Modeling subjects' experience while modeling the experimental design: A mild-neurophenomenology-inspired approach in the piloting phase

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Modeling Subjects' Experience While Modeling the Experimental Design

A Mild-Neurophenomenology-Inspired Approach in the Piloting Phase

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> Context • The integration of data measured in first- and third-person frameworks is a challenge that becomes more prominent as we attempt to refine the ties between the dimensions we assume to be objective and our experience itself. As a result, cognitive science has been a target for criticism from the epistemological and methodological point of view, which has resulted in the emergence of new approaches. Neurophenomenology has been proposed as a means to address these limitations. The methodological application of this discipline, even in its mildest form, enriches the methodology typically used in cognitive sciences. **> Problem** • Nowadays psychological studies are difficult to replicate. As a way to achieve replication of results published in a previous study in order to develop a methodological adaptation suitable for electroencephalographic (EEG) measurements in a subsequent experiment, first-person accounts from the participants in our pilot study were included in the experiment construction. This study's objective is to show the benefit of including a mild-neurophenomenology-inspired approach in the adaptation from an original paradigm, which requires, foremost, the ability to replicate the original results. **> Method** • Interviews with open and semi-structured questions were carried out at the end of an Approach-Avoidance Task (AAT). The first-person reports, together with the behavioral outcomes of each pilot, were taken into account for the development of the next piloting phase until replication of the original results was achieved, and the final experimental design was elaborated. **> Results** • A sequence of four pilots, where the integration of third- and first-person information derived from subjects' behavior and reported experiences while carrying them out rendered the behavioral replication we sought to achieve, providing support for a first-person enriched cognitive science paradigm. **> Implications** • Including first-person accounts systematically during the development and performance of classic cognitive paradigms ensures that those paradigms are measuring what they claim to measure. This is the next logical step to improve replication rates, to refine the explanation of the results and avoid confounding third-person data interpretation. **> Constructivist content** • Including first-person experiences and acknowledging the active role that participants' experiences regarding the paradigm had in the modeling of its final version is in concordance with a constructivist standing. **> Key words** • **Mild neurophenomenology-inspired approach, piloting, first-person enriched experimental paradigm, phenomenological validity, replication.**

Introduction

« 1 » The integration of data measured in first- and third-person frameworks is a challenge that becomes more prominent as an attempt is made to refine the ties between the dimension we assume to be objective and our experience itself. In the methodological pursuit of achieving this, the philosophical problem of trying to understand the relation of the experiential dimension with brain and body physiology must be taken into consideration. This problem has been formalized as the "explanatory gap," the issue of how to methodologically and epistemologically tie together the subjective domain of experience (first-person framework) and the domain of brain, body, and behavior (third-person framework) (Roy et al. 1999). Despite the actual existence of complex and refined models of the neural correlates of consciousness (or any cognitive and behavioral outcome), the challenge of incorporating the experience reported by the subject is still pending (Thompson, Lutz & Cosmelli 2004). Because of this, in recent decades, the cognitive science field has been subjected to much epistemological and methodological scrutiny (e.g., Lara Zavala et al. 2000), which has resulted in the emergence of new approaches.

« 2 » "Neurophenomenology," a methodological strategy started by Francisco Varela in 1996, aims to make progress on these issues. It proposes specific methods for a first-person data collection framework rooted in the phenomenological tradition by guiding subjects to achieve phenomenological reduction, i.e., a suspension of the "naïve" (common sense) attitude aimed at developing precise descriptions of their experience as it is (Varela 1996). These disciplined phenomenological explorations of experience allow for richer first-person data which, if used in a systematic way, can serve as constraint guidelines for describing and quantifying the physiological processes accompanying the described conscious experience (Lutz & Thompson 2003). The working hypothesis of neurophenomenology is that "both domains of phenomena have equal status in demanding a full attention and respect for their specificity" (Varela 1996: 344), thus the interplay of this multi-source data should take place under a system of *dynamic reciprocal constraints* (DRCs) where the two accounts serve as mutual constraints on each other, establishing a co-determination between subjective experiential accounts and neurophysiological data.

« 3 » The application of neurophenomenology as a methodological strategy, even in its mildest form, provides enrichment to the methodology used by the cognitive sciences, in the sense of providing a more refined correspondence between described conscious subjective experience and its empirical psychophysical counterparts (Lutz & Thompson 2003). From a naïve empirical position, one could see neurophenomenology as a tool to propitiate a refinement of third-person methodologies by investigating conscious experiences, while still remaining within its explanatory epistemological framework. This neurophenomenological approach has been referred to by some philosophers as "mild-neurophenomenology" (Bitbol & Petitmengin 2017). In this mild form, neurophenomenology is no longer framed in a larger ontological or epistemological controversy, but rather in a strictly methodological one: what are the methodological stages and procedures that would allow neurophenomenology to be used in behavioral psychology and cognitive neurosciences? How is it going to be integrated in this praxis?

Phenomenology in experimental design construction

« 4 » There are different levels, degrees of depth and stages where we can introduce experiential distinctions in experimental designs. For instance, in a cognitive science paradigm, a first-person account can be introduced in 3 temporal stages (Overgaard, Gallagher & Ramsøy 2008):

a in the pre-experimental process,
b in the actual experimental situation, and
c after the experiment, during result analysis.

« 5 » Generally, in the cognitive science paradigm, the main research question and the general experimental design are derived from theory and previous literature research. As an alternative, previously established phenomenological insights or distinctions could be used to determine the way experiments are set up. This way of introducing phenomenology has been established as the "front-loaded" phenomenology approach (Gallagher 2003; Gallagher & Varela 2003), where "previous insights gained in phenomenology and preliminary trials, generally in a dialectical movement, specify or extend these insights for purposes of the particular experiment or empirical investigation" (Gallagher 2003: 12), remaining consistent with neurophenomenology and the DRC framework, which avoids the need for training subjects (Bockelman, Reinerman-Jones & Gallagher 2013).

« 6 » Even if the main research question and the general experimental design are in the first instance derived from theory, one can apply a front-loaded neurophenomenology approach when the paradigm is tested for the very first time (Pilot 1). Insights from first-person reports, together with the behavioral data obtained from the experimental task, are taken into account in the development of the next piloting phase or the final experiment. At this second stage, constraints on data come not only from an externalized assumption of objectivity, but from a co-regulated interaction of subjective experiential reports and analyses of neurophysiological data (Lutz 2002). This way, the pre-experimental process provides "phenomenological validity" to the experimental design (Bockelman, Reinerman-Jones & Gallagher 2013).

Mild-neurophenomenology-inspired approach in the piloting phase

« 7 » In our main study we wanted to assess the brain dynamics and associated experience of the dereification phenomena, in our view brilliantly behaviorally captured by Esther Papies, Lawrence Barsalou and Ruud Custers (2012) in their article "Mindful Attention Prevents Mindless Impulses." They showed that a mindful attention attitude reduces automatic unconscious impulsive behavior towards images of attractive foods compared to a control/immersion attitude in an approach-avoidance task (AAT). The adaptation of this paradigm from its behavioral form, to be addressed neurophysiologically, required some slight changes (e.g., increased number of images). These changes had an enormous impact on how the participants responded to this task.

« 8 » Interviews with open and semi-structured questions were carried out to learn about the subjects' experiences while carrying out the experimental tasks, in order to recognize previously undetected factors affecting the outcome, as a means of achieving the replication of results reported by Papies, Barsalou & Custers (2012).

« 9 » The present article specifically focuses on the preparatory process for the adaptation of this paradigm, particularly inspired by the dialogue between first-person and third-person data proposed by the neurophenomenological research program,[1] and using a front-loaded phenomenological logic. This article aims to demonstrate, by means of an example, the relevance of recollecting first-person data in a systematized way, as a way of overcoming difficulties in the replication of behavioral results from an original behavioral paradigm (i.e., Papies, Barsalou & Custers 2012) in a newly derived paradigm, suitable for electroencephalographic (EEG)[2] and qualitative measures

1| Note that the study presented here is not a neurophenomenology study itself since it does not involve neural activities or extensive phenomenological experience description, and the constraint between first- and third-person data occurs ultimately at group level.

2| Electroencephalography (EEG) is an electrophysiological monitoring method of recording the electrical activity of the brain. It reflects the changes in extracellular voltage that occur at any

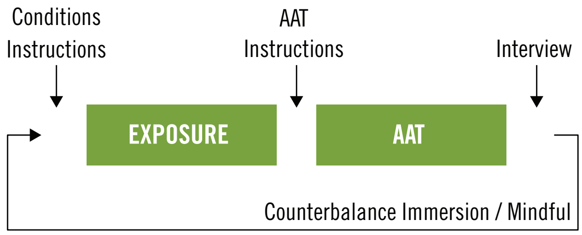

Figure 1 • Experimental design scheme: Participants were first exposed to 120 images, under the mindful or the control/immersion instruction condition. They were then asked to perform the AAT. Finally an interview was conducted. Participants carried out this sequence two times on different days, each time under one of the two conditions.

as preparation for neurophenomenological scrutiny in the main study (which is currently in preparation). The outcomes of this attempt show progressively how a process of successive mutual restrictions between data accessed from first- and third-person points of view (in a four-step piloting process) allowed for integration of a subject's experience into the experimental design. Thus, the process afforded phenomenological validity (as confirmed by first- and third-person accounts) to the experiment conducted using cognitive neuroscience methods.

« 10 » Firstly, we present the results from the pilot phase of each experiment and the transformations they underwent before achieving the final adapted experimental design. At each step, we present the main necessary changes in order to achieve the results found in the original study, along with the reasons that sustain them, based on our understanding extracted simultaneously from first- and third-person data analysis. Next there is a summary section of the piloting process where we discuss some of the findings; also we present some additional controls and qualitative instruments derived from this process, which will later serve as "fertile soil" for the neurophenomenological inquiry of the main study.

« 11 » The discussion focuses on:

- Our findings and the reflection of how a mild-neurophenomenology-inspired application serves as a skillful tool to achieve first-person-enriched cognitive neuroscience and phenomenologically valid paradigms;
- How our mild-neurophenomenological-inspired approach converges with and diverges from neurophenomenology in its application to solve our daily cognitive neuroscience laboratory problems; and
- How very basic mild-neurophenomenology-inspired methodologies could help to overcome what has been referred to as a "replication crisis" (Schooler 2014) by addressing "subjective noise," an important factor for low replication rates, specifically in psychology.

Methods

Paradigm adaptation from original to pilot 1 design

« 12 » We adapted a protocol of exposure to a pool of images of neutral and attractive foods, with either a Mindful or Immersed attitude followed by an Approach-Avoidance Task (AAT) as described below. The participants in the original study (Papies, Barsalou & Custers 2012) contemplated an image pool of only 10 different food images (constituted by 5 attractive foods and 5 neutral foods) from the IAPS database, and only considered behavioral data. The images were not calibrated with regard to contrast, object size, brightness and space distribution, as is required for ERP-EEG measurements. Furthermore, the number of images was not enough to obtain an event-related potential (ERP)[3] without a considerable number of trial repetitions. The adaptation we have developed considered a pool of 120 images, rated and classified as attractive or neutral foods through a survey and containing 60 items belonging to each validated category, and was built in Psycopy presentation software as described by Papies, Barsalou & Custers (2012). In this methods section we present the first adapted experimental design for the paradigm, corresponding to pilot 1, although this experimental design changes as we present the pilot results. These changes will be properly identified.

Participants

« 13 » Ten healthy adults were recruited via flyers posted in universities and football, volleyball, political, literature, dance, meditation, tae kwon do and capoeira centers. Participants with a history of self-reported psychological disorders (depression, anxiety, eating disorders), dieting intentions or physical conditions (such as excessive body mass index (BMI), heart conditions) that could interfere with the study aim or put participants' health at risk were excluded from the study. (Overall 40 volunteers participated in this pilot study, the first 10 volunteers participated in pilot 1, the following 10 in pilot 2 and so on for the 4 pilots.)

General procedure

« 14 » Each participant gave their informed consent prior to taking part. They were first exposed to each of the 120 images in the pool under either the mindful or the control/immersion instruction condition. In the original study, after the exposure, they performed the AAT as an independent task (Figure 1). Here in pilot 1, after the exposure block, participants were asked to perform the AAT while maintaining the previously requested attitude towards the images. The interviews were conducted immediately after the task, after a short period of evocation. The participants carried out this sequence two times, i.e., under each of the two instruction conditions, on two different days.

moment in the cerebral cortex, and that can be detected on the scalp (Rowan & Tolunsky 2004).

3 | Event-related potentials (ERPs) are electrical *potentials* generated by the brain that are *related* to specific internal or external *events* (e.g., stimuli, responses, decisions). Those are typically obtained by averaging the time-locked EEG signals at each event (Luck 2005).

Task

Exposure block

« 15 » Participants were asked to simply watch the images, following the instructions given. Images were presented for a total of 5 seconds: first for 4 seconds and then for 1 second, with a 100 ms gap in between.

Approach-avoidance task (AAT)

« 16 » The AAT is an implicit task frequently used for assessing automatic approach-avoidance behavior (Phaf et al. 2014). This task consists in the presentation of attractive or neutral foods inside a blue or purple frame. Participants were instructed to respond with a single press of an arrow key to "move towards the image" when it appeared inside a blue (or purple) frame, and pressed another arrow key to "move away from the image" when it appeared inside a purple (or blue) frame, with the frame color designation for approach vs avoid conditions counterbalanced between participants. "After every response, the image grew or shrank, thus simulating approaching or distancing respectively" (Papies, Barsalou & Custers 2012: 3). The response latencies (RLs) were measured, analyzed and compared.

Stimuli

« 17 » To construct an image pool, 300 different food items sourced from *Food-pics:* an image database for experimental research on eating and appetite (Blechert et al. 2014), were rated according to their attractiveness by 100 participants from the Chilean population via an online questionnaire. 60 images with the highest scores in the "very attractive" and "attractive" categories, and 60 images with the highest scores in the "neither attractive nor unattractive" and "not attractive" categories were selected for the experiment. The selected images did not differ in contrast, brightness or any other visual parameter relevant to the EEG measurements.

Instructions

« 18 » *Mindful attention condition:* Participants were asked to consider the character of their thoughts and reactions to the images, and experience them as constructions of their mind, which "appear and disappear."

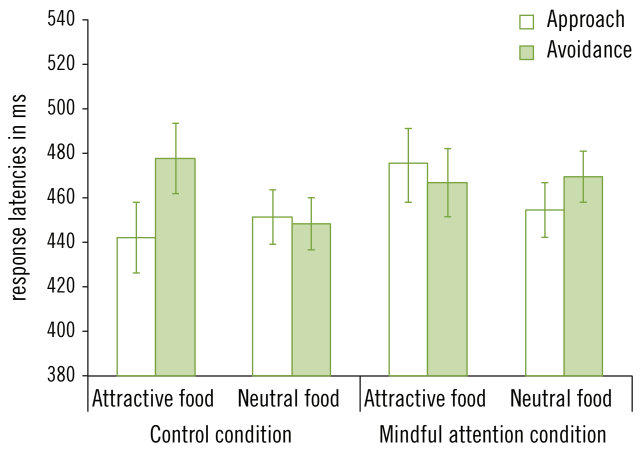

Figure 2 • Response latencies for approach and avoidance reactions toward food images. Error bars represent standard errors of the mean. (Extracted from Figure 1 in Papies, Barsalou & Custers 2012).

« 19 » *Control/Immersion condition:* They were asked to "get immersed" in the images and "completely experience them as being real" (Papies, Barsalou & Custers 2012: 3).

« 20 » *Interview conducting:* The main investigator and the research assistant conducted the interviews. Participants were interviewed using open and semi-structured questions. Immediately after performing the task under each condition, 2 open questions were asked followed by 8 semi-structured questions, added to gain more specific knowledge about hunger perception, feelings evoked by the stimuli, and the difficulty of the task, etc. All interviews were recorded with the participants' agreement.

Analysis

Behavior analysis

« 21 » Due to the sample's reduced size, as it was a pilot sample (10 participants per pilot), and in the knowledge that in AATs effect sizes are small (RL variations are minimal, though consistent) (Rotteveel et al. 2015), a statistical analysis strategy using repeated-measures ANOVA could lead to a Type II error. Therefore, the following statistical analysis strategy was employed for each pilot to guide the piloting process. Firstly, the effect of food type (attractive vs neutral) on approach vs avoidance RLs during the immersion condition was tested using paired t-tests. If this effect was significant (either for attractive or neutral foods), then the paired t-tests were used to test the food effect in the mindful condition. The p value significance level for all analysis was set at .05. All RLs are presented in milliseconds (ms).

Interview analysis

« 22 » The interviews were analysed using the grounded theory method. After interview transcription, an open coding stage was performed where key points were identified. Collections of codes of similar content allowed the data to be grouped in concepts. Finally those concepts with similar contents according to their main theme were grouped under "experiential categories." Thereby, data was grouped systematically in categories according to their thematic axes. Different thematic axes appeared to be relevant in each piloting phase, even though we incorporated the information from most of them into the construction of the next pilot. For practical reasons, in this article we show how this information serves as criteria to look at behavioral data only in one thematic axis (Theme 1) during the piloting process.

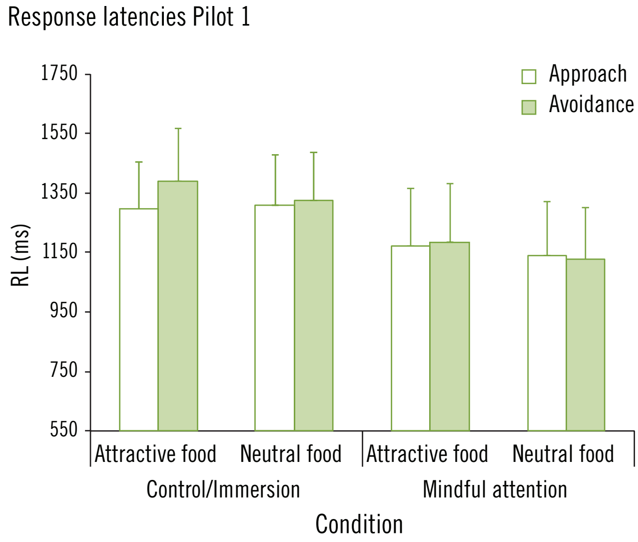

Figure 3a • Pilot 1 Behavioral result. The RLs (in ms) for approach and avoidance responses towards attractive and neutral food items under the Mindful Attention and Immersion conditions. Bars denote Standard Error.

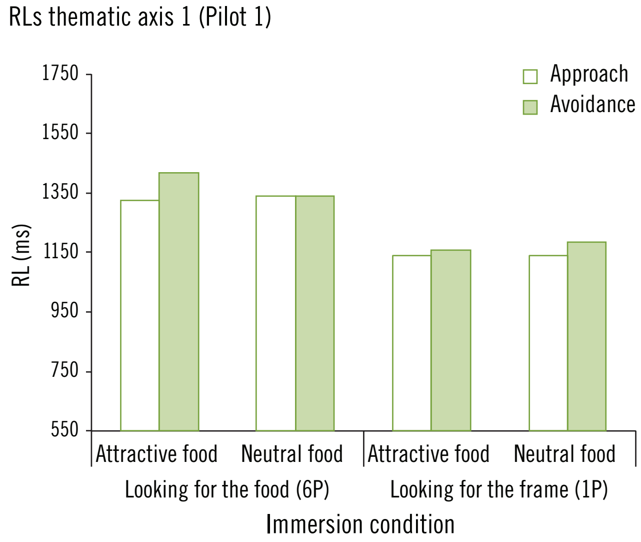

Figure 3b • RLs separated according to the two main experiential invariants from the thematic axis 1 (i.e., main attentional focus). Left: participants that mainly look at the food. Right: participants that mainly look at the frame.

Results

Brief summary of the study we attempted to replicate

« 23 » Papies, Barsalou & Custers (2012) in the article "Mindful Attention Prevents Mindless Impulses," showed that requesting a mindful attention attitude reduces automatic unconscious impulsive behavior towards attractive foods compared to a control/immersion attitude in an AAT. To arrive at this conclusion the authors analyzed response latencies of 40 participants (20 per condition) in a 2 (condition: mindful attention vs. immersion/control) × 2 (food category: Attractive vs. Neutral) × 2 (response: Approach vs. Avoid) repeated-measures analysis of variance (ANOVA). Figure 2 shows the predicted interaction of Condition, Food Type, and Response ($F(1,38)=13.12$, $p=.001$, $Z_p^2=.26$). They then examined the relation between food category and response in the immersion/control condition and the mindful attention condition separately in two different 2 (food type: Attractive vs. Neutral) × 2 (Response: Approach vs. Avoid) ANOVAs, one for each condition. The interaction between food category and response type was only found in the control/immersion ANOVA condition ($F(1,19)=8.61$, $p=.009$, $Z_p^2=.31$), not in the mindful one.

Expected results

« 24 » In concordance with the behavioral results obtained by Papies, Barsalou & Custers (2012), we expected that under the immersion condition participants would present longer RLs for avoiding compared to approaching attractive, but not neutral, food. This difference in response latencies towards attractive food would not be present under the mindful condition. For each pilot we attempted to replicate the above-mentioned results.

Pilot 1

Design

« 25 » See "Methods" section above (§§12ff).

Behavioral results

« 26 » During the immersion condition, attractive foods required shorter RLs for approach responses ($M=1296$, $SD=502$) compared to avoidance responses ($M=1389$, $SD=565$, $t(9)=1.849$, $p=.0492$), while the neutral foods approach RLs ($M=1309$, $SD=529$) were not different from avoidance RLs ($M=1325$, $SD=515$, $t(9)=1.224$, $p=.126$). In the mindful condition, there was no effect of the approach vs avoidance RLs either in attractive food ($t(9)=.713$, $p=.493$), or neutral food ($t(9)=.633$, $p=.423$). During this pilot, the average RL was 1243 ms ($SD=544$), while in the original study it was 482.5 ms (Figure 3a).

Qualitative results

« 27 » There were three main consistent themes in the experience of participants when asked "how was your experience of doing the task?" For practical reasons, we show how this information serves as criteria to look at behavioral data only in one thematic axis (Theme 1), but we incorporated the three of them into the construction of the next pilot.

Theme 1: Main attentional focus

« 28 » Relevant invariant: Generally, participants were looking at the food images.

"I felt like I connected a lot more with the ones I liked, I wanted them to be purple so I could make them come closer.. when I had to bring a cooked carrot closer it was like how boring, but when I had to push a donut away it was like nooo why?!" (S.4.i)

« 29 » Relevant invariant: one participant focused on the frame instead of the image content.

"I kind of paid more attention to the colors than to the image itself … There were moments in which I didn't care about what I felt about the image, I was just focused on the frame." (S.9.i)

Theme 2: Dual task interference

« 30 » Relevant invariant: Participants reported having a certain degree of interference between applying the immersion or mindful attention instruction and the AAT instruction.

"The task of pushing the buttons wasn't so hard for me, but I think I got some of them wrong, sometimes the feelings evoked or thought upon an image interfered … I think I was better at trying to connect with the feeling the image evoked in me [talking about the performance during the AAT, compared to selecting the right answer at the same time]." (S.2.m)

Theme 3: Frame color distinctions

« 31 » Relevant invariant: Participants reported difficulties distinguishing between frame colors, with the purple and blue tones being perceived as too similar.

"First, purple showed up, and I thought it was blue, but then it came up as a darker color and I realized that the one before was actually purple, and now I was seeing blue." (S.3.i)

Summary of findings from pilot 1 and considerations for the next pilot

« 32 » The expected behavioral effect was observed (longer avoidance RLs regarding approaching responses to attractive foods), although with longer RLs than reported by the original study (Papies, Barsalou & Custers 2012). We attributed these long RLs to the fact that we asked them to maintain a certain mental attitude (mindfulness or immersion) while performing the AAT task. This was a modification from the original study (see Methods section, §14), since we wanted to exaggerate the exposure effect as much as possible in order to enable its detection and measuring through EEG.

« 33 » Thanks to participants' experience accounts, we realized that participants were actually experiencing the AAT task as a dual task, where in addition to the food attractiveness by response type conflict of the AAT itself, they were applying a specific mind setting, added another level of interference. This last level of interference is a cognitive process that could be undesirably detected in the EEG recordings, in addition to the Approach-Avoidance conflict. Therefore we decided to keep the original instruction and present the AAT as a separate independent task.

« 34 » During this pilot, several participants mentioned difficulties in differentiating the colors used to frame the images, which could have resulted in at least two behavioral outcomes: more mistakes due to confusion of the colors, and increased RLs, since more attentional resources would have been allocated to differentiate between them. In order to correct this, we adjusted the color to allow for better differentiation. Specifically, we changed the purple color to a combination of purple and fuchsia to make it more easily distinguishable from blue.

« 35 » Only one participant reported not looking at the image itself, rather concentrating exclusively on the frame, therefore this was not considered as a problem in the experimental design at that moment. This participant had shorter RLs for approaching attractive and neutral food, while the group who reported looking at the images had shorter RLs only for approaching attractive food (Figure 3b), which is in line with expected results.

Pilot 2

Design

« 36 » 10 participants were first exposed to each of the 120 images for 5 seconds, in random order, under the mindful or immersion condition. After the exposure block, participants were asked to perform the AAT, as an independent task, answering as accurately and quickly as they could. The frame colors were adjusted to increase contrast and enable participants to differentiate between them. Interviews were conducted immediately after the tasks. Participants carried out this sequence two times on different days, each time under one of the two conditions.

Behavioral results

« 37 » During the immersion condition, attractive foods elicited shorter RLs for approaching responses ($M = 690.8$, $SD = 119.3$) compared to avoidance responses ($M = 734.3$, $SD = 166.3$, $t(9) = 1.917$, $p = .0437$), while neutral foods approach RLs ($M = 700.5$, $SD = 121.2$) were not different from avoidance RLs ($M = 720.9$, $SD = 162$, $t(9) = 1.073$, $p = .155$). In the mindful condition, RLs between approach and avoidance responses were not different either for attractive ($t(9) = 1.175$, $p = .27$) or neutral foods ($t(9) = .98$, $p = .35$). The average RL during this pilot was 683 ms ($SD = 120$) (Figure 4a). The expected effect was observed, that is to say, participants were quicker to approach attractive food images than to avoid them during the immersion condition, even though RLs were somewhat longer than in the original study (Papies, Barsalou & Custers 2012).

Qualitative results

« 38 » During this pilot again there were two main themes characterizing participants' experience when asked, "How was your experience of doing the task?"

Theme 1: Main attentional focus

« 39 » Relevant invariant: The participants reported focusing on the frame of the image instead of the images themselves while doing the AAT.

"In general I focused on the color, like I looked a lot to the left side for example to see just the frame. I only saw the foods after I pressed the button, when they were approaching me or getting further away, to see what food it was … At the beginning, when I pressed the arrow, I didn't know what food was getting closer or further." (P.10.i)

« 40 » Relevant invariant: Participants reported looking at the food images:

"When there were food images I liked more, I stared at them a little longer (before pressing them with the other images)." (P.2.i)

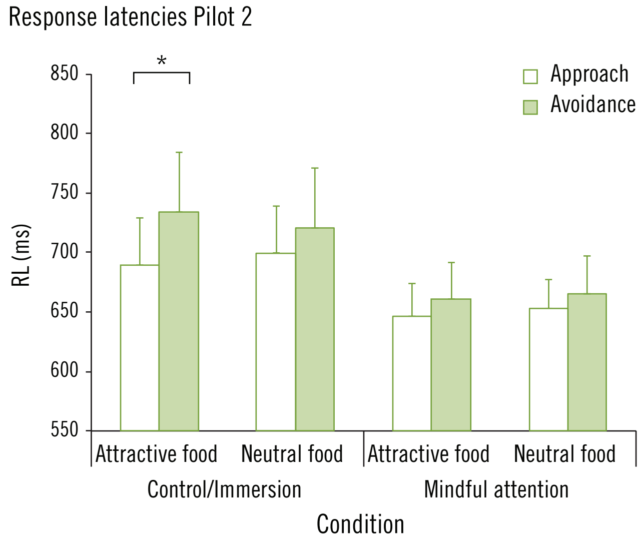

Figure 4a • Pilot 2 Behavioral result. The RLs (in ms) for approach and avoidance responses towards attractive and neutral food items under the Mindful Attention and Immersion instructions. Bars denote Standard Error. *$p < .05$.

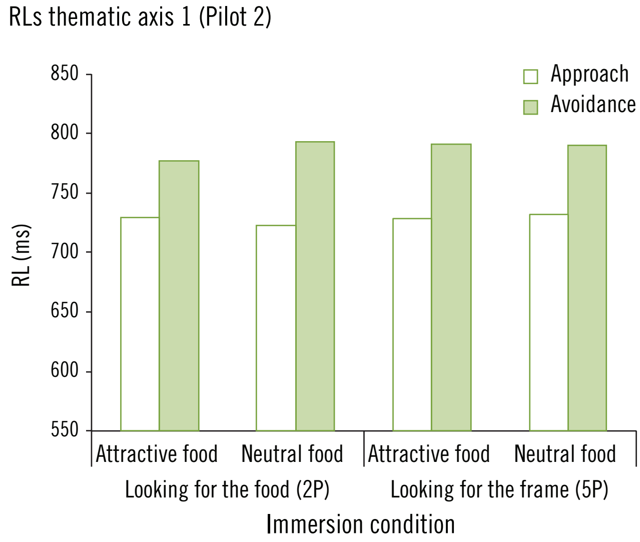

Figure 4b • RLs separated according to the two main experiential invariants from the thematic axis 1 (i.e., main attentional focus). Left: participants that mainly look at the food. Right: participants that mainly look at the frame.

Theme 2: Block length

« 41 » Relevant invariant: The participants reported that the exposure time was too long, and that they tended to "forget" to apply and maintain the attitude requested by the instructions.

"It was boring, I thought it was going to be different … I kept in mind for a while that I had to think that another person would feel it differently, but then I was just like 'it's chocolate, it's a hamburger, etc.'." (P.9.m)

Summary of findings from pilot 2 and considerations for the next pilot

« 42 » The expected behavioral result was observed, therefore we decided that the design was suitable for EEG implementation on the next pilot. As RLs were still somewhat longer compared to those observed in the original study, we decided to put especial emphasis on instructing them to press the key *as quickly as possible*.

« 43 » Since participants reported that exposure was too long, and as time passed during the exposure block they "forgot" to apply the requested attitude toward the images, we decided to add a reminder of the instructions between some of the images, prompting the participants to maintain the requested attitude toward the images throughout the entirety of the exposure block.

« 44 » From the conducted interviews we noticed that at least half of the participants reported looking exclusively at the frame, instead of looking at the images as a whole with the frames, before responding in the AAT. These subjects were faster at approaching than avoiding, presenting the same bias towards attractive and neutral foods indiscriminately. This may be due to the fact that they were not focusing on the image content (Figure 4b). In order to force participants to look at the image and make it more difficult to just focus on the frame color before responding, we decided to make the frame thinner, with the intention that this would encourage participants to look at the images before looking at the frame to produce an answer.

« 45 » Finally, we decided to have the immersion and mindful sessions on the same day, adding a break in between, because of the possible variability of food desire presented across days, and to avoid two EEG installment sessions to minimize the dropout rate.

Pilot 3

Design

« 46 » 10 participants were tested at a similar time of the day (approximately 3pm). Once the EEG system was set up, they were exposed to each of the 120 images for 5 seconds, under either the mindful or immersion condition. During this exposure block, once every 7 images, a message appeared, reminding the participants of the attitude requested from them. After the exposure block, participants were asked to perform the AAT, as an independent task, answering as accurately and quickly as they could. After this, participants had a brief break and performed the same procedure (Exposure-AAT) again under the second condition.

Behavioral results

« 47 » Unlike in previous pilots, during the immersion condition, approach RLs for attractive foods ($M = 673.1$, $SD = 84.8$) were not different from avoidance RLs ($M = 682.9$, $SD = 86.6$, $t(9) = .568$, $p = .2917$). Neutral food approach RLs ($M = 663.7$, $SD = 72.4$) were not different from avoidance RLs ($M = 670.1$, $SD = 72.5$, $t(9) = .740$, $p = .238$). The average RL was 668.4 ms ($SD = 76.9$) (Figure 5a).

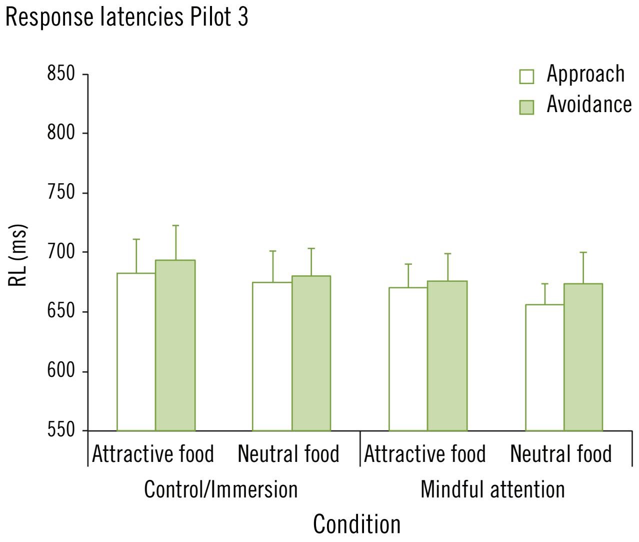

Figure 5a • Pilot 3 Behavioral result. The RLs (in ms) for approach and avoidance responses towards attractive and neutral food items under the Mindful Attention and Immersion conditions. Bars denote Standard Error.

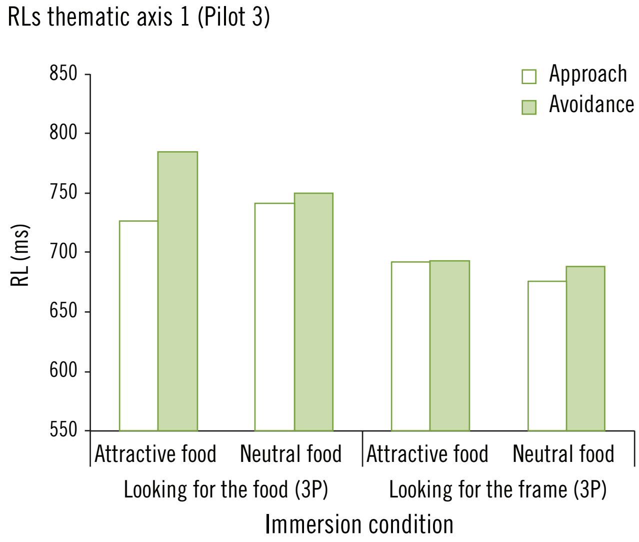

Figure 5b • RLs separated according to the two main experiential invariants from the thematic axis 1 (i.e., main attentional focus). Left: participants that mainly look at the food. Right: participants that mainly look at the frame.

Qualitative results

Theme 1: Main attentional focus

« 48 » Relevant invariant: Participants reported looking exclusively at the frame and not paying attention to the images while doing the approach-avoidance task, as a means of making the task easier and being able to provide quicker answers:

"I concentrated and looked only at the frames, I didn't look at the images … I looked up, the upper part of the frame." (S.2.i)

« 49 » Relevant invariant: Participants reported looking at the food images:

"I looked from the frame to the image and then I would press the button … I looked at it like generally … I also looked at the image." (S.4.i)

Theme 2: Block length

« 50 » Relevant invariant: Participants reported that the exposure time was too long and that they forgot or lost motivation to apply the instructed attitude toward the food images during the exposure block:

"It was hard not to fall asleep on the part where you had to only look at the images … after a while I was counting the images just so I wouldn't fall asleep." (S.5.i)

Theme 3: Foreground and background

« 51 » Relevant invariant: Participants mention that the white background began to feel tiring for the eyes to maintain the gaze while carrying out the experiment:

"After a while the background became too bright for me." (S.3.m)

Theme 4: Instructed attitude strategy

« 52 » Participants employed different strategies to apply immersion vs mindful attitudes as instructed towards the images during the exposure block.

"I felt like mentally nodding, because sometimes I moved, like I nodded to myself, so I moved my head if I liked it, and if I didn't like it I kind of shook my head. I did it both externally and internally, so I also was saying to myself yes, no, hmmm yummy." (S.1.i)

"I tried to remember the flavor and kind of tasted it, like making the connection between the image and the flavor of that image." (S.4.i)

Theme 5: Individual food preferences

« 53 » Participants provided examples of previous personal experiences with favorite foods, and participants had in fact different preferred food items.

"The pie was yummy … I had more affinity towards sweet stuff, and more rejection towards salty foods and vegetables." (S.1.m)

"I got hungry for pizza … I wanted the pizza." (S.2.i)

"Broccoli was the only thing I didn't like at all." (S.6.i)

Summary of findings from pilot 3 and considerations for the next pilot

« 54 » The behavioral result expected for the immersion condition was not replicated. RLs were long, but in the same range as those presented in the original study (Papies, Barsalou & Custers 2012). This is most likely because during the AAT, most participants reported that they looked only at the frame, as a means of making the task easier for themselves, basically fixating the gaze in a corner of the frame to answer more quickly and with less effort. They claimed to see and identify the images' content only when they were moving away or toward them. For this reason, we decided to eliminate the frames and added instead a blue circle or square figure in the center of the image as a cue for approaching or avoidance.

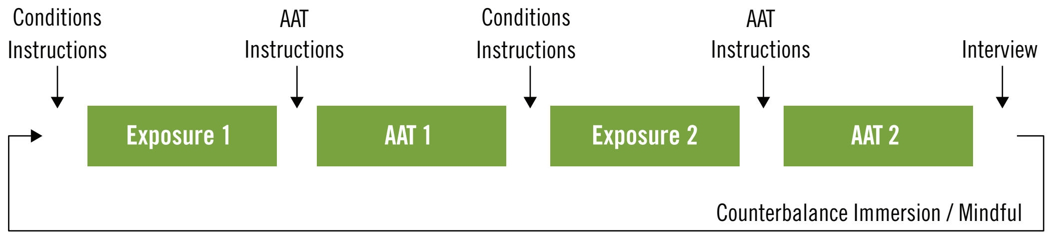

Figure 6 • Experimental sequence scheme: Participants were exposed to images of neutral and attractive foods under either the Mindful or Immersion condition (EXPOSURE 1), then they were asked to perform the AAT (AAT 1). After an optional break, participants were asked to carry out a new exposure block (EXPOSURE 2) and AAT (AAT 2). After a 45-min break participants followed the same experimental sequence under the second condition. Interviews were carried out immediately after the AAT 2 in each condition.

« 55 » Despite the display of a message once every 7 images, participants insisted that the long duration of the exposure block caused loss of motivation and tiredness as time passed throughout the experiment. This feeling of tiredness due to the monotony of the task was accentuated by conducting the experiments under both conditions in tandem during the same day. We believe this made the experiment too long and tiring for the participants, causing loss of motivation and promoting strategies to make the task easier, which was reflected in a decrease in the variation in the RLs. To cope with this obstacle, we decided to split up the experimental session (Exposure–AAT) again into separate blocks, resulting in two exposure and two AAT blocks, in order to make the experiment more dynamic and provide more rest periods in between. Also, the background in the images was changed from white to gray to prevent ocular fatigue.

« 56 » During the AAT, most participants reported that they looked only at the frame, as a means of making the task easier for themselves, basically fixating the gaze in a corner of the frame to answer more quickly and with less effort. They claimed to see and identify the images' content only when they were moving away or toward them. Subjects that looked at the images had a profile consistent with the approach-avoidance effect expected, while the group who focused on the frames did not have shorter RLs towards attractive images compared to neutral ones (Figure 5b). For this reason, we decided to eliminate the frames and added instead a blue circle or square figure in the center of the image as a cue for approaching or avoidance.

« 57 » In this round of interviews, and considering the interviews from previous pilots, we realized that participants applied the requested instruction (either immersion or mindful attitude) toward the images in very different and diverse ways. We realized that considerable variability in how participants applied the instructions could have an impact on the RLs. So we decided to slightly change the instructions, moving toward a step-by-step instruction style, in order to avoid different interpretations and thus heterogeneous applications of mindful and immersion instructions during the exposure blocks (you can find these step-by-step instructions fully displayed in the supplementary materials).

« 58 » Again, in this round of interviews and considering the interviews from previous pilots, we realized that participants had different favorite foods, since they were given examples of different food items to report the foods they liked or disliked. We decided that it was necessary for all participants to fill in a food-rating questionnaire at the very end of the experiment, in order to produce personalized image pools of attractive and neutral foods for the subsequent RL analyses. Therefore from pilot 4 onwards, after performing the experimental task with 120 selected food images, each participant was asked to rate each of these images according to their individual preference from 1 ("not attractive") to 5 ("very attractive") in an online questionnaire. With this information, personalized pools of attractive and neutral food images were constructed for each participant to subsequently perform the RL analysis.

Pilot 4

Design

« 59 » 10 participants were exposed to 60 images during a first exposure block, under each attitude instruction. Once every 7 trials, a message appeared, reminding the participants to maintain the requested attitude. This exposure block was followed by two AAT blocks, where the 60 images previously seen in the exposure block were displayed. The AAT blocks were presented as an independent task and participants were asked to answer as accurately and quickly as possible. Then, a second exposure block where the remaining 60 images were displayed with its subsequent two AAT blocks was carried out (Figure 6). Afterwards, subjects took a 45–60-minute break during which a first interview was conducted. Following the break, participants repeated the Exposure-AAT sequence under the second condition, ending with a second interview.

Behavioral results

« 60 » During the immersion condition, images of attractive foods elicited shorter RLs for approach responses ($M = 628.4$, $SD = 72.9$) compared to avoidance responses ($M = 651.2$, $SD = 103.4$, $t(9) = 1.941$, $p = .0421$), while neutral food approach RLs ($M = 636.8$, $SD = 92.3$) were longer than avoidance RLs ($M = 627.6$, $SD = 91.8$, $t(9) = 2.002$, $p = .038$). During this pilot the average RL was 625 ms ($SD = 82.9$) (Fig.4), which is close to the RLs observed in the original study (Papies, Barsalou & Custers 2012) (Figure 7a). The

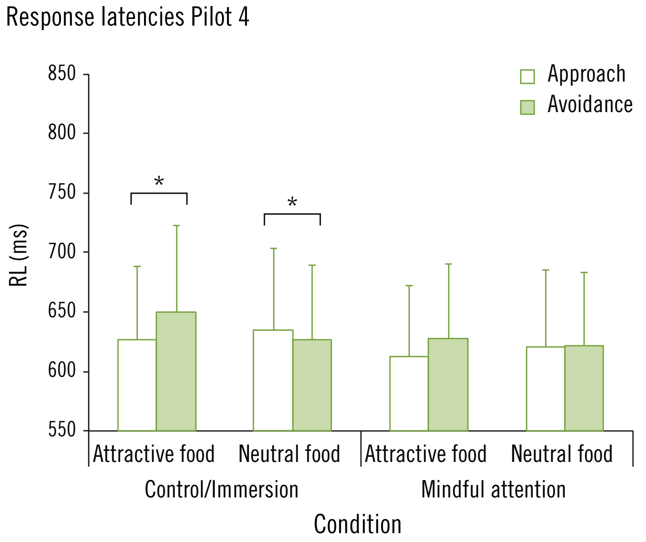

Figure 7a • Pilot 4 Behavioral result. The RLs (in ms) for approach and avoidance responses towards attractive and neutral food items under the Mindful Attention and Immersion conditions. Bars denote Standard Error. *$p < .05$.

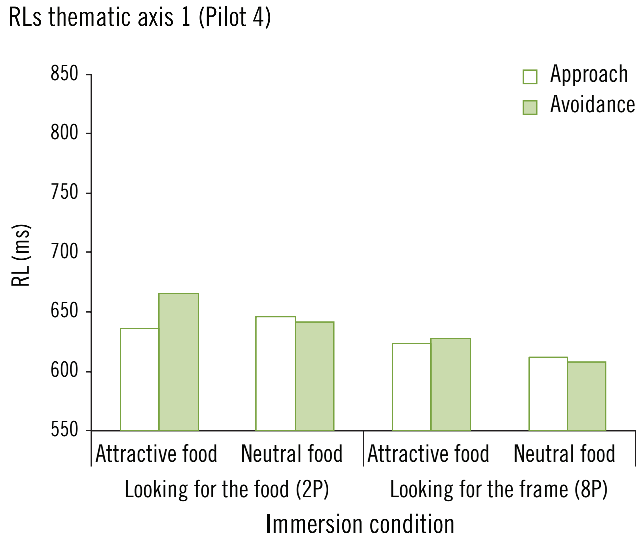

Figure 7b • RLs separated according to the two main experiential invariants from the thematic axis 1 (i.e., main attentional focus). Left: participants that mainly look at the food. Right: participants that mainly look at the frame.

expected behavioral effect towards attractive food in the AAT under the immersion condition was observed and, interestingly, neutral foods rendered the opposite effect. In the mindful condition, RLs between approaching and avoidance responses were not different either for attractive or neutral foods.

Qualitative results

Theme 1: Main attentional focus

« 61 » Relevant invariant: Most participants were actually seeing the food image under the cue.

"First the photo appears, I focused on the image and then I looked at the circle or square and after that I answered." (Z.6.i)

« 62 » Relevant invariant: Some participants were only focusing on the cue (square/circle)

"I just looked at the circle and square." (Z.3.i)

Theme 2: Instructed attitude strategy

« 63 » Relevant invariant: Each attitude instruction has produced a greater homogeneity along the instruction application strategies participants spontaneously developed during the exposure block, compared to previous pilots, yet the strategies to apply one instruction were still very different from the strategies developed to apply the second requested attitude.

« 64 » Immersion:

"I tried to remember the smells at first … then I was evoking the textures … when an image appeared, I would first feel it with my tongue as if they were actual foods, then I felt the textures … I imagined myself touching them." (Z.1.i)

"I remembered how it felt to grab it, for example … if it had a texture, or a particular smell, or if I had a memory of what I had done with that object … In my memories I saw myself inside of it, like a video." (Z.3.i)

« 65 » Mindful:

"I saw the image and I tried to look at it as just an image … there were some images that made me feel sensations, I simply eliminated them, and I was like no, this is just an image." (Z.4.m)

"I tried to realize that what I was seeing was only an image, even if it made me feel a sensation, it was only an image." (Z.5.m)

Theme 3: Emotional response

« 66 » Instructed attitude strategy: Participants expressed having positive or negative emotions when approaching or avoiding certain food items.

"When there was a really good food, approaching it kind of gave me pleasure, like it was cool for it to come closer … it was like a reward … when it went away I was like noooo!, like sad." (Z.4.i)

Summary of findings from pilot 4 and considerations for the final experiment:

« 67 » The behavioral results in this pilot were in concordance with what was expected, that is, the RLs for avoidance responses were longer than for approaching responses toward attractive foods, with RLs comparable to those in the original study.

« 68 » After taking into consideration personal food preferences, different image pools of attractive and neutral foods were constructed for the RL analyses, which produced more pronounced approaching-avoidance response RL profiles.

« 69 » Thanks to the new design of several separate blocks, participants were able to better retain motivation to maintain the instructed attitude during the exposure block. Likewise, subjects reported a correct understanding of the instructions. The change to this step-by-step instruction during exposure somewhat helped homogenize how people understood the instruction, but they still executed each of these instructions through widely different strategies.

« 70 » During the AAT blocks, participants reported seeing the food images, either together with the geometric cue or considering them as a background. Subjects who reported seeing the food images had a profile of shorter RLs for attractive foods, in accordance with the expected AAT paradigm, contrary to the results obtained by the participant group who focused on the frames (Figure 7b).

« 71 » Overall, the original study's behavioral effect towards attractive foods was replicated in pilot 4. To ensure the maintenance of this effect in the final experiment, we decided to give an additional instruction before each AAT block, telling participants to *"respond as accurately and quickly as possible, but looking at the content of the image before answering"* to encourage processing of the content of the food images together with the approach-avoidance task.

« 72 » 5) Participants reported having the sensation of food items moving towards and away from them, producing the experience of obtaining or losing the food items and the emotions associated with it.

Summary of the piloting process and considerations for the final experiment

« 73 » The objective of this piloting process was to replicate the behavioral results obtained by Papies, Barsalou & Custers (2012) in order to adapt their methodology to one suitable for EEG measures, but securing its phenomenological validity by applying a front-loaded phenomenological-inspired approach. In the original study, the authors showed that following an immersion instruction there was an automatic approach bias toward attractive food stimuli (faster approaching than avoidance RLs), that was not present toward the stimuli in the mindful condition. As our aim was to understand the neural correlate of this bias towards attractive food images under the immersion condition, and its loss during the mindful condition, we had to replicate this behavioral effect in a paradigm suitable for EEG analysis.

« 74 » The adaptation of this paradigm for neurophysiological evaluation required a greater number of images (increasing from the 10 used in the original behavioral study to 120 for the EEG paradigm) and some changes in the images' characteristics, since physical properties of the images used in electrophysiological studies need to be specifically calibrated. Even though these changes could appear as minor modifications, they had an enormous impact on how the participants responded to the task, resulting in diminished effects compared to those found in the original behavioral task.

« 75 » As a means of overcoming these limitations, we decided to collect first-person reports in order to understand which aspects of these modifications were the main factors making it difficult to replicate the results. The interviews and first-person data allowed us to realize that some conditions that we were relying on needed to be modified. For example, in Pilot 3, when we carried out the AAT for the first time with the EEG recording, we did not find the expected approach-avoidance response effect in the RLs toward attractive foods under the immersion condition. The fact that during this pilot we measured both conditions on the same day, making the experiment long and tiring, could have been one of the factors influencing the results, as participants mentioned during the interview carried out in this pilot. Consequently, we decided to split up the task into shorter blocks. However, it is possible that the main reason for these unexpected results was that a considerable number of participants fixated their gaze in the corner of the frame as a spontaneous strategy to perform the task faster and with less cognitive effort, as they reported to the investigators. This phenomenon had already been mentioned by participants in pilot 2, but since it was not a consistent report and the expected behavioral effect was observed, we did not introduce further changes at that time. In pilot 3, this issue became significantly relevant, so we decided to change the colored frame cue for geometric figures inside the image for the next piloting phase.

« 76 » Another important point that we considered just at the end of pilot 3, is that every person has different food preferences. Probably this was not such a decisive factor in the original study, since finding 5 food items that are attractive for the majority of participants to make an attractive foods image pool is much easier than finding 60 food items that are universally attractive and could constitute a homogeneous pool for all subjects. Therefore, we decided to carry out a questionnaire at the end of the experimental phase in pilot 3 where participants had to rate all the presented food items in terms of attractiveness. With this information we constructed personalized image pools of attractive and neutral foods to analyze the RLs of each participant. Finally, after the incorporation of the above-mentioned changes, we were able to replicate the original behavioral results with comparable RLs, in pilot 4, which became our final paradigm to incorporate EEG measures into the experiment and execute the final data collection.

« 77 » In addition, interviews were refined: for instance, we decided to ask the participants directly about the strategies they applied during the exposure block, since this information could be useful for electrophysiological results interpretation and was not spontaneously addressed by all participants under the previous open-question format.

« 78 » Lastly, for practical reasons, through this piloting process we decided to exemplify how one thematic axis (thematic axis 1) and its invariants emerged on the different pilots. We showed how these invariants and the corresponding third-person data provided information to decide which aspects of the experimental design should be maintained and which aspects should be modified. But it does not mean that only the invariants corresponding to this one thematic axis were taken into account for the next pilot construction, actually all the thematic axes and the variants that emerged in each pilot were considered to build the next pilot phase.

Discussion

« 79 » The objective of this piloting study was to demonstrate through an example the usefulness of a mild-neurophenomenological-inspired approach with a front-loaded logic (Gallagher 2003; Gallagher & Varela 2003) in refining the design of the experimental paradigm to be used concurrently with EEG in a subsequent neurophemonomenological study. We argue that a neurophenomenological-inspired approach allows for a deeper piloting process and better paradigm design, which fosters replicability and phenomenological validity.

« 80 » Here we explore how the neurophenomenological method can be integrated into experimental settings. Therefore, we do not use neurophenomenology here to describe a conscious experience and its mirroring physiological counterpart, but to draw inspiration from this process to solve a very concrete everyday laboratory problem: the replicability of behavioral results and ensuring of the phenomenological validity of our adapted paradigm for a further neurophysiological and neurophenomenological evaluation.

Mild-neurophenomenology-inspired application to achieve first-person-enriched paradigms, convergences and divergences from traditional neurophenomenology

« 81 » In our piloting process, we incorporated some of the principles of neurophenomenology as a procedure guide. We sought to integrate phenomenology into an explanatory framework of the experimental paradigm we designed, relating the phenomenological and the behavioral aspect of it, which is in line with the objectives of neurophenomenology.

« 82 » From pilot 1 onwards we were able to observe how common structures of experience began to emerge across participants (i.e., phenomenological invariants) (Lutz et al. 2002) by accessing the experiential process they were undergoing while performing the task. Furthermore, we identified phenomenological invariants, corresponding to both variations of experiences that were responding to the paradigm itself (i.e., legitimate experiential variations according to the aim of the paradigm) and a diversity of invariants that were in response to misleading issues within the paradigm ("Unwanted" experiential variation due to need of refinement of the paradigm).

« 83 » These phenomenological invariants were constructed based on the intersubjectivity achieved from the described experiences of the subjects, aiming for them to be uncritical and non-judgmental when reporting them, without focusing on what they thought about their experiences, but rather what they lived through when performing the task. We understand that there was not a pure phenomenological reduction and "epoché," since subjects were not trained beforehand in this method, but this is one of the flexibilities that front-loaded phenomenology presents, divergent to neurophenomenology. This point, mentioned above in our procedure, was partially remedied by conducting highly detailed interviews. Here the phenomenological interview places the impetus for training on the interviewer, not the participant, so that the interviewer acts to support the participant in precise experiential reporting while carefully avoiding any priming of the participant (Bockelman, Reinerman-Jones & Gallagher 2013). This does not mean an absolute abandoning of phenomenological methods, but taking what we learn about first-person experiences within the phenomenological attitude and using it in the enterprise of the cognitive sciences (Gallagher & Varela 2003). It is relevant to point this out because this form allows us to bring the neurophenomenology spirit to a wider experimental setting, making it more feasible to apply so that first-person perspectives are systematically considered in cognitive science and not neglected as we feel has so far been the case.

« 84 » Phenomenological invariants install themselves as crucial information to guide and review the questions being investigated by the experiment and to revise the concepts used to describe and interpret the results. This also allows for a deeper understanding of the applied methodology, how the subjects are to be trained or instructed, how they should report, etc. (Bockelman, Reinerman-Jones & Gallagher 2013). Finally the acknowledgement of repeated patterns of experience brings us closer to the experiential domains relevant to our investigation. Therefore, in these pilot studies, the information provided by the subjects allowed us to identify a new experiential dimension to explore through conducting interviews in the final experiment (with EEG), as well as new cognitive aspects that needed to be controlled in the design. It also indicates a need for the development of post-condition questionnaires to quantify the modulation of some specific psychological constructs with each instruction.

« 85 » Another important issue here is the strategy used for building the bridge between first- and third-person data. We are very aware that originally the instance of mutual constraints in neurophenomenology is the individual subject's experience (and her phenomenological invariants), constraining its own physiological data, as brilliantly demonstrated by Lutz et al. (2002) and Lutz & Thompson (2003). In addition to focusing on the precise relation between brain dynamics and first-person experiences, this neurophenomenology proposal is limited in terms of the types of experiments that can be conducted. Alternatively, as "front-loaded" phenomenology proposes (Gallagher & Varela 2003), it is also possible to introduce previously established phenomenological insights or distinctions into the design of an experiment. This widens the scope of experiments that can be informed by phenomenology. Especially important for the DRC, this approach "widens the scope of the dynamic factors that can be studied to include extra-neural and extra-experiential factors, such as bodily, environmental, social, and cultural constraints" (Bockelman, Reinerman-Jones & Gallagher 2013: 2).

« 86 » In our pilot study, despite the fact that the Pilot 1 design came from theory (specifically following others' paper results), first- and third-person data derived from reported experiences and behavior measures from this pilot provided an instantiation of the mutual constraints that resulted in the next pilot design. In this logic, a loop of mutual constraints was carried in a sequence of 4 pilots, refining the relation between first- and third-person domains at each stage (Figure 8). Specifically intersubjective invariants, obtained from the group of persons experiencing the task, were utilized as criteria to analyze behavioral data. Those results were employed to guide which core and technical aspects of the task should be conserved (to ensure the survival of the phenomenological invariant, according to the objectives of the task) and which had to be modified (to foster the disappearance of experiential invariants given by any misunderstanding of how to perform the task).

« 87 » In this sequential piloting process both third- and first-person accounts

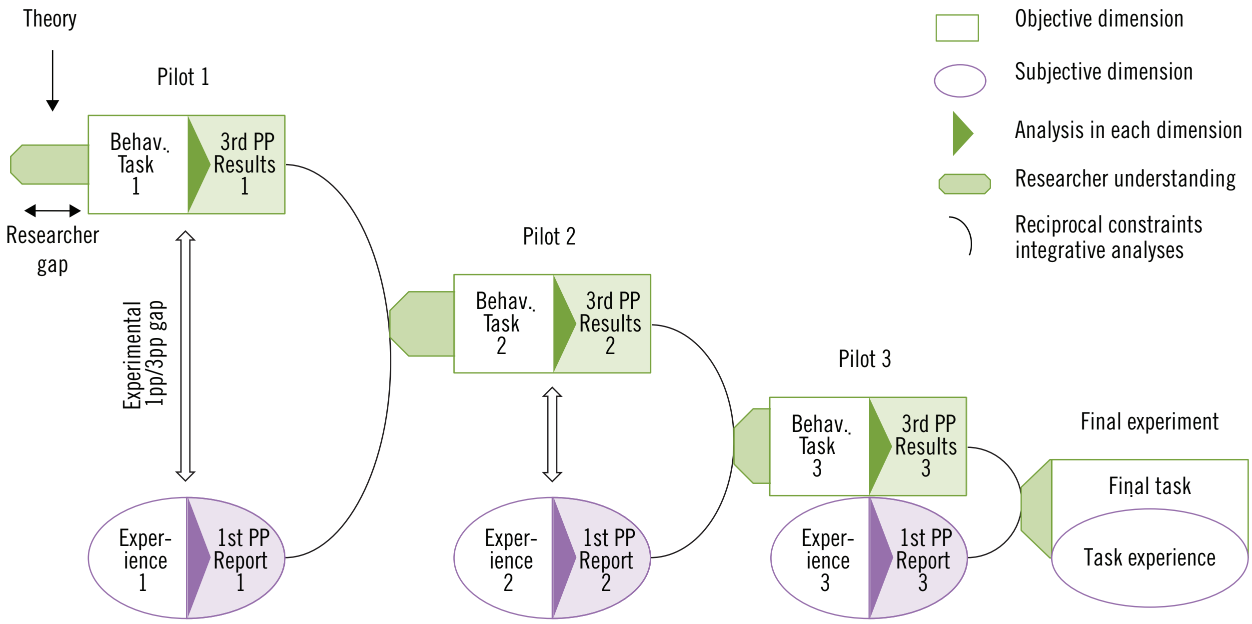

Figure 8 • Scheme of reciprocal constraints during a successive piloting process. At Pilot 1 the behavioral task came from theory or previous empirical results and researchers had a theoretical assumption about how participants were going to react to the task. There was a gap between what subjects supposed they would experience in the task and what they actually experienced. Data using first- and third-person methods was collected and analysed. Afterwards the researcher integrated this information to produce a new version of the task, modifying the task parameters or instructions, etc. to maintain or obtain the behavioral result. At the same time these modifications were expected to result in greater and more specific constraints on subjects' experience. Moving forward through the piloting steps, the researcher began to gain more knowledge of what each parameter of the task specifically produced in the subject's experience, and how they had to be modified to constrain the experience. At each step more detailed parameters of the task were reshaped until a greater correspondence was achieved between what the task was supposed to measure and the subjective experience during its performance. At the end of this process valuable information was obtained to guide data analysis and interpretation of results.

of the performance and experience of the task were equally valid pieces of information to take into consideration for the next pilot task construction. This allowed us to achieve a first-person-enriched cognitive paradigm, in the sense that the final reported experience was closer to what the experiment was expected to provoke in participants than in the beginning, and in concordance with collected third-person data, therefore it was a more "phenomenologically valid" paradigm.

Mild-neurophenomenology-inspired methodologies as a tool to overcome low psychological science replication rates

« 88 » Today's science is passing through what has been referred to as a "replication crisis" (Schooler 2014). "More than 70% of researchers have tried and failed to reproduce other scientists' experiments, and more than half have failed to reproduce their own experiments" (Baker 2016: 452). Replication constitutes a key point in scientific methodology and knowledge construction. This difficulty in replication impacts to different degrees across disciplines, and several authors, such as Baker (2016) and Earp & Trafimow (2015), claim that it is mainly due to sociological reasons. There is low interest in replication studies, among other things, because they are generally harder to publish since they are viewed as being unoriginal, and they bring less recognition and reward and even basic career security to their authors, etc. (for details see Baker 2016; Earp & Trafimow 2015).

« 89 » Psychology is the discipline with the lowest replication rates. An investigation of replication rates in psychology in 2012 indicated that only 64.6% of the studies were successfully replicated when there was no author overlap between new and original studies, which increases to 91.7% when at least one author participates in both studies (Makel, Plucker & Hegarty 2012). This author overlapping effect arguably supports our view that researchers are active participants in the construction of science.

« 90 » Although all descriptions of observations are influenced and guided by theoretical assumptions or previous empirical reports, one cannot assume in advance which experiences a certain experimental set-up will give rise to in a subject. Cognitive paradigms and replication attempts should be the built-in realization that we cannot know beforehand details regarding the experimental subjects' experiences during the experiment. An important problem we want to point out is the fact that ex-

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CATALINA FABAR
is a psychology student at Pontificia Universidad Católica de Chile, currently specializing in community psychology as part of her undergraduate studies. She has been working as a research assistant with Constanza Baquedano and Diego Cosmelli for the last 3 years, in parallel with working as a teaching assistant on different courses within the neuroscience field. Her involvement with meditation as a research topic comes initially from a personal interest, particularly as a yoga practitioner, which has been nurtured through her work and under Constanza's guidance, along with the concerns about research paradigms and the integration of neurophenomenology.

perimental designs made within the third-person epistemological framework leave no formal room for qualitative and subjective experience. Most of the time, studies use reports from participants to set up their experiment or when interpreting results. But this first-person procedure and this data are not systematically included in the methods section. Consequently, when different authors attempt to replicate the study, there is a great amount of first-person "know how" acting as an obstacle to success in replication. Negligence of first-person accounts during experiments, we believe, is one of the important reasons for low replication rates, specifically affecting cognitive psychology or neuroscience paradigms.

« 91 » In this study we show how even slight changes in the experimental paradigm altered the participants' experience, and therefore their behavior. Using a mild-neurophenomenology-inspired approach we were able to capture and categorize attentional factors and to understand internal strategies used by participants that are usually difficult to manipulate and control in experimental designs; hence, the effect of such factors is usually regarded as "noise" (Lutz et al. 2002). A mild-neurophenomenology-inspired approach made it possible to implement a better means of handling first-person data in a reliable and productive way, providing clarifications and classifications that are not captured by typical cognitive science approaches, therefore improving replication rates.

Conclusion

« 92 » The integration of third- and first-person data has been shown to be fundamental in the field of cognitive science. The questioning of the cognitive paradigm and the rigorous inclusion of first-person accounts is a necessary consideration, which has epistemological and methodological repercussions in the experimental process as a whole. Despite the fact that these ideas have been under discussion for a considerable amount of time (Gallagher 2003; Gallagher & Brøsted 2006; Overgaard, Gallagher & Ramsøy 2008; Petitmengin 2006; Thompson, Lutz & Cosmelli 2004; Varela 1996; Varela & Shear 1999), and that there have been successful examples of their integration (Lutz et al. 2002; Petitmengin & Lachaux 2013; Berkovich-Ohana et al. 2013), it has not been a mainstream debate thus far, and it has not been widely incorporated into the neuroscience paradigm.

« 93 » A mild-neurophenomenological-inspired approach is presented as a "flexibilization" of traditional neurophenomenology, while remaining consistent with it and the DRC model. As front-loaded phenomenological logic, it avoids the necessity of training subjects, and widens the scope of experiments that can be informed by phenomenology and the scope of the dynamic factors that can be studied to include extra-neural and extra-experiential factors as constraints (Bockelman, Reinerman-Jones & Gallagher 2013; Gallagher & Varela 2003).

« 94 » It is important to address what subjects are actually doing while performing laboratory tasks, and how, that is, what strategies they use in their understanding of the task and how they are experiencing the task, in order to:

- ensure that the paradigms and instruments we employ are measuring what they claim to be measuring;
- to improve replication rates and provide a more detailed interpretation of results; while

- avoiding confounds in the interpretation of the behavior and physiological data derived from them.

« 95 » Therefore, the aim and process of our pilot study presented here are in line with a constructivist horizon, because of the active role that participants' experiences of the paradigm had in modeling the experimental design and paradigm itself.

« 96 » Finally, including the first-person in a systematic way during the development and performance of classic cognitive paradigms is a natural step in the attempt to refine the explanation of these multilevel integrative processes (subjective attributes and their objective scientific counterparts). The inclusion of first-person accounts in the study of subtle changes of cognitive functions that ultimately start in, and only make sense in, subjective experience, is becoming mandatory. Mild-neurophenomenology is an inspiring framework for this integration. A wider critical mass of researchers willing to expand cognitive science is required to discuss, enrich, systematize and apply neurophenomenological approaches. Overall, this will help improve the production and interpretation of information, generate new hypotheses, and lead to more rigorous cognitive neuroscience research.

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Open Peer Commentaries

on Constanza Baquedano & Catalina Fabar's "Modeling Subjects' Experience While Modeling the Experimental Design"

A Newcomer to the Neurophenomenological Family?

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> Upshot • Demonstrating the relevance of collecting first-person data and of establishing reciprocal constraints between this these data and behavioral data to overcome the issue of behavioral data replication is an interesting result. However, this result, as such, falls short of offering any theoretical reorientation of the neurophenomenological project, strictly understood.

The phenomenological tribe and the neurophenomenological family

« 1 » In my opinion, the central purpose of the target article is to introduce a newcomer to the already extended neurophenomenological family. This raises two questions: Who is this newcomer exactly? And how much does it deserve to be treated as a family member? To answer these questions we first need to provide a brief characterization of the present situation of the neurophenomenological family, as this situation is far from being a clear one.

« 2 » From my viewpoint, Francisco Varela's original neurophenomenological project is only one specific version of a more general claim, which I have called the "phenomenological claim" (Roy 2000, 2004). It can be formulated as follows: a *bona fide* phenomenological level of investigation must be introduced in the explanatory framework of contemporary cognitive science in order to overcome the explanatory gap problem. Nearly every word in this formulation counts and there are as many ways to make sense of the claim as there are ways to understand each of them. That Varela's neurophenomenological project is just one of these many ways is perfectly corroborated by the fact that the bulk of its initial statement (Varela 1996) was integrated into the collective essay "Beyond the Gap: An Introduction to Naturalizing Phenomenology" (Roy et al. 1999), which Varela co-authored. Indeed, this introductory chapter to *Naturalizing Phenomenology* (Petitot et al. 1999) contains the first presentation (although it is not without ancestors, such as Nagel 1974 and Marbach 1993) of the phenomenological claim so formulated and refers to some of the specificities of the neurophenomenological approach only as one of the possible directions to pursue in order to turn it into a full-blown research program. However, one distinctive feature shared by all possible versions of the phenomenological claim – and therefore of Varela's neurophenomenological one as well – is that the introduction of a *bona fide* level of investigation in the explanatory framework of contemporary cognitive science is motivated by, and geared toward, solving the explanatory gap problem. It is this motivation and finality that distinguish it from the even more general claim that a *bona fide* level of investigation must be introduced in the explanatory framework of contemporary cognitive science, without any specific reference to the explanatory gap problem. The difference is important as this more general claim had been put forward before and independently of the emergence of the phenomenological one, although not necessarily with the appropriate terminology and degree of explicitness (as emphasized in Roy 2004). In this sense the labeling I have proposed is in fact inadequate, since it is no less deserved by versions of this more general claim. Accordingly, one might want to distinguish between a broad sense of the phenomenological claim and a narrow one, of which Varela's original neurophenomenological project is again nothing more than a specific version. My additional contention is nevertheless that, in both cases, the notion of phenomenological investigation is appropriately defined as a first-person and purely descriptive investigation of phenomenological properties. A definition that is deliberately very liberal, as it contains no intrinsic connection with a specific methodology, tool or tradition, even though one might consider that only a phenomenological investigation operating certain choices regarding methodology, tool or tradition can be considered *valid*. When considered at its most general level, the definition of the very idea of a phenomenological claim, be it in a broad or a narrow sense, should include no specific reference to Husserlian or any other phenomenology. So, in this respect my original labeling was not fully adequate either as it did not sufficiently emphasize the difference between a narrow phenomenological claim at large and a narrow phenomenological claim of a Husserlian kind. This inadequacy was corrected in later publications (Roy 2000, 2004) and was due to the context in which the phenomenological claim was initially formulated, namely the examination of the general problem of the relevance of the Husserlian tradition to contemporary cognitive science.

« 3 » In spite of their intrinsic importance and their helpfulness for delineating the precise meaning of the original project of Varelian neurophenomenology, these various distinctions have not always been respected. The resulting confusions have advantages and disadvantages. On the infelicitous side, one could cite the illusion of refuting the phenomenological claim at large when only the unacceptability of its neurophenomenological version has at best been established. In my opinion Tim Bayne (2003) committed such a fallacy, when he stated that the phenomenological claim does not provide a solution to the explanatory gap problem, but as a matter of fact focused his attention only on its restricted Varelian version. On the felicitous side is essentially the fact that these confusions favored the emancipation of the idea of neurophenomenology from its original meaning and made possible the blooming of a family of different projects under a unique terminological umbrella. It is for instance arguable that in many hands the connection with the explanatory gap problem got lost and that the expression of neurophenomenology became synonymous with the sheer introduction of a level of first-person investigation (at times not even purely descriptive) of cognitive phenomena. Though they consider the seminal 2002 study of Lutz et al., usually seen as the first concrete attempt to implement the neurophenomenological program, as an "excellent example of the tailored use of introspective evidence," Anthony Jack and Andreas Roepstorff (2002), for example, motivate their plea in favor of such a use only by its usefulness for reaching a better neurocognitive explanation of higher-order cognitive processes.

Which neurophenomenological baby is born?

« 4 » From one perspective the authors' proposal belongs to the core of this neurophenomenological family as it explicitly intends to pave the way for a "subsequent neurophenomenological study" (§79) of the "dereification phenomena," (§7) and also because it conceives of the nature of a neurophenomenological study in rather strict accordance with its original Varelian formulation (§2). In particular, it does not ignore its essential connection either with the explanatory gap problem or with the strategy of establishing mutual constraints in order to solve it. Even espousing that which the authors call a "mild" approach to neurophenomenology is, according to my reading of Varela, faithful to this original conception, even though one might suspect Varela of a certain inconsistency that may have favored diverging interpretations.

« 5 » From another perspective, however, the authors clearly take a step away from Varelian neurophenomenology as they explicitly intend to offer a "neurophenomenological-inspired approach" (§79) that in several respects is "divergent to neurophenomenology" (§83). But wherein lies the difference exactly? And what does it exactly retain from Varelian neurophenomenology?

« 6 » On the most general level, the authors seem to locate this difference primarily in the fact that their proposal is one that addresses the process itself of setting up the experimental design of a neurophenomenological study, and that also defends an approach to this process that incorporates within certain limits "some of the principles of [Varelian] neurophenomenology" (§81). On a more specific level, they seem to locate the difference also in the fact that it demonstrates how such a neurophenomenologically inspired way of setting up an experimental design can be instrumental in overcoming the difficulty of replicating experimental results. A difficulty that affects science at large and is faced head on when pursuing, as the authors do, the objective of investigating the neural correlate of a certain feature of derealisation previously established by other scientists working in a purely behavioral perspective.

« 7 » There are, essentially, two neurophenomenological principles that they borrow within certain limits from Varelian phenomenology. The first one is the principle that makes neurophenomenology phenomenological, namely taking into account the point of view of the experimental subjects themselves about what they experience during the experimental task. A principle that, by being implemented through debriefing interviews that involve open and semi-structured questions and supposedly incarnate a "front-loading" type of description, is different from the one recommended in the original Varelian project. The second principle is that of mutually constraining the subjective data collected in this way and the objective features of the experimental task, but focusing only on the behavioral dimension of these objective features while – somehow paradoxically – leaving aside their neurobiological dimension.

Is this a genuinely neurophenomenological baby?

« 8 » If the above account of the authors' proposal is correct, I see two possible ways of understanding their claim of having introduced a newcomer to the neurophenomenological family, and both are equally problematic.

« 9 » According to one possible interpretation, the authors propose a new way of carrying out a neurophenomenological investigation that deviates from Varela's original project by retaining only some elements of its defining principles, and decide to demonstrate the usefulness of this alternative way only at the level of the preparatory phase of the neurophenomenological investigation. In this perspective, assessing the degree of neurophenomenological innovation of the authors' proposal comes down to determining whether their alternative form of neurophenomenological investigation is genuinely an alternative and indisputably qualifies as a neurophenomenological one, and if so, whether it is in addition correct. In this respect, I think that it is firstly unclear whether the interviewing strategy that they propose is innovative with regard to previous neurophenomenological studies. Also, it is unclear what its front-loading character actually consists in as the descriptions seem to be largely produced, although dialectically, by the experimental subjects themselves – without mentioning that the mindful condition is one very close to Varelian style *epoché*. Secondly, the fact that the mutual constraints involve only behavioral and no neurobiological data is quite problematic, since consequently a crucial element is missing from the alternative framework without which it can hardly qualify as neurophenomenological. Therefore, this framework can be called a partial and incomplete neurophenomenological one at best. Although, in my opinion, one could further object that the relations it establishes between subjective and behavioral data do not even fully qualify as mutual constraints of the required sort. According to this first interpretation, the proposal is therefore consistent and, as such, certainly belongs to the broad phenomenological family, but much less so to the narrow one, let alone to the neurophenomenological one. So, no new neurophenomenological baby has been born with it.

« 10 » However, this first interpretation ignores the idea undeniably suggested by the authors that their modified neurophenomenological approach is only to be applied to the preparatory phase of the neurophenomenological investigation. Nevertheless, taking this suggestion seriously raises a concern about its consistency. How, indeed, could the principles of investigation applied in the preparatory phase of a neurophenomenological study legitimately differ from the ones operating during this study itself? A piloting phase is a tuning-up one, when one adjusts all the various components that will be part of the full investigation. Consequently, the sheer process of adjusting the behavioral data, in order to reach a good replication rate with respect to a previous behavioral study, through an interaction with subjective ones, can only be made neurophenomenologically consistent if this adjustment process is to be considered as one aspect of the full setting-up process of the neurophenomenological investigation. However, if this is what is meant by the authors no new neurophenomenological baby is born either with their proposal. What this proposal only shows – and this is a significant contribution – is how a certain take, already on offer, on the specifically phenomenological component of the Varelian neurophenomenological framework can help take care of the preliminary problem of replicating behavioral data, when there is one, during the setting-up phase of the neurophenomenological study.

Jean-Michel Roy collaborated with Francisco Varela at the time Varela laid the grounds of his neurophenomenological project. A co-founder of the Paris research group *Phenomenology and Cognition*, he organized the 1995 Bordeaux conference that gave birth to the collective volume *Naturalizing Phenomenology*, of which he is a co-editor (Stanford University Press, 1999). In a series of subsequent papers he developed his own view of the possible relevance of a phenomenological investigation to contemporary cognitive science, and of Husserlian phenomenology in particular.

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Plurality of Consciousness Appearances – Plurality of Methods

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> Upshot • Baquedano and Fabar's provoking article highlights several difficulties of neurophenomenology, and brings into light the necessity of further clarification of its basic concepts such as human experience, first-person perspective, phenomenological validation, explanation, adequate measurement and so on. Particularly, it becomes more and more clear that the "explanatory gap" cannot be liquidated by means of explanation procedures alone, for the unavoidable variety of modes and forms of (mutual and individual) human understanding cannot be exhaustively reduced to just any one of these modes.

« 1 » Constanza Baquedano and Catalina Fabar's excellent target article leaves almost no room for internal critiques, as the goal, the context of research, the criteria of theoretical success and methodology are stated with sufficient precision, and the conclusion looks very convincing. The very concrete goal, as it is formulated by Baquedano & Fabar, is to achieve the replication of results by Esther Papies, Lawrence Barsalou and Ruud Custers (2012) in their article "Mindful Attention Prevents Mindless Impulses" (§§7f), and then, on the basis of this example, to discuss general reasons for the "replication crisis" in modern psychology as well as ways of resolving this difficulty. Baquedano & Fabar attribute this amazingly low replication rate in experimental psychology to the fact that even slight changes in experiment design lead to great divergence in the observed results (§91). They show via experiment that the integration of a subject's experience into the experimental design becomes crucial. Authors purposely narrow down their search to purely methodological aspects, avoiding ontological and epistemological speculations (§3). They clearly state that their study "is not a neurophenomenology study itself since it does not involve neural activities or extensive phenomenological experience description" (Footnote 1). In fact they adopt a classical scientific "black box" methodology enriched by first-person data, recursively incorporated into the experimental moves (for they treat consciousness as a "black box" in order to produce certain predictions about its behavior). The authors do not seek to predict new patterns because even the replication of previously observed patterns appears to be a substantial problem. All these carefully explicated restrictions and presumptions, together with the final interpretation of results, make this work highly consistent and self-sufficient.

« 2 » Another positive side of the target article is in that the difficulties described by the authors provoke further questioning. The latter is the only point where I feel myself competent in joining the discussion raised by the authors. So my goal is to become one more drop in a potential sea of "researchers willing to expand cognitive science" in terms of neurophenomenological approaches (§96). I plan to make a few philosophical comments, aimed at the interpretation of such fundamental terms as (a) first-person reports, (b) human experience, (c) explanation, measuring, replication, modeling and analytical description as theoretical tools of research.

« 3 » The very fact that first-person data could be successfully adopted for the third-person framework shows that there is already a gap between the *experience* itself and publicly announced first-person *reports* about it. In many cases the latter appear in the form of objectivized messages, generated under different external and internal pressures, and many times they should be considered more like citizens of the third-person framework (or at least as the citizens of inter-subjective space). It is nowhere near clear enough how and where to draw a borderline between *genuine expressions* of human experience (which are an essential constituent of consciousness) and just "patterns of talking." It is not accidental that Baquedano & Fabar are pointing to the necessity placing "the impetus of training on the interviewer, not the participant, so that the interviewer acts to support the participant in precise experiential reporting"(§83). One more distinction must be mentioned here: the difference between the first-person reports themselves and the third-person view on (and usage of) the first-person reports. To illustrate the significance of these two distinctions, assume that (instead of humans) we have a number of specifically designed computers involved in the same experiment. As of today, the internal life of extremely complex computer programs (especially those that deal with "big data") is no less a "black box" for us then our own consciousness (see, for example, Napoletani, Panza & Struppa 2011 and Pietsch 2016). If we were interested in a diagnostic search of the inner life of such programs we would face exactly the same conceptual difficulties since the same conceptual and terminological apparatus (except the concept of "experience"!) would be applicable here due to the self-learning and self-correcting statistical nature of the corresponding programs. It is perfectly fine to talk about first-person reports here. However, the computer-simulated first-person reports could not be considered an expression of genuine experience due to the absence of such (as it is usually assumed so far). The concept of a "first-person report" is wider then the concept of "experience expression." Here is a big problem. Neither science nor philosophy has worked out any satisfactory idea of such a language (more precisely, of appropriate speech-generating procedures), which could guarantee us that (human) experience is manifesting itself via the results of correctly organized speech acts. The analysis of Turing Test (e.g., Hofstadter 1995) shows that the problem lies neither in the choice of an appropriate vocabulary nor in grammar competence. It is rooted in deeper layers of our experience and language competence. Some researchers such as Douglas Hofstadter (1995) and Daniel Dennett (1990) argue that this difference will never be found, as it simply does not exist (i.e., the nature of human brains and that of artificial brains is the same, there is no hidden difference between the two).

« 4 » One more shade of doubt. I agree that we have to be sure that "the paradigms and instruments we employ are measuring what they claim to measure" (§94). Practically it means that researchers have to play an active role in the measuring process (§§83, 89). In some sense, this implies that researchers *force* subjects' experience to correspond to a certain theoretical framework. But the question then is: how could the amount of researchers' influence on the final outcome be measured, and how far might it go (in general)? We can consider the following example: assume you want to investigate the nature of the market economy. You want to measure certain *replicating* aspects of it, which presumably should be in line with your initial hypothesis or initial plan. So you design an appropriate experiment to allow you to force certain aspects of the market evolution to be adequate to the initial conditions of your hypothesis. The question then is the following: are we still studying the market economy, or we are already in the territory of the planned economy? Indeed, it may well happen that for the sake of replicability and in order to get rid of a certain "market noise," in fact we will force a tiny segment of the economical process (covered by the experiment) to obtain certain features of a planned economy. I am not sure that this could be addressed in the context of Baquedano & Fabar's experiment, but in general this consideration definitely has to be taken into account.

« 5 » I cannot fully agree that "psychology is the discipline with the lowest replication rate" (§89). I think that among humanity studies the lowest replication rate belongs to history. By definition, history deals with unique events with a zero replication rate, which makes it highly problematic to apply classical scientific methods to *the original content of* historical process. This conceptual puzzle was recognized more than 100 years ago, and its study resulted in a couple of significant distinctions. It was argued that the essence of the natural sciences is constituted by the generalization methodology, while methods for the humanities (Geisteswissenschaft) could be understood in terms of individuation procedures. It is important to take this into account, because history is one of the most significant arenas of human consciousness manifestation. To a great extent phenomenology is the phenomenology of historical appearances of human experience. From this point of view psychology and (neuro) phenomenology are somewhere in between the above-mentioned extremes, with experimental psychology being closer to natural sciences, while descriptive psychology and phenomenology are closer to the other pole. This could mean that neither of them can just stick to one specific methodological paradigm. Both of them are constituted by the pressure of (at least) two counter-oriented, mutually contradicting theoretical approaches. Baquedano & Fabar show that first-person enrichment of generalization methodology will bring up a great deal of fruitful dividends to the studies within the third-person framework. We must now understand how the phenomenological dimension (of neurophenomenology) could benefit from the progress in its other dimension.

« 6 » Finally, I would like to make one more rather speculative comment. Science and analytical philosophy tend to talk about "explanations" of consciousness (as they do about any subject under consideration). However, an explanation is a very specific epistemic procedure, with a certain internal structure and specific criteria of success. Particularly it means that it is a specific type of *mode of understanding*, which is quite different from other modes and acts of human understanding (say, when one finds something funny or intriguing, or from such a mode as description). Therefore, one may ask: if we are guided in our theoretical inquiries by such a "sample of understanding" as explanation, then what kind of evidence could be provided in support of the idea that *any* kind of human understanding could be "grasped" totally by such a particular mode of understanding as "explanation"? Can a particular type of a mode of understanding exhaustively cover all other types of modes of understanding? For example, it is correct that while the language of grown-ups can successfully predict, model and explain the behavior of children it does not mean that this language will adequately serve the needs of children's expressions of *experience*. So I assume that the "explanatory gap" cannot be eliminated solely by means of explanations. Any improvement in our understanding of the "hard problem of consciousness" will depend on our ability to synthesize different *patterns of understanding* and different *samples of comprehension* into a multi-dimensional network of approaches, recursively intertwined and equipped with certain rules of translation of one into another.

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Modelling Subjectivity and Uncertainty in "Real World" Settings

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> Upshot • The authors show in their pilots how open it is to participants not to obey the instructions during an experiment. Their findings leave us to choose between two options: either we (a) accept that subjective confounds are inevitable and stronger than we think, but in this case, why should we continue trying to measure subjective experience?; or (b) strive at designing better experiments in order to control for these fluctuations. I will argue for option (b) and propose an alternative model to go beyond the first- and third-person data gap, namely "predictive processing."

« 1 » One perennial concern within both philosophical and cognitive science is to identify the most suitable method for bridging the gap between first- and third-person data, in other words between subjective, qualitative experiences on the one hand, and objective, scientific measurements on the other. In their target article Constanza Baquedano and Catalina Fabar argue that a mild-neurophenomenology-inspired approach (Gallagher 2003; Gallagher & Varela 2003; Bitbol & Petitmengin 2017) might prove useful in implementing better means of handling first-person data in a reliable and productive way, providing thereby clarifications and classifications that are not captured by typical cognitive science approaches. Ultimately, this new approach is designed to address the "replication crisis" in cognitive science research (Schooler 2014) by allowing for a deeper piloting process and better paradigm design, to foster replicability and phenomenological validity. The authors have run a set of pilots in which they asked the participants to tell them how they were completing the task. Hence, they identified a number of potential confounds whereby the participants were executing the task somewhat differently from the way the experimenters had intended.

« 2 » While I applaud their attempts to tackle the very difficult question of how the neurophenomenological method can be integrated into experimental settings, I suggest that an alternative explanation of their findings is that one simply needs a better designed and controlled experimental setting in order to get rid of the confounds. In other words, while taking the fluctuations of the first-person subjective reports into consideration is an important step in achieving scientific measurements, the main challenge for a scientist remains that of setting up an experimental design that overcomes these fluctuations. Whether the study by Esther Papies, Lawrence Barsalou and Ruud Custers (2012) is the best example to follow up with a replication study is questionable.

« 3 » Consequently, the point made by Baquedano and Fabar would be stronger if they were targeting at least two studies from different research paradigms and then comparing them. Their findings leave us to choose between two options: either we

a. accept that subjective confounds are inevitable and stronger than we think, but in this case, why should we continue trying to measure subjective experience in the first place?; or
b. strive at designing better experiments in order to control for these fluctuations.

« 4 » The Baquedano and Fabar article presents us with option (a) without considering option (b), which I consider to be the most suitable one from a scientific perspective. To sum up: the "replication crisis" in contemporary psychological science teaches us at least two things:

a it is highly challenging to measure first-person experience or to eliminate the subjective confounds in experimental settings;
b some experimental settings that have been put forward up to now are unable to deal with fluctuations in first-person reports.

« 5 » I would suggest that we need better designs and understanding of (b) in order to deal with (a). I also suggest that another option in moving beyond the first- and third-person perspective divide is by incorporating second-person and dynamic approaches in contemporary philosophy and cognitive science. In what follows I sketch one promising way of articulating the "dynamic factors that can be studied to include extra-neural and extra-experiential factors, such as bodily, environmental, social, and cultural constraints" (Bockelman, Reinerman-Jones & Gallagher 2013: 2), namely the "predictive processing" (PP) account inspired by recent computational models in neuroscience (Friston 2005). I will conclude that neurophenomenological and PP approaches can inform one another in a fruitful way.

« 6 » Let us return to the classic question: how are we supposed to bridge the gap between first-personal subjective experience or introspection (understood as "inner observation") and third-person measurements ("outer observation")? One influential way of addressing this issue has been developed within the "embodied cognition" research paradigm (Varela, Thompson & Rosch 1991) by taking into account the wider brain-body-environment dynamics. Indeed, our subjective experiences do not occur in a vacuum, but they are given to us through our body, an organism situated in a broader physical and social context. While many accounts have been proposed to relate intra- and inter-individual dynamics (Hasson et al. 2004; Konvalinka & Roepstorff 2012; Dumas et al. 2010), the link between third- (objective) and first-person (subjective) accounts remains unclear. Introspection has been vigorously criticised in the past decades (see Thomasson 2003). However, recently more rigorous approaches have been put forward in order to study subjective experience, such as:

a neurophenomenological approaches aiming at integrating first-person data with objective measures from cognitive neuroscience (Lutz et al. 2002);
b interactive approaches focusing on the lived experience of the intersubjective dimension of coordination (Froese & Di Paolo 2010).

« 7 » These accounts build upon the insight that the "everyday" environment differs significantly from the experimental setting. Indeed, the understanding gained from an interactor's point of view is qualitatively different from the one gained from a spectator's point of view (Schilbach et al. 2013). The PP model (Friston 2005; Hohwy 2014; Clark 2013; Fotopoulou 2015) takes the wider brain-body-environment dynamics into account. The intuitive starting point is that humans are biological, self-organizing agents that need to occupy a limited repertoire of sensory states for homeostatic reasons (for example, humans need to stay within certain ranges in environmental temperature in order to survive). However, given the inescapable ambiguity, complexity and uncertainty of the signals an organism receives from the world over its lifespan, we risk finding ourselves in states for longer periods than those we could biologically sustain (e.g., in cold climates). Hence, we need to be able to predict (infer) the causes of our possible sensory states despite the limited or noisy information available to our sensory organs (Helmholtz 1971). The "solution" found by the brain in order to solve the problem of sensory uncertainty and to reduce "free energy" is to engage in a form of "predictive processing," in building up probabilistic representations of the causes (e.g., the weather) of our future states (e.g., our bodily temperature) on the basis of noisy sensory information. In other terms, it generates hypotheses ("generative models") of the hidden causes of sensory input. The brain is thus processing dynamically shifting generative models of what is causing incoming sensory events, based on probabilistic predictions about how likely something is to have happened and what the likely causes are. Crucially, in this framework, perception and subjective experience are intrinsically linked to action, which is defined as the inverse way to reduce free energy. Specifically, while perception reduces free energy by prediction updating and cancelling out prediction errors, action can reduce free energy by changing sensory inputs (e.g., if I am hungry I reach for an apple).

« 8 » Of course, there is much more to be said about the PP framework, but for our purposes here, suffice it to say that one important aspect is that the PP framework seems to accommodate the embodied/enactive insights (see Allen & Friston 2016 for a recent discussion).[1] If this is so, then one important future question to be addressed is to what extent the attempts to show how a process of successive mutual restrictions between data accessed from first- and third-person points of view (in a four-step piloting process) – which allows for integration of a subject's experience into the experimental design – can be accommodated within the highly influential PP framework in contemporary philosophy and cognitive science.

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1| But see Jakob Hohwy for a different take: he argues that we should resist conceptions on which "the mind is in some fundamental way open or porous to the world, or on which it is in some strong sense embodied" (Hohwy 2014: 1). See also Burr & Jones (2016) for a reply.

Author's Response

Multiple Views in Search of Unifying Models

Constanza Baquedano & Catalina Fabar

> Upshot • We respond to three main challenges that the commentaries have raised. Firstly, we clarify our misunderstood intention of introducing a newcomer to the neurophenomenological family. Rather, we situate our approach under the broader umbrella of phenomenology. Secondly, we argue that from our empirical position it is questionable that the strategy we pursued in the target article left the black box of consciousness completely closed. Thirdly, we argue that the subjective fluctuations that may appear as outcomes in an experimental paradigm are not to be considered with a resigned attitude but as valuable information to work with. We conclude our response by agreeing with the concerns of two of the commentators about extending the perspectives and plurality of the methods to investigate the explanatory gap problem.

« 1 » In our target article we aimed to demonstrate, through the example of a pilot study, the usefulness of a mild-neurophenomenological-inspired approach with a front-loaded logic (Gallagher, 2003; Gallagher & Varela, 2003) to adapt and refine the experimental paradigm of Esther Papies, Lawrence Barsalou and Ruud Custers (2012). These adaptations and refinements were necessary to use this paradigm with electroencephalographic (EEG) data in a subsequent neurophenomenological study. We argue that a neurophenomenological-inspired approach allows for a deeper piloting process and better paradigm design, which fosters replicability and phenomenological validity.

« 2 » Throughout this study we explore how the neurophenomenological method can be integrated into experimental settings. Therefore, we do not use neurophenomenology to describe a conscious experience and its mirroring physiological counterpart, but to draw inspiration from this framework to solve a very concrete everyday laboratory problem: the replicability of behavioral results and ensuring of the phenomenological validity of our adapted paradigm for further neurophysiological and neurophenomenological evaluation.

« 3 » In what follows, we shall respond to three main challenges that the commentaries have raised. We will clarify some ideas that may have led to misunderstandings and reflect upon and discuss other ideas raised by our commentators.

The alleged newcomer to the neurophenomenological family

« 4 » In his commentary **Jean-Michel Roy** assumes that we, somehow, want "to introduce a newcomer to the already extended neurophenomenological family"(§1). Later, based on how the borrowed ideas and principles of neurophenomenology are put into practice in our piloting proposal (mainly for the two reasons discussed below), the author concludes that no new neurophenomenological baby has been born (§§9f).

« 5 » The first point he makes mainly refers to the fact that there is no neurobiological data involved in our analysis. The author maintains that our mild-neurophenomenological-inspired approach with a front-load logic "belongs to the broad phenomenological family, but much less so to the narrow one, let alone to the neurophenomenological one" (§9).

« 6 » It is important to clarify that nowhere in our article did we claim that our mild-neurophenomenological-inspired approach constitutes a neurophenomenological baby. The target article discusses ideas of how our methodological approach converges with and diverges from neurophenomenology in §9 and §§79–81). Also, in Footnote 1 we discuss the missing analysis of neurobiological data. There, we also acknowledge the fact that, for this reason, our preparatory study is not a formal neurophenomenological study. However, we are grateful that **Roy** discussed (what he calls) the "phenomenological claim" (§2) in such a clear way, because we agree that the target article presents a methodological adaption that is part of a broader conceptual umbrella than neurophenomenology. In fact, we could not agree more with **Roy**'s claim that our proposal supports the phenomenological claim without constituting a neurophenomenological stance. Nevertheless, it would have been irresponsible not to give a principal role to neurophenomenology when declaring the source of our inspiration, since we borrow and adapt ideas that are constitutive of the neurophenomenological stance and methodology.

« 7 » **Roy** adds a second argument to support his claim that no new neurophenomenological baby has been born. He states:

> "the sheer process of adjusting the behavioral data, in order to reach a good replication rate with respect to a previous behavioral study, through an interaction with subjective ones, can only be made neurophenomenologically consistent if this adjustment process is to be considered as one aspect of the full setting-up process of the neurophenomenological investigation." (§10)

« 8 » We do not completely agree with the aspect of the argumentation referring to the fact that a pilot study that pursues a future neurophenomenological study also has to use strictly neurophenomenology methods, i.e., include the analysis of brain signals or neurological data in general. We think that preparatory steps are necessary to guarantee that the experimental paradigm assesses what it is supposed to assess, i.e., that the experimental paradigm succeeds in manipulating the variable the researchers expect it to. Those steps are required *before* neural activity can be exhaustively analyzed, in particular if it is an exploratory neural approach. So, it might raise doubts as to why EEG measurements are even included in the piloting process, if they were not to be taken into account as a constraining factor. In our case we used them because we needed to ensure the technical quality of such data, and also to implement the procedure in its most complete version possible so that participants underwent exactly the same set-up experience prior to and during the task itself. Different steps of an experimental study have different methodological requirements, even though they all have the same ultimate goal.

« 9 » Another topic addressed by **Roy** is what he perceives as a lack of clarity about the way front-loading phenomenology is incorporated in our target article, since the experimental subjects themselves produced the experiences' descriptions (§9). Front-loading phenomenology stands by the idea of building the experimental design through an input of previously acquired phenomenological insights (Gallagher, 2003; Gallagher & Varela, 2003). In our case, first-person data corresponding to phenomenological descriptions were extracted from one former pilot to use in the following pilot as an orientation in its construction, creating a front-loading phenomenological loop across pilots.

« 10 » Since we never claimed to give rise to a neurophenomenological baby, we substantially agree with **Roy**'s constructive criticisms and we are thankful for his commentary. Also, we are pleased that he acknowledges that there is a "felicitous side" concerning the potential confusion of having intended to introduce a newcomer, which has "favored the emancipation of the idea of neurophenomenology from its original meaning and made possible the blooming of a family of different projects under a unique terminological umbrella" (§3). We allude to this issue in our article in §§9 and 96, where we claim that other measures have to be integrated with the objective third-person measurements that are going to connect with the phenomenological dimension, which is in agreement with Bockelman, Reinerman-Jones & Gallagher (2013) and Gallagher & Varela (2003). See also the commentary of **Konstantin Pavlov-Pinus**, who makes a similar point in §§5f.

The black box of consciousness

« 11 » In his commentary, **Pavlov-Pinus** states that we adopt the "classical scientific 'black box' methodology" to treat consciousness during the pilot procedure (§1), meaning that we treat conscious experience of our participants as a single and closed unit. We can only partially agree with this statement. While we did not put emphasis on the qualia aspect or on the process of emergence of the cognitive acts, for us the black box was very present in the laboratory. It was specifically situated in each subject watching certain stimuli on a screen while following our instructions and subsequently reacting behaviorally to their perceptions. We explored participants' experience of the task, and subsequently used distinctions arising from their conscious experience to interpret the behavioral results and construct the ensuing paradigm. Would this not count as an attempt to partially open the black box?

« 12 » Regarding the question of whether there is a gap, for us the answer is: it does exist in the explanatory framework, but not necessarily in our perceptual experience itself. However, whether the explanatory gap can be solved or whether neurophenomenology is a remedy for it remain open questions for us. Our interest has always been on the experimental side regarding the explanatory gap and consciousness, so we only link our results to the conceptual discussion in the scientific literature to a limited extent. Clearly, more reflection on methodology and epistemology (in particular on the limits of explanations) is needed.

The need for better designs and the modeling of "real world" settings

« 13 » In her commentary, **Anna Ciaunica** argues that our findings oblige us to choose between two options:

> "either we (a) accept that subjective confounds are inevitable and stronger than we think, but in this case, why should we continue trying to measure subjective experience in the first place?; or (b) strive at designing better experiments in order to control for these fluctuations." (§3)

« 14 » Later she claims that in the target article we go with the first option without considering the second option, which **Ciaunica** believes to be the most suitable one from a scientific perspective (§4).

« 15 » We disagree with this last statement because we are convinced that our piloting process precisely pursues a better experimental design in order to control and characterize subjective fluctuations. It results in what we call a "first-person enriched cognitive science paradigm" (abstract) that could account for phenomenological validity, which in our view situates our attempt much closer to option (b) than (a).

« 16 » In fact, we disagree almost completely with option (a). Scientists working with humans and cognitive (consciousness) phenomena should be well aware of the experiential component and the necessity of incorporating this component into their explanations and research programs. Subjectivity and lived experience vary and fluctuate within and between subjects. The possible confusions this situation raises are not to be met with a resigned attitude, as may have been understood (§4), but rather with an active intention of recognizing this difficulty in order to construct better paradigms in cognitive science. In other words, the conscious acknowledgment of researchers of this situation should be translated into an orientation of the cognitive field that aims never to exclude the phenomenological aspect of human cognition, yet also aims to minimize the possible fluctuations of experience that could be crucially detrimental to the testing of a specific paradigm.

« 17 » Finally, we would like to revisit the complexity of subjective experience in an everyday setting, which would correspond to the ideal type of measurement. In our understanding, methods and technology make such a setting very challenging.

« 18 » In accordance with what was stated previously, we think that the most fruitful path forward is to understand that there are many modes of human understanding, which can hardly be grasped by just one model of explanation, as **Pavlov-Pinus** stated in §6. There are many variations and singularities in everybody's way of experiencing and understanding a particular experimental paradigm, and more than one way to express or study a cognitive process. By choosing a specific theoretical and methodological approach, the research question and the phenomenon under study are enclosed in a particular framework. In this sense, from the very start, researchers bias the outcome of the results to some extent toward their own hypothesis. A partial solution to the question **Pavlov-Pinus** raises about how to know the extent to which researchers influence the outcomes of their studies (§4) would be to have a reflexive and critical attitude throughout the process of producing scientific knowledge, and to be focused on one's own theoretical position and its influence on the production and interpretation of the experimental results. This should be accompanied by a rigorous triangulation, in which not only are the subject under study and the data carefully discussed with other researchers (Jick 1979), but there is critical discussion and examination of how the phenomena have been outlined and how the outcomes have been influenced throughout by theoretical and experimental decisions made by researchers. In carrying out this process, an increased awareness of the extent to which outcomes are not entirely independent of the researchers' decisions will emerge. This can offer scientists and science a new perspective when evaluating the limitations of the explanations they provide.

« 19 » The evolution of science is marked by the search for better explanatory models at a certain moment in time, and we share Pavlov-Pinus's (§6) view of a horizon where the complexity will be addressed via multi-dimensional networks of models of understanding. In this way, different approaches, such as the method discussed in the target article, neurophenomenology itself, predictive processing (Ciaunica §5) and other models yet to be elaborated, could converge in the search for a coherent synthesis of explanation.

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Combined References

Allen M. & Friston K. (2016) From cognitivism to autopoiesis: Towards a computational framework for the embodied mind. Synthese, first online.

Baker M. (2016) Is there a reproducibility crisis? Nature 533: 452–454.

Bayne T. (2003) Closing the gap? Some questions for neurophenomenology. Phenomenology and the Cognitive Sciences 3(4): 349–364. ▸ http://cepa.info/2260

Berkovich-Ohana A., Dor-Ziderman Y., Glicksohn J. & Goldstein A. (2013) Alterations in the sense of time, space, and body in the mindfulness-trained brain: A neurophenomenologically-guided MEG study. Frontiers in Psychology 4: 912.

Bitbol M. & Petitmengin C. (2017) Neurophenomenology and the elicitation interview. In: Velmans M. (ed.) The Blackwell companion to consciousness. Second edition. Wiley & Sons, Hoboken NJ, In press.

Blechert J., Meule A., Busch N. A. & Ohla K. (2014) Food-pics: An image database for experimental research on eating and appetite. Frontiers in Psychology 5: 617.

Bockelman P., Reinerman-Jones L. & Gallagher S. (2013) Methodological lessons in neurophenomenology: Review of a baseline study and recommendations for research approaches. Frontiers in Human Neuroscience 7: 608.

Burr C. & Jones M. (2016) The body as a laboratory: Prediction-error minimisation, embodiment and representation. Philosophical Psychology 29(4): 586–600.

Clark A. (2013) Whatever next? Predictive brains, situated agents and the future of cognitive science. Behavioural Brain Sciences 36: 181–204.

Dennett D. (1990) Evolution, error and intentionality. In: Wilks Y. & Partridge D. (eds.) Sourcebook on the foundations of artificial intelligence. Cambridge University Press, Cambridge: 190–212.

Dumas G., Nadel J., Soussignan R., Martinerie J. & Garnero L. (2010) Interbrain synchronization during social interaction. PloS One 5: E12166.

Earp B. D. & Trafimow D. (2015) Replication, falsification, and the crisis of confidence in social psychology. Frontiers in Psychology 6: 621.

Fotopoulou K. (2015) The virtual self-mentalisation of the body as revealed in anosognosia for hemiplegia. Consciousness and Cognition 33: 500–510.

Friston K. (2005) A theory of cortical responses. Philosophical Transactions of the Royal Society of London 360: 815–36.

Froese T. & Di Paolo E. A. (2010) Modelling social interaction as perceptual crossing: An investigation into the dynamics of the interaction process. Connection Science 22(1): 43–68.

Gallagher S. (2003) Phenomenology and experimental design toward a phenomenologically enlightened experimental science. Journal of Consciousness Studies 10(9–10): 85–99.

Gallagher S. & Brøsted J. (2006) Experimenting with phenomenology. Consciousness and Cognition 15(1): 119–134.

Gallagher S. & Varela F. J. (2003) Redrawing the map and resetting the time: Phenomenology and the cognitive sciences. Canadian Journal of Philosophy 33 (sup1): 93–132. ▸ http://cepa.info/3740

Hasson U., Nir Y., Levy I., Fuhrmann G. & Malach R. (2004) Intersubject synchronization of cortical activity during natural vision. Science 303(5664): 1634–40.

Helmholtz H. von (1971) The facts of perception. In: Kahl R. (ed.) Selected writings of Herman von Helmholtz. Weslyan University Press, Middletown CT: 366–408. German original published in 1878.

Hofstadter D. R. (1995) Fluid concepts and creative analogies: Computer models of the fundamental mechanisms of thought. Basic Books, New York.

Hohwy J. (2014) The self-evidencing brain. Noûs 50(2): 259–285.

Jack A. & Roepstorff A. (2002) Introspection and cognitive brain mapping: From stimulus-response to script-report. Trends in Cognitive Sciences 6(8): 333–339.

Jick T. D. (1979) Mixing qualitative and quantitative methods: Triangulation in action. Administrative Science Quarterly 24(4): 602–611.

Konvalinka I. & Roepstorff A. (2012) The two-brain approach: How can mutually interacting brains teach us something about social interaction? Frontiers in Human Neuroscience 6: 215.

Lara Zavala N., Cervantes Pérez F., Franco Muñoz A. & Herrera A. (2000) Doctrinas filosóficas, procesos mentales y observaciones empíricas. Contextos 33: 31–58.

Luck S. J. (2005) Ten simple rules for designing and interpreting ERP experiments. In: Handy T. C. (ed.) Event-related potentials: A methods handbook. MIT Press, Cambridge MA: 17–32.

Lutz A. (2002) Toward a neurophenomenology as an account of generative passages: A first empirical case study. Phenomenology and the Cognitive Sciences 1(2): 133–167.

Lutz A., Lachaux J. P., Martinerie J. & Varela F. J. (2002) Guiding the study of brain dynamics by using first-person data: Synchrony patterns correlate with ongoing conscious states during a simple visual task. Proceedings of the National Academy of Sciences 99(3): 1586–1591. ▸ http://cepa.info/2092

Lutz A. & Thompson E. (2003) Neurophenomenology: Integrating subjective experience and brain dynamics in the neuroscience of consciousness. Journal of Consciousness Studies 10: 31–52. ▸ http://cepa.info/2363

Makel M. C., Plucker A. & Hegarty B. (2012) Replications in psychology research: How often do they really occur? Perspectives on Psychological Science 7(6): 537–542.

Marbach E. (1993) Mental representation and consciousness. Kluwer, Dordrecht.

Nagel T. (1974) What is like to be a bat? The Philosophical Review 83(4): 435–450.

Napoletani D., Panza M. & Struppa D. C. (2011) Agnostic science: Towards a philosophy of data analysis. Foundations of Science 16(1): 1–20.

Overgaard M., Gallagher S. & Ramsøy T. Z. (2008) An integration of first-person methodologies in cognitive science. Journal of Consciousness Studies 15(5): 100–120. ▸ http://cepa.info/4041

Papies E. K., Barsalou L. W. & Custers R. (2012) Mindful attention prevents mindless impulses. Social Psychological and Personality Science 3(3): 291–299.

Petitmengin C. (2006) Describing one's subjective experience in the second person: An interview method for the science of consciousness. Phenomenology and the Cognitive Sciences 5(3–4): 229–269. ▸ http://cepa.info/2376

Petitmengin C. & Lachaux J.-P. (2013) Microcognitive science: Bridging experiential and neuronal microdynamics. Frontiers in Human Neuroscience 7: 617. ▸ http://cepa.info/934

Petitot J., Varela F. J., Pachoud B. & Roy J.-M. (eds.) (1999) Naturalizing phenomenology: Issues in contemporary phenomenology and cognitive science. Stanford University Press, Stanford CA.

Phaf R. H., Mohr S. E., Rotteveel M. & Wicherts J. M. (2014) Approach, avoidance, and affect: A meta-analysis of approach-avoidance tendencies in manual reaction time tasks. Frontiers in Psychology 5: 378.

Pietsch W. (2016) The causal nature of modeling with big data. Philosophy & Technology 29(2): 137–171.

Rotteveel M., Gierholz A., Koch G., van Aalst C., Pinto Y., Matzke D., Steingroever H., Verhagen J., Beek T. F., Selker R., Sasiadek A. & Wegenmakers E.-J. (2015) On the automatic link between affect and tendencies to approach and avoid: Chen and Bargh (1999) revisited. Frontiers in Psychology 6: 335.

Rowan J. A. & Tolunsky E. (2004) Conceptos básicos sobre EEG. Elsevier, Madrid.

Roy J.-M. (2000) Argument du déficit d'explication et revendication phénoménologique Intellectica 2(31): 35–83.

Roy J.-M. (2004) Phénoménologie et cognition. In: Poust J. & Pacherie E. (eds.) La philosophie cognitive. Editions de la Maison des Sciences de l'Homme, Paris: 103–121.

Roy J.-M., Petitot J., Pachoud B. & Varela F. J. (1999) Beyond the gap: An introduction to naturalizing phenomenology. In: Petitot J., Varela F. J., Pachoud B. & Roy J.-M. (eds.) (1999) Naturalizing phenomenology: Issues in contemporary phenomenology and cognitive science. Stanford University Press, Stanford CA: 1–80.

Schilbach L., Timmermans B., Reddy V., Costall A., Bente G., Schlicht T. & Vogeley, K (2013) Toward a second-person neuroscience. Behavioral and Brain Sciences 36: 393–414.

Schooler J. (2014) Metascience could rescue the "replication crisis." Nature 515(7525): 9.

Thomasson A. (2003) Introspection and the phenomenological method. Phenomenology and the Cognitive Sciences 2: 239–254.

Thompson E., Lutz A. & Cosmelli D. (2004) Neurophenomenology: An introduction for neurophilosophers. In: Brook A. & Akins K. (eds.) Cognition and the brain: The philosophy and neuroscience movement. Cambridge University Press, New York: 40–97. ▸ http://cepa.info/2356

Varela F. J. (1996) Neurophenomenology: A methodological remedy to the hard problem. Journal of Consciousness Studies 3(4): 330–349. ▸ http://cepa.info/1893

Varela F. J. & Shear J. (1999) First-person methodologies: Why, when and how? Journal of Consciousness Studies 6(2–3): 1–14. ▸ http://cepa.info/2080

Varela F. J., Thompson E. & Rosch E. (1991) The embodied mind: Cognitive science and human experience. MIT Press, Cambridge MA.