sciendo

GESTALT THEORY, DOI 10.2478/gth-2019-0024
© 2019 (ISSN 2519-5808); Vol. 41, No. 3, 263–276

Original Contributions - Originalbeiträge

Riccardo Luccio

Perceptual Simplicity: The True Role of Prägnanz and Occam

Rose is a rose is a rose…
Gertrude Stein, *Sacred Emily*

The Moving Finger writes; and, having writ,
Moves on: nor all thy Piety nor Wit
Shall lure it back to cancel half a Line,
Nor all thy Tears wash out a Word of it.
Omar Kayyám, *Rub'ayyāt*

1. Introduction

I must confess that sometimes, when reading theoretical articles on perception, I feel a little uncomfortable. This tends to happen when I think that some classical concept of the history of psychology is being quoted erroneously. This happens often in the field of Gestalttheorie (I must confess that my research is in the Gestalt tradition, even if I am convinced that Gestalt psychology no longer exists as a school). It also happens when historical references are made, in my opinion superficially, if not erroneously. I would therefore like to put a few things back in their proper place (as I see it), which I hasten to point out makes no claim to infallibility. In my opinion, the main problem to pose is related to the Gestalt concept of Prägnanz, often invoked inappropriately when the issue of complexity is addressed. I will also discuss shortly the introduction of Occam in connection with perceptual simplicity. In my opinion, this introduction is erroneous. It must be said that while the point related to Prägnanz often appears too in the same way in other areas, this "original" appeal to Occam, as far as I know, is a novel contribution to the debate.

2. The Problem of Prägnanz

The concept of Prägnanz was introduced for the first time by Wertheimer (1912) in his essays on thought processes in primitive peoples, where he speaks of privileged, *ausgezeichnet*, or "pregnant" zones in connection with numerical series. An actual "law of Prägnanz" was formulated just two years later, during the VI Congress of Experimental Psychology in Göttingen (Wertheimer, 1914), and the same subject was better developed in Wertheimer's 1922/1923 essays. It is here that we find the origins of some of the ambiguities in the concept of Prägnanz that will accompany Gestalt psychology over the years (Kanizsa & Luccio, 1986).

2.1. Prägnanz as Tendency

The main meaning of Prägnanz, according to Wertheimer (1923), is that of the *lawfulness* of the process leading to the formation of visual objects. In Wertheimer's view, the main error of associative psychology was to conceive the perceptual process as accidental or arbitrary, as having a summative and blind associative nature, whereas in his opinion, the term Prägnanz is used to indicate the fact that it actually is a "meaningful" (*sinnvoll*) process. The principles of organization act as precise laws, to which the process is forced to obey overall in the sense of maximum economy and simplicity.

This concept was further developed by Wolfgang Köhler and Kurt Koffka. Köhler developed this law of tendency to Prägnanz within the framework of the so-called "physical Gestalten". According to Köhler (1920, § 250),

> "for if, for a given physical topography given as immutable, a material at the beginning (of our observation) possesses a certain grouping and at all points certain velocities, and if after a short or long time an immutable state is attained, then there will be some particular quality that is prägnant (*ausgezeichnet*), for whose sake the change in him comes to an end. Since in nature in fixed conditioned forms only one way leads from a certain initial state to the corresponding time-independent end-grouping, time-independent pregnant state is hereby distinguished in a simply infinite manifold or series of preceding states".

It should be noted that later Köhler would have preferred to use the word "goodness", a term used principally by Koffka. However, there is another aspect worth noting in Köhler's theorising. In a famous article (Köhler, 1922, p. 531), he writes: "In optics, a circle, a form unique in its properties, frequently tends to result even when the stimulus configuration deviates considerably from such extreme symmetry". Of course, as we will see, this is not the case, and it is the source of numerous misunderstandings.

Koffka (1935, p. 110) defines the "law of Prägnanz" as follows: "psychological organization will always be as 'good' as prevailing conditions allow. In this definition the term 'goodness' is undefined". The definition is admittedly vague. Further (p. 138), he says: "Of several possible organizations, the one which actually occurs will be the one which possesses the best, the most stable shape".

We also have Koffka to thank for elaborating a concept that was to have a significant influence on subsequent developments in the debate: the concept of minimum and maximum simplicity. In his view (*ibidem*, p. 171), "la law of Prägnanz [relates] the resulting stationary organisation to certain maximum-minimum principles […]. A minimum simplicity will be the simplicity of uniformity, a maximum simplicity that of perfect articulation". It is interesting to note that in

the current debate, only the concept of minimum simplicity has been preserved, while that of maximum simplicity has disappeared.

We could add other quotations from the classic works of Gestalt psychology, but we would not be adding anything significant. It would seem that since Wertheimer, Köhler, and Koffka no one has said anything more significant in the context of the Gestalttheorie on the problem. It turned out that a *Vulgata* was affirmed according to which Prägnanz could be considered as an interesting concept, but vague, and one that needed specifying. What appeared most interesting was the Köhler concept of tendency toward a minimum (in Köhler, minimum energy) and the Koffkian principle of minimum simplicity. Indeed, all subsequent theorizations have been expressed in terms of "tendency to the minimum": this is the case of Hochberg and MacAlister (1953), Attneave (1954), Hatfield and Epstein (1985), and above all the very influential work of Pomerantz and Kubovy (1986).

More recently, and mostly, but not exclusively, among those who refer to Bayesian models of perception and those who apply information theory to the study of perception (two categories of non-mutually exclusive scholars), the concept of Prägnanz has become *sic et simpliciter* synonymous with simplicity. In this regard, it is sufficient to cite Feldman (2016) as an example of the former (especially for his excellent review on simplicity in perception) and van der Helm (2017) as an example of the latter.

Now, while conceiving Prägnanz in terms of simplicity may indeed work in many cases, in many others (and perhaps in the majority), other factors emerge. Excellent examples of this are the cases of multistable figures, especially of the figure-background type, as demonstrated by a pupil of Rubin (see Bahnsen, 1928 for a broader review, and for the many examples given, see Kanizsa & Gerbino, 1982; Kanizsa & Luccio, 1996). The factors that lead to the emergence of the figure with respect to the background thus appear to be the convexity of the contours, the symmetry, the equality of amplitude, the equality of the style, and so on, and what is seen as figure does not necessarily have to be simpler than that which appears as ground. A factor often not considered is given by the direction of the visual exploration. When we explore Figure 1 from left to right, the white emerges as figure, but when we explore it from right to left, the white is ground.

In reality, simplicity is only one aspect of Prägnanz. Rausch (1966), who developed this concept most masterfully, sees this multidisciplinary concept as having seven dimensions: 1) regularity or conformity to rules, as opposed to randomness or arbitrariness; 2) autonomy and independence, as opposed to derivation and dependency; 3) integrity and completeness, as opposed to lack and incompleteness; 4) structural simplicity as opposed to structural complexity; 5) complexity

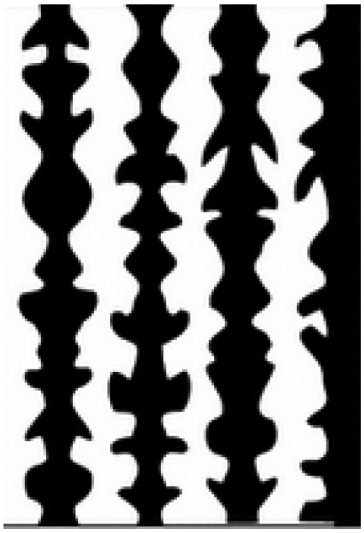

Fig. 1. Exploring Figure 1 from left to right, the white emerges as figure, but exploring it from right to left, the white is ground.

and structural richness, as opposed to structural poverty; 6) richness of expression as opposed to poverty of expression; and 7) fullness of meaning as opposed to absence of meaning.

Notice that among all these dimensions of Prägnanz, only number 4) refers to simplicity and the last three go in the opposite direction, focusing on richness, complexity, and meaningfulness. The fact is that if a tendency does exist in perception, it is toward the stability of the perceptual world, and to achieve this stability, we obtain a world that is anything but constituted by simple and regular forms, in the simplified and misleading sense of the term, in which all the richness of the concept is reduced to simplicity.

One may therefore wonder why the equation Prägnanz = simplicity has been so pervasive. I believe the main reason is linguistic. Since the end of the Second World War, the world of psychology has been an almost exclusively English-speaking world. Now, Rausch's greatest shortcoming was to write in German and never be translated. Moreover, although it may seem incredible, the fundamental essays by Wertheimer (apparent movement and Gestalt laws) were not translated until 2012, and most psychologists are only familiar with the fragments translated (rather inaccurately) by Ellis. The same is true of Köhler's essay on the physical Gestalten.

However, the idea that Prägnanz is a multidimensional construct, in which several coexisting factors contribute to a final perceptive solution, is also presented by other authors. At this point, it is worth mentioning a paper that came from an

unexpected source and, namely, from Bayesian modeling. Froyen, Feldman, and Singh (2015) recently proposed a Bayesian hierarchical model (BHM), according to which a percept is made up of a mixture of different elements, each of which requires, in a hierarchical order, a Bayesian inferential process. I think there are various reasons for being skeptical about this model. If nothing else, one of the typical characteristics of Prägnanz is the immediacy of the salience of the percept. If we had to face a series of inferential processes arranged into a hierarchy before the percept reaches us (?), I fear that there would be serious problems with decision times.

We are talking here of Prägnanz as a tendency, that is, of a process by which we tend to perceive objects with certain characteristics. One misunderstanding must be clarified immediately: in this process, there is no change in the features that make up the percept. It is completely untrue, as is often written, that in the face of a deformed circle, there is a tendency to see a perfect circle. On the contrary, as Rausch (1952) has shown, our system is particularly sensitive to small deviations from the pregnant configuration. As anyone who struggles to have picture frames hanging perfectly straight is well aware, the slightest deviation from the vertical position is immediately noticeable, but no one can tell the difference between an angle of 79° and one of 77°. If the outline of a circle has a small gap, there is no tendency to see an entire circle: it is the gap that emerges clearly (Luccio & Vardabasso, 1986). Of course, in the field of memory, the opposite occurs, with the memory trace changing in the direction of a maximally prägnant outcome (Goldmeier, 1982). This is not the case, however, with perception.

The same could be said about another story in the same vein that we are often told: the "tendency to right angles". This story may have started life in empiricist circles and then gained great popularity with the so-called theory of "carpentered environments", according to which we should tend to see all the angles as straight because from birth, we are accustomed to living in dwellings with all the sides square and arranged at right angles (Segall, Campbell, & Herskovitz, 1966). As far as our interests are concerned, the regression to right angles should be a manifestation of the tendency to the Prägnanz – as we know, unlike acute and obtuse angles, right angles are pregnant. However, look at Figure 2, which shows a variant of Ehrenstein's (1925) famous illusion. The regression to right angles is absolutely invisible, while the circle, a figure paradigmatically pregnant, now appears deformed and no longer pregnant at all!

2.2. Prägnanz as Singularity

However, Wertheimer gives another meaning to Prägnanz. When the "tendency" is a process, Prägnanz is also considered a property of some percepts, unlike others. One may ask whether it was a good idea to give the same name to a property

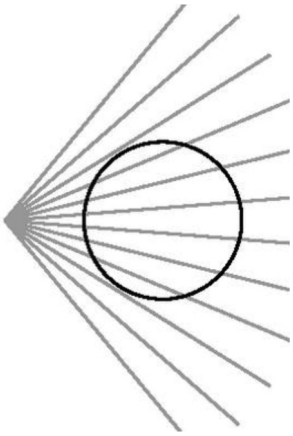

Fig. 2. Ehrenstein's illusion.

and to a process, but there it is, and here lies the origin of so many of the ambiguities that have accompanied the history of the problem (Kanizsa & Luccio, 1966). Prägnanz as property means *Ausgezeichnetheit*, a quality or property that certain perceptual configurations possess, while others do not: this renders such configurations "unique", "singular", and "privileged". For this reason, in 1972 (f. 39), in the English translation of his 1936 paper on similarity, a pupil of Wertheimer, Erich Goldmeier, suggested translating Prägnanz with *singularity*, indicating special values of the parameters describing the features of a visual pattern. For instance, the vertical or horizontal orientation of a straight line is singular, an inclination of 10° is not.

This is worth remembering, also because in a recent work Koenderink, van Doorn, and Pinna (2018, p. 8) point out "Gestalts are not singular; they are experienced as instances of an enveloping taxonomy, a 'style'". On the previous page (p. 7) they had just said that, "a good Gestalt is both simple and unique […] 'Unique' means that nothing can be added or omitted without causing a qualitative change". I don't think this is a satisfactory definition of "simple". No one would agree that eliminating the mouth from the Mona Lisa (the famous "smile") and thereby obtaining a radically different configuration is a demonstration of the "simplicity" of the Gioconda. What does "unique" mean, if not singular in the sense of Goldmeier?

Note that the meaning of singular is at least fourfold (leaving out specific meanings in mathematics and physics). According to Merriam-Webster, singular means a) individual; b) exceptional; c) unusual; or d) peculiar/odd. When Koenderink et al. say that "Gestalts are not singular", precisely which meaning are they referring to? Is there no contradiction with the alleged "uniqueness"?

The fact is that according to these authors, the concept of Prägnanz is equivalent to the ethological concept of "releaser". So they say (p. 9): "The famous example is the releaser 'mammal' for the female tick (which is blind and deaf): *the combination of warmth and the smell of butyric acid*. Compared to any dictionary definition of 'mammal', this is remarkably simple and unique". I must agree on this point alone with Koenderink et al.: their concept of Prägnanz is certainly singular (in the fourth sense), but far from being prägnant. However, let us now turn to Occam.

3. A Proper Place for Occam

There is an old game, "What did so-and-so really say?", which in my opinion is not particularly interesting. The point was raised by Westheimer (2008) in a careful historical analysis of the original contributions by Bayes and Helmholtz compared with the positions attributed to them today. From a historical point of view, I might also mention that some authors (and in particular Stigler (1982), with a series of stringent arguments) have questioned whether the current supporters of the Bayesian approach are faithful to what Bayes actually said, since his posthumous work is very difficult to interpret. What Stigler clearly demonstrates is that, by translating the thought of Bayes into modern terms, it is necessary to postulate a flat distribution of the priors. Of course, this is more of a problem for historians of statistics; we are dealing with the Bayes formula as it has been worked out until today.

I must say that both arguments are not really of much relevance to this discussion, while they really are of great value to the historian of ideas. As for Stigler's investigation, shared by Westheimer (2008), into "what [Bayes] really said", Westheimer himself poses the same question about Helmholtz. Unlike Bayes, however, Helmholtz did indeed say certain things (see, in particular, Helmholtz, 1856, 1878, and especially the introduction to the *Handbuch,* 1867), and he said them at the height of his scientific maturity. As Westheimer points out, when Helmholz mitigated his positions for philosophical, academic and/or political reasons, this does not mean that we are not entirely legitimized in referring to the texts as they originally were, also because Helmholtz did not consider changing them for almost all of his life.

Something similar could be said about Occam: what is important is not what really Occam said, but the meaning of Occam today. In fact, in my opinion, the authors who have brought into play William Ockham (Occam in Latin), the *Venerabilis Inceptor*, have not only given him views that Occam never put forward but have had him say things that are the exact opposite to what he actually thought. Perhaps, I am being pedantic here, but to hear Occam described as a "scholastic philosopher", without any further specification (Balasubramanian, 2005), makes one cringe a little. It is true that he was trained during the so-called

third period of Scholasticism, but he has passed into history (and into the textbooks of philosophy) as a *destroyer* of Scholasticism. It is a bit like saying that Martin Luther was educated in the Catholic religion and after graduating as an Augustinian friar became a Catholic theologian.

Let us come to the principle of parsimony, mentioned so often by those who have brought Occam into this debate. The principle certainly did not originate with Occam: it can be found in numerous other authors, from Aristotle to Priscian, and, in a period closer to that of the *Venerabilis Inceptor*, in Duns Scotus. As for Occam himself, we are acquainted with various aphorisms on this subject that have been attributed to him, each with small variations. The only ones we can definitely attribute to him are "*frustra fit per plura quod potest fieri per pauciora*" (in vain you have for many what you may have for less), "*pluralitas non est ponenda sine necessitate*" (do not suppose more things without necessity, which is found in the treatise *De Sacramento Altaris*), or even more probably "*sufficiunt singularia, et ita tales res universales omnino frustra ponuntur*" (singular things are enough, so that such universal things are generally supposed without reason). The famous "*Entia non sunt ponenda praeter necessitatem*" (entities must not be supposed beyond necessity) should instead be in Clauberg, not until the 17th century. The popular expression "Occam's razor", despite often being expressed in Latin (*novacula Occami*), was actually coined by Sir William Hamilton in the mid-nineteenth century. The obligatory reference in this discussion is Thorburn (1918).

This is not the place to discuss the complex philosophy of Occam, and for this, we refer to the specific studies on his thought (see, for example, Baudry, 1949). Here we shall just mention a few points that I think it is essential to be clear about. To understand the crux of the problem, in the first place, we need to consider Occam's gnoseology. According to Occam, there are two ways of knowing about the objects of the world: intuitive knowledge (*notitia intuitiva*) and abstract knowledge (*notitia abstractiva*). Intuitive knowledge concerns what comes by way of our senses, while abstract knowledge (which derives from the former) concerns only what is present in our mind. The important thing to stress is that for Occam, the product of intuitive knowledge cannot be questioned: it is what it is. However (and Occam is quite explicit about this, particularly in the *Prologus* of the *Commentarium in Sententias*), we can discuss the process by which we arrive at this product, though not the product itself.

The second point concerns the principle of parsimony. Apart from the aforementioned aphorisms, and in spite of the difficulty in putting them in precise relation to some specific position held by the *Venerabilis Inceptor*, it is clear that in Occam, the principle of parsimony, the *novacula*, refers specifically to the controversy between nominalism and realism. For Occam, a supporter of nominalism, the *entia* that were not to be multiplied were the universals, which for him were not real.

However for Bayes (and Helmholtz), one thing is what Occam actually intended, what today is Occam's razor, a principle widely accepted by contemporary epistemology (see, for example, Quine, 1981), but certainly not related to the problem of universals. Here the razor is used to indicate the need to favor simple scientific theories as opposed to more complex ones. Moreover, as noted by Johnsen (2014, p. 980), "more modest theories, ones whose consequences do not greatly outrun what is needed to explain the relevant data, are, ceteris paribus, superior to less modest ones".

In any case, even in contemporary epistemology, the razor is used as a tool for criticizing processes (here, scientific theories), and not the products of the processes. However, this is exactly the opposite of what is done in the discussion of the relationship between simplicity and Bayesian modeling (BM). Authors such as van der Helm start with the product of the perceptual process and argue that the simplest percept is preferable to the more complex. Better, he says (van der Helm, 2017, p. 1274) that the minimum description length principle by Rissanen (1978) "can be seen as a modern version of Occam's razor, which, by way of paraphrase, states that simpler models are better". However, this is false. Occam's razor states that the hypothesized simpler processes are better, regardless of the simplicity of the resulting products. The resulting length might be longer, but when the process of description is simpler, we must prefer it. (This criticism of course does not apply to those who use Occam's razor to test Bayesian principles; cfr. Ma, 2012 or Wolpert, 1993, which however denies that Bayesian models necessarily include Occamian factors.)

In my opinion, MacKay's account of the problem, which is partly erroneous and partly ambiguous, is a perfect illustration of the misunderstanding (2003, pp. 243 ssg.). He starts with a classic example of amodal completion (Figure 3, modified). Looking at the pattern in a), we clearly see two rectangles, one partially hidden from the other, as in b), and not three rectangles, as in c).

According to MacKay, this perceptual result is due to the fact that the two-rectangular configuration is simpler than the three-rectangular configuration, and for Occam's razor, we "accept the simplest explanation that fits the data", because the razor "is the principle that states a preference for simple theories". Here is the error. The theory to choose is the one relative to the process that leads to this perception, but seeing two or three rectangles is not the process, it is the *result* of the process. In line with Occam's razor, we can favor the simplest among different theories, but not among perceptual results, which are what they are, irrespective of the hypothetical process that generates them. In this, Occam was very clear. The *notitia intuitiva*, the percept, cannot be questioned, but the process that generates it can.

It should be pointed out, though, that when defining something like "Occamian", the authors tend to be rather ambiguous, referring sometimes to a concept,

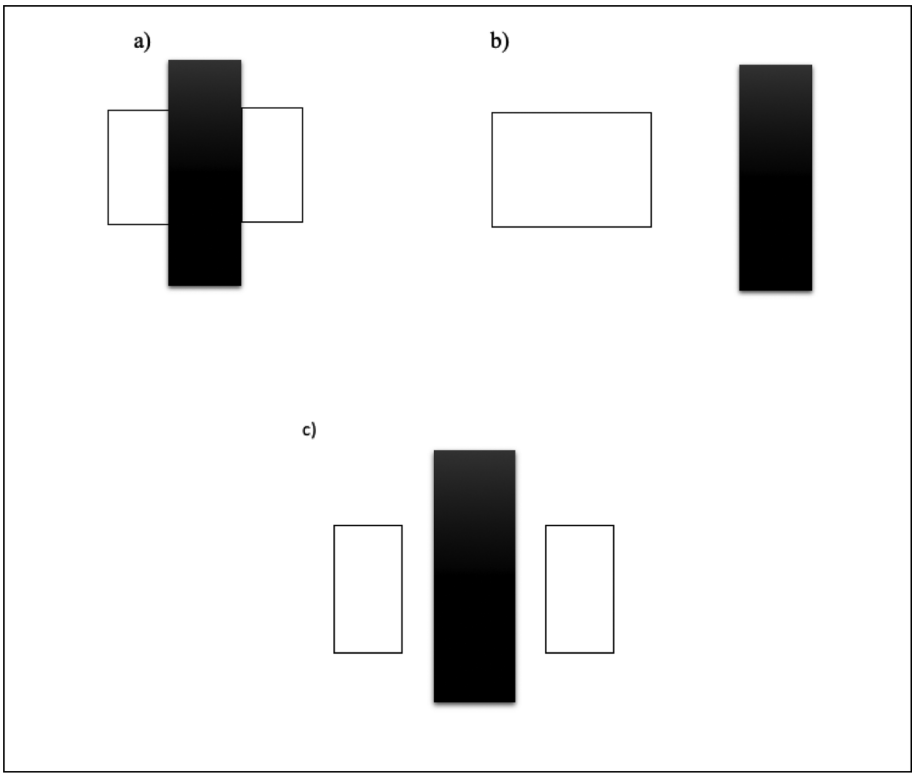

Fig. 3. Amodal completion. Spontaneously, the observer see in (a) the two rectangles, in (b) with the white partially occluded by the black one, and only with an effort of scrutiny, one can see the three rectangle in (c).

sometimes to a model, and sometimes to a process; the unequivocal reference, however, is always to the first mentioned, as shown by the parallelism often made with Prägnanz.

It should also be noted that Occam's razor cannot be used in absolute terms but only as a criterion of choice, between two theories or two models. In other words, I can use Occam's razor to accept, for example, the minimal lenght description (MLD) model of Rissanen (1978), but only if it allows me to exclude other models, because they are less simple. However, it makes no sense if it refers to a percept which, whether it be simple or complex, is still what it is. "Rose is a rose is a rose ...".

I shall end by observing that the *Venerabilis Inceptor* was a polemical spirit. In the controversy on poverty that especially opposed him to Pope John XXII (and which culminated in 1328 in his excommunication and flight from Avignon), he wrote on papal texts and collaborators of the pope: "[there are] many heretical, erroneous theses, foolish, ridiculous, fantastic, senseless, defamatory of the

orthodox faith, clearly contrary to good morals, natural reason, experience and fraternal charity" (Baudry, 1926, p. 202). Reading this, I really would not care to imagine what he would have to say today about the way he is introduced into a discussion that concerns him so little.

For the sake of clarity, the problem is not about what Occam actually said. However as absurd it would be to claim that Bayesian is an approach that denies the relevance of the a priori probability in the evaluation of the posterior or Helmholtzian is an approach that denies the role of inferential processes in perception, so it is erroneous to qualify Occamian as an approach that considers the complexity of the product of a theory, and not of the theory.

4. Conclusion

In this work, I have tried to show how concepts that have a long and interesting history are used today in a way that tends to be imprecise, distorted, misleading and often simply wrong. We have taken a closer look here at the use made of the concepts of Prägnanz and Occam's razor: both are used to define what is simple in perception. In my opinion, as far as the former concept is concerned, it must be said that as demonstrated by Rausch for more than half a century, the concept of pregnancy is multidimensional and does not absolutely coincide with that of simplicity, which represents only one of its elements. As regards the latter concept, it must be said that Occam's razor can only be applied to choose among theories that explain why we have a certain perceptual result, but not to the latter.

In conclusion, let us take a look at Figure 4, originally by Rausch and extensively studied by Piesbergen (1991). If we consider only the first configuration a), we see two parallel oblique lines and two points located at some distance from their ends. The two points are objectively placed on the continuation of the two parallel oblique lines but clearly appear shifted toward the right. The variations in the figure, from b) to f), show some differences in the entity due to the effect of the illusion.

Piesbergen has demonstrated the effect of four factors on the illusion: a) the Prägnanzstufe (degree of Prägnanz of the form [parallelogram/rectangle]); b) the Prägnanzstufe of the figure (open/closed); c) the angle of inclination; and d) the distance of the end of the line from the point of destination (short/long). Furthermore, each of these main factors or effects can interact with others.

Why is this illusion so instructive in my opinion? The overall configuration appears extremely simple, yet its overall Prägnanzstufe is certainly not high – simplicity itself, I repeat, is not synonymous with pregnancy. However, in its simplicity, there are several factors that act in isolation or interact with each other for the final result.

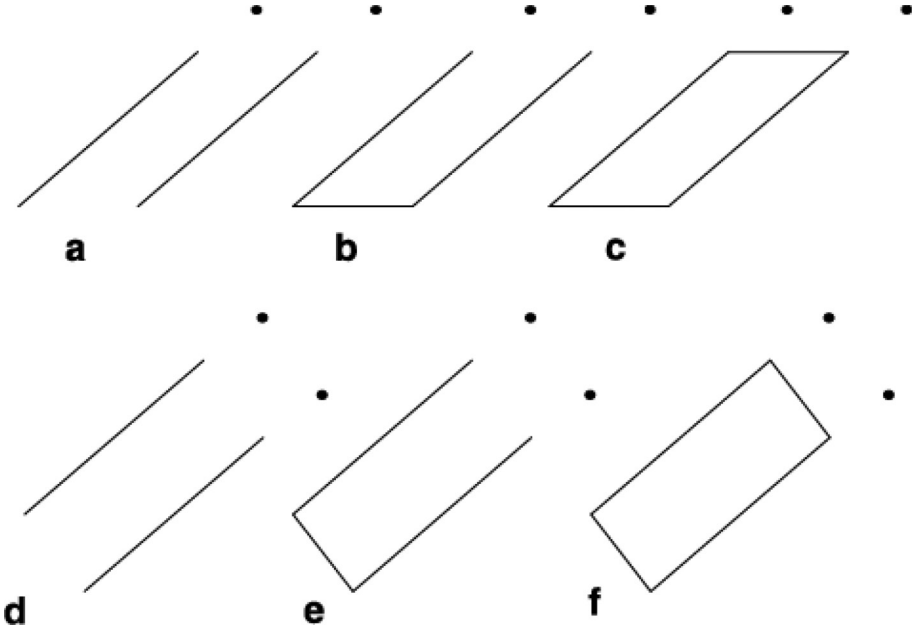

Fig. 4. The parallelogram – dots illusion (from Rausch and Piesbergen).

In short, I believe that we still lack an adequate definition of simplicity and Prägnanz. I myself am unable to provide it, and as far as Prägnanz is concerned, I do not even believe that it is possible to give an exhaustive definition. As for simplicity, it seems to me that what has been done so far with theories derived from information theory and especially with the structural information theory developed by Leeuwenberg (1968) and his students is definitely on the right track – but the journey looks to be a long one.

I do wonder sometimes what kind of world some of my colleagues live in. Mine consists of quasi-circles, frames of paintings not perfectly aligned with the corners of the room, and imperfect squares. I am perfectly well aware of these deviations from simplicity and regularity, but they do not affect the stability of my perceptual world in the slightest. Moreover, the smaller the deviations from regularity and simplicity, the more evident they are. A tendency to Prägnanz, as so many authors would insist, should consist of a tendency to cancel out the slightest deviations from simplicity and not to make them more evident, which is what happens in my world.

Summary

In recent years, the concept of simplicity in perception has acquired a leading role, above all thanks to scholars linked to Bayesian modeling and to theories like structural information theory derived from information theory. Unfortunately, two misleading ideas made their way into the discussion: that in perception, simplicity is equivalent to Prägnanz

and that Occam's razor plays a role in the simplicity of percepts. Here it is shown that in Gestalt theory, simplicity is only one of the factors of Prägnanz and that the use of Occam's razor is improper, because it applies only to the theories that generate, in this case, a percept, and not to the product of the theory.
Keywords: Simplicity, Prägnanz, Gestalttheorie, Occam's razor.

Einfachheit in der Wahrnehmung: Die Rolle von Prägnanz und Occam

Zusammenfassung:
In den letzten Jahren hat das Konzept der Einfachheit in der Wahrnehmung eine führende Rolle erlangt, vor allem dank der Gelehrten, die mit der Bayes'schen Modellierung und mit Theorien wie der aus der Informationstheorie abgeleiteten Strukturgleichungstheorie verbunden sind. Leider kamen zwei irreführende Ideen in die Diskussion: In der Wahrnehmung ist Einfachheit gleichbedeutend mit Prägnanz, und Occams Rasiermesser spielt eine Rolle in der Einfachheit der Wahrnehmung. Hier wird gezeigt, dass in der Gestalttheorie Einfachheit nur einer der Faktoren von Prägnanz ist und dass die Verwendung von Occams Rasiermesser unangemessen ist, da sie nur für die Theorien gilt, die in diesem Fall eine Wahrnehmung erzeugen, und nicht für Produkt der Theorie.
Schlüsselwörter: Einfachheit, Prägnanz, Occam´s Rasiermesser.

References

Attneave, F. (1954). Some informational aspects of visual perception. *Psychological Review, 61*, 183–193.

Bahnsen, P. (1928). Eine Untersuchung über Symmetrie und Asymmetrie bei visuellen Wahrnehmungen. *Zeitschrift für Psychologie, 108*, 129–154.

Balasubramanian, V. (2005). MDL, Bayesian inference, and the geometry of the space of probability distributions. In P. D. Grünwald, I. J. Myung, & M. A. Pitt (Eds.), *Advances in minimum description length: Theory and applications* (pp. 81–99). Cambridge, MA: MIT Press.

Baudry, L. (1926). La lettre de Guillaume d'Occam aux chapitre d'Assise (Epistola ad fratres minores in capitulo apud Assisium congragatos). *Revue d'Histoire Franciscaine, 3*, 185–215.

Baudry, L. (1949). *Guillaume d'Occam*. Paris, France: Vrin.

Ehrenstein, W. (1925). Versuche über die Beziehungen zwischen Bewegungs- und Gestaltwahrnehmung. *Zeitschrift für Psychologie, 96*, 305–352.

Feldman, J. (2016). The simplicity principle in perception and cognition. *WIREs Cognitive Science, 7*, 330–340. doi:10.1002/wcs.1406

Froyen, V., Feldman, J., & Singh, M. (2015). Bayesian hierarchical grouping: Perceptual grouping as mixture estimation. *Psychological Review, 127*, 575–597. doi:0033-295X/15/$12.00

Goldmeier, E. (1936). Über Ähnlichkeit bei gesehenen Figuren. *Psychologische Forschung, 15*, 146–208 [eng. tr. Similarity in Visually Perceived Forms. *Psychological Issues, 8*, n. 1, 1972, Non. N. 29].

Goldmeier, E. (1982). *The memory trace: Its transformation and its fate*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Hochberg, J., & MacAlister, E. (1953). A quantitative approach to figural goodness. *Journal of Experimental Psychology, 46*, 361–364.

Johnsen, B. C. (2014). Reclaiming Quine's epistemology. *Synthese, 191*, 961–988.

Kanizsa, G., & Gerbino, W. (1982). Amodal completion: Seeing or thinking? In J. Beck (Ed.), *Organization and representation in perception*. Hillsdale, NJ: LEA.

Kanizsa, G., & Luccio, R. (1986). Die Doppeldeutigkeiten der Prägnanz. *Gestalt Theory, 8*, 99–135.

Kanizsa, G., & Luccio, R. (1996). Multistability as a Research Tool in Experimental Phenomenology. in: P. Kruse & M. Stadler (eds), *Ambiguity in mInd and Nature*. Berlin: Springer, 47-68.

Koenderink, J., van Doorn, A., & Pinna, B. (2018). Measures of Prägnanz. *Gestalt Theory, 40*, 7–28. doi:10.2478/gth-2018-0002.

Koffka, K. (1935). *Principles of Gestalt psychology*. London, England: Routledge and Kegan Paul.
Köhler, W. (1920). *Die physischen Gestalten in Ruhe und im stationären Zustand: Eine naturphilosophische Untersuchung*. Braunschweig, Germany: Friedr. Vieweg and Sohn.
Köhler, W. (1922). Gestaltprobleme und Anfänge einer Gestalttheorie. *Jahresberichte über die gesamte Physiologie und experimentelle Pharmakologie, 3,* 512–539.
Luccio, R., & Vardabasso, F. (1986). La percezione di figure interrotte. *Ricerche di Psicologia, 14*(1), 119–137.
Ma, W. J. (2012). Organizing probabilistic models of perception, *Trends in Cognitive Sciences, 16*, 511–518.
MacKay, D. J. C. (2003). *Information theory, inference, and learning algorithms*. Cambridge, England: Cambridge University Press.
Piesbergen, C. (1991). Experimentelle Untersuchungen zur Parallelogramm-Punkttäuschung. *Gestalt Theory, 13*(4), 232–242.
Pomerantz, J. R., & Kubovy, M. (1986). Theoretical approaches to perceptual organization: Simplicity and likelihood principles. In K. R. Boff, L. Kaufman, & J. P. Thomas (Eds.), *Handbook of perception and human performance, Vol. 2. Cognitive processes and performance* (pp. 1–46). Oxford, England: John Wiley & Sons.
Quine, W. V. (1981). *Theories and things*. Cambridge, MA: Harvard University Press.
Rausch, E. (1952). *Struktur und Metrik figural-optischer Wahrnehmung*. Frankfurt, Germany: Kramer.
Rausch, E. (1966). Das Eigenschaftsproblem in der Gestalttheorie der Wahrnehmung. In W. Metzger & H. Erke (Eds.), *Handbuch der Psychologie*. Bd 1/1. *Wahrnehmung und Bewußtsein*. Göttingen, Germany: Hogrefe.
Rissanen, J. (1978). Modelling by the shortest data description. *Automatica, 14*, 465–471. doi:10.1016/0005-1098(78)90005-5
Rissanen, J. (1989). *Stochastic complexity in statistical inquiry theory*. River Edge, NJ: World Scientific Publishing Co.
Segall, M. H., Campbell, D. T., & Herskovitz, J. (1966). *The influence of the culture on visual perception*. Indianapolis, IN: Bobbs-Merrill.
Stigler, S. M. (1982). Thomas Bayes's Bayesian inference. *Journal of the Royal Statistical Society A, 145*, 250–258.
Thorburn, W. M. (1918). The myth of Occam's razor. *Mind, 27*, 345–353.
van der Helm, P. A. (2017). On Bayesian simplicity in human visual perceptual organization. *Perception, 46*(1), 1269–1282. doi:10.1177/0301006617719604
von Helmholtz, H. (1855/1903). Über das Sehen des Menschen. In *Vorträge und Reden* (pp. 85–117). Braunschweig, Germany: Vieweg.
von Helmholtz, H. (1867). *Handbuch der physiologischen Optik*. Leipzig, Germany: Lieferung.
von Helmholtz, H. (1878/1903). Die Tatsachen in der Wahrnehmung, in *Vorträge und Reden* (213-247). Braunschweig, Germany: Vieweg.
Wertheimer, M. (1912). Über das Denken der Naturvölker, *Zeitschrift für Psychologie, 60*, 321–368.
Wertheimer, M. (1914). Diskussion zum Vortrag von Benussi: Kinematohaptische Scheinbewegung und Auffassungsformung. In F. Schumann (Ed.), *Bericht über den VI. Kongreß für experimentelle Psychologie. I. Teil*. Leipzig, Germany: Barth, 11.
Wertheimer, M. (1922). Untersuchungen zur Lehre von der Gestalt I, *Psychologische Forschung, 1*, 47–58.
Wertheimer, M. (1923). Untersuchungen zur Lehre von der Gestalt II, *Psychologische Forschung, 4*, 301–350.
Wertheimer, M. (2012). *On perceived motion and figural organization*. Cambridge, MA: The MIT Press [L. Spillmann Ed.].
Westheimer, G. (2008). Was Helmholtz a Bayesian? *Perception, 37*, 642–650. doi:10.1068/p5973
Wolpert, D. H. (1993). On the Bayesian "Occam factors" argument for Occam's razor. *SFI Working Paper*: 1993-10-065.

Riccardo Luccio, born in 1941, emeritus of Psychometrics in Trieste, has taught History of Psychology and Psychometrics, mainly in the Universities of Florence and Trieste, and retired in 2011. He works on visual perception, mathematical models, and history of psychology. He is the author of about 300 papers and 12 scientific books. In 1987, he was awarded the Wolfgang Metzger Prize and in 1999, the Golden Medal for Science of the Italian Republic.
Address: Department of Life Sciences, Psychological Section "G. Kanizsa", University of Trieste, via Weiss, 2 (Pal. Q) – st. T16, I-34128, Trieste, Italy.
E-mail: rluccio@units.it