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Stuck in between. Phenomenology's Explanatory Dilemma and its Role in Experimental Practice

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Abstract

Questions about phenomenology's role in non-philosophical disciplines gained renewed attention. While we claim that phenomenology makes indispensable, unique contributions to different domains of scientific practice such as concept formation, experimental design, and data collection, we also contend that when it comes to explanation, phenomenological approaches face a dilemma. Either phenomenological attempts to explain conscious phenomena do not satisfy a central constraint on explanations, i.e. the asymmetry between explanans and explanandum, or they satisfy this explanatory asymmetry only by largely merging with non-phenomenological explanation types. The consequence of this dilemma is that insofar as phenomenological approaches are explanatory, they do not provide an own type of explanation. We substantiate our two claims by offering three case studies of phenomenologically inspired experiments in cognitive science. Each case study points out a specific phenomenological contribution to experimental practice while also illustrating how phenomenological approaches face the explanatory dilemma we outline.

Keywords Phenomenology · Explanation · Explanatory asymmetry · Concept formation · Data Collection · Experimental design

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1 Introduction

In this paper, we argue for two claims. First, we claim that phenomenological approaches do not offer sui generis explanations of the phenomena they investigate because they currently face an unresolved dilemma. Either phenomenological approaches fail to respect the well-accepted constraint of explanatory asymmetry, or they respect asymmetry by merging with other types of explanation. This dilemma seems to counter the idea that phenomenological approaches imply a sui generis explanation type (cf. Albertazzi, 2019, 11). Second, we claim that regardless of whether phenomenology provides sui generis explanations, phenomenological approaches substanially contributed to how scientists study mental phenomena in scientific practice. An exclusive focus on phenomenological *explanation* conceals these contributions, just as a narrow focus on scientific explanation in philosophy of (cognitive) science has concealed other crucial epistemic aspects of scientific practice such as concept formation, experimental design, or data collection procedures. Because phenomenological approaches make these unique contributions to the investigation of mental phenomena, we argue that their scientific value goes beyond their role in explanation.

We speak of phenomenological *approaches* because in the last 30 years, phenomenology developed into several subfields, which have distinct answers to questions like "Are phenomenological approaches explanatory?" or "Can the phenomenon of subjective experience be naturalized?". For current purposes, we take the naturalization question to be whether phenomenological methods satisfy current standards of empirical research, and whether results produced by such methods can be integrated into or at least contribute to the current conceptual and ontological frameworks found in cognitive science, psychology, and neuroscience (cf. Roy et al., 1999, 43 ff.).

Phenomenologists have developed a whole spectrum of techniques already used in scientific research. *Neurophenomenology* trains subjects phenomenologically to produce precise descriptions of their subjective experiences in experimental settings (Lutz & Thompson, 2003; Varela, 1996). A related approach is *microphenomenology*, in which a phenomenologically trained interviewer guides an untrained interviewee towards unattained aspects of a singular conscious experience they made (Petitmengin et al., 2019, Petitmengin 2006).[1] Another prominent approach is *front-loaded phenomenology* which aims to influence experimental design to test phenomenologically inspired hypotheses (Gallagher, 2003; Feest, 2019). Finally, *experimental phenomenology* uses subjectively meaningful stimuli and qualitative methods to discover invariant conditions underlying phenomenal appearances (Albertazzi et al., 2015a, b).

Proponents of neurophenomenology, microphenomenology, and front-loaded phenomenology affirm the question of whether the results of phenomenological methods can be integrated into or contribute to the conceptual and ontological framework

[1] Although differences between both approaches exist, we treat them together in this paper because (a) microphenomenologists sometimes label their approach as neurophenomenology (Petitmengin et al., 2006, Bitbol and Petitmengin, 2017) (b) both are forms of phenomenological data production, (c) use first person reports to identify generic structures in conscious experience, and (d) aim to form novel concepts for experimental practice (Sect. 3.1).

of natural science. They are naturalization-friendly phenomenologists who hold that their approaches are compatible with and complementary to, e.g., dynamical explanations of mental phenomena (Kirchhoff & Meyer, 2019). However, none of these better-known methods explicitly claims to offer explanations on their own. By contrast, experimental phenomenologists not only deny that phenomenological methods can be integrated with natural scientific research, but also claim that phenomenology produces explanations of their own kind (Albertazzi, 2019; Da Pos et al., 2021).

Our aim in this paper is not to settle whether phenomenology can or cannot be explanatory. That would require a general notion of explanation that would fit the heterogeneous views about what explanation is found in the phenomenological literature (Williams, 2020; Da Pos et al., 2021; Williams & Byrne, 2022, see Sect. 2.1). Rather than providing a general definition of explanation, we evaluate the prospects of phenomenological explanation on a well-accepted constraint on all types of explanation: the asymmetry between explanans and explanandum (Sect. 2.2). In order to fulfill this constraint, a type of explanation must establish a dependency between an explanatory factor (e.g., a cause, a norm, a law) and the phenomenon to be explained. Our dilemma suggests that phenomenological explanations which fulfill this constraint are not a unique kind of explanation.

So rather than arguing that phenomenology cannot be explanatory, our claims are meant as a friendly challenge for those who assume that phenomenology offers *sui generis* explanations (Albertazzi, 2019). Those interested in situating "phenomenological explanation" within existing taxonomies of explanation, such as Williams and Byrne (2022), will not find it problematic that phenomenological explanations merge with other explanation types. Yet, our dilemma encourages proponents of other approaches, such as experimental phenomenology, to clarify how their explanation of conscious phenomena satisfies general constraints such as explanatory asymmetry - without merging into other types of explanation. At the same time, our claims invite naturalization-friendly phenomenologists to determine more distinctly the indispensability of phenomenology in scientific practice and its epistemological contributions in that context.

The paper is structured as follows. Section 2 introduces the dilemma of phenomenology. At the core of the dilemma is the demand that explanations need to adhere to a special asymmetry between explanans and explanandum. If we accept the asymmetry condition as a benchmark for explanations, then phenomenological explanations cannot be both sui generis and explanatory. In Sect. 3 we analyze case studies of experiments supported by phenomenology. These case studies substantiate our first and second claim. When phenomenological approaches become explanatory, they merge with other explanation types. At the same time, phenomenological methods significantly and positively influence different domains of scientific practice, such as data collection, concept formation, and experimental design.

2 A dilemma for sui generis phenomenological explanations

Whether phenomenological methods and research can substantially influence scientific practices is a hotly debated issue (Feest, 2019). This debate includes questions such as "Can phenomenology inform empirical research?", "Can phenomenological concepts be used in natural sciences?", "Might phenomenological approaches influence experimental design?", and "Is phenomenology strictly descriptive or does it provide explanations as well?".

While we will provide positive answers to the first three questions in Sect. 3, in this section, we articulate a dilemma that casts doubt on affirming the last one, at least when phenomenological explanations are construed as their own type of explanation. We leave open the possibility that phenomenological explanations belong to a known type of explanation (e.g., intentional, constitutive or unificationist explanation, see below).

2.1 Explanation in "big P" and "little P" phenomenology

Because we are interested in whether phenomenological explanations are sui generis, our primary targets are not classical phenomenologists like Husserl or Merleau-Ponty. These authors either deny that phenomenology is explanatory or construe phenomenological explanation in a way compatible with established types of explanation. For example, Merleau-Ponty clearly and frequently claims that phenomenology "is the attempt to provide a direct description of our experience such as it is, and without any consideration of its psychological genesis or of the causal explanations that the scientist, historian, or sociologist might offer of that experience" (Merleau-Ponty, 1945/2012, 7). Phenomenology "involves describing, and not explaining or analyzing" (Merleau-Ponty 1945/2012, 8). It is elsewhere similarly characterized as a "description of structures" (Merleau-Ponty, 1963, 157). At the same time, Merleau-Ponty is open to including results from the natural sciences (such as Gestalt psychology and neuropathological case studies) in his phenomenological descriptions (Zahavi, 2004). Yet, if this inclusion does not aim to explain conscious phenomena, the dilemma we discuss below does not apply to Merleau-Ponty.

Husserl also sometimes emphasizes that phenomenology is mainly descriptive (Husserl, 2009, 5, 411). This emphasis is part of his anti-naturalism, which claims that phenomenological methods (e.g., the epoché) ignore causal factors and focus directly on invariant structures in conscious experience.[2] However, even if Husserlian phenomenology cannot be integrated with natural science (see Gallagher & Zahavi, 2020), it might still be the case that it aims to provide explanations. According to

[2] A conventional requirement of phenomenology is the bracketing of acquired knowledge about the natural world in order to purify the focus on how things appear to us. The phenomenological method of bracketing is called "epoché", "phenomenological reduction", or "transcendental reduction". With that method, phenomenologists like Husserl want to enable us to study first-person level experiences. The aim is not to transcend experiences by thinking about their causes but to develop an approach to experiences that stays "immanent", that remains within the phenomenal domain. Depending on how strongly phenomenologists insist on the epoché as a hallmark feature of phenomenological studies, they tend to affirm or deny the compatibility of phenomenology with natural sciences.

Williams (2020), Husserl thought that phenomenology can provide explanations that make intelligible why people act as they do in terms of their motivational nexus (a set of intentionally related desires, feelings, and attitudes). Williams (2020, 10), however, is not committed to Husserlian motivational explanation being an own kind of explanation but rather views it as a particularly rich and articulated version of what other authors call *intentional* explanation. More recently, Williams and Byrne have additionally argued that Husserl's general account of explanation is a version of unificationism in which specific propositions (e.g., about empirical facts) are grounded by more general propositions (Williams & Byrne, 2022). Like intentional explanation, unificationist explanation is a well-known type of explanation in philosophy of science. We thus take it that Williams' and Byrnes' work situates Husserlian phenomenological explanation within familiar taxonomy of explanation, rather than showing its sui generis character.[3]

The target of our dilemma is thus not "big P" phenomenology since we do not apply it to claims about explanation in the classical texts of Husserl, Merleau-Ponty, or Heidegger. Rather, we focus on the status of phenomenological explanations in "little P" phenomenology, such as neurophenomenology, experimental phenomenology, or front-loaded phenomenology. We consider these approaches phenomenological because they explicitly rely on phenomenological concepts or methods when conducting experimental research about conscious phenomena. Taking a practice-based approach, we also only consider explicit appeals to explanation by practitioners and do not ask if a phenomenological approach might be interpreted by philosophers as fitting some explanation type. For example, neurophenomenologists integrate phenomenological and neuroscientific concepts. However, they do not claim that their experimental results are explanatory (Sect. 3.1). Experimental phenomenologists, by contrast, claim that Husserlian phenomenology cannot be integrated with natural science, but that the experimental discovery of invariant structures in conscious experience provide sui generis explanations of conscious phenomena (Sect. 3.2). Our arguments against this position only extend to big P phenomenology insofar as the original authors also view phenomenology as both explanatory and as providing sui generis explanations. Williams' and Byrne's work suggests that in the case of Husserl, they are not. Since our primary target is recent (little P) phenomenological approaches, we sideline these interpretative issues and leave it to a future scholarship if our arguments also affect the classical texts.

In sum, we ask if little P phenomenology offers sui generis explanations of conscious phenomena, regardless of whether this kind of phenomenology can be integrated with natural science. We think that the positive role of phenomenology in experimental context speaks in favor of affirming this question of integration (Sect. 3). However, we primarily ask if phenomenological explanations live up to certain standards which explanations need to satisfy more generally - no matter if such explanations aim at consciousness as such or at specific phenomena in the natural world. The

[3] One reviewer suggested that phenomenological explanations are constitutive explanations because they are non-causal, and because they describe aspects of conscious phenomena (e.g. invariant structures in consciousness which constitute the explanandum). Like Williams and Byrne, this reconstruction establishes asymmetry by showing that phenomenological explanation is a subtype of constitutive explanation, rather than a sui generis type.

relevance of understanding whether phenomenological approaches can be genuinely explanatory extends beyond phenomenology as a philosophical discipline. The "4E approach" is a good example.

It consists of four major positions: the extended, enacted, embodied, and embedded mind theory (Clark, 2011; Gallagher, 2005; Varela et al., 1991; Hutto, 2013). Their central claim is that cognitive systems span the brain, body, and environmental structures. Some 4E positions, especially enactivism, are mainly based on phenomenological (Husserlian) premises, while Heidegger and Merleau-Ponty are also prominent sources for 4E research (Rowlands, 2010). A prominent critical point against 4E researchers is that they do not explain their target phenomena at all (Abramova & Slors, 2019). Supporters of the 4Es who rely strongly on phenomenology (e.g., Bruineberg 2014, Gallagher, 2003) seem to be especially vulnerable to this critique. The point being made here with this example is that the question of phenomenology's explanatory value also affects research projects that are not merely philosophical. Although such projects can take advantage of phenomenology's numerous unique qualities, such as data collection, including precise descriptions of subjective experiences, the issue of whether phenomenological stances help to explain specific target phenomena remains to be clarified. Finding an answer to this question or at least an option to handle the issue means to sorting out possible problems with phenomenology's role in interdisciplinary research projects. A way to reach this aim is to focus on the dilemma for sui generis phenomenological explanations.

2.2 The horns of the dilemma

We claim that phenomenological approaches face a dilemma when it comes to explanation. It is widely accepted that explanations need to be asymmetric (Hausmann, 1993). This claim means that if A explains B, B cannot explain A. Consider the well-known flagpole example, in which we assume that the pole is standing on an even surface, that light is emitted by a steady source at a specific angle from a distance, and that light travels in straight lines. In this setting, it is possible to calculate the pole's height, shadow length, or the light's angle of elevation if two of these three variables are known (Bromberger, 1966). It is usually said that (i) the pole's height and the light's angle explain the length of the flagpole's shadow but (ii) the same angle and the shadow's length do not explain why the flagpole is as high as it is. It is usually agreed that the dependencies which we find in (i) are taken to be explanatory, whereas the dependencies in (ii) are non-explanatory.

According to causal accounts of explanation, the dependency in (i) is asymmetrical because it tracks causal relationships, whereas the dependencies in (ii) do not: the height is a cause of the shadow's length, but the shadow's length does not cause the height of the flagpole. However, causal accounts of explanation are not the only ones that account for explanatory asymmetry. Inferentialist approaches to explanation suggest that explanations involve valid inferences, whereas transposing the explanandum involves a fallacy. The inferential role that prohibits transposing explananda introduces an explanatory asymmetry between explanans and explanandum without reference to causal asymmetry (Khalifa et al., 2018). Additionally, some views claim that mathematical explanations (e.g., topological or dynamical explanations) are non-causal and satisfy the condition of asymmetry (Kostić, 2020; Povich, 2021). Only a few argue that there are genuine (non-causal, mathematical) explanations that do not respect explanatory asymmetry (Baker, 2012). The upshot is that the majority of philosophers of science agrees that any satisfactory account of explanation has to take explanatory asymmetry into account. As far as we can see, there are no phenomenologists who disagree and argue against explanatory asymmetry as such.

With explanatory asymmetry in mind, we now turn to phenomenology's dilemma. *The first horn* of phenomenology's dilemma is the failure to satisfy explanatory asymmetry. Some phenomenologists argue that they explain subjective experience while staying "immanent", i.e. staying in the phenomenal domain (Albertazzi, 2019). This claim means they never refer to the psychophysical causes of subjectively experienced phenomena to talk about and explain them. The entities, processes, or relations that are supposed to explain phenomena of consciousness are presented as "invariants". These invariants are described as rules, principles, structures, or laws of the phenomenal organization (Roy et al., 1999) that govern the (change of) phenomena and their perceivable qualitative characteristics (Poli, 2006). Importantly, these invariants are part of the very same domain in which phenomena appear, the mentioned phenomenal domain. We take invariants to be a distinguishing feature of phenomenological explanations (Schmicking, 2010). However, this focus on invariants impedes the satisfaction of explanatory asymmetry. Statements about subjective phenomena and statements about their general invariants refer to each other in an interchangeable way, yet the latter are supposed to explain the former. This problem has been noticed by others already. Consider the explanation of visual illusions such as the Kanizsa Triangle. Here, the experienced incompleteness is supposed to explain the illusion of a triangle in conscious perception. Yet, as Pinna and Conti note:

> The explanans, that is, the explanatory elements, and the explanandum, that is, the phenomenal target that has to be explained, belong to the same domain. Within this approach, the main risk is an epistemological circularity that is a logical fallacy in which the first element is used to explain the second and the second to explain the first (A is true because B is true; B is true because A is true) (Pinna & Conti 2021, 165).

Pinna and Conti point out that phenomenological explanations that quote invariants in the phenomenal domain (e.g., incompleteness) are not asymmetric because the explanandum (e.g,. the illusion of a triangle) seems to also explain the invariants. This problem also affects phenomenological explanations in "big P" phenomenology. Consider Husserl's famous analysis of the structure of time consciousness as consisting of primal impression, retention, and protention. This invariant structure is meant to be explanatory: "only because there is a *Präsenzzeit*, a temporally extended conscious act, can there be something like a specious present, a temporally extended sensed content" (Gallagher 2013, 138). Husserl claims that the invariant structure of *Präsenzzeit* explains how we can sense content as temporally extended. But what prevents us from claiming that protention, retention, and primal impression asymmetrically depend on the appearance of a temporally extended content? In other words: without having established asymmetric dependence between explanans and explanandum, analyses of invariant structures do not count as explanations.

Pinna and Conti claim that asymmetry can be established by introducing a hierarchy within the phenomenal domain - invariants seem more basic than the phenomena they explain. The Husserlian analysis could also use this strategy since he assumes a hierarchy of essences in the domain of consciousness. We return to this point and the failure of explanatory asymmetry when discussing a case study from experimental phenomenology (Sect. 3.2).

A way for phenomenologists to confront the first horn of the dilemma is to insist that phenomenological explanations *are* asymmetric. Their strategy then is to cite an explanatory factor X for a specific phenomenon. This factor is then construed as asymmetrically responsible for the constitution of the phenomenon under study. This explanatory factor might be a multilevel mechanism, a mathematical regularity in a dynamically adaptive system, or emergent entities such as socially established norms. If phenomenologists follow this procedure, they jump from the first to *the second horn* of the dilemma. By citing one of the explanatory factors mentioned, phenomenological approaches largely merge with other explanations types, the mechanistic (Craver, 2007), dynamical (Chemero, 2009) or normative explanations (Satne, 2015, Casper 2019).[4] These explanations adhere to explanatory asymmetry by quoting causes, dynamical laws, or norm-guided practices to account for a phenomenon. Hence, when phenomenological approaches jump onto the second horn of the dilemma, they establish explanatory asymmetry by virtue of these other, non-phenomenological factors. In other words: by merging with other kinds of explanation, phenomenological explanations cease to be sui generis.

One objection to the second horn could be that not all attempts to merge phenomenology with other explanation types aim to achieve explanatory asymmetry. Consider dynamical explanations, which are strongly favored by phenomenological approaches and enactivist accounts of cognition (see also Summa 2022). Dynamical explanations are meant to consider dynamic co-emergence (Thompson, 2007, 10 ff., 60 ff.) or continuous reciprocal causation (Gallagher, 2018). These explanations target phenomena that appear when entities and processes are organized into some form of unity (an autopoietic system or metastable process cf. Di Paolo, 2009, Kelso, 2016). This unity, once established, determines how its constitutive entities and processes behave. Dynamic co-emergence is the occurrence of such a determination from unity to parts. Hence, a continuous reciprocal causality between parts and system organization exists. A result of dynamic co-emergence and reciprocal causality seems to be that the temporal order of cause and effect is abolished. If phenomenological explanations of conscious phenomena merge with dynamical explanations that invoke dynamic co-emergence and reciprocal causality, they do not aim to pick out asymmetric dependence relations between explanans and explanandum.

[4] Some 4E researchers claim that specific cognitive states and processes, such as having a belief or making an inference, are only constituted, if the organism that exhibits such states is part of a normatively guided practice. Although non-physical entities like norms or rules figure prominently in this way of explaining the constitution of specific cognitive phenomena, it is still a naturalist position. It is called "relaxed" (Hutto & Satne, 2015) or "liberal naturalism" (Macarthur, 2015).

Phenomenological critiques of reductive (causal or mechanistic) explanations and the emphasis on reciprocal causality, emergence, and non-reductive explanation often go hand in hand (Merleau-Ponty, 1945/2012, 10–12, 1963, 46–51, Thompson, 2007, 62–72, Summa, 2022). Yet, we insist that explanatory asymmetry is a crucial constraint on reductive and non-reductive explanations alike. The mere invocation of reciprocal causality or emergence is not necessarily incompatible with explanatory asymmetry although it is often presented that way. For example, Boogerd et al. (2005) provide an analysis of strongly emergent biological systems in which system behavior cannot be diachronically predicted from the states of its parts while retaining a sense in which system behavior asymmetrically depends on – and is thus explained by – its interacting parts. Similarly, Baedke et al. (2021) provide formal models of reciprocal causation that retain a temporal order between cause and effect while allowing that effects are themselves causes of system behavior at a later temporal stage. Although these accounts from philosophy of biology have not been used by phenomenological or enactivist approaches to cognition, they suggest that dynamical explanations that appeal to dynamic co-emergence or reciprocal causality may well be asymmetric, even if they do not reduce system behavior to its parts. By contrast, dynamic accounts of conscious phenomena that do not aim at asymmetry are likely to give up the explanatory game as such.[5] We thus think that merging phenomenological explanations with other explanation types should establish explanatory asymmetry, regardless of whether these explanations are reductive or not.

If we identified the two horns of the dilemma correctly, then phenomenological approaches are stuck between two options: either they provide explanations that are genuinely *phenomenological* but violate explanatory asymmetry, or they establish an asymmetric dependence between explanans and explanandum by merging with other, non-phenomenological types of explanation. The result of the dilemma is that phenomenological explanations are either sui generis or explanatory, but they cannot be both.

3 The role of phenomenological approaches in scientific practice

The dilemma described in the previous section suggests that if phenomenological approaches are explanatory, they do not constitute a distinct type of explanation. This negative conclusion seems to call phenomenology's value for the scientific study of mental phenomena into question. In this section, we attempt to dispel this suspicion by claiming that phenomenology's role in contemporary cognitive science extends far beyond explanation.

While explanation has been a dominant topic in philosophy of science since Hempel (Salmon, 1989; Craver, 2007, Strevens, 2011), practice-based philosophers of science have recently emphasized that the success of empirical research depends on

[5] Note that dynamical explanations face a number of other problems, such as merely re-describing the phenomenon mathematically (Gervais, 2015) or failing to distinguish between phenomenal and explanatory models (Kaplan & Craver, 2011). Giving up on explanatory asymmetry would further complicate the explanatory status of dynamical models rather than solve these problems.

several epistemic activities besides explanation. These activities include, amongst others, data collection and the development of new measurement tools (Chang, 2004; Bickle, 2018), concept formation (Steinle, 1997; Nersessian, 2008, Haueis, 2022a), and experimental design (Sullivan, 2009; Feest, 2019). A narrow philosophical focus on explanation alone would misportray how empirical researchers come to understand the phenomena they study in scientific practice.

Taking a cue from practice-based philosophy of science, we show that besides explanation, phenomenological approaches contribute to other epistemic activities in cognitive science, such as concept formation (Sect. 3.1), data collection (Sect. 3.2) and experimental design (Sect. 3.3). While the three sections suggest a rather clear distinction between concept formation, data collection, and experimental design, we acknowledge that overlaps between these epistemic procedures are not only possible but highly likely. Besides exemplifying how phenomenology's epistemic role extends beyond explanation, our case studies also demonstrate how the above-described dilemma about explanation manifests in scientific practice.

3.1 Case 1: Neurophenomenology and concept formation

Our first case study concerns the experiments by Lutz et al. (2001), which is a classic example of the neurophenomenological approach to mental phenomena. Neurophenomenology's core idea is to train study participants in what Gallagher (2003) calls "practical epoché". First, participants should suspend their beliefs and theories about their own subjective experience. Second, they should gain intimacy with the domain of conscious experience that the neurophenomenologist intends to study (e.g., visual perception). Third, participants should offer descriptions of their experience which can be used to design experiments.

Lutz et al. (2001) recorded reaction times and electroencephalography (EEG) data while participants were asked to execute a visual depth perception task. This experimental design implements step one of the practical epoché. It offers participants open questions about what they experienced while executing the task. The goal was that participants describe, without using predefined theoretical vocabulary, how present or distracted they were or what cognitive strategy they used to solve the task. Lutz et al. implemented step two of the practical epoché by re-exposing participants with stimuli until they found "their own stable experimental invariants" (Lutz, 2002, 142) when perceiving three-dimensional figures in a two-dimensional autostereogram. In a third step, the researchers use these experiential invariants to define phenomenological clusters, i.e., descriptions of conscious experience during the task which can be validated between subjects and used to classify behavioral and neurophysiological data.

The results of this procedure were three phenomenological clusters (steady readiness, fragmented readiness, and unreadiness) which Lutz et al. used to classify EEG and behavioral data. The variability of EEG signals between trials is often treated as "noise" and averaged out. However, Lutz et al. discovered distinct patterns of neural synchrony defined in trials grouped according to the phenomenological clusters. In trials where subjects showed steady readiness, for example, neural oscillations in the gamma frequency range (around 35 Hz) increased both locally and globally before subjects saw the 3D stimulus. In trials where subjects were unprepared and reported to be surprised by the stimulus, this pattern of frontal gamma synchrony was not observed. Given that this pattern extends both before and after the stimulus itself occurs, Lutz et al. (2001) argue to "redefine the interval of interest for a neural correlate of a conscious act" (ibid., 1591). To better understand the neural basis of conscious experience, researchers need to take the extended temporal horizon in which it appears into account.

We propose that neurophenomenological approaches such as the ones mentioned contribute to empirical research of the mind via *concept formation*. The formation of novel concepts allows researchers to identify and characterize previously unknown phenomena in their domain of inquiry (Feest, 2011; Colaço, 2020). In empirical research, concept formation frequently occurs in exploratory experiments which do not test a theoretical hypothesis but use methods such as varying parameters to determine which experimental condition is indispensable for an experimental effect and which one modifies that effect (Steinle, 1997). To form a concept in an exploratory experiment, researchers (C1) use experimental conditions to operationally define its meaning, (C2) evaluating its significance by comparing the experimental conditions to real-world conditions, and (C3) using tools to tentatively fix its reference to an entity or activity (Haueis, 2022a).[6]

We claim that concept formation in neurophenomenology proceeds analogously to the process of exploratory concept formation just outlined. The first step of the practical epoché corresponds to finding operational definitions in an exploratory experiment (C1). Researchers who use exploratory experiments suspend theoretical hypotheses and frameworks because they cannot reliably guide the study of unknown or ill-understood phenomena. By analogy, neurophenomenologists require participants to suspend theories and beliefs about consciousness and cognition and to offer their own descriptions of conscious experience. In Lutz et al. (2001), these descriptions were categorized as different states of preparedness of the subjects during the experiment. These categories were used to sort the behavioral and neurophysiological data generated by the experiments.

The attempt to use only those categories which are intersubjectively valid (epoché steps two and three) corresponds to evaluating the significance of an operational definition (C2). Exploratory experimenters compare the experimental condition defining the novel concept to an aspect of the real world situation in which the organism has to solve a cognitive task. Analogously, neurophenomenologists focus on those aspects of conscious experience which invariantly occur across trials and subjects and are thus likely to correspond to factors that are significant to everyday experience. The preparedness states identified by Lutz et al. are likely significant to conscious visual perception in everyday situations.

Finally, neurophenomenologists hold that first-person phenomenological and third-person neuroscientific evidence mutually constrain each other (for details of

[6] In cognitive neuroscience, an example of this process is the formation of "bug detector" in frogs (Lettvin et al., 1959), which is (C1) operationally defined by optic nerve responses to convex stimuli, (C2) evaluated as significant by comparing how detecting convex stimuli is relevant to detecting food (i.e. bugs) in the frog's environment, and (C3) using anatomical and physiological tools to fix the reference of "bug detector" to a specific fiber type in the frog optic nerve.

this “mutual constraint”, see also Varela, 1996, 1997). They thus use tools such as EEG to tentatively fix the reference of concepts formed by the practical epoché. For example, Lutz et al. argue that the phenomenological cluster “ready preparedness” refers to a specific spatiotemporal activity pattern in the brain (local and global gamma synchrony in frontal cortical areas). This reference fixation is tentative because the spatial resolution of EEG is too coarse to identify particular networks whose activity is being integrated via synchronization in the gamma range.

The upshot of this comparison to concept formation in exploratory experiments is that explanation is not the main goal of neurophenomenology. Lutz et al. neither claim that the phenomenological clusters explain neural and behavioral responses nor that neural patterns explain different preparedness states. The reason is that scientists who form novel concepts in exploratory settings aim to discover hitherto unknown phenomena - but not to explain why these phenomena occur. Lutz et al., for example, discovered that (a) trial-to-trial variability in visual perception tasks contains stable patterns of neural activity and that (b) the neural correlates of conscious visual perception are temporally extended beyond a narrow stimulus interval. The neurophenomenological method of letting participants (operationally) define novel concepts was indispensable to making these discoveries.

The goal of concept formation is also pursued by other neurophenomenological experiments. An example is the study of neural events and conscious experience before epileptic seizures – so-called *preictal phenomena* – by Petitmengin et al. (2006). These researchers use a microphenomenological interview method that is in many respects similar to the practical epoché: epilepsy patients are first guided towards and then describe unattended aspects of their experience before an epileptic seizure. The researchers secondly try to identify synchronic and diachronic regularities in the microstructure of experience, both at an individual and a group level (cf. ibid., 301). All interviewed epileptic patients who experienced preictal phenomena described them negatively (e.g., feeling tired, feeling weak). The researchers then use previous EEG studies to suggest that the negative symptoms during the preictal state “reflect a loss of phase synchrony” between the locus of the seizure and surrounding areas (ibid., 304).

Like Lutz et al., these researchers use phenomenological methods to operationally define experiential invariants (negative aspects of preictal states) and they use neuroscientific methods to tentatively define the reference of these descriptions in dynamic brain patterns (loss of phase synchrony). The negative aspects of preictal phenomena have real-world significance because patients used them to prevent or stop seizures. While microphenomenological methods were indispensable to making these discoveries, neither the authors of this study nor microphenomenologists in general claim to explain how the microstructure of experience is generated. Rather, their explicit methodological concerns are descriptive: how generic structures can be identified from descriptions of individual experiences (Petitmengin et al., 2019) or whether phenomenological self-reports are reliable (Bitbol and Petitmengin, 2017).[7] Applied

[7] Whether first person data, even if obtained through systematic and reproducible procedures, is a reliable source for scientific analyses is a heavily debated issue. This issue has recently been called “the problem of phenomenological data collection” (Miyahara et al., 2020).

to neurocognitive experiments, microphenomenology thus provides conceptual tools that promote the discovery of "previously unnoticed microdynamics" of cognitive process and the formation of novel concepts.

Forming novel concepts is of fundamental epistemic importance because any theory or explanation of the phenomena needs to incorporate the findings these concepts describe (Steinle, 1997, Haueis 2022a). Applied to the Lutz study, this means that any explanation of conscious visual experience needs to incorporate the discoveries that the researchers made by using phenomenological clusters. In the case of Petitmengin et al. (2006), it means that explanations of epileptic seizures should take the progressive nature and the significance of top-down interventions into account (van Quyen & Petitmengin, 2002). The case of neurophenomenology thus highlights how phenomenological approaches make indispensable contributions to scientific practice while these contributions are decoupled from the explanatory status of phenomenological explanations.

3.2 Case 2: Experimental phenomenology, data collection and explanatory asymmetry

The second case study comes from a series of experiments on cross-modal associations in conscious experience, which use the framework of experimental phenomenology (Albertazzi et al., 2015, 2016a, b). In contrast to neurophenomenology, this approach does not implement epoché by training subjects or conducting guided interviews. Instead, it chooses stimuli and methods which capture the qualitative and meaningful character of everyday conscious experience. Rather than forming novel concepts via exploratory experiments, experimental phenomenologists test hypotheses about invariant conditions underlying phenomenal appearances. In cross-modal experiments, for example, subjects are presented with opposing adjectives such as "warm" - "cold" or "agitated" - "slow" to search for associations between different sensory modalities (vision - sound, vision - haptics). Any physical and causal characteristics are "bracketed off" from the experiment's design, execution, and interpretation. Some proponents of experimental phenomenology claim that the identification of invariants produces sui generis phenomenological explanations. They also claim that these invariants are supposed to be found with this kind of experiment by tracking structural commonalities across different modalities of experience via participants' introspection (Albertazzi, 2019; Da Pos et al., 2021).

In a study on cross-modal interactions between sound and vision, for example, Albertazzi et al. (2015) tested if there was an association between a particular style of music and a particular style of painting. The researchers chose Spanish flamenco guitar music and abstract paintings in the Matera style because they hypothesized that cross-modal associations result from similarities in artistic mode of expression, and between multimodal features and connotations present in visual and auditory stimuli. To determine the connotative properties, the first experiment presented 63 subjects with 15 paintings and 15 music pieces and asked them to rate cross-modal associations using Osgoord's semantic differential rating scale. The purpose of this method is to determine the connotative meaning of concepts by measuring how similar or different respondents rate connotative similarities (Ploder & Eder, 2015). Using this method, Albertazzi et al. (2015) selected 22 adjectives (e.g., warm, cold, happy, sad, hard, soft) to "check whether complex images and music clips with varying perceptual characteristics led to consistent choices of adjectives" (ibid., 5). Subjects had to evaluate which adjective fit each image or music clip, respectively.

In a second experiment, subjects were presented with images and music simultaneously, and had to list up to three images they associate with a particular music clip. By performing statistical analyses on data collected in both experiments, the researchers showed that semantic ratings for 21 combinations of music clips and artistic paintings were positively associated. The attributes with the strongest associations were "calm," "agitated," "slow," "quick," "strong," "presto," and "adagio". The cross-modal studies on associations between tactile and visual features of abstract paintings and between visual and acoustic modalities of poetry proceed in a similar fashion (Albertazzi et al., 2016a, b). They use the semantic differential to have subjects rate which adjectives consistently describe artworks or parts of artworks that are of the same style but vary in content and expression. All experiments revealed consistent associations in subjects who represent the general population. This result suggests that there exist naturally biased associations between modalities in subjective awareness (captured by the adjectives), which are responsible for cross-modal perception of complex stimuli (Albertazzi et al., 2015, 3; Albertazzi et al., 2016a, 818; Albertazzi et al., 2016b, 18).

In all three studies, the researchers chose complex stimuli (artworks, poems, classical music) because they "are closer to the natural global perception of stimuli in the environment" (Albertazzi et al., 2015, 11). In other words, ecological validity is the the primary value guiding these experimental phenomenologists is ecological validity. The goal of staying as close to natural perception as possible rules out certain methods (reaction times, forced-choice response) while making others salient (semantic differential, natural coloring system). The result of prioritizing ecological validity is that experimental phenomenologists collect data that differ in kind from other psychological experiments and other phenomenological approaches (Albertazzi, 2019, Sects. 5 and 6). The experiments discussed above are phenomenological because they explicitly take the qualitative and semantic nature of first-person subjective experience into account. Neurophenomenological data, by contrast, are not phenomenological in this sense.

We suggest that the emphasis on ecological validity and the resulting role in data collection is a unique contribution of experimental phenomenology that is independent of its explanatory status. Mainstream approaches in experimental psychology can and have been rightfully criticized for putting participants in highly artificial situations whose relevance to "cognition in the wild" is questionable (Ladouce et al., 2017). In systems neuroscience, there is a similar debate about the adequacy of using simplified stimuli versus stimuli that resemble natural perception (e.g., movies or natural sounds). Those in favor of simplified stimuli stress that the statistics of natural stimuli are unknown (Rust & Movshon, 2005), whereas those rooting for complexity stress that analyses based on simple stimuli miss robust patterns in the data (Jääskeläinen et al., 2021). Clearly, experimental phenomenologists align with the position of the complexity camp in this debate.

Notice, however, that this is a debate about data, not explanation. In our view, discussions about which data are appropriate for the domain of psychological phenomena are at least partially independent of one's view on the explanation of such phenomena.[8] For example, neuroscientists in the complexity camp could agree with experimental phenomenologists on the value of ecological validity for data collection. But they do not have to share a common view on explaining phenomena those data are about. Consider Jääskaläinen et al. (2021), who argue that naturalistic movies and narratives allow neuroimaging to collect data about phenomena that are otherwise difficult to access (e.g., complex emotional responses or perspective-taking). These authors favor natural movies for the same reasons that experimental phenomenologists favor artworks to study cross-modal associations in subjective experience, yet, Jääskaläinen et al. appeal to neural mechanisms which underlie complex emotions or perspective taking. This appeal suggests a mechanistic view on explaining cognitive phenomena that would be rejected (or bracketed off) by experimental phenomenology. This dissociation between the value of ecological validity and views on explanation suggests that experimental phenomenology's role in data collection is quite independent of its explanatory power.

To be sure, experimental phenomenologists claim that their approach is explanatory:

> Phenomenology aims to uncover the principles of organization that guarantee (qualitative) invariants. The explanation of the nature of appearances and their behaviour in subjective time and space by appeal to these invariants is the aim of a science of phenomena, or experimental phenomenology (Albertazzi, 2019, 5).

What is the nature of qualitative invariants that experimental phenomenologists appeal to? In the case studies discussed above, the qualitative invariants are naturally biased associations between sensory modalities. These associations are supposed to explain that the perception of artworks is similar across sensory modalities. In the case of paintings and Spanish guitar music, adjectives like "warm" and "cold" express "multisensorial and connotative dimensions of both the visual and the auditory stimuli" (Albertazzi, 2019, 15). These dimensions are supposed to explain the experience of cross-modal similarity of both kinds of artwork.

We think that this case study nicely illustrates the dilemma for phenomenological explanations. Experimental phenomenologists face the first horn of the dilemma because their explanations appeal to factors from the phenomenal domain to explain other features in that very same domain (cf. Albertazzi, 2019, 10). But what guarantees that such explanations are asymmetric? Take the crossmodal case: how do we show that multisensorial connotative dimensions of stimuli explain crossmodal

[8] Of course, experimental phenomenologists collect data about invariants because they hold a theory according to which such invariants are explanatory. It would be wrong to infer from this fact, however, that ecological validity in experimentation is directly tied to a theory's explanatory power. When researchers conduct exploratory experiments or build descriptive models, for instance, they value collecting or using ecologically valid data, without aiming to explain the behavior of the phenomenon (Haueis 2022a,b). Similarly, one can appraise the ecological validity of data collected by experimental phenomenologists without sharing their view on the explanatory power of invariants in subjective experience.

similarity in perception, but rule out that perceptual similarity does not explain the multisensorial and connotative dimensions of the stimuli as they appear to the subject? Without an answer to these questions, the explanations of experimental phenomenology fail to establish the asymmetric dependence of the explanandum on the explanans.

One possible response of experimental phenomenologists to this challenge is to appeal to the invariant character of the explanatory factors their experiments identify. In crossmodal research, for instance, connotative dimensions remain invariant across paintings and music clips which vary in content, thus explaining the crossmodal appearance of similarity. We think this answer works to establish asymmetry, but only by jumping on to the second horn of the dilemma. For example: according to Woodward (2003), a hallmark of causal explanations is that they provide invariant generalizations under certain interventions. Exactly this generalization is what the crossmodal studies of experimental phenomenology establish: certain images, music pieces, or poems invariantly appear similar, despite interventions on the perceived characteristics and content.[9] The interventionist theory of causal explanation seems liberal enough to accommodate the bracketing of physical causes. In Woodward's view, anything that can be expressed as a variable whose values can be changed by interventions can play the role of a "cause". Therefore, qualitative invariants, such as connotative dimensions, may play the role of causes that explain the stability of phenomenal appearances across interventions. In this way, the explanations of experimental phenomenology are asymmetric, but only in virtue of merging with another explanatory style, namely causal explanations a lá Woodward.

Another response open to experimental phenomenologists is to reject the similarity to causal explanation. They could instead insist that invariants are explanatory because they are higher up in the hierarchy of Husserlian essences than the phenomenal appearances they explain (Roy et al., 1999). While this solution may avoid an appeal to causes as explanatory factors, it still requires a principle to order essences within the Husserlian hierarchy. One possibility is that essences at higher levels are more general than essences at lower ones and allow researchers to describe a larger set of phenomena as they appear in consciousness. This certainly captures that in the case of crossmodal research, experimental phenomenologists take naturally biased associations to be more general than the specific phenomena of art perception they asymmetrically explain. Note, however, that generality is a hallmark of unificationist accounts of explanation, according to which explanations should maximize the scope of phenomena they can account for under one description (Kitcher, 1989). So while generality as an ordering principle of Husserlian essences works to establish asymmetrical relations, it does so by merging phenomenological explanations with the unificationist type of explanation. While one might still call this subtype of unificationist explanations phenomenological – because they unify the phenomenal domain – there is no reason to posit that they are a sui generis type of explanation.

[9] This causal construal of invariance is consistent with textual passages in which experimental phenomenologists write that certain phenomenal conditions "contribute to causing" the appearance of phenomena (Albertazzi, 2019, 8) or when they describe explanatory dispositions as "a predisposition to perceive specific cross-modal natural associations" (Albertazzi et al., 2015, 3). In philosophy of psychology, "contribution" and "of a disposition" are usually seen as causal notions.

We conclude that the case study from experimental phenomenology supports both claims advanced in this paper. First, we illustrate that phenomenological explanations either fail to be asymmetric or seem to merge with other types of explanations (here: causal or unificationist explanation). Second, our case study reveals a unique epistemic role of experimental phenomenology: collecting data about first-person qualitative experience with high ecological validity.

3.3 Case 3: Front-loaded phenomenology, experimental design and multilevel mechanistic explanation

Our third case study concerns experiments on the rubber hand illusion by Tsakiris and Haggard (2005), which is an example of front-loaded phenomenology. In contrast to the exploratory formation of novel concepts, this approach incorporates phenomenological concepts or insights into the experimental design (Gallagher, 2003). Because the experiments use concepts or insights from prior phenomenological analysis, those who conduct these theory-driven experiments do not have to consider themselves to be doing phenomenology (cf. Feest, 2019, 9). Psychologists and neuroscientists use phenomenological concepts to formulate hypotheses which are tested by manipulating specific parameters during the experiment.

The phenomenological concepts used by Tsakiris and Haggard (2005) are "sense of ownership", and "body schema", which refers to the sense "that it is my body which moves", and the "body schema", which they construe as an abstract and general representation of one's own body and its capacity to interact.[10] This representation can be modified by sensory input and learning. Using these concepts, Tsakiris and Haggard hypothesized that the rubber hand illusion manipulates the sense of ownership such that the rubber hand becomes part of one's body schema. In rubber hand illusion experiments, subjects feel as if the seen rubber hand is their own hand (which they cannot see), when both receive synchronous tactile stimuli. Tsakiris and Haggard's aim is to show that the illusion is a result of two processes: a "bottom-up process of integrating synchronized visual and tactile percepts" and "persistent, vivid phenomenological changes in body representation, namely, the experience that the rubber hand is part of one's own body" (ibid., 80).

To investigate the interaction between both processes, the researchers designed four experiments. The first experiment manipulated the hand's posture and the rubber object's identity to investigate the process of visuo-tactile integration. This experiment established that the congruent position of one's own and the rubber hand is an indispensable parameter for the rubber hand illusion to occur. The identity of the object (a rubber hand or a wooden stick) and the mode of stimulation (synchronous vs. asynchronous visual and tactile stimuli) are only modifying parameters. From this separation, Tsakiris and Haggard conclude that correlated visual and tactile stimula-

[10] One may question the relevance of this experiment by arguing that "body schema" and "sense of ownership" are not phenomenological concepts. Although "body schema" originated in neurology, phenomenologists have adopted and refined this concept (see Ataria et al. 2021, part 1). By contrast, the distinction between sense of ownership and sense of agency by phenomenologically reflecting on two aspects that come apart in involuntary movement but are both present during intentional action (Gallagher & Sørensen, 2006).

tion alone is insufficient to induce the rubber hand illusion. Only when the position of the hand is congruent with the representation of hand position in one's body schema does the sense of ownership extend to the rubber hand.

In the second experiment, the researchers investigated the interaction between bottom-up visuo-tactile integration and the top-down effect of the body schema. Manipulating the handedness of the rubber hand confirmed the finding. Congruence is necessary to induce the illusion while manipulating which finger was stimulated showed that the changed sense of ownership did not extend to unstimulated fingers.

In the third and fourth experiment, both index and little finger were stroked simultaneously and subjects should either judge whether a stimulated or an unstimulated finger feels closer to the rubber hand. Subjects judged both stimulated and unstimulated fingers to be closer to the rubber hand, with the strongest effect found when two of their own fingers and of the rubber hand were stimulated synchronously. Haggard and Tsakiris interpret this result as showing that the rubber hand illusion is caused by an interaction of bottom-up visuo-tactical integration, which accounts for the strong effect on judgments of synchronous stroking, and top-down preservation of body schema representation, which accounts for the perceptual drift effect in the unstimulated finger when two neighboring fingers are stimulated.

The experiments discussed above, as well as those analyzed by Gallagher (2003) and Tsakiris et al. (2007), show that front-loaded phenomenology contributes to the design of experiments in cognitive psychology and neuroscience. Phenomenological concepts like "sense of ownership" shape which hypotheses researchers aim to test and consequently which experimental conditions they use to investigate mental phenomena. We think that front-loaded phenomenology can shape experimental design regardless of whether researchers use the data generated by those experiments for explanatory purposes. Whether or not such data provide constraints on explanation is an additional question, which is independent of the epistemic role of influencing experimental design. Gallagher (2003), who coined the term "front-loaded phenomenology" seems to hold a similar position. He writes that this approach "starts with experimental design", that phenomenology is "part of the analytical framework" of the experiment (ibid., 92), and that such experiments "test [a phenomenological] description and extend its application" (ibid., 95). But experimental design, hypothesis testing and, data analysis, while clearly being epistemically significant parts of experimentation, do not equal explanation. Thus, identifying the scientific value of front-loaded phenomenology with its explanatory power would be an unmotivated philosophical imposition onto scientific practice.

While a narrow focus on explanation may seem unjustified, it is still worth asking whether and how front-loaded phenomenology contributes to explanations of mental phenomena. Tsakiris and Haggard (2005) answer this question in a way that illustrates the second horn of our dilemma. They ask: "What is the mechanism underlying the self-attribution of the rubber hand to one's own body?" (ibid., 89). Previous researchers proposed a Bayesian perceptual learning model, according to which the sense of ownership arises from the strongest statistical correlations between different types of sensory information. Tsakiris and Haggard argue that their results rule out such a purely bottom-up mechanism because the Bayesian model cannot explain why the subject's sense of ownership also changes for unstimulated fingers. Such fingers provide no correlation between visual and tactical stimuli over which a Bayesian mechanism could generate self-attribution.

By contrast, the authors think that their experimental results can be explained by a model in which a top-down process representing a different aspect of the body (here: hand position and hand identity) modulates the bottom-up process of visuo-tactile integration: "sensory inputs related to the body seem to be integrated against a set of conditions that guarantee the functional and phenomenological coherence of bodily experience" (ibid., 90). Tsakiris and Haggard quote neuroscientific experiments on the incorporation of tools in the neural representation of body parts as being consistent with this model of the rubber hand illusion. They take this model to be both superior to the Bayesian one and of capturing the "relation between different levels of functional description, from neural to phenomenological" (ibid., 91).[11]

Given the authors' mention of mechanisms and their use of experiments to adjudicate between explanatory models, it seems that the explanatory virtue of phenomenological concepts arises from their integration into a model of a *multilevel mechanism* underlying the sense of ownership. According to new mechanists such as Craver (2007), each level is equally important to finding all factors upon which the occurrence of the phenomenon depends. This fits well with Taskiris and Haggards' insistence that processes described by phenomenological concepts ("sense of ownership", "body schema") are indispensable to explain under which conditions the rubber hand illusion occurs.

According to mechanistic accounts, experimental evidence contributes to the construction of mechanistic explanation by pruning the space of possible mechanisms that are responsible for a phenomenon to occur (Craver & Darden, 2013, ch. 8). Tsakiris and Haggard employ this pruning function when they argue that their experimental results make the Bayesian mechanism an implausible candidate for explaining why the rubber hand illusion changes the sense of ownership. The fact that these authors use an experiment based on phenomenological concepts to execute the mechanistic pruning strategy suggests that, in this case, front-loaded phenomenology contributes to the construction of a multilevel mechanistic explanation. Thus, this case study supports our claim that phenomenological approaches are explanatory insofar as they merge with other types of explanation (here: mechanistic explanation). We do not consider this a negative result; it simply shows that in order to account for phenomenology's role in explanation, we do not need an own kind in our philosophical taxonomy of explanatory types.

[11] Note that despite the positive role of front-loaded phenomenology in experimental design and explanation, phenomenologists can and should critically evaluate how psychologists or neuroscientists interpret their results. For example: it is questionable whether Tsakiris and Haggard adequately define "body schema". Gallagher (2005) argues that this concept does not refer to representations in the brain but to an ongoing and dynamic process in which the body updates its current positions with reference to its previous position. This definition is not applicable to rubber hand illusion experiments, which include no movement. This lack questions the ecological validity of the results (Tsakiris et al. 2007). It is an important ongoing task of phenomenology to assess whether experimental design appropriately reflects phenomenological distinctions.

4 Conclusion

Phenomenology already became part and parcel of scientific practices in cognition research. These practices include epistemic processes that go beyondexplanation. We showed in three different case studies that the phenomenological subfields of neurophenomenology, experimental phenomenology, and front-loaded phenomenology impact scientific practices by modifying concepts, data collection protocols, and experimental design. Thus, we can answer the first three questions from Sect. 2 as follows: “Can phenomenological concepts be used in natural sciences?” Yes, they can. “Can phenomenology inform empirical research?” Yes, through new kinds of data production. “Might phenomenological approaches influence experimental design?” Yes, they definitely do. We, therefore, claim that phenomenology significantly contributes to empirical investigations of cognition.

Regarding the question of whether phenomenological approaches are explanatory, we argued that phenomenology does not provide sui generis explanations of the phenomena it studies. Phenomenology is stuck between two options when it comes to explanations. The first option is that phenomenological explanations focus on entities in the phenomenal domain (subjective experiences and their invariants). Phenomenological approaches who choose this option owe an account that establishes why conscious phenomena asymmetrically depend on these entities. The second option is that phenomenologists explain phenomena of consciousness by citing factors (cause, mechanisms, dynamical laws, grounding relations, etc.) that are known from other types of explanation. So, while this dilemma does not exclude the possibility that phenomenology is explanatory, it casts doubt on the view that phenomenological explanations are sui generis. Regardless of how phenomenologists choose to resolve this dilemma, we should move beyond our focus on explanation to fully appreciate how phenomenology enhances cognitive science and supports real-world investigations of consciousness.

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