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# Picking up the gauntlet. A reply to Casper and Haueis

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**Abstract**
In recent years phenomenology has attracted the interest of science, acquiring a role far beyond philosophy. Despite Husserl's clear denial of a possible naturalization of phenomenology, scientists from different fields have proposed its naturalization. To achieve this goal, different methodologies have been proposed. Most scientists seem to agree on the claim that phenomenology cannot be a science itself because it fails to respect one of the prerequisites of science, that is, the capacity to explain its phenomena. Phenomenology, thus, is forced to remain a purely descriptive effort, preliminary to authentic scientific practice. I argue, instead, that the experimental development of phenomenology explains phenomena (that is, appearances and/or subjective experiences in first person account) and uses rigorous methods, conducts valid measurements, and can validate its results. The paper provides a variety of examples of how experimental phenomenology works.

**Keywords** Experimental Phenomenology · Causality · Explanation · Naturalization

## 1 Introduction

I read with great pleasure Casper and Haueis' paper entitled "Stuck in between. Phenomenology's Explanatory Dilemma and its Role in Experimental Practice," published in this Journal (2022). I enjoyed both its clear analysis of the issues covered, and its sharp style of discussion. I also broadly agree with the authors' grouping of the different phenomenological approaches to science and the evaluation and criticism brought to each of them (although, in my opinion, it remains far from clear what naturalizing phenomenology would look like, due to the wide variety of strategies available (Albertazzi, 2013a, 2018b, 2021a; da Pos, 2008; Harney, 2015), including formal models (Lubashevsky & Lubashevskiy, 2023; Petitot, 2011). Consequently, I will not focus or comment further on this matter. There is another point, however, that raised my interest and requires a reply.

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Casper and Haueis maintain that phenomenology either does not satisfy a central constraint on explanation, i.e. the asymmetry between *explanans* and *explanandum* (if A explains B, B cannot explain A, see Hausmann, 1993) or merges with non-phenomenological explanatory types, which is the case with other phenomenological approaches like neurophenomenology (Lutz & Thompson, 2003; Varela, 1999), micro-phenomenology (Bitbol & Petitmengin, 2013; Petitmengin, 2006; Petitmengin et al., 2019) and front-loaded phenomenology (Gallagher, 2003; Gallagher & Sørensen, 2006). My contribution deals less with the specific arguments and examples from experimental practice presented by Casper and Haueis and focuses on how experimental phenomenology works and how an understanding of how explanations might get shaped by it, without being necessarily asymmetric at least in the classical sense (see Sect. 9).

The proposed justification of a neurophenomenological project resorting to the transcendental focus of Husserlian phenomenology (Husserl, 1970, Book III) is a critical point. Transcendental phenomenology, the stage in the constitutive process of phenomenology (following the so-called eidetic reduction), that is used to discuss clarifications of assumptions in knowledge and to explain the invariant aspects of a structure or phenomenon, is what leads to a withdrawal from the natural attitude in science. Transcendental phenomenology, therefore, argues for the possibility of phenomenology as a science per se, like many other sciences, not the reduction of phenomenology to neuroscientific methods and explanations. In recent decades, phenomenology has unfortunately become trapped in numerous contradictions and arguments by a series of -isms; and its development in neuroscientific terms has weakened its original potential and experimental value (see Hatfield & Epstein, 1985).

In this light, the flagpole example which Casper and Haueis focus on, although a classic in the philosophy of science, is rather unfortunate in terms of the phenomenological field, because it concerns physical parameters. And the defined primary qualities of physics (spatiality, solidity, hardness, weight, shape, size, position, and motion are *not* attributes of appearances (Albertazzi, 2013b; Albertazzi, 2021a; da Pos, 2021). It would be more appropriate for a phenomenological discussion to ask what happens if the subjectively perceived height of the flagpole is considered. To offer a proper example in a discussion of this kind, an experiment should be conducted on the *subjective* parameters of evaluations of the perceived height of the flagpole by a large number of participants. A laboratory experiment, as I argue below, would be more appropriate than a simple participant questionnaire that may involve implicit top-down components (such as language, past experience, knowledge of physical variables, and so on). The inadequacy of the flagpole example for phenomenology, however, is not the main point. One may argue, in fact, that the relation of explanatory asymmetry needs to be in place regardless of what the statements contain (as there could be phenomenological propositions that, if related correctly, can explain something). I shall deal with this point below.

Casper and Haueis maintain that "phenomenological approaches are stuck between the two aforementioned options: either they provide explanations that are genuinely phenomenological but violate explanatory asymmetry, or they establish an asymmetry dependence between *explanans* and *explanandum* but merge with other, non-phenomenological types of explanations" (Sect. 1.1). In this context, they publicly launch a friendly challenge to experimental phenomenologists, and are therefore throwing down a kind of modern gauntlet. As an experimental phenomenologist, whose work has been widely cited by the authors, I am ready to pick up that gauntlet and seek an equally friendly discussion on the nature of explanation in experimental phenomenology. In fact, I have already expressed my views on experimental phenomenology and the issues of explanation and causality, but as these have appeared in different publications for a variety of disciplinary fields (see for example, Albertazzi, 2013a, b, 2021a, b, the information may have gone missing. In any case, this is an excellent opportunity for looking at these issues again, even at the cost of having to occasionally repeat myself. For more detailed explanations and literature, please see my publications cited for the individual points.

### 1.1 A professional and theoretical caveat

Explanation is a central issue in science, and in philosophy of science as well, and the debate on the difference between causal, explanatory and descriptive information is extremely varied and dense (Woodward, 2003). As pointed out by Casper' and Haueis' contribution, in the last years the issue of explanation underwent a series of analyses, arousing different accounts, for example, unificationist (Kitcher, 1989), mechanistic (Bechtel, 2008), pragmatic (Mitchell, 1997), inferentialist (Khalifa et al., 2018), interventionist (Woodward & Hitchcock, 2003a, b). See Rescorla, 2018), non-causal (Lange, 2007; see Reutlinger, 2017), reciprocal causation (Baedke et al., 2021), and so on. I am not entering the debate from a point of view strictly internal to philosophy of science, and specifically into the level of a metatheory, that would go out the present contribution. As I wrote, in showing how experimental phenomenology works, my aim is to clarify how explanations might get shaped by it.

To simplify let us just say that addressing the issue of explanation in the sciences may differ when considered from different perspectives (empirical or formal, causal, or non-causal sciences, and so on). Regarding experimental phenomenology, the perspective is empirical, while phenomenal causality presents its own features (see Sect. 6). It is also worth noting that any comparison of experimental phenomenology with other concrete and empirical sciences is biased by the non-eliminable presence of consciousness as an intrinsic dimension of the observables under examination. For the time being, we do not know what consciousness is, only how it is manifested. This bias is also partially true when conceiving an a priori theory of explanation in a science like this. As I shall try to show, for the time being, experimental phenomenology keeps the concepts of cause (even if non-standard, see Sect. 6 below) and explanation on an empirical basis, rather than for logical or conceptual reasons.

In this article, I therefore assume the point of view of an *experimentalist* (even if with a substantial background in phenomenology), so I am not adopting a formal stance regarding scientific *knowledge* and *representation* in the sciences. In so doing, I shall try to highlight which are the characteristics and the *requirements* of an idiosyncratic science such as experimental phenomenology, which includes a proper understanding of the issue of explanation. Experimental phenomenology is the empirical science of the phenomena of consciousness, from which a series of consequences follow. This includes, for example, the conceptualizations of principles, causality, and explanation appropriate for this field. Given the current state of affairs, I shall also express concern about whether translating experimental phenomenology into logical terms through the processes of abstraction and idealization is feasible.

In particular, given the focus of Casper and Haueis' contribution, in this article I will discuss what is considered to be an "explanation" in phenomenology, and whether it is asymmetric. As is well known, Husserl's late antinaturalism (Husserl, 1970) was directed against the Galilean concept of nature as explicative of the phenomena of consciousness, and of the concept of efficient cause (although Suarez (1994) had already observed the complexity of the concept). However, as Casper and Haueis correctly observe, the issue of an asymmetry between *explanans* and *explanandum* concerns both reductive and non-reductive sciences regardless of the concept of nature, and even of the concept of cause, hence it should hold for experimental phenomenology, too, if this is considered a science. Nevertheless, as I shall discuss, the need to "naturalize" phenomenology, i.e. to merge it with other sciences (such as neuro-phenomenology), does not necessarily follow. I will also discuss with examples the *three* main types of phenomenological explanations: demonstration, lawfulness, and ostensive descriptions. It is worth noting that certain forms of description play a unique role in developing strategies for experimental phenomenology compared to the role of descriptions in other scientific disciplines. Finally, I would like to recall that by reasoning in the legacy of Gestalt theory, some kinds of explanations are *wired* in perceptual phenomena themselves (see for example Fig. 6. below). Hence, the use of images, which demonstrate a basic phenomenological method, i.e. demonstration (Kanizsa, 1979, 1991; Metzger, 2006). My last caveat concerns the difference between the idea of phenomenology as retrievable in the writings of Brentano, Stumpf, and Köhler, and the Husserlian idea of phenomenology. The lack of clarity, and knowledge about this difference often makes the different approaches blurred. Experimental phenomenology is much more Brentanian than Husserlian, and in fact it proceeds in the legacy of Gestalt psychology, from Stumpf onwards. In my opinion, for the time being it is possibly easier to approach a metatheory in Husserlian terms (see for example, Williams & Byrne, 2022), because there is still too much to clarify in the foundations of the other empirical approach. The idea of subjective space–time continuum, *where phenomena appear and have to be explained* is a striking example (Brentano, 1988. See Albertazzi, 2002).

More specifically, I shall organize my reply to Casper and Haueis in the following focus points:

Sect. 2. What the "Experimental phenomenology" label refers to.
Sect. 3. Theory and experimental standpoints in phenomenology.
Sect. 4. Phenomenology as science: observables, methods, invariants and objectivity in experimental phenomenology.
Sect. 5. Principles and laws of Experimental phenomenology.

Sect. 6. Causality in Experimental phenomenology.
Sect. 7. Obstacles to a formal theory of explanation in Experimental phenomenology.
Sect. 8. Science, art, and the lab.
Sect. 9. Conclusive remarks.

## 2 The "Experimental phenomenology" label

I freely admit that the label of "experimental phenomenology" covers a wide range of remarkably different approaches to the study of phenomena, and the methods and protocols required to implement them often blurs the picture still further (Albertazzi, 2013a, 2013b, 2019a, 2021a; Bozzi, 1990, Ch. 8; Burigana, 1996; da Pos, 2008; da Pos & Burigana, 1996; Kanizsa, 1991, Ch. 1, § 7; Katz, 1935; Koenderink, 2015; Kubovy & Epstein, 2001; Masin, 1993; Massironi, 1988; Michotte & Thinès, 1991; Stumpf, 1883; Vicario, 1993, 202ff; Wagemans et al., 2012). One particular point that remains shadowy and still controversial, even amongst researchers who are sympathetic to phenomenology, is where to draw the line between psychophysical and subjective phenomena, and consequently which methods and explanation to adopt. This state of affairs may be one of the reasons for an alleged naturalization of phenomenology. It was Köhler, however, who criticized the physical foundation of psychophysics (Köhler, 1947), a point of view shared by Brentano (1995a, 1995b) and James (1950). In short, to be sympathetic or sensitive to "phenomena", it is not enough to be experimental phenomenologists, one must adopt a radical stance and proceed accordingly.

This blurring of boundary areas continues to exist, and most experimental psychologists may refer to the Gestalt tradition but continue to accept the epistemological and conceptual framework of physics. But physics does not and should not be considered a bedrock for experimental phenomenological analyses and tests, which deal with a specific kind of observable, i.e. the subjective phenomena of consciousness (appearances). This is because phenomena cannot be reduced to physical and neurological stimuli (Albertazzi, 2013a) for the simple reason that *qualitative experiences* are not to be found in physical and neuroscientific domains. Furthermore, they cannot be functionalizable as second order properties, because they have intrinsic properties (Kim, 1988). I am aware that, to fully adopt a phenomenological stance in experimental phenomenology requires a sort of scientific revolution (a mind-set revolution as well), which also implies the need to redefine the main concepts currently available in science, such as stimulus (da Pos, 2021; Michotte et al., 1991; Stumpf, 1906, 1939–40; Ternus, 1926); modal and amodal complements of perceptive structures (Kanizsa, 1979); the nature and classification of phenomenal events (Vicario, 2005); causality (Michotte, 1962; Scholl & Tremoulet, 2000); time (subjective, internal) (Albertazzi, 2019b; Benussi, 1913; Calabresi, 1930; Fraisse, 1964; D'Angiulli & Reeves, 2021); space (subjective, anisotropic) (Albertazzi, 2021a, 2021b; Arnheim, 1954; Brentano, 1988; Ebbinghaus, 1902; Husserl, 1997; Koffka, 1935; Metzger, 2006; Wade, 1982); qualities (Albertazzi, 2015c; Arnheim, 1954; Rausch, 1966), and even the concept of nature itself (*Umwelt*) (Husserl, 1966, 1970; Metzger, 2006; von Uexküll, 2012. See also Albertazzi, 2015b; Albertazzi, 2021a, b; Koenderink, 2014). The scientific terminology must also be redefined for this area (see Husserl, 1966; Albertazzi, 2015b; Albertazzi, 2021a, b. See also Sect. 7 below).

## 3 Theory and experimental standpoints in phenomenology

Phenomenology both as a movement and a science is far more complex than the usual vulgate (although authoritative) assumes. In fact, the original roots of phenomenology are Brentanian, and a large part of his legacy is conserved in the Meinong school in Graz (Albertazzi et al., 2001), and by Stumpf and the Gestalt school in Berlin (Albertazzi, 2015a) and their followers. Both schools offer a systematic and descriptive approach and have conducted experimental work to *explain* subjective experiences (Benussi, 1913; Koffka, 1935; Wertheimer, 1922, 1923, et al.), as well as establishing two of the most famous experimental psychology laboratories in Europe at the beginning of the last century (for the differences and similarities of the different scholars from these two schools see Albertazzi, 2015a). It is also worth noting that Brentano was one of the first critics of Fechnerian psychophysics (Brentano, 1995a. See, for a modern approach, Hoffman, 2013). This included highlighting the differences between different analyses of psychic phenomena, that positioned him closer to Weber, even while clearly distinguishing between physiology (which he called "genetic" psychology) and the science of consciousness (Albertazzi, 2018a; Brentano, 1995a, 1995b). Brentano, in fact, analyses consciousness as a self-referential and self-organizing system that is closed to *internal causation*, which is seen as internally generative and creative. As such, the consciousness "system" embeds final, top-down causes, while not dealing with the causes and laws governing physical systems on which psychophysics, for example, is grounded (see below, Sect. 6.).

While systematic phenomenology provided the foundations for a thorough science of consciousness, experimental phenomenology considers a part of its richness (mainly perceptual appearances) and addresses it the empirical methods of experimentation. To get an idea of this, consider how, using the same source (Husserl, 1991), the concept of internal time (and specifically of the brief duration of the psychic present) can be treated in purely philosophical/metaphysical terms (Heidegger, 1962) or in scientific and experimental terms (Benussi, 1913; Vicario, 1993). Similarly, according to Husserl (1997), the concept of subjective visual space can be treated in philosophical terms (Husserl, 1997; Merleau-Ponty, 2013, Part II, ii; Thinès, 1990) or in scientific and experimental terms (Gestalt psychology, and in particular Koffka (1935) and Arnheim (1954, Ch. V)), and so on.

The grounding point for an experimental science of consciousness is to put in brackets any reference to physical stimuli (Kanizsa, 1980, 1991; Metzger, 2006). More specifically, if one considers the three kinds of reductions as discussed by Husserl (namely 1. epoché ("bracketing"), 2. eidetic, and 3. transcendental), "experimental" phenomenology focuses on 1 and can include aspects of 2. That is to say, it brackets any other kind of observables beyond what is experienced in the here and now as it is a presentation (NOT representation, see Sect. 7 below), that aims at excluding the intervention of top-down functions and contents. It is no coincidence that before starting the experiments, the participants are *openly* requested to avoid as far as possible (i.e. at a conscious level) any top-down references to past experience, theoretical knowledge, data stored in their memory, etc. Participants are required to remain firmly at the *presentational* level of what they are seeing, hearing, or touching (also cross-modally). It is even believed that the expert observer is more genuine than a naïve one because he knows what dangers and obstacles stand in the way of a bias-free description of phenomena.

Secondly, at a methodological level, an experimental phenomenological setting considers different aspects of a phenomenon and subjects them to variation in order to identify the phenomenon's invariants (its *eidos*, see Sect. 7 below). The task of experimental phenomenology, in fact, is *to extract* invariants from subjective perceptual experiences. From a philosophical viewpoint, one may claim that experimental phenomenology verifies the issues raised by Husserl in his *Lectures on the Passive Synthesis of Experience* (Husserl, 1966) following reductions 1 and 2 as indicated. The categories of the layer of passivity (regarding the experience of laws and regularities in the environment), in fact, are homogeneity, similarity, contiguity, contrast and configuration, which follow the laws of perceptual organization. These aspects of perception are pre-categorial, which means that they do not involve representations.

So, let us try to identify the distinctive characteristics of experimental phenomenology, as a preliminary step to understanding the concept of explanation in this science.

## 4 Phenomenology as science: observables, methods, invariants and objectivity

It is commonly agreed that a scientific inquiry into perception must satisfy the (controlled) dimensions of stimuli, principles, accredited methodologies, and objectivity of results, *obtained in a third-person account* based on the idea of the existence and testability of a universal observer (criticism in Koenderink, 2014).

The divide between the psychological research methods grounded in physics and the methods adopted in experimental phenomenology, as mentioned, rests on the largely subjective concepts adopted by the latter of *stimulus* (da Pos, 2021; Köhler, 1929; Kanizsa, 1980, Ch. 4) and *perception* (Kanizsa, 1980, Ch. 2; Musatti, 1958), both of which dictate the style and standards of *explanation* (Vicario, 1993, 9). Lastly, the objectivity of the results is obtained in a *first person account*, which apparently would be a bias due to its explanatory value.

The explanation of phenomena in physics, psychophysics and cognitive neuroscience follows the procedures of protocols, measurements, validation of data, objectivity, etc. which are valid for *physical* stimuli. Similar procedures occur in experimental phenomenology (protocols, measurement, validation of data, objectivity, etc.) but with marked differences: (1) stimuli (observables) are not physical as are, for example, those used in vision science (such as features, cues, edges, but also frequencies in acoustics, etc.), and (2) evaluations are given in first person accounts, therefore objectivity is usually built on the basis of an reasonably large number of participants, whose evaluations, similarities and differences are validated statistically. So, what is obtained from the statistical validation of subjective evaluations is *intersubjective* objectivity. However, the number of subjects necessary for useful generalizations may vary depending on the tasks and contexts, when experience guarantees accurate and bias-free descriptions (Metelli et al., 1985).

### 4.1 Observables

A paradigmatic example of observables in phenomenological research is given by the so-called visual illusions, whose conceptualization and explanation in the science of vision may vary (da Pos, 2021; Gregory, 2009; Koenderink, 2014; Mausfeld, 2013; Shapiro & Tororović, 2017). Illusions are deemed to be errors, from the point of view of physical stimuli, whereas they are perfectly adequate perceptions from the point of view of appearance, because these follow principles and laws of organization that *explain* their perceived nature (for the difference between principles and laws in experimental phenomenology see Sect. 5 below). However, not every illusion is an appearance, as some of them are physiological. da Pos (2021), for example, offers a useful categorization of so-called color and light illusions by dividing them into different classes, of which some are definable as phenomenological, while others are not, which also implies the need to adopt more suitable terms for the different meanings.

Other widely discussed visual phenomena, like the amodal perception of occluded boundaries can be explained as byproducts of neural processing (Corballis et al., 1999; Gerbino, 2020; Thielen et al., 2019), or in terms of inferences based on past experience (Gregory, 2009), or as a phenomenon caused by the Gestalt laws of perceptual organization (Kanizsa, 1980; Pinna & Conti, 2021). It is important to highlight that the explanations given of those "odd" (Gregory, 1986) and other perceptions by psychophysics, neurophysiology and experimental phenomenology are not "different ways" of looking at the same phenomenon, but explanations of "categorially different phenomena." So, the question is whether categorially (one may say, ontologically) different phenomena can or cannot be submitted to the same rules of explanation.

### 4.2 Methods

The methods of inquiry into and explanation of perceptions are necessarily different, because they deal with different observables (high level cognitive functions, neural activity, or appearances), guided by different ideas of perception (representations of physical stimuli or the presentation of phenomena of awareness).

Both theoretical and experimental psychological sciences, sometimes appreciate the *descriptive* role of phenomenology as the proper methodology for inquiring into subjective experiences. The importance of description in phenomenological methodologies, however, although it may be the starting point in an analysis, should not be absolutized, and most of all if by description a sort of introspection developed at the level of higher mental function is meant (Külpe, 1912). In fact, after reading Husserl (1982) and Merleau-Ponty (2013), one may be led to assume that phenomenology only describes, and psychophysics and neuroscience explain (Spillmann, 2009). Accredited descriptive methodologies in phenomenology are based on *linguistic reports* of the subjective experience collected through questionnaires (Giorgi, 1983, 2009; Varela, 1999; however, see also Koffka, 1935, Ch. 3), or through free observations and verbal descriptions from which ostensive definitions (Bozzi, 1989; Michotte, 1959), or interviews (Petitmengin, 2006) are created. As such, besides the potential issue of linguistic ambiguity, that can affect the objectivity of the subjectively intended meaning, descriptive methodology does not directly face the issue of a phenomenological scientific explanation per se. The natural consequence of limiting the phenomenological description to subjective records only, means either rejecting its naturalization *tout court* (Husserl, 1970) or, as more recently occurs, inclining to the naturalization of phenomenology by merging it with other non-phenomenological sciences, as Casper and Haueis widely discuss. Of the three methodologies mentioned above, I have always considered the method of demonstration the most powerful, because it is self-explanatory (examples are given below). In fact, by manipulating the conditions for their appearance, the experimental phenomenologist shows the characteristics and behavior of phenomena in consciousness. Experimental tests validate the intersubjective validity of these phenomena. Wertheimer, Metzger, and Kanizsa, but also da Pos, Massironi, and Pinna have been excellent in this endeavor.

### 4.3 Variables

A further important point of difference between experimental phenomenology and the other psychological sciences concerns the nature and behavior of the variables. The standard practice in experimental psychology is to assume the existence of a correlation between certain variables and certain physical stimuli, which implies a sort of given relationship between their respective values. It is important to note, however, that we can accurately describe our subjective perception more accurately than physical objects, which we know through physical measurement and representation, because our awareness is something that we directly experience (see also Chalmers, 1995).This obstacle does not exist for experimental phenomenology, because (1) it considers *only phenomenological variables,* and (2) it searches for the correlation between *only subjectively perceived aspects, objects, and entities*, according to the laws of perceptual organization (see da Pos, 2021, Appendix).

In other words, independent and dependent variables that belong to the same (phenomenological) domain, are *simultaneously* observable in terms of present awareness, and measured as such (Metzger, 2006, p. 198). *Explanations of the phenomena have to be given at this level belonging to experimental phenomenology* (Hartmann, 1940).

## 4.4 Invariants

In the phenomenal field, phenomenological invariant conditions are not conceived as given in the external world (Gibson, 1979). Examples of phenomenological invariants are the different ways a color may appear (such as surface, volume, and film color, which have been never questioned (Katz, 1935, although they can be enhanced). Their organization in the visual field (as unique and mixed hues), follows only the principle of perceivable qualitative similarity and difference (Hering, 1964) on which the Natural Color System has been construed (Hård & Sivik, 1981). Whereas, the principles governing the appearance of color spreading and perceptual completeness are based on shape only (Pinna, 2011). This *qualitative and invariant* structure of phenomena holds for any kind of appearance and can be *described as phenomenologically varied and manipulated.*

Consider the Fuchs assimilation effect (1923) of how a disc within a series of discs changes color when intentionally organized in a diamond pattern on the left (consisting of dark gray discs) or in a diamond pattern on the right (consisting of light gray discs). This correlation occurs only within the phenomenological variables and is explained by the phenomenal laws of its organization only (in this case, color assimilation). This phenomenon occurs in several variations, and each time the color appearance changes according to its relationships with the adjacent colors (see also the Bezold spreading effect, Bezold, 1873) (Fig. 1).

The explanation of the Fuchs effect is given by the following (necessary and sufficient) conditions. Given a set of figures that are separate enough from each other to be distinguished into two different groups by their different colors (in the example above, two perceivable different shades of grey) and there is a common part with an

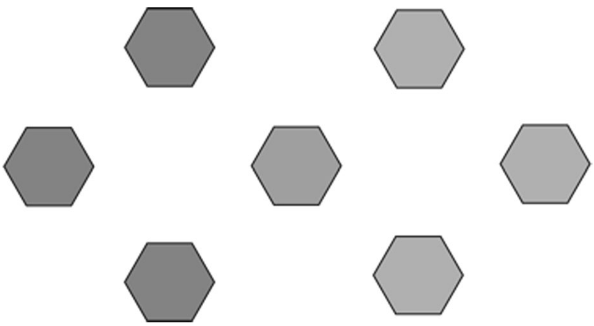

**Fig. 1** A variant of the Fuchs effect. The four hexagons on the left appear of the same gray color, the four hexagons on the right also appear of the same gray color. The two groups are clearly different, darker on the left and lighter on the right, and the shared hexagon in the center changes its appearance according to the group it is perceived with. This change in appearance does not depend on a change in the stimulation, which is the same, but on a perceptual organizational factor (image in da Pos, 2021). Physical stimuli
The figure is composed of seven regular hexagons, each with two horizontal sides (0.44° side at 65 cm viewing distance), arranged to form the vertices of two rhombuses with equal sides and angles, one on the right and one on the left, with a common central hexagon. The distances between the centers of two consecutive hexagons that form the sides of the rhombuses are 1.322° at 65 cm viewing distance. Hexagons are gray Hex.RGBright = #B3B2B1; Hex.RGBcenter = #A3A19E; Hex.RGBleft = #858582

intermediate color between the two; then, the intermediate element is assimilated (i.e. perceived more similar) into one or the other group, to form a *whole*. The comparison is implicit between the two groups and results from the law of grouping producing an effect of similarity (homogeneity).

Let us also consider the case of perceptual transparency. The laws governing phenomenal transparency are different from those governing physical transparency, as no physical stimuli are responsible for it and above all because, by definition, the analysis of phenomenal transparency is independent of (physical) stimuli as it depends on the perceptual spatial organization of differently colored areas. Visual spatial organization arises in subjective space (time); therefore, it is no part of physical stimuli.

For a surface to appear phenomenally transparent, certain topological, configurational, and chromatic (similarity of colors) conditions are required (each of which are necessary, but not sufficient on their own) (da Pos, 1989; da Pos, 2023; Kanizsa, 1980, Ch. VIII; Metelli, 1967), and these have been modeled (da Pos & Burigana, 2013; van der Helm, 2015). Again, topological, configurational, and chromatic conditions are to be understood as applied to the phenomenological space.

These conditions allow the scene to be organized in terms of figure and background. In brief, if *all* three (necessary and sufficient) conditions are present in the field and related to each other, at the awareness level, you see transparency (Fig. 2).

This example demonstrates that the component pieces (figure on the right) cannot explain the whole phenomenon on the left (perceived transparency), although the laws governing the phenomenon are predictable (the presence of the three above mentioned conditions).

The same holds for the phenomena of amodal contours, musical groupings and overlapping (Hachen & Albertazzi, 2018; Vicario, 1982), and many other percepts (Fig. 3).

## 5 Principles and laws of experimental phenomenology

A distinction between the principles and laws of perceptual organization may also prove useful to further clarify the issue of explanatory asymmetry in experimental phenomenology. It is worth noting that principles and laws are used as synonyms also in Gestalt literature (Metzger, 2006; Wertheimer, 1923). Principles, being principles, have no need for post-hoc validation. They are based on the immediate *evidence* given by awareness of the subjective experience (for the concept see Sect. 7 below). Principles provide order, laws (proximity, similarity, common fate, good continuation, closure, symmetry, parallelism, and so on) and are a demonstration of how things work. Principles and laws governing subjective experience are both *qualitative*, i.e. they do not concern the transformation of physical stimuli in representational states, as conceived in other psychological sciences. Principles allow us to make predictions about new phenomena and develop laws that exemplify them. In so doing, principles behave as rules or guidelines allowing the subjects to perceive and orient themselves in the natural environmental field (*Umwelt-Feldes*, Koffka, 1935).

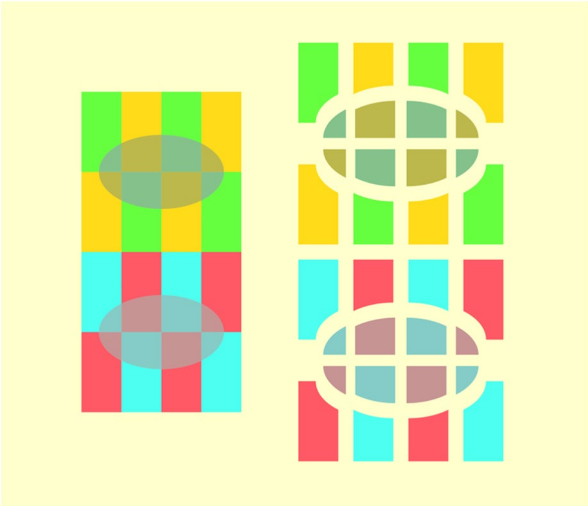

**Fig. 2** The single adjacent parts of the full figure on the left, and the separated parts on the right have the same physical stimuli. However, on the left you see an organized whole (transparency), which does not stand out straightaway. It is like a mosaic where the colors of individual 'tiles' appear strikingly different when they are separated from when they are adjacent. (Image in da Pos, 1988) Physical stimuli
The figure is composed of two rectangular parts, an upper and a lower one, of the same shape and size but different colors. Each part is divided into 4 columns of the same width (0.44° at 65 cm viewing distance) and of the same height (1.6° at 65 cm viewing distance), which are in turn divided in half vertically. The 4 columns of each of the two parts have 2 colors (in the upper figure: Hex.RGB = #19DBFF; Hex.RGB = #40FF66; in the lower figure Hex.RGB = #F0FF4C; Hex.RGB = #6655FF) which alternate so that no two are the same consecutively. A horizontal oval (height 0.7° at 65 cm viewing distance; width 1.15° at 65 cm viewing distance) is superimposed in the center of each part, one on the upper one and one on the lower one. The intersection areas have the following colors: on yellow Hex.RGB = #7258813; on green Hex.RGB = #9209477; on Blue Hex.RGB = #C7CC85; on red Hex.RGB = #9494C7. In the figure on the right there are the same colored areas as on the left, but separated from each other by approximately 0.26° at a 65 cm viewing distance

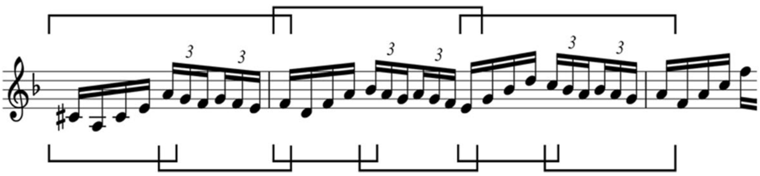


**Fig. 3** Excerpt from the *Allemande* in Bach's Partita in D minor, for solo violin (BWV 1004). Different possible perceptual groups are marked with brackets (in Hachen & Albertazzi, 2018a, 2018b)

If distinctions are made between principles and the figural laws of organization, *personally* I would put the following at the top of the list of Principles: (1) figure/ground organization, (2) whole/part relationship, and (3) the structure of the psychic present, where every phenomenon necessarily occurs (in Husserlian jargon, the locus of constitution of phenomenal objects). These are the cornerstones of phenomenology (Brentano, 1995a, 1995b; Husserl, 1991, 1997, 2001) and of experimental phenomenology as well (Wertheimer, 1912; Koffka, 1935; Metzger, 2006; Kanizsa, 1979).

Finally, the laws of perceptual organization obey a *modifiable hierarchy*, according to the relationships present in the single contexts. In other words, different laws sometimes give a univocal direction and sometimes there may be alternation or the prevalence of one over the other, but *not* in a random way. There are famous examples amongst figural laws (Wertheimer, 1923). Some classic examples are the fact that symmetry and proximity can alternate; common fate can prevail over good continuation; similarity can win over proximity; common fate can win over closure; and closure can win over common fate. (https://psychclassics.yorku.ca/Wertheimer/Forms/forms.

Other forms of hierarchy concern the relationship of whole to part in appearances. A hierarchy between the whole and parts is shown, for example, in works such as Arcimboldo's *Spring* (1573) (Fig. 4).

This painting shows a spatial hierarchy, from largest to smallest, which occurs because the individual parts visually maintain their shape even when viewed in isolation. In fact, although what you first see is a head/bust of a man, with a selective focus you can also see a necklace of flowers or a single petal. We call these "parts" of the head, but when I see a flower (a necklace, a petal, etc.) this is also a unitary whole. I can identify the presence of different kinds of whole with different roles. For example, the face is a higher whole and an individual leaf is a lower whole.

The necessary and sufficient conditions that explain this phenomenon are figurality (smaller and larger dimensions of the parts) and positionality (above/below, right/left), center/laterality (see Arnheim, 1982).

In certain other cases, the shape itself is altered and no longer visible when the parts are brought together, for example, in the case of visual masking (Metzger, 2006, Ch.1).

**Fig. 4** Arcimboldo, *Spring* (1573)

What is shown in the phenomena above is the co-determination of the whole/parts: spatial position, color nuances, shape, etc. that can modify the state of affairs. So, on the basis of the same physical stimuli, a certain percept is triggered instead of another. The use of simple figures (points, lines, small geometric figures, etc.) made by the Gestaltists in their demonstrations highlights the essence (for the concept, see Sect. 7 below) of the percept and its behavior.

To conclude, the normative, definitional approach to the concept of law in experimental phenomenology does not work. Since the laws in experimental phenomenology are not physical laws, they cannot be *syntactically* rendered as *universal* generalizations in first order predicate logic; then, the necessary and sufficient conditions explaining the appearance of a phenomenon (for example, transparency) are not such according to the concept of *natural* necessity: in fact, context, attention, and even past experience (which is anyway a law of perceptual organization, although with minor weight) may modify the appearance; finally, the objectivity of such science, based on intersubjectivity, cannot be rendered in absolute terms. In other words, one cannot exclude the exceptions. Nevertheless, the laws of organization allow predictions on certain phenomena to appear, therefore in this respect they remain “laws”. A similarity with the laws in biology, addressed as lawful generalizations (Mitchell, 1997), could be considered for a comparison, although the laws governing the two fields cannot merge, because of the different (scientific and ontological) kind of observable to which they apply (see Sect. 9).

## 6 Causality in experimental phenomenology

The analysis of a core concept of explanation in science, such as causality, in experimental phenomenology shows how specific and non-comparable it is with the same concept in other sciences that admit causes and the consequences they bear.

Generally, natural causation in science is taken as paradigmatic and causal approaches to the issue of asymmetry have been widely favored (Strevens, 2008; Woodward, 2003), even if non-causal approaches maintain asymmetry too (see Khalifa et al., 2018; Reutlinger, 2017), as Casper and Haueis discuss. The long-held idea of cause in science is based on the asymmetry between *explanans* and *explanandum*: if something is the consequence (effect) of a cause, it cannot be the cause of that same consequence. In other words, the effect cannot be the cause from which it is derived. This asymmetry is linked to the idea of temporal succession (before-after). However, there are situations of interdependence or intrinsically relational situations, for example, the tendency to create a good form or Gestalt (Katz, 1935, VI, 4), where the temporal relation also has to be revised. Experimental phenomenology shows several occurrences of this kind.

Classic examples are stereokinetic movement (Albertazzi, 2004; Kanizsa, 1991; Metelli, 1974; Musatti, 1924; Vezzani et al., 2013), stroboscopic movement (Wertheimer, 1912), and intentional (psychological) movement such as avoiding, attraction, etc. (Kanizsa & Vicario, 1968). All these perceptual movements occur in the brief extension of the psychic present where the before-after relation is also peculiar for two reasons: in the psychic present, both positive and negative dislocations can occur (Benussi, 1913; Vicario, 1963), and the phenomena progress according to an interdependent relation between their parts. In other words, you cannot detach any component from the others in compositional terms, as these phenomena occur as wholes. The problem is that currently very few analyses exist that experimentally address the central issue of the psychic present from an internal viewpoint (an exception being Albertazzi, 2019b; D'Angiulli & Reeves, 2021).

Stroboscopic movement (β movement) is a phenomenon that takes place in a state of awareness.In considering the stroboscopic effect (and others as well), one has to distinguish between (1) the construction of physical stimuli in the lab (emission of lights, metric temporal duration of the interstimulus interval, etc., see below), which are used to manipulate what is subjectively seen; and (2) the perceptual phenomenon (the effect), whose nature and behavior cannot be reduced to these stimuli. It is also important to note that the temporal order of the emission of the physical stimuli does not correspond to the perceptual organization of the effect (the visual movement). Certainly, a mechanistic explanation would not fit here (Fig. 5).

One can lengthen or shorten this (subjective) time along a continuous line and observe that in certain cases (a perceived "very short" time) you see only two fixed lights. If the perceived time is "very long", you see two independent lights that switch on and off alternately. Whereas, after a certain perceived duration, you regularly see the movement of a light from left to right. Please note that we are not talking about seconds or milliseconds (which are measures of the *underlying physical stimuli*), but about *perceptually* "very long", "long", "short", "very short" etc. times (from Benussi, 1913, onwards) along an orderly qualitative scale, and these

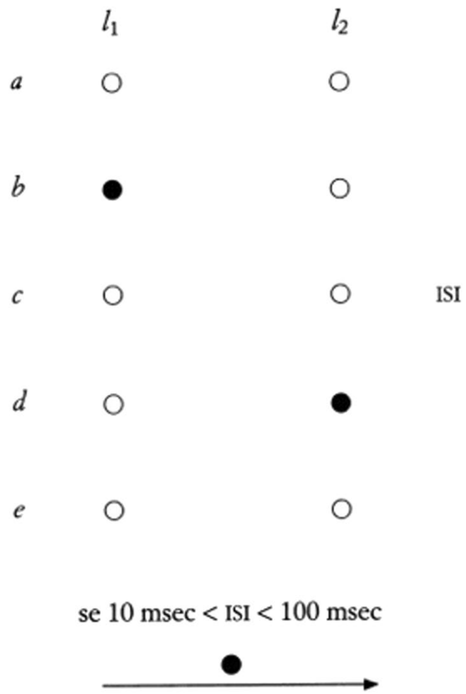


**Fig. 5** If you see two lights that alternately appear, when the time between the end of one and the appearance of the other has a specific (subjective) duration (i.e. "very short", "very long"), one perceives a movement from one light to another (Image in Vicario, 2005, p. 186) Physical stimuli
**Five** phases of activation of two lights ($l_1$, $l_2$). ISI (interstimulus interval) is the duration of phase c. White discs = Light off; black discs = light on. If ISI < 10 ms, one sees 2 fixed lights. If ISI > 500 ms, one sees 2 fixed lights alternatively present to the right or to the left. If ISI ca 50 ms, one sees 1 light in motion from left to right (β movement)

are ordinal *measures*. The scale is quite coarse, but can be improved, as was done several decades ago for the measure of subjective color. The color lightness scale, in fact, has a much higher resolution, which is useful when defining the *essential conditions* for perceiving certain specific phenomena. Unfortunately, as I say, we have *not yet* developed a *subjective* metric of time (as we have done for colors). What is argued here, is that an explanation of the phenomenon is possible only in terms of subjective awareness, i.e. the change of *phenomenal location*, not of neural or retinal location (Rock & Ebenholtz, 1962).

In stroboscopic movement, the law of common fate (Katz, 1935, VI, 44) induces the components (non-independent parts, in Husserlian terms) involved in the phenomenon to assume the role of a figure and produce the percept of a single constantly moving figure (a whole), instead of a complex of distinct elements in relative movement (parts as pieces, in Husserlian terms) (Husserl, 2001, 3rd *Logical Investigation*).

Stroboscopic movement *calls into question the common idea that* the knowledge of past events is typically more trustable, certain and detailed than that of future events. Here the *explanandum* (qualitative internal time structure) co-determines the *explanans* (figure/ground inner temporal organization due to the law of common fate). In this sense (at the microscopic level of psychic time), phenomenological explanations deal with a future to come before the physical stimulus occurs. So, causality in appearances is not strictly ruled by the classic before-after relation, because it depends on a complex inner relational structure. Again, phenomenal observables are neither reducible nor follow the same rules of physical observables, consequently they cannot be explained in the same way. There are cases, for example as in the color field, in which different physical stimuli (RG or white light) can produce the same phenomenal effect. In dealing with observables of experimental phenomenology one should always bear in mind that we are dealing with qualitative, intrinsic properties, which are neither reducible nor functionalizable, although they are analyzable, as the experimental practice demonstrates.

As I have already mentioned, a relevant aspect of the explanation of perceived causality *is due to it being wired* in the phenomena itself, and this concerns both dynamic events (such as stroboscopic movement), and (apparently) static things, like images. The following examples are worth of consideration (Pinna & Albertazzi, 2011; see also Massironi, 2002). Furthermore, they show the priority of the phenomenological explanation by *any* kind of linguistic descriptive statements (both natural and formal) (Fig. 6).

The *structural* characteristics of phenomenal events, like those shown above, constitute the origin of conceptual categories, whose *afterword* can be linguistically expressed by causatives such as “melting”, “exploding”, “stretching”, etc. In other words, the thing currently under observation (be it a, b, c, through to f) *contains its own explanation* and the linguistic meaning is given by the structure of the thing itself.

The necessary and sufficient conditions explaining what is happening visually here are figural and compositional (how the pieces of the images are organized).

There is a range of other examples showing the characteristics of causality in the phenomenological field, even if paradigmatic, and perhaps the best known are

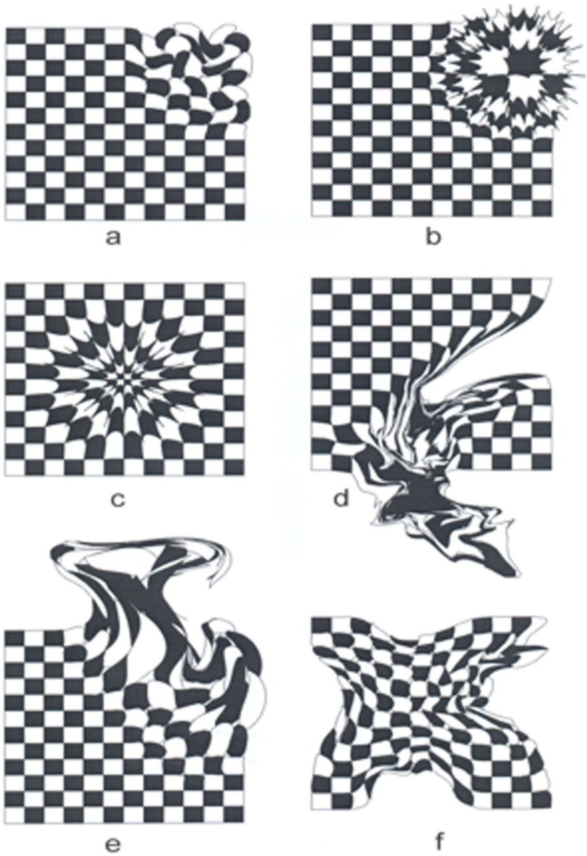


**Fig. 6** Perceptual deformations of surfaces endowed with meaning. (Images by Pinna. In Pinna & Albertazzi, 2011)

Michotte's experiments in *perceived* causality (Michotte, 1962). The phenomenon occurs when one perceives a cause-effect process where no physical transmission of energy between the relevant entities is in play. Perceptual causation has its own categorial structure (see also Scholl & Tremoulet, 2000). Consider the classic "Launching effect", here shown in its original realization on a paper screen (Michotte, 1962) (Fig. 7).

Unlike physics, in psychology there is neither a transmission of energy from one object to another nor a before-after relationship. However, one *perceives* an effect of causality (launching).

Further developments demonstrate that we can perceive certain relationships in moving objects behind a screen too (i.e. an amodal launching effect) (Vicario & Kiritani, 1999).

Similar effects of perceived "animation" are in Heider & Simmel (1944). https://www.youtube.com/watch?v=VTNmLt7QX8E

Once more, these examples demonstrate that the inner (space-)time structure of events is part of the meaning of these events (i.e. "they appear causally related"), and that the organization of the diverse functional factors acting on the

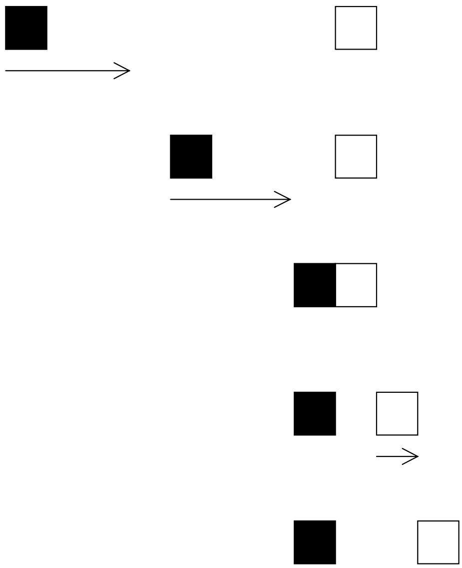

**Fig. 7** "Launching" diagram. Key: A horizontal slot is cut into a screen. Behind the slot, there is a uniform white background on which two different colored squares (A and B) can be seen. B is located at the center of the slot and A to its left. At a certain moment, A begins to move in a linear direction towards B and stops when it reaches it, while B starts moving away from A at the same perceived speed (or more slowly). After travelling briefly, B halts. The percept is described as A "which shoves," "which launches," "which propels,'" 'which pushes' B. In short, the *production of movement* in B is ascribed to the impact of A Physical stimuli
Horizontal slot: l 150 mm, h 5 mm. Square: 5 mm wide. Velocity of movement of A towards = (v = ±30 cm sec). B stops after travelling for about 20 mm

perceptive structures gives rise to equally diverse linguistic renderings (shown in the "launching" example above).

Examples like stroboscopic and launching effects highlight the subjective space–time micro-structure of the psychic present. The continuity of other percepts of longer duration can be explained using the Husserlian theory of double intentionality (Husserl, 1991).

Lastly, perceived causality is *connoted* by other structural components bearing *expressivity* (Albertazzi, 1997, 2010; Arnheim, 1954**;** Metzger, 2006). From this viewpoint, movements of *psychological causation* (Minguzzi, 1961; Massironi, 1967; Kanizsa & Vicario, 1968) are of particular interest. These experiments show a variety of phenomenal movements which *manifest emotional states* (e.g. "intentionally avoiding", "inducing," "seducing," "involving," etc.). So-called *reactive* movements manifest not an energy that passes from one subject to another but an *energy internal to the moving subject*. The analysis of how these movements are deployed (Minguzzi, 1961; Massironi & Bonaiuto, 1966; Kanizsa & Vicario, 1968) accounts for those aspects of meaning that relate to a psychological type of causation (Köhler, 1929).

To sum it up, in the other sciences that refer to it, causality is never perceived. When a moving billiard ball strikes another launching it off in a certain direction, I cannot say that there is a causal bond. It is a link between a before and an after, without direct contact with the cause. It is a theoretical construct that can also explain other observables. In phenomenology, instead, a "force" is *perceived* passing from one body to another. In other words, causality is a perceived phenomenon.

All in all, the issue raised by the examples of perceived causality given above is what is required to be *explicative* when analyzing phenomena that are *not* physical stimuli, do not allow a universality of knowledge guaranteed by a (assumed) universal observer (i.e. a universality given in a third person account), and where the relationship between *explanans* and *explanandum* is given and simultaneously perceived within perceptual appearance in awareness. To address the issue of explaining subjective experiences from a *formal* viewpoint, firstly we need to define a corpus of conceptual categories congruent to phenomenology.

## 7 Obstacles to a formal theory of explanation in experimental phenomenology

I will now try to explain the last point above in more detail. One of the difficulties that experimental phenomenology encounters in being fully understood or even considered in the realm of other established sciences of perception is that of having to merge with other non-phenomenological sciences. This is because of (1) the awkward terminology of its grounding concepts and (2) the abovementioned stages of its characteristic experimental methodology (reduction) in scientific terms. A clarification in more friendly terms of these concepts, even if it is stodgy in terms of content due to the accredited list of mainstream scientific conceptualizations, is highly desirable for at least two reasons. Firstly, it would make experimental phenomenology more understandable to other scientists; and secondly, it would shed light on the possibility of construing a *formal* definition of explanation in this field and even reaching the stage of an *abstract* set of laws.

In empirical practice, these concepts do not need to be made explicit, but they do govern and methodologically characterize the research and its results. As we have already shown, the method of eidetic reduction allows the subject when concretely experiencing a thing to perceive its invariant and essential structure, its inner principle (its “form” or categorial “typus” (τύπος), which requires an intuitive judgment (*anschauende Urteilskraft*) (for the concept, see Husserl, 1907). In the typus, the lawfulness of the phenomenon itself is evident to awareness (as the examples presented above show), and again *explanans* and *explanandum* are bonded together.

The concepts of *presentation (Vorstellung)*, *intuition/insight* (*Anschaaung*), and *evidence* provide a solid point of departure for the analysis of the structure of reality experienced by the perceiver. In Koffka’s terms, to understand why things look as they do (Koffka, 1935; Kant, 1999). However, the concept of presentation (synonymous with psychic present or awareness) in science has been largely replaced by that of representation. The forms of intuition (a concept close to Kant’s *Anschaaungsformen*), categories such as extendedness (*Extensität*) in a subjective space–time continuum (Brentano, 1988), and the continuity of individual things in awareness, their behavior and relationships, have been replaced by the theory of unconscious inferences (as Metzger himself observed, 2006, Sect. 3, and Sect. 4), and/or developed in dispersed research fields, mainly in the domain of application (Hodgkinson et al., 2010). As far as the nature of evidence is concerned, which is a cornerstone of Brentano's psychology because it is incontrovertible (so called illusory phenomena such as the Müller-Lyer (1889) or the Bezold effect (1874) remain such whatever knowledge I may have of the underlying physical stimuli), still remains a research topic that has been backed into a corner. These concepts in their original phenomenological meaning are strictly related to each other, for example, the *eidos* (form, idea, essence-*Wesenheit*) is the object of intuition (see also Ingarden, 1925).

To clarify the issue of explanatory symmetry for experimental phenomenology, not even the inferential accounts (Khalifa et al., 2018) may be a a viable option, from an epistemological viewpoint. Relying on inferential approaches to explanation is problematic in the light of experimental phenomenology. Phenomenological explanations, in fact, are non-linguistic.

In experimental phenomenology, meaning is neither cognitive nor propositional in character, and is an immediate datum of experience (*erlebt*). However, interesting results might arise by comparing ostensive descriptions and inferential models as discussed by Casper and Haueis, to verify whether they might be coupled.

## 8 Science, art, and the lab

In addition to its different methodology and requirements, experimental phenomenology shows its richness not only in the study and explanation of simple phenomena (be they color spreading or assimilation, geometric illusions, perceived light, subjective depth, overlapping of shapes, and so on) but also in the study and explanation of more complex phenomena that are closer to everyday experiences. Whatever the target may be, no study of perception can afford to be totally detached from the analyses conducted in other disciplines, such as aesthetics, provided we understand aesthetics as being an interplay and balance of visual and auditory phenomenal forces in the field (Actis-Grosso et al., 2017; Albertazzi, 2023; Arnheim, 1954, 1982). To give just one example from the complex phenomena of everyday experience, interest in cross-modality has recently grown, prompted by studies in synesthesia (Cytowic & Eagleman, 2009). These phenomena can be analyzed from different viewpoints and methodologies, and are given different explanations (see, for example, Albertazzi et al., 2012, 2014, 2015, 2016a, 2016b; Hanson-Vaux et al., 2013; Belkin et al., 1997; Lau et al., 2011; Marks, 1987a, 1987b; Osterbauer et al., 2005; Sagiv & Ward, 2006; Bremner et al., 2012). What experimental phenomenology does in this field is to analyze congruency effects between attributes or dimensions of observables in different sensory modalities as they are subjectively perceived in first-person accounts. When compared with parallel studies in sensory-to-sensory perception, experimental phenomenology offers wider dimensions of perceiving. Here, I can point to a study of my own in this field (Albertazzi et al., 2020) where complex abstract paintings by Kandinsky and complex music works by Schönberg show a relatable path towards abstractionism. The two artists were linked by both a personal relationship and their shared belief in artistic innovation. Choosing these works of art as observables for the cross-modal experiment, therefore included a preliminary wide context of analysis of perceptual and cognitive dimensions. Consequently, the concept underlying the design of the lab experiment also had to consider an interplay of subjective and cognitive aspects, such as literary and religious factors, that other experiments, based on different methodologies (like IAT) and assumptions usually do not or even cannot consider. It is very rare, in fact, to find cases in which scientific research has had to resort to literary or symbolic (i.e. cultural) aspects.

The question is: How can the inner relationship in such complex observables as Schönberg's compositions and Kandinsky's paintings be explained? What would be the *explanans* of the perceived association of patterns between this music and the shape of these works of art (*explanandum*)? In designing this experiment, I assumed that the destruction of figurality in painting and the destruction of the octave in musical composition would show a perceived similarity. Factually, the participants matched certain shape/color configurations of the paintings with certain musical patterns, and the outcomes were sound. What the experiments shows is that the subjective factors in perceiving, both empirical (in the phenomenal field) and inner (in awareness), are conditions of the existence and appearance of the percept. In awareness the explanation of the phenomena is shaped by those conditions, and it might be considered asymmetric because the subjects identify the necessary and sufficient conditions for the explanandum to appear. From this point of view, there might be a correlation between law-based accounts of explanation (Lange, 2007; Rouse, 2015) and experimental phenomenology.

However, to figure out precisely for each association (*explanandum*), what are the decisive necessary and sufficient conditions (*explanans*) from the various pitches, pauses, dissonances, color shades, shapes (including round/angular, aggressive/soft appearances), and so on is a complex analytical task. Participants, in fact, perceived *wholes*. The task is feasible, but it requires extra work. For the time being, the lab work showed that the matches exist.

The issue of how to put this complexity into *formal* statements, on the other hand, is obviously more complex. In my opinion a viable route could be the hierarchical interplay between presentations and contents, developed by the Graz theory of production (Ameseder, 1904; Meinong, 1891; See Albertazzi, 2001). However, the theory is awkward, almost forgotten, and difficult to translate even in applicative terms. Nevertheless, experimental phenomenology, on the basis of all the scientific procedures required, demonstrates that factually the subjective association between complex cross-modal patterns exists.

## 9 Conclusive remarks

Psychology as a science was established by lab work. Experimental phenomenology is no exception, although it has not yet been firmly recognized. The fact is that reading and understanding Brentanian, Husserlian and Meinongian texts and vocabulary (and comparing their differences) requires years as well as the competence and practice of a scientist working in a laboratory work. This may explain the gap and misunderstandings that occur between philosophers and experimental psychologists. Where, then, is the place of experimental phenomenology in the world of sciences?

A scientific theory considers a part of "reality" and tries to find the correct tools to describe a certain type of observable. Sciences such as psychology and sociology (I would also include biology among them) differ from the so-called natural sciences for at least two main aspects: the presence of individuality, and the fact that the state of a system is not only defined by a previous state (Rosen, 1991). In such sciences, in fact, the behavior of the system depends on the previous state *and* also on the future ones: planning and intentional emotional states (as those mentioned in the psychological causation), for example, condition the present.

For what concerns the scientific *representation*, the specific historical codification of scientific knowledge of a science tends to pass through the codification of laws, principles, etc. For some sciences it has been easier to arrive at this result, for others like psychology, biology, and sociology they are still in progress, because of the presence of a variety of different perspectives (briefly, there isn't any dominant paradigm). Psychology is poly-paradigmatic (think of the perspective of a psychoanalyst, a perceptologist, a psychophysicist, a neurophysiologist, etc.). There are many scientific ways of doing psychology, and we still don't know how to put the different perspectives together *because we don't know what consciousness is*.

My work (and that of a few other colleagues) has shown how the coding of some protocols work to be able to conduct the experiments in this field. In so doing, the experimental phenomenologist has to make a series of assumptions which are suitable for a series of experimental tasks.

I have tried to present certain reasons for the current undefined *formal* status of the science of experimental phenomenology. Since Casper and Haueis' contribution addresses the issue of explanatory asymmetry at the level of representation, i.e. at the level of a potential formal theory of experimental phenomenology, that can be compared to other sciences, my answer is this. To begin addressing this issue, we first need a thorough systematic clarification (and definition) of the categories on which phenomenological reduction rests such as *evidence* and *insight* (*Anschaaung*). As they are grounded on the nature of consciousness (something still deserving much work) the aforementioned categories are specific and do not apply to other empirical sciences. Detailed studies of these categories are still pending. For what concerns the possibility of using *inferential mathematical models* for the formalization of phenomena, I can mention Kubovy & van der Berg (2001) mathematical model to formalize some Gestalt Principles, and Burigana model for perceptual transparency based on ordinal scales, which however holds for phenomenology and psychophysics as well (da Pos & Burigana, 2013**)**. On all this, I must assume a neutral position, because the evaluation of abstract models is not included in my work as an experimentalist (although I may have some opinions and criticism, especially regarding the kind of mathematics to be needed). Eventually, my work includes the reference to purely phenomenal color *systems* such as the NCS, which I consider in my experiments on color perception.

To summarize, the main point under discussion, i.e. whether experimental phenomenology satisfies the asymmetry between *explanans* and *explanandum*, my conclusions are the following. As is well known by philosophers of science, cause, causality and explanation are concepts whose meaning may change according to perspective (Woodward, 2003). Thus, if (i), as far as experimental phenomenology is concerned, explanatory asymmetry is used in the sense of there being an *explanans* (the highlighted necessary and sufficient conditions ruled by the laws of organization) that make a phenomenon appear (the *explanandum*); if (ii) we agree on the fact that *explanans* and *explanandum* bond together in the phenomenon, and that their relationship is neither logical nor conceptual; if (iii) any reference to the classic idea of asymmetry (physical energy transmitted from an object to another, linear before-after temporal order, etc.), and even to other proposals such as inferential theories of explanation are excluded; and (iv) that, for the time being, one does not ask for the empirical practice and outcomes of such a science to be rendered in a formal apparatus of statements and definitions; then on the basis of this entire caveat, the answer can be affirmative.

To further clarify the place of experimental phenomenology among the sciences of perception, a conclusive philosophical comment concerns the issue of emergence. The definition and clarification of how the levels of reality jointly operate in the perception of the environment, and the definitions of their boundaries, make of the phenomena of consciousness a biologically useful interface (Hoffman, 2009; Koenderink, 2011, 2019), although the interface per se doesn't explain how internally consciousness works.

Because of its intrinsic characteristics, phenomenology cannot be incorporated into other sciences (naturalized), and for the same reason I do not agree that we can discuss explanation regardless of the specific kind of science. However, the strong claim made by experimental phenomenology to sharply distinguish between physical stimuli and subjective experienced phenomena doesn't make of it a solipsistic, self-contained science. Its methodology can also be used in other sectors of psychology and probably as a proxy in some sections of biology, such as ethology (Tinbergen, 1974), and it already has a value in social sciences, even if this is largely overlooked (Schütz, 1932). Finally, whether the specific characteristics of experimental phenomenology can contribute to revising the foundations of other psychological sciences, as Brentano believed, is a matter for future inquiry. First and foremost, we must understand what consciousness is.

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## Declarations

The contribution is not the result of experimental work. Consequently, there is no need to produce.

**Competing interests** There are no competing Interests (financial and not financial).

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