Synthese
https://doi.org/10.1007/s11229-019-02209-6

S.I. : GESTALT PHENOMENOLOGY AND EMBODIED COGNITIVE SCIENCE

Experimental phenomenology: What it is and what it is not

Liliana Albertazzi[1]

Received: 8 June 2018 / Accepted: 10 April 2019

Abstract
Experimental phenomenology is the study of appearances in subjective awareness. Its methods and results challenge quite a few aspects of the current debate on consciousness. A robust theoretical framework for understanding consciousness is pending: current empirical research waves on what a phenomenon of consciousness properly is, not least because the question is still open on the observables to be measured and how to measure them. I shall present the basics of experimental phenomenology and discuss the current development of experimental phenomenology, its main features, and the many misunderstandings that have obstructed a fair understanding and evaluation of its otherwise enlightening outcomes.

Keywords Experimental phenomenology · Psychophysics · Description · Demonstration · Explanation

1 Phenomenology in disguise

Recent approaches in cognitive neuroscience have seen a reappraisal of phenomenology (Spillmann 2009; Varela 1999; Wagemans 2015; Wagemans et al. 2012b), a second revival of this undoubtedly challenging philosophical discipline, after the interest aroused by the analytic interpretation of Husserl's thought in the 1960s (see for example Bell 1991; Chisholm 1960; Smith 1982). This renewed interest in phenomenology has several motivating factors. Over the years, increasingly many works by Husserl have been edited and/or published in English translation, and consequently greater information on the corpus of Husserlian production, such as the lectures on space (Husserl 1973b), time (Husserl 1991), and the pre-categorial structures of experience

✉ Liliana Albertazzi
liliana.albertazzi@unitn.it

[1] Department of Humanities, Experimental Phenomenology Laboratory, University of Trento, Trento, Italy

(Husserl 1973a), have been made available to a willing reader. These readings have led to reconsideration of some *foundational* dimensions (*Begründungen*) in phenomenology concerning, first of all, the understanding of consciousness and its structures as the *direct and primary access* to every kind of reality for a human being. Secondly, as corollaries, these works explained the (non-propositional) nature of *conscious* phenomena appearing in awareness, the *subjective* nature of space and time, the emergence of *qualitative* configurations in the perceptual fields and their rules of organization along lines similar to the Gestalt principles (Husserl 1973a, 2001b). These issues, corroborated by the above-mentioned renewed interest in Gestalt psychology by neuroscience, have recently helped researchers to conceive a potential affinity between phenomenological theory and the empirical study of perception and consciousness, core topics of the new-born cognitive science, introducing phenomenological themes into the scientific debate. Phenomenology has then been recognized for its potential to help bridge the gap between brain and mind. Nevertheless, the epistemological and conceptual framework of the natural sciences, including experimental psychology (be it psychophysics or neuro-physiology), remains firmly grounded in *physics*. It seems that Husserl's criticism of a (generally defined) Galileian science (Husserl 1970) continues to be ignored by these reductionist proposals, misleadingly presented as faithful developments of the phenomenological and Gestalt ideas.

While phenomenology within cognitive neuroscience is seen as a "return to the things themselves", recent interpretations include a wide variety of different claims, conceptions, and formalisms (for an introduction see Petitot et al. 1999, Ch. 1). What these current revivals in phenomenology share is the assumption that the Husserlian claim *against* the naturalization of phenomenology (Husserl 1965) can finally be overcome on the basis of new scientific achievements in the field of neuroscience. Nevertheless, exactly how to naturalize phenomenology remains far from being clear, because of the wide variety of strategies for pursuing this proposal (Albertazzi 2013a, 2018; Harney 2015). These otherwise different theories and approaches are united by the conviction that the repeated statements by Husserl and scientists in the Gestalt tradition that phenomenology is *independent* from psychophysics and neuro-physiology (Kanizsa 1991, pp. 43–44; Koffka 1935; Köhler 1947; Metzger 2006, p. 197; Michotte 1950) should be dismissed because they have been superseded by the more recent achievements of brain science. Or, in other words, that phenomenological subjective experience *can* and *is to be explained* in terms of objective brain functioning (in which its naturalization would consist). For example, to explain perceptual grouping in terms of neural dynamics (Grossberg and Mingolla 1985, 1987; Wagemans et al. 2012a), and more generally to rewrite the Gestalt foundations in terms of biological evolution, considering the brain as an adaptive system implementing Bayesian computations, and encoding the external veridicality of the physical environment. The principles, methods, and scientific achievements that have been offered as basis for this supposed transition from *descriptive* phenomenological theory to its scientific *explanation* may be traced back to cognitive neuroscience in the Helmholtzian tradition (von Helmholtz 1962; Kersten et al. 2004; Yuille and Kersten 2006): to wit, *inferentialism* and its strong evaluation of *past experience* and *learning* as sources of implicit knowledge, *unconscious impressions*, *Bayesian mathematical models of simulation and prediction*, and *cognition understood as brain activity*. None of these principles, however, are grounded in phenomenology. These principles are generally considered explanatory of higher-order processes (so-called "secondary" processes), such as making inferences and verifying hypotheses, making decisions, producing classifications (such as established taxonomies or dictionary-based ontologies), and construing probabilistic mathematical models. Extending them to the explanation of subjective experience in actual perceiving is an illegitimate use of the category "phenomenology", to use a Kantian expression. The "logic" of perception, the phenomenologists maintain, is *not* the "logic" of thought (Kanizsa 1980, Ch. 2; Musatti 1958; for the opposite viewpoint see Gregory 1997, 2009; Rock 1983).

Only a relatively small group of experimental researchers have resisted the dominant view: they refer to the original ideas that gave rise to the first application of the phenomenological theory to scientific practice, from Stumpf (1883–1890) and Meinong (1899) to the development of the schools of Gestalt psychology in Berlin and Graz (see Albertazzi 2013a, 2015a; Albertazzi et al. 2001). In particular, researchers such as Metzger, Katz, Arnheim, Michotte, Rausch, and Kanizsa among others, deeply imbued with philosophical theory, laid the bases of an *experimental approach to phenomena and consciousness* (on the general relevance of Husserlian philosophy for the Berlin Gestaltists, see Spiegelberg 1967). Nowadays the main group of researchers currently adhering to a programme of *experimental phenomenology* works in Italy, a legacy of the above-mentioned psychologists. Attracted by the richness of phenomenological theory, its variety, and its strong divergence from the behavioral and reductionist approaches that characterized the rise and development of psychophysics and (neuro)physiology, these researchers pursue an apparently impossible mission, i.e. *a science of phenomena*. It is worth noting, however, that some of these researchers continue to work in psychophysics as well. Consequently, even here the boundary between different possible approaches to perception may appear blurred (Horst 2005), and sometimes needs clarification. Furthermore, currently under the label of "experimental phenomenology" one may find a variety of remarkably different approaches to the study of phenomena, methods, and protocols to apply for implementing them (Albertazzi 2013a, b; Bozzi 1990, Ch. 8; Burigana 1996; Da Pos 2008; Kanizsa 1991, Ch. 1, § 7; Koenderink 2015; Kubovy and Gepshtein 2002; Masin 1993; Massironi 1988; Thinès 1977; Vicario 1993, pp. 202ff). Practically, one may say that the boundary between psychophysical, neurophysiological, and experimental phenomenological approaches shifts according to the methodologies adopted and the dimensions taken into consideration; nevertheless, from a systematic viewpoint, the issue of exactly where to draw this boundary is exceptionally controversial. As emphasized above, the epistemological and conceptual framework for most experimental psychology remains grounded in *physics*, which does not and should not hold for an authentic experimental phenomenology.

Most fundamentally, the divide between the psychological methods grounded in physics and phenomenology is to be found in the style and standards of *explanation*, especially with regard to the concepts of stimulus and perception (see below, Sect. 2). For example, common phenomena in vision such as the amodal perception of occluded boundaries can be explained in terms of inferences based on past experience, as byproducts of neural processing, or as a consequence of the Gestalt principles of perceptual organization. As to the claim that the brain sciences or reduction to neural activity may explain subjective experience, Köhler for example observed that:

> "If someone states that things seen must first be experienced as if they were in the brain, he has not realized that the first part of his statement refers to the visual field as a fact of experience, whilst in the second part, where he uses the expression "the brain," he is speaking of a physical object in physical space. This means that he expects to see parts of visual space localized in relation to parts of physical space, and this notion is entirely impossible" (Köhler 1947, p. 213).

Passages like this reveal the core of the Gestalt viewpoint, which has been ignored by contemporary, physicalist approaches to perception. Elsewhere I have extensively analysed phenomenological theory historically, systematically, and experimentally, including its core concepts, its legacy, and its development (see, for example, Albertazzi 2013a, b, 2015a). I have also advanced a proposal for a science of qualitative experience in first person account, and its potential mathematical model (Albertazzi 2015c; Albertazzi and Louie 2016). In the present study, starting from the basic misunderstanding of phenomenology in contemporary science (Albertazzi 2018) I shall recall its grounding principles, and give examples of the distinctive methods and results of experimental phenomenology. After delving more deeply into the question, what is phenomenology proper (Sect. 2), I develop the distinctive features of the methodology of experimental phenomenology, differentiating it from psychophysics (Sect. 3). After elaborating more on the distinctive role of participants (Sect. 4), and of data collection and analysis (Sect. 5) in experimental phenomenology, I illustrate these methods through a detailed example from a recent study on the perception of cross-modal similarities in the arts (Sect. 6).

2 What is phenomenology?

Phenomenology, in Husserlian terms, is a *descriptive* theory of the *essences* (*Wesenlehre*) of pure phenomena or lived experiences (Husserl 2001a, LI 2, 343), i.e. of the nature of perceptual (a bunch of red and orange roses) and mental (a thought, memory of a bunch of red and orange roses) contents given in present awareness. Synonyms of lived experience and phenomena (however idiosyncratic they might sound) are "appearances" or "what appears as such" (Husserl 1982, I, Sect. I), "the immediate or encountered datum" (Metzger 1941, p. 12), and "the directly given" as an "evident fact of experience" (Stumpf 1906). All these terms refer to the *concreteness* of the phenomena. This terminology implies the core concept of "things (i.e. having *Dingcharakter*) as they appear" (in more philosophical terms, "the unity of a manifold of appearances" (Husserl 1950)). The new terminology was initially coined to avoid the psychophysical term "stimulus" and its metricized, physicalist connotations. From the "Galilean," physicalist perspective, in fact, the phenomenological approach can only be viable if subjected to a *quantitative* revision in terms of computational principles, ecological statistics, and neural mechanisms (Wagemans et al. 2012b)—a project that grounds perception on the *re*presentation of physical stimuli. However, *no* "physical objects" or physical dimensions are implied in the analysis of appearances, rather 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.

Appearances occurring in the different perceptual fields are colours, tones, configurations, scenes, sources of light, movements, shape transformations, shadows, space, time, whatever can be subjectively experienced in the perceptual fields (and in imagination as well): in short, reality as it appears and is phenomenally and *consciously* manifest (see the peculiar definition of "physical" phenomena in Brentano 1995a, pp. 79–80). For example, under a certain slant of light, grass appears to be dusty yellow: that grass is green is a matter of knowing, not of seeing. These appearances are *not* (more or less adequate) *re*presentations *of* constant (or non-constant) physical features or formless invariants (Albertazzi 2013b).

It follows that even the "primary qualities" of appearances are *not* attributes of physics, i.e. properties such as spatiality, solidity, hardness, weight, shape, size, position, and motion *defined in terms of metric cues*: primary qualities are *these* dimensions *as* subjectively perceived. Thus, they should be redefined and addressed (again no matter how it may sound linguistically) in terms of voluminousness, remoteness, solidness, squareness, etc., i.e. in terms of relational, distributed qualities of appearances (although one has to admit that a crisper and more established vocabulary would be of great benefit for the discipline). Paradigmatic examples of "primary qualities"—a source of debate even in experimental phenomenology (Albertazzi 2015c; Bozzi 1990)—are given by so-called apparent motions, size deformations in the visual field, three-dimensional visual corporeality and solidity of things, stratifications of surfaces due to occlusion, colour, transparency, etc.

"Secondary qualities" (Hume 1975) such as sounds, colours, tastes, odours, lighting, etc. as *subjectively* perceived, manifested in terms of "more or less" and "similar to or different from", have long been considered impossible to mathematize (Galilei 1623/1957, p. 274) or undergo exact measurement, unless *indirectly*; and in traditional experimental psychology they are still *explained* in terms of their physical/neuronal correlates. From a phenomenological point of view, however, this strategy is misguided; colours, for example, are not wavelength: what appears to awareness in the visual field are patches of colours variously shaped (Hering 1964). Finally, "tertiary qualities" are bearers of expressive character and affordance value, being instantiated by the encounter between subject and perceived object in the environment (Arnheim 1991; Bozzi 1990; Koffka 1935; Metzger 1941; Rausch 1966) (on the topic see Albertazzi 2015c). Among particularly significant tertiary qualities are the *connotative* properties of appearances, such as the subjective warmth and coldness of colours. From a phenomenological point of view, these three types of qualities are inextricably entangled; qualities are not isolated (they are neither qualia nor sense data) but are embedded and innerly related in multifarious appearances: a burning fire is a phenomenon perceived as a *whole*, a dynamic form, a lightness, a nuance of color in the red-yellow interval of the hues, and a lively characteristic which are not separable parts of the visual thing.

Although subjectively experienced, appearances are *inter-subjectively objective*, because they are internally coded by qualitative invariants. Examples are the ways of appearing of colour (as surface, volume, and film colour, see Katz 1935) and their organization in the visual field (as unique and mixed hues) following the principle of *perceivable qualitative similarity and difference* (Hering 1964); the rules governing the appearance of phenomenal transparency (Metelli 1967; Kanizsa 1955, and below) or of amodal contours (Kanizsa 1980). This qualitative invariant structure of phenomena holds for any kind of appearances and can be described, phenomenologically varied, and manipulated—these variations and manipulations provide the empirical basis for a science of phenomenology.

3 Methodological requirements

Because of the nature of its observables, the correct methods for experimental phenomenology cannot be the same methods currently applied in psychophysics and/or neurophysiology (Husserl 1965; see also Kanizsa 1991, Ch. 2). Currently, experimental research on perception is mainly conducted on quantitative objects by quantitative methodologies. Specifically, psychophysics comprises a series of methods for both determination of the degree of sensitivity of the sense organs (thresholds) and measurement of sensations (psychophysical functions), and a series of psychological operations of judgment, expressed as "comparison" between or evaluation of stimuli. However, this expression is a source of terminological and theoretical confusion. In fact, in psychophysics stimuli are measured according to their physical nature, while the answer given by the subject is given in terms of what he/she perceives. It is the experimental theoretician who knows the stimuli and sets the subject's answers in relation to those stimuli, whose role is only that of having triggered the perception effectively evaluated.

Methods distinctive of psychophysics are two alternative forced choice tasks (the subject is required to make binary choices between different percepts), and double-blinding (applied to any experimental situation in which there is a possibility that the results will be affected by conscious/unconscious bias on the part of both researchers and participants, bias which derives from expectations and other sorts of knowledge or experience when evaluating only the percept). Even the revision of psychophysical methods by Stevens (1957), allowing qualitative estimation of magnitudes in terms of "more or less heavy", "more or less good" or "more or less round," supposedly expressing merely the "intensity" of the subjects' sensations has its difficulties, because Stevens-style *explanations* of perceived quality are still made in terms of integration between perceived variables (good, round, heavy) and imperceptible correlates (retina and brain). And indeed, the concept of intensity of a sensation is a very disputable one: when is a sensation weak or intense? Does "black" correspond to a weak or an intense sensation? Hering excludes the concept of intensity for colours: colours are not more or less intense in an energetic sense (power of the stimulus), but more or less light, dark, saturated, bright, etc. (Hering 1874). A certain black can be very intense, independent of the intensity of the stimulus. It is the concept of intensity, indeed, that needs revision, because it has different meanings if attributed to the stimulus or to the "sensation". For example, one can perceive a very intense cold when a certain temperature is exceeded, which has been called "paradoxical cold" (see Ruffini corpuscles) because the perceptual intensity does not correspond to the intensity of the stimulation. One also speaks of "paradoxical warmth", when simultaneously touching adjacent warm and cold objects. However, these phenomena are not illusions, but specific aspects of the relationship between stimuli and perception.

As Husserl correctly observed, psychological methods such as these suffer from an unacceptable *simulation of the physical sciences*, leading to the denial of the typical characteristics of psychic phenomena. In contrast, an authentic science of phenomena aims to discover the conditions of the appearances and their phenomenal variables starting from their accurate *description*. Masterpieces of the phenomenological descriptive method are to be found in the works of Wertheimer, Metzger, Michotte, Musatti, and Kanizsa, to cite only a few (Metzger 2006, p. 197). Koffka, for example, observed that:

> "A good description of a phenomenon may by itself rule out a number of theories and indicate the definite characteristics which a true theory must possess. We call this type of observation 'phenomenology'.... For us phenomenology means as naïve and full a description of direct experience as possible" (Koffka 1935, Ch. 3).

Once described, phenomena are modified and manipulated to discover their *invariants*. Manipulations range from mental operations (Necker cube's vistas) to operations on the physical stimuli. Take the case of a visual square: I can change (perceptively and/or in imagination) the shape of a square in many ways as to size, colour, texture and orientation in the visual and/or pictorial field (Albers 2013), it remaining a square, even in absence of stimuli, to wit the so-called Kanizsa square (Kanizsa 1991, Ch. 10).

In describing, the phenomenologist takes care to avoid the so-called 'stimulus error', i.e. including in the analysis what she/he knows from physics, biology, or social sciences; in other words, including the description of the physical change of the stimuli that leads to the perceptual change. For instance, a very specific orientation in space (45° relatively to the canonical orientation with horizontal basis) of a square, gives rise to its "diamond" appearance, so that its angles no longer appear as right, but as two obtuse and two acute ones. In these conditions, although the stimulus remains metrically a square, there is no longer a visual square, but a different appearance entirely, a "diamond". Conversely, I may visually evaluate as a square what, from the viewpoint of its metric structure, is indeed a (metrical) rectangle. The visually perceived square need not coincide with a Euclidean square: occasionally it may, but to be and remain a visual square, the shape only obeys the qualitative principle of Simplicity (*Pregnänz*) to appear as a well-balanced squared form (a "squaroid", Albertazzi 2015b). Crucially, the squares we see in the visual field do not resemble Euclidean squares, according to a more or less good match with or representation of the physical stimulus (as maintained by the Likelihood principle, see Pomerantz and Kubovy 1986): they do not "look like squares" nor are they seen "as if they were" squares (Wittgenstein 1993, 204ff., § 118ff), they *are* visual squares.

The systematic manipulation and description of appearances themselves, carefully disregarding our knowledge of the stimulus, is the first step of Husserl's method of phenomenological reduction (Husserl 1950; Scanlon 1997), namely the *epoché* (Husserl 1982, I, § 31ff); in his words:

> "the methodical and rigorously consistent epoché of every objective positioning in the psychic sphere, both of the individual phenomenon and of the whole psychic field in general; and in the seizing and describing of the multiple "appearances" as appearances of their objective units and these as units of component meanings accruing to them each time in their appearances" (Husserl 1999, p. 325).

Translated into experimental terms, the method of phenomenological reduction avoids any information that the researcher may have on distal stimuli, neural correlates, or proximal stimuli, because appearances have their own intrinsic meaning and do not need any external validation (Köhler 1971; Uttal 1993, p. 14). As mentioned, in Kanizsa' words (Kanizsa 1979), one must avoid substituting the list of the characteristics of the physical stimulus or its definition ("square as a flat shape with four equal sides and every angle a right angle") for the description of the direct unbiased experience, as in the examples above. The phenomenological level, although depending on physics and physiology, has proper observables, ruled by specific laws of organization, to be discovered by the description, and the manipulation of the conditions of their appearance (Poli 2006). Both Brentano and Husserl, in fact, maintained that phenomenology "is prior in the natural order" (Brentano 1995b, pp. 8, 13), and provides *guidance* for *correlated* neurophysiological and psychophysical researches; but they also maintained that phenomenology *explains* the nature of appearances themselves, *by discovering the structural conditions of their appearing in consciousness*.

These structural conditions include, as *general* features, figure/ground organization (Kanizsa 1991, Chs. 1, 6; Rubin 1921), concavity and convexity, the behaviour of margins (Kanizsa 1991, Ch. 6, 10), spatial localization, and many more. Then, *specific* phenomenal conditions are responsible for the appearance of any particular target phenomenon. Such are, for example, topological, configurational, and chromatic conditions (each of them referring to necessary, but not sufficient conditions) that contribute to causing, say, an impression of phenomenal transparency (Da Pos 1989–1991; Kanizsa 1991, Ch. 8; Metelli 1967). This phenomenon (the transparent layer) occurs when an object or medium appears to lie before or over some other objects that, however, keep their properties (shape, colour, texture, etc.), i.e. they are not occluded by the layer. In order for the phenomenon to occur, the colour of the area where the transparent layer covers the background must resemble the colours of both the background and the transparent layer, so that it can "phenomenally" split into those two colours. In these cases, the apparent superposition of the layer upon the background has no direct physical correlate in the image being observed. In psychophysical models (Metelli 1967) this "likeness" is assumed to derive from physical mixtures, additive, partitive, subtractive; conversely, in the phenomenal model (Da Pos 1989–1991) the "similarity" is a characteristic of the colours themselves: in fact, with the exception of the unique colours, and of white and black, all colours "resemble" at least two unique colours, and it is this similarity that is relevant in the phenomenal model, which uses psychometry (e.g. the quantification of colour appearances used by Hering), and does not deal with physical or chemical mixtures. A *model* that may correspond to the eidetic structure of colour is the "ideal structure" of the Natural Color System (NCS) (Hård and Sivik 1981). This model *explains* why you can see two different colours one above and one below (for transparency), because the "reduction" colour (that of the overlap area) is already similar to the two colours into which it "splits" (Da Pos 1989–1991; Kanizsa 1991, Ch. 8). In contrast, the visual phenomenon of transparency cannot be explained in terms of physical transparency: if a physically transparent triangle is placed on an opaque square, in fact, phenomenal transparency does not occur.

The target phenomena for experimental phenomenology are not artificial, or ad hoc creations of the experimenter. Perceptual transparency can be seen in standard situations of daily life, as in the case of a veil covering a surface, or in cases of paintings in pictorial space (even by simple drawn lines) or in computational images on a screen (Kanizsa 1991, 235ff). Consider the phenomenon of masking, when a geometrical figure such as a triangle phenomenally disappears (i.e. it does not have perceptual existence for the observer) when inserted in a network of lines (Galli and Zama 1931; Kanizsa 1991, Ch. 5), or of animal mimicry and camouflage (Metzger 2006, Ch. 5), where a physical object is totally absent to awareness, because perceptually annulled by the context. Or the so-called "Ponzo illusion", which can occur each time an observer is looking at tracks that stretch in front of her/him (Ponzo 1912). In each case, an everyday pattern of appearance cannot be explained through reference to physical features of the stimulus, but may be explained by appeal to perceptual laws internal to the appearances themselves.

Once a description is in hand, experimental phenomenology attempts to identify functional connections among phenomena, manipulating them to discover the (necessary and/or sufficient) conditions of their appearance, by the method of *demonstration* (Vicario 1993, p. 205). Like description, demonstration does not require psychophysical or neurophysiological testing for its validation. Pencil and paper may be enough to make visible the internal structure of the phenomena and the elements responsible for the appearing of forms: consider Wertheimer and Rubin's studies on lines, points and perceptual figures (Rubin 1921, 1950; Wertheimer 1922, 1923). These pencil and paper experiments, made classic as the first studies of Gestalt, are, in fact, accurate descriptions and manipulations of (visual) phenomena to discover the laws of seeing (Metzger 2006).

The criticism brought against the demonstration of the Gestalt laws through drawings (see Metzger, 2006; Kanizsa 1980, 1991; Wertheimer 1923) as unable to offer any clarification of the utility of perception towards the external world (Gibson 1978, p. 227) because involving only abstract signs, rests on a deep misunderstanding. From the standpoint of experimental phenomenology, the nature of the stimulus is (as it were) irrelevant, since attention is directed entirely toward appearances and the regularities they obey. A simple abstract drawing, and a rich realistic scene are equally valid experimental tools insofar as both may aid in the generation and manipulation of appearances. This critical point reveals how misplaced are the attempts to find a similarity between ecological optics and Gestalt psychology (Wagemans et al. 2012b), a similarity defended even by some experimental phenomenologists (Bozzi 1989). For, by stressing the importance of particular types of stimuli, ecological psychology falls into the "Galilean" trap, erroneously supposing that qualitative appearances may be explained by appeal to features of the external, *physical* world (whether those external features are labeled “ecological”, or not; Gibson 1979). In contrast, we may think of the Gestalt psychologists as sharing a theoretical stance with the painters of the nineteenth-century avant-garde: both turned their backs on the physical world, searching for the qualitative invariants in perception and describing them on the basis of the “grammar” of the phenomena as appearing in the visual field (Kandinsky 1926; Klee 1961). Both may be said to be working on a theory of composition and elements (parts) of the subjective (visual) experience (Massironi 2002). Subjective space and perceptual appearances, in fact, are very similar to pictorial appearances, sharing with them the laws or organization (Ross 1907; Albertazzi 2013a). These subjective spaces, however, to reiterate the point, are *not* the space of the external environment, whether understood in the terms of physics, of psychophysics, or of ecological optics.

Demonstration can be performed by or may require the manipulation of the conditions in a laboratory-controlled environment, to find which among the multiplicity of the perceived dimensions are those which obey the laws of organization, be they shapes of things, temporal events (such as the *Beta* or *Phi* movement (Wertheimer 1912)), or more complex scenes. In this case, attention should be directed to the instrumental (and/or computational) setting for the phenomena to be observed (Brown 1930; Kanizsa and Minguzzi 1984; Kubovy and Pomerantz 1981). The demonstration and the evidence of the validity of the laws governing specific phenomena, in fact, are based on the evidence of their behaviour in different phenomenal conditions.

A classic example of demonstration in the appearance of dynamic structures remains Michotte’s studies on *perceived* causality, showing how the “morphology of movement” (Michotte 1963) arises from specific perceived *spatial–temporal structures* which are not affected by higher-order cognitive processes, such as beliefs and intentions. These experiments show that the factors meaningfully shaping a dynamic event for a perceiver produce the final rendering (for example, the perception of causation between two events). Different outcomes depend on the specific relation that arises between *perceived* direction and velocity, pause and velocity, distance/direction and velocity, etc. In other words, *meaning* (in this case, *causal significance*) is a relational concept intrinsic to the specific relationship ruling the appearance of the dynamic event. The perceived *direction* of the movement in Michotte’s experiments includes merging of two or more units, their distancing and separation, and an emotional dimension of ‘seeking’ or ‘avoiding’ a contact. The perceived *velocity* of the movement conveys different expressive meanings according to whether it takes place more or less rapidly (‘violently’), more or less slowly (‘gently’, ‘smoothly’), and with or without interruptions (‘wait’, ‘hesitation’). In identifying these patterns, a science of appearances strives not only to describe *but also to* “demonstrate” and “explain” the nature of *meaningful* experiences and their ways of appearing, employing methods of subjective judgement “in first person account”. In Husserlian terms, “eidetic” (i.e. structural) analysis, *description,* and *demonstration* of the causation—*where the independent and dependent variables belong to the same domain and are simultaneously observable*—is valid as such: it constitutes a complete explanation. The fact that there is a manipulation also of physical stimuli (as triggers of the phenomena) is largely irrelevant because the description, manipulation and demonstration is performed at the level of appearances only. The relationship between the physical and phenomenal here is understood as mere *correlation*, and plays *no* explanatory role; this contrasts with those explanatory traditions, such as ecological optics, that explicitly invoke some causal dependence between appearances and the chain of external events (Gibson 1979).

From this perspective, experimental phenomenological methodologies must exclude classic discrimination tasks, the "bombardment" of participants with a great number of stimuli in very short presentations, requiring quick reaction times. This standard psychophysical method fails to realize the lessons of phenomenology, instructing the participants without following the procedure suggested by Kanizsa: i.e. to analyze and compare the perceptual fields corresponding to different stimulations so as to identify the general conditions of a phenomenon. An example of the identification of the general conditions of phenomena are the textural perspective (Gibson 1950) or the tunnel effect (Burke 1952). These phenomena show, for example, how the identity that is established in the visual experience mainly depends on the relationships that exist in proximal stimulation, whatever the nature of the real objects from which the stimulation is carried out through the distal stimuli (Kanizsa 1983, Ch. 4). Another important point concerns the participants to the experiments, that should be neither naïve nor expert, but warned, i.e. they have to understand the task very well (Kanizsa 1991, pp. 38–44; and below). Bombarding the participants with stimuli and asking them for quick reaction times are bottom-up procedures that exclude the careful "observation" of the scene, and the training of the participants to observe it and the inner relationships among its parts. *Seeing* (without thinking) requires a certain amount of time and resembles the preliminary work of a painter (Ruskin 1843, vol. IV, Ch. 4) more than a momentary quick glance at a single stimulus. A longer observation of the scene, however, does not necessarily imply the introduction of elements taken from past memories or logical processes, as the traditional methods seem to presuppose, thought these may in fact be introduced or suppressed through the instructions given to participants (see below).

In sum, then, these are the distinctive features of *explanation* in a science of phenomena. First, the observables to be explained are different from the physical stimuli of psychophysics and neurophysiology, rather the proper observables of a science of qualitative phenomena are the appearances themselves. Then, experimental phenomenology searches for *regularities or explanations within the phenomenon itself* rather than relying on extrinsic mechanisms or explanations. Phenomenal explanation is given by a series of relationships among phenomena that have to hold for the phenomenon to occur. In other words, the *explanans* must derive from the phenomenon itself (which from a systematic viewpoint implies a non-reductionist stance).

For example, the task in colour studies is to classify the great multiplicity of colour and light impressions in order to acquire a systematic framework. An ideal phenomenological study should be able to designate colours with such a precise and comprehensible description that a person (of normal visual acuity) can apply it to his/her own internal chromatic world, without needing an external atlas because the descriptive characteristics used refer directly to the qualities of a chromatic world that every person has (Albertazzi and Da Pos 2016; Da Pos and Albertazzi 2010). For example, the order of colours on the basis of their similarities and dissimilarities, and the direct evaluation of colours in relation to the extent of their resemblance to unique colours (Hering 1964), as based on subjective visual inspection alone, evinces well-structured perceptual categories. These categories and their invariant relationships constitute an *explanation* at the phenomenological level (in this case, *opponent colour theory*, Hering 1964), and support the construction of a *perceptual color model* such as the Natural Color System (NCS). The NCS, in fact, represents in a spatial form the inter-relationships between colours as they are qualitatively perceived by humans. Furthermore, the phenomenological observation of colours makes it possible to explain and define specific phenomenological characteristics, such as *pronouncedness* (the accentuated characteristic that makes a colour marked or prototypical), and *insistence* or forcefulness (the fact that a colour appears as most vivid or brightest in the field (Katz 1935)). In so doing, phenomenology *confutes* the common physicalist definition of colour parameters, and it *explains* phenomenal characteristics that are not in the physical stimuli, such as the fact that colours with greater insistence always tend to stand out *before* other colours: since red is more insistent than blue, it appears to stand closer to the beholder (Da Pos and Albertazzi 2010), or the capacity of colours to carry emotional information (Da Pos and Green-Armytage 2007), for instance by appearing cold or warm, as psychophysically (Ou et al. 2004) or phenomenologically identified in NCS (Da Pos and Valenti 2007).

4 The distinctive role of the participants

A particular importance in experimental phenomenology is given to the *competences* required of the research team in choosing the stimuli. For example, because phenomenology deals with *qualitative* phenomena, in the case of acoustic stimuli, be they brief scales, sounds, or melodies, a specific musical knowledge is required. The same holds for visual phenomena, be they lines, abstract patterns, scenes or paintings. Briefly, the research team cannot rely on abilities in engineering or physics only. Consequently, the drawing up of the experimental design requires a broader and more varied researcher expertise than in typical experimental psychophysical testing.

The choice of the participants requires attention as well, because the test is based on and accounts for subjective judgments made from a first person perspective. For this reason, the number of subjects is required to be very high (usually from 50 to 90 participants)—in contrast to the very few subjects required for psychophysical experiments (often as few as 2 to 3). This follows from the nature of the task: subjective judgments require a participant to *evaluate* stimuli—on linguistic or sensory scales or by direct associations (see below). They do not consist in mere comparison between two different atomically detachable percepts, through the intervention of a bottom up or top down cognitive operation. What are evaluated, in fact, are not independent and distinct percepts, but holistic features of experience, for example, a similarity/dissimilarity of phenomena visually presented and given in the field, be they colours, brightness, sounds, and so on. The percepts in present awareness are not detachable parts of the overall presentation, although keeping their distinct forms, or *eidos* (for example, in judging similar patterns in acoustic and visual modalities). In principle, different individuals may give different evaluations, due to a variability depending on many factors, and to demonstrate the objective intersubjectivity of their judgments a high statistical consistency is required. Then, according to the task of the experiment, participants may or must be varied as to expertise, age, gender, etc.

Instructions given to the participants must also be carefully considered (Kanizsa 1991, pp. 38–44). The observation and awareness of colours (or sounds or lighting) similarity or difference, for example, are usually neglected attitudes in the general population. Furthermore, it must be ensured that the evaluations of the participants neither refer to past experience nor draw on associations stored in memory; briefly, subjects are instructed not to reflect or think on what is presented, but to observe it and render their subjective evaluation, which requires training. Stimuli should be as natural as possible although slightly simplified because of the laboratory constraints, and equally so the posture of the participants (no chin rest is required in visual tasks, for example), who have to feel "comfortable".

Laboratory conditions must be considered with extreme attention, because of the relational nature of appearances. In analyses of colour and light, for example, it is preferable to use black textiles behind the screen to avoid any potential reflex. When possible, the use of material equipment instead of simulations is also preferable (for example, the use of a viewing booth—a miniaturized room—rather than a computer screen in the study of colour or light appearances).

5 Distinctive methods of data collection and analysis

The Osgood Semantic Differential (OD) is a classic, linguistically based phenomenological method (Osgood et al. 1957). It aims at determining the semantic content of perceptual phenomena. Because semantic dimensions find ample expression in the adjectival descriptions of natural language, to date differential semantics has been the most common method with which to establish correlations between qualitative aspects of perception and their intersubjective meanings. Osgood's semantic differential uses the associations made by the observer between the perceived object under study and qualities expressed in linguistic form, normally adjectival. The participants are asked whether or not a certain adjective is appropriate on a discrete scale of categorial evaluation (often converted into a pseudo-continuous scale for the purposes of statistical processing). Or again, the subject may be asked to indicate, on a bipolar scale whose extremes are two adjectives regarded as opposites, whether a perceived object is associable more with one than the other. The main advantages of this method are that it (i) enriches the qualitative description of the semantic meaning with a sufficiently long list of adjectives and (ii) makes it possible to group the different scales into factors that can be considered common criteria underlying different perceptual judgments, each of which is characterized by scales closely correlated with each other and little correlated with scales extraneous to that factor.

The use of verbal language to describe sensory experience and to produce judgments about its characteristics, however, involves a rather complex step of a *representative* nature after direct perception. A revised semantic differential procedure, completely excluding the use of verbal language, is the method of sensory scales (Da Pos and Pietto 2010). This method presents the subject with pairs of opposite perceptions in regard to which s/he has to evaluate the extent to which they are associable with the studied target. This evaluation can be made in a visual way (by using for example a pencil (or similar devices) to cut a segment into two parts, whose length correspond to the degree of associability of the target with the two extremes). Other similar systems of evaluations can be conceived in order to satisfy the requirement of a qualitative evaluation of the stimuli without referring to language.

Albertazzi and Da Pos (2016) recently adopted a method for producing and objectifying mental contents. Using dedicated software, the participants were asked to produce colours directly, instead of choosing among a number of colours presented on the screen (which is the usual practice). The procedure allowed the participants to produce those colours that corresponded, *in their minds*, to labels such as green, red, yellow, blue and to labels corresponding to perceptually mixed hues such as orange and lime. This method, besides providing new information on colour (for example on balanced colours among the mixed hues, within the Colour Circle), sheds light on the famous philosophical conundrum on the incommunicability of subjective colour contents that followed the debate started by Wittgenstein in his *Philosophical Investigations* (1993).

Finally, one must ask whether the mathematical models currently available, developed in response to a very different concept of "stimuli", and in whose predictive power current scientific research trusts, are apt or sufficient to *explain* the nature of appearances as given in visual awareness. Sometimes, in fact, researchers working in experimental phenomenology are asked to evaluate whether mathematical models developed by psychophysical researchers on an apparently similar topic (studies on colour, lighting, cross-modality, and so on) fit the results of their work. However, as already mentioned above in connection to transparency, models in the phenomenological and psychophysical traditions apply to radically different types of property (perceptual qualities *vs* physical magnitudes of the stimuli), and do not overlap. The phenomenal percept, in fact, goes far beyond the physical input (spatial–temporal energy patterns). As to the possibility of a *direct* mathematisation of subjective experience, one should take Husserl's negative opinion on this score as strictly conditioned on the mathematics of his time. New mathematical theories may offer possibilities previously not available for a formalization of phenomenal experience, and even consciousness, although for the time being this area of research is still tentative and undeveloped.

6 Example: cross-modal perceptual associations

Experimental phenomenology has recently proved successful in the field of cross-modality. These experiments have targeted, for the general population, the natural associations perceived between shapes and colours, but also between very complex "scenes", such as paintings, poetry, and musical pieces, much closer to our lived experiences than highly simplified stimuli (Albertazzi et al. 2015; Albertazzi et al. 2016a, b). In these cases, the observables were phenomena such as classical musical pieces (Albertazzi et al. 2015; Albertazzi et al. 2016b; Murari et al. 2014), abstract paintings of different styles (Albertazzi et al. 2016a), classical poems (Albertazzi et al. 2016b), etc.

As an example, one of these studies verified whether the general population exhibits cross-modal associations between a series of impasto paintings and a series of clips of classical (guitar) Spanish music, and whether these associations were consistent when evaluated on the same individual. The research also sought to evaluate whether the findings were confirmed on different individuals with different backgrounds and expertise. Briefly, the participants were asked to associate highly complex Gestalten in the visual and acoustic fields (i.e. no single parameters such as pitch and loudness) while listening to the clips. In other words, the task was complex, and closer to the natural global perception of stimuli in the environment (in this case, of an artistic kind). The selection of the paintings and the music clips was discussed with the painter (also an expert musician), who provided a description of the individual art work and the characteristics of the music clip selected. The choice of the paintings was made on the basis of their visual characteristics. The hypothesis was that corresponding to these visual characteristics were similar patterns in the acoustic modality as to vibrato, coloratura and quick tempo: for example, it was expected that a quick tempo would correspond to a very bright red or yellow. Specifically, the hypothesis was that an association, if found, would be due to *multisensorial* and *connotative* dimensions present in both the visual stimuli and the auditory stimuli, such as warmth/coldness, brightness/darkness, sadness/happiness, softness/hardness, etc. Because of the complexity of the stimuli, the authors tried to keep the maximum amount of uniformity possible. The purpose of using fifteen works by the same painter as stimuli was to maintain the same style (impasto painting) and composition (expressionist), notwithstanding the diversity of content and colours (achromatic and mainly chromatic paintings depicting landscapes and figures were tested). The purpose of using fifteen clips from the same repertoire was to maintain the timbre and feel of classical Spanish guitar music. The clips were then chosen for their specific musical features, such as having a strong, hard, agitated sound and a quick tempo (*presto*) (for example, *Asturias* by Albéniz). The experiment was performed in a laboratory with constant and controlled lighting conditions, and the study tested the association in two experiments. One was conducted using the semantic differential on a unidimensional rating scale of adjectives; the other was based on subjective judgments of the direct association between visual and auditory stimuli, asking the subject to choose the image(s) that s/he most naturally associated with that music (for details on the methods see Albertazzi et al. 2015). The tested adjectives with the semantic differential very frequently exhibited a linear pattern in the association between the paintings and the music clips: for example, having low values for ‘happy’, ‘agitated’, ‘quick’, ‘presto’, and strong and high values for ‘sad’, ‘horizontal’, ‘slow’, ‘calm’, and ‘continuous’. Associations between the variables were statistically evaluated by means of the non-parametric “rho” correlation coefficient. The Chi square test for a contingency table was employed to evaluate the associations between the paintings and the music clips. A residual analysis was performed to identify which painting/clip combinations were significant (Canal and Micciolo 2013). The results showed the existence of an association between paintings and music clips among experts in music, experts in painting, and individuals with no artistic training, within each group and overall. The associations were shown to follow from patterns of qualitative similarity present in percepts of different sensory modalities, experienced and evaluated as such by the participants (Albertazzi et al. 2015; Palmer and Schloss 2010; Palmer et al. 2013).

This study is an example of experimental phenomenology with observables (complex, natural, qualitative, intrinsically meaningful stimuli) closer to our everyday experience; with competences in the team required to produce the design and the choice of the stimuli, kind of evaluations (subjective, in first person account), and so on. There are several methodological differences between this study and standard studies in cross-modality because it neither relied on psychophysical methods, such as reaction times (RTs) (as in Marks 1974; see Spence 2011), implicit association test (IAT) (as in Parise and Spence 2012), or forced choice responses (Walker 1987), nor made use of computational models of perception. The aim of the above-mentioned study, in fact, was to remain as close as possible to the perception of natural auditory and visual items. On the basis of these findings, and the fact that no difference was found between expert and non-expert participants, the tested semantic connotations of the stimuli might be considered to play the role of general semantic information cues for the general population.

This and other similar studies on complex scenes (literary texts, abstract paintings, atonal music pieces, oriental calligraphy and pictorial strokes, shells, and other natural "things") show that, despite the complexity, *a science of phenomena or subjective experiences (and their categorization) is possible,* without reducing its "stimuli" to metric features. However, one has to describe, analyse and manipulate proper observables by means of adequate methods, and search for patterns of perceptual invariance, i.e. true phenomenological explanations, rather than physicalist reductions. As recalled more than once, this and other cross-modal studies paradigmatically exemplify the explanatory framework for experimental phenomenology: in fact, they deal with qualitative stimuli as part of everyone's subjective experience (such as melodies, poems, paintings), are evaluated in first person account, without any short reaction times, and conducted either with Osgood's semantic differential, a classic phenomenological method, or by direct association without any use of linguistic means.

7 Conclusion

To summarize, experimental phenomenology is a science based on subjective experience. As a science, it has proper observables (appearances), proper causes (including teleological ones), dependent and independent variables within the same level, based on subjective evaluations in first person accounts, and needs its own specific methods. Experimental phenomenology is not and cannot be reduced to psychophysics or neurophysiology, although it is correlated to them. However outrageous it may sound, physical stimuli must be "bracketed off" from experimental phenomenology, regarded merely as external triggers of appearances. Hopefully, future developments will produce a refinement of methodologies, measurements, models, and a vocabulary to decrease linguistic ambiguity across the plurality of kindred approaches to phenomenology (think of the analogous but distinct concepts of "phenomenology" and "qualitative" in mathematics, philosophy and experimental phenomenology (Albertazzi 2015c)). For instance, experimental phenomenology would benefit from the development of a general theory of subjective space and time, its geometry, and a mathematics able to cope with its qualitative complexity.

For the time being, the temptation to *explain* subjective experiences in terms of behavioural responses to stimuli (in the classical psychophysical sense) or in terms of new neural findings is still strong. For example, the above mentioned findings in cross-modality have been explained in terms of statistical phenomena (a mere adaptive response of the brain to the regularities of the environment), structural phenomena (e.g. the characteristics of the neural systems used to code sensory information), and semantically mediated phenomena (mainly the linguistic influence in stimuli description, for example the use of features such as 'low' and 'high' in referring to pitch variations). None of these "explanations", however, truly *explains* the qualitative aspect of the associations given in first person account by the participants, yet this is precisely what the identification of phenomenal invariants and their laws can do. Although language can be used as a methodological tool in experimental phenomenological tests for these invariants (OD), linguistic pairs of contraries are not assumed to work top-down, influencing or let alone determining the associations. Rather, these associations should be understood as intrinsic to the perceptual experience itself.

Moreover, subjective evaluations in first person account are not "a problem" that the neurocognitive sciences are supposed to solve, through indirect methods, reaction times and psychophysical techniques such as threshold discrimination or computational models assumed to have explanatory power. These methods and techniques pertain to neuro-psychophysical inquiries, but no degree of understanding of the neural basis of perception could explain the *nature* and *meaning* of subjective experience. Furthermore, appeals to an explanatory role for language or culture cannot be a panacea to solve what seems impossible through psychophysical methods. In contrast, researchers in experimental phenomenology face these challenges directly, though they too must constantly struggle against the reductivist lens and the misplaced concreteness of phenomena, either bottom-up or top-down, despite the evidence delivered by their own studies. In fact, no matter how exact the choice of the stimuli, the plausibility of the assumptions and hypotheses, the complex, accurate design, the conduct of the experiments on the basis of an unusually high number of participants, and the statistical analyses may be, the tendency to force and *explain* the results of experimental phenomenology in terms of *physical causes* is still strong among those with preconceptions about the nature of exact science. But what is missing from this strategy is any demonstration or explanation of the functional relationship between physical stimuli and percepts. For these reasons, a phenomenological descriptive theory of experience in first person account is generally still the best option available, not least of which reason being that it is successfully susceptible to experimentation. From this perspective, a label such as *phenomenological psychophysics* (Kubovy and Gepshtein 2002) is misleading; a better term might be *phenomenological psychometry*.

A final remark. In order to be successful, the naturalization of phenomenology envisaged by cognitive neuroscience needs a radical change of viewpoint concerning the concepts of *nature* and *consciousness*, a reform which still seems a long way off. As one may recall, the behaviourists denied that the realm of consciousness could be open to experimental investigation. The claim to do psychology disregarding all reference to consciousness was mainly due to the opinion that it was not determinable as such.

In pursuing this project, however, behaviourism (Watson 1913) nevertheless exposed real problems, that have continued to haunt perceptual science: what is consciousness, whether auditory sensations have the quality of "extension", whether "intensity" is an attribute which can be applied to colour, etc.; what are the appropriate methodologies to adopt for the analysis of consciousness, in what consists the objectivity of subjective judgments in first person account, and so on. A century later, experimental phenomenology shows at last how to begin to address these issues. Nowadays, the behaviorist's fear of being left in "a world of pure psychic" seems no more dreadful than being left in "a world of pure physics".

Acknowledgements I thank Alistair Isaac and two anonymous reviewers for their comments on a previous version of the paper.

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