trials may therefore show a negative signal, as a consequence of averaging the unbalanced background fluctuations. Eccles' hypothesis can explain the existence of a RP prior to voluntary action without making it the cause of that action. Schurger et al. (2012, 2016) designed an accumulator-model based on the idea that these fluctuations cross a certain threshold at some point which results in a decision to move. However, our own hypothesis takes a somewhat different approach (see also Dominik et al., 2024).

The SCP sampling hypothesis assigns the role of the background fluctuations in Eccles' hypothetical model to the SCP, which are fluctuations found in the EEG with a frequency below 1 Hz. They are called fluctuations rather than oscillations since they do not show any rhythmic patterns (Birbaumer et al., 1990; He & Raichle, 2009). Indeed, these fluctuations have been associated with variations in reaction times and with sensory thresholds in the sense that negative potentials were related to shorter reaction times and lower sensory thresholds (Schmidt et al., 2016). We have conducted several studies exploring the relationship between SCP and voluntary action initiation (Jo et al., 2013, 2014a; Schmidt et al., 2016). This has been particularly successful in working with Tilmann Borghardt as a highly experienced meditator. Based on the above reasoning and our empirical findings, the SCP sampling hypothesis states the following:

"(i) there are continuous fluctuations of slow cortical potentials; (ii) during the negative phase of these neural fluctuations the excitability of the neuronal system related to action initiation is raised; (iii) during the negative phase of these fluctuations the feeling of an urge to act is reported; (iv) spontaneous voluntary movements are started more likely during a negative phase or negative peak of these fluctuations; and (v) consequently, the averaging of many trials started during negative slow cortical potentials and time-locked to movement onset results in the curve of the early RP…." (Schmidt et al., 2016, p. 642). This hypothesis can explain the presence of the RP prior to w-time in the Libet task without challenging the notion of free will. The RP is no longer seen as a cause of the action but as a signal indicating a moderating variable with respect to self-initiated action.

Protocol of a Refined Neurophenomenological Libet Experiment

Based on the neurophenomenological work described above and in particular the derived SCP sampling hypothesis, as well as other empirical works pointing in a similar direction (Fried et al., 2011; Keller & Heckhausen, 1990), we have developed a protocol for a new experiment to further investigate the relationship between negative deflections in the EEG and the phenomenology of action initiation.

Here, we hypothesize that individual trials in the Libet task in which a clear negative deflection of the slow cortical potential precedes the button press will be associated with a qualitatively different subjective experience compared to trials with a preceding deflection in the positive direction. In particular, if the SCP sampling hypothesis is correct (see statement (iii) above), negative fluctuations should be accompanied by a stronger feeling of an urge to act. To obtain the respective first-person evidence, a methodological approach is needed to elicit and analyze these first-person reports in a reliable and fine-grained way. The micro-phenomenological interview (MPI) fits these needs and is introduced in the next section.

For the empirical test of our predictions, we use real-time analysis of EEG data in the Libet task performed by experienced meditators to select trials with either a clear negative or positive deflection. While the participant performs the task, a computer algorithm analyzes the ongoing EEG data and interrupts the task as soon as one of the two types of trials is identified. The interviewer then directly enters the EEG chamber and conducts a micro-phenomenological interview to describe the experience during the preceding trial. This procedure is performed twice for each participant, once for a strong negative and once for a strong positive trend in the SCP. Importantly, participants need to be blind to the hypothesis, conditions, and the real-time setup, and the interviewer needs to be blind to the conditions (positive or negative deflection). These interviews are then analyzed according to the procedure described below, allowing to extract generic structures of experience during the Libet task. In the analysis, this material was used to group the two trials from each participant into one of two categories. The descriptions of these two categories were obtained inductively by examining the interview pairs for invariant patterns and structures. One of these categories was then related to the negative potential, where we expected a stronger urge and a more immediate decision than in the other category. This analysis was carried out in a completely blinded manner and by multiple raters. Finally, this phenomenology-based grouping wais compared statistically with the EEG-based grouping of trials (positive or negative deflection of the SCP).

The Micro-phenomenological Interview (MPI)

The *micro-phenomenological interview* is a specific type of phenomenological interview (Petitmengin, 2006; Petitmengin et al., 2019), which is a further development of the elicitation interview developed by Vermersch (2000) and incorporates some techniques originally developed within the approaches of Focusing (Gendlin, 1969), and neuro-linguistic programming. It was developed from these techniques specifically for research purposes to act as a microscope, enabling to "zoom in" on very short moments of experience.

It is particularly suited to investigate brief singular experiences, for example in the context of neuroscientific research. It can be used to obtain rigorous phenomenological data from naive participants without the requirement to be trained or expert about a certain topic. Micro-phenomenology is unique in that it provides access to those experiences that are pre-reflective and/or difficult to verbalize. That is, when having an experience or performing a task, it is almost impossible to be fully aware of how this unfolds sequentially or what facets are occurring at any given moment. Therefore, the first phase of the micro-phenomenological interview consists of an evocation phase to help the interviewee to return to and to re-enact (relive) the moment or event under study. Then, by asking simple questions, regularly summarizing the descriptions in the interviewee's words, and closely attending to the details reported, the interviewer supports the interviewee to retrieve more and more features of that moment. There are no pre-defined questions or pre-defined protocols on a micro-level, only the moment to be studied is defined in advance. The interviewer aims at getting a diachronic (sequential) description of the moment under study and to explore all the elements that happen at any given point in time, termed the synchronic dimension.

For analysis, interviews are recorded and transcribed, also including para-verbal and non-verbal elements. The transcripts are then checked for quality and internal reliability using specially developed and validated quality assessment tools. The use of the present tense, the slowing down of speech, the presence of hesitations, pauses, neologisms, unusual comparisons or cross-modal descriptions, and non-verbal gestures are considered as indicators that the interviewee was in an evocation state and accessing their experience and not confabulating. Sections of the interviews in which the interviewee does not report features of the singular experience under study but theorizes, interprets ("I think this is because…"), or generalizes ("this always happens to me") are not taken into account for the micro-phenomenological analysis.

With respect to the evocation of the event, there are some epistemological considerations. It is important to emphasize that the event under study is almost never the original event, since this is impossible, but its re-evocation. The re-evocation is therefore an essential part of the interview process that requires time. Part of the interviewer's training is to learn how to re-evoke an experience without being suggestive. This involves learning to use open questions and to identify instances of possible suggestive questions in the analysis phase. Reliability is checked through assessing the internal coherence of the interview (Petitmengin et al., 2019). Strong indicators that an interviewee is not confabulating are when there is an element of surprise upon suddenly remembering something about the experience, or correcting the interviewer when they summarize or reformulate what the interviewee has told them. External validity can be ensured by comparing multiple interviews and extracting generic structures.

Critical Reflections on the Protocol

Here, we would like to emphasize and explain the uniqueness of this methodological approach. Given the effort involved in obtaining such detailed phenomenological data, it could be argued that the same hypothesis could be investigated using a standard psychometric approach (e.g., asking participants to rate the degree to which they felt an urge after each trial). However, we speculate that this „urge" is usually hidden in the pre-reflective „fringe" of experience. If it were in the foreground of experience, individuals would be quite overwhelmed by the ongoing rise and fall of "urges." Thus, only upon conscious close-up examination of the (re-evoked) experience, might participants discover that a certain trial was accompanied by a sense of lightness, spontaneity, or rising tension in the body, whereas another trial might be elicited by more thoughtful and effortful processes, more detached from any spontaneous urge. Such nuances could easily escape the attention of participants in a psychometric experiment with many trials. This is also the reason why we again worked with experienced meditators in this study, based on the assumption that they might be more attentive and sensitive to these nuances. Finally, an interesting feature of this experiment is that the phenomenological examination is guided by neurophysiological measurements. The contrast between two neurophysiologically very different trials may facilitate becoming aware of otherwise unnoticed experiential features. This exemplifies another way of how neurophenomenology may bridge the gap between brain and consciousness in a non-reductive way, interweaving and mutually enlightening different first- and third-person perspectives on mental phenomena.

The experimental protocol described above is currently being implemented in our lab. The results of this research will be reported elsewhere.

Ethical Aspects

Finally, we would like to pay attention to the ethical aspects associated with this type of research as well as its contents. The question of whether human beings have *free will* is of course related to ethical aspects. This relationship becomes obvious when free will is negated. If there is no free will, one could argue that there is no responsibility for one's actions. It is clear that such a basic attitude would radically change the coexistence in our society in a negative way. Additionally, within the long-standing philosophical debate about free will, aspects of (moral) *responsibility* (e.g., with Kant, see Garfield, 2016) and of *self-determinism* are of importance. According to Garfield (2016, p. 48), "Freedom is not absence of determination, but self-determination." The consequences of not believing in free will have also been demonstrated empirically. In a study by Vohs and Schooler (2008), participants who were led to believe that human behavior is predetermined exhibited more cheating behavior.

With respect to the relationship between *meditation* practice, free will, and ethics, the issue of *self-determination* is of importance. Whether free will exists in a particular philosophical framework is more of an academic debate. However, it has direct consequences for our lives whether we have greater or lesser capacities and capabilities of self-determination and self-control, and thus can take responsibility for our actions.

It was mentioned above that we are clearly not in control of all of our actions. It has also been shown that in some circumstances, inhibiting our behavioral tendencies can be an act of self-determination. There are many behavioral domains that exhibit a degree of partial autonomy such as attention or breathing. These are in principle accessible and consciously controllable when we bring them into the foreground of awareness. However, when this is not the case, they operate according to autonomous principles resulting from the organism's needs (e.g., breathing), or according to habits and learning experiences (e.g., eating habits).

Sustained meditation practice can, among other things, lead to an increase in the capabilities for self-determination and improved self-regulation. Self-determination refers to the ability to make choices and decisions based on one's own preferences, values, and interests and relates closely to intrinsic motivation (Ryan & Deci, 2000). Self-regulation is understood as the ability to modify and control one's own behavior, emotions, thoughts, and impulses (Muraven & Baumeister, 2000; Vago & Silbersweig, 2012). There is a large body of empirical evidence demonstrating that long-term meditation practice improves self-regulation skills (e.g., Ataria et al., 2015; Chételat et al., 2022; Lykins & Baer, 2009; Winter et al., 2020) as well as interoception (Bornemann & Singer, 2017; Fox et al., 2012). Automatic action is replaced by deliberate action. Such conscious action can draw on reflection, deliberation, and also moral principles. Deliberate action is self-determined and involves the possibility of making choices, of acting differently, or of not acting at all. By increasing the amount of conscious action in this sense, new habits can be formed that are more consistent with one's ethical stance than previous habits. In this way, meditation may have an indirect ethical influence on our actions (see also Grossman, 2015; Repetti, 2018) by increasing the amount of self-determined choices. According to Wallace (2011), there are mainly two processes within Buddhist practice that lead to such an increase. One is the cultivation of attentional skills and the other one is the development of metacognitive and introspective capacities that lead to insights into how actions arise from attitudes, intentions, feelings, and thoughts.

Our neurophenomenological approach to the Libet task described here contributes to such ethical aspects in two ways. One is the process of science itself. As scientists, we make decisions about which questions to pursue, which hypotheses to investigate, and which directions to take. These choices have consequences because they determine what kind of knowledge will or will not be available. In the present case, we chose to include the first-person perspective in the Libet task. The scientific discourse around the Libet task has so far been entirely based on third-person data and the third-person perspective (Dominik et al., 2024; Neafsey, 2021). In the majority of Libet-task studies, the only contribution of the conscious participant has been to mark the moment of w-time on the clock. Excluding the richness of first-person experience leads to simplistic models that reduce the decision to act to a mere binary phenomenal content ("I want to act") and assumed underlying neural processes (e.g., "a ramping up" of activity in action-related cortices). However, if we shift gears and focus our attention on the inner experience of the participants, a different perspective emerges. We suddenly understand that the simple button press in the Libet task is accompanied by complex and rich inner processes. There are expectations, bodily sensations, urges, cognitions, e.g., about timing or about the experimenters' expectations, and an emotional tone, to name but a few (see also Pacherie, 2008). Thus, the scientific description of volitional action gets a lot of new input, which in turn can be aligned with the third-person perspective, as we have done, for example, with the SCP sampling hypothesis or with our three-stage model of action initiation.

In addition to these extended scientific models, such investigations can also have an impact on how people understand and conceptualize decision making, once they transpire into the larger cultural context. Becoming aware of these otherwise opaque processes may lead to changes in the perception and description of action (initiation). People may come to a different understanding of how they (and others) initiate action and how this process can be self-regulated. Thus, a neurophenomenology of action may not only have implications for intellectual discussions of the nature of free will, but may, in the longer term, lead to an expansion of self-determination and self-regulation in the wider society.

Conclusion

For the past 20 years, our research group has been concerned within the field of meditation research with the problem of incorporating the rich subjective experience from meditators into our research. In initial EEG studies with highly experienced meditators (either long-term teachers or/and monks and nuns), the comparison between EEG patterns and first-person accounts revealed that neuroscientific research alone does not capture the full phenomena at stake, and thus cannot fully address key questions in the science of mind and consciousness, such as the notion of free will. In the approach described here, we followed the direction suggested by Varela's neurophenomenology and systematically combined first-person and third-person accounts. We exemplify how this can be achieved by interweaving phenomenological methods (including the micro-phenomenological interview) with adapted experimental neuroscience designs (e.g., the Libet task) as well as collaborating with long-term meditators. Finally, we showed how following such a phenomenologically enriched approach allowed us to develop a more differentiated model of action initiation that avoids clashes between neuroscientific and experiential perspectives but rather integrates both in a coherent account. This approach not only restores the ethical accountability of the conscious subject but also promises to strengthen awareness of the inner dynamics of action initiation, thereby potentially fostering self-determination and ethical behavior.

Our view and approach is best expressed in a quote from Jack and Roepstorff (2003, p. xx): "Cognitive scientists should not fear that introspective evidence will impugn the scientific credibility of their work. They should fear the Frankenstein science they will create without it."

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Author Contribution Stefan Schmidt wrote an initial draft of the manuscript, Fynn-Mathis Trautwein wrote the initial section on neurophenomenology, and Prisca Bauer wrote the initial section on microphenomenology. All authors revised and edited the manuscript several times and contributed to all parts.

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Declarations

Conflict of interest The authors declare no competing interests.

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