The emergence of insight in problem solving

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This paper relates the notion of insight in problem solving to the current debate concerning epistemological and ontological emergence. The psychological school that stresses the relevance of insight for solving certain types of problems has been Gestalt theory. In classical Gestaltist writings, however, there is not much information about the question of whether or not insights are wholes with emergent properties. It is only in the more recent literature that this question is formulated. The present paper provides examples of insight problems (section I). Then it shows how insight was characterized in Gestalt theoretical writings, in particular by K. Duncker (II), and how this relates to the philosophical debate on emergence (III). After presenting two stances in research on problem solving that resemble the positions arguing for epistemological and ontological emergence (IV), I conclude with suggesting an alternative by complementing the basic part-whole framework with bidirectional processes found in perceptual reversals of ambiguous figures (V). In so doing I suggest to understand insight as 'intersight,' which is not an emergent whole, but a hinge or switch that mediates between two or more part-whole structures (here: problem and solution).

INSIGHT PROBLEM SOLVING GESTALT THEORY DUNCKER EMERGENCE

I. Introduction

Imagine that after a long and adventurous journey, in which you've died countless times, you finally reach the exit out of your nightmare. You've wandered through a *selva oscura* with spikes and spiders, you've found your way around cruel machines in factory buildings, and you've tricked the laws of magnetism in order to proceed and not to die again. Now you can clearly see the way out, it's just a few more steps to safety. But as soon as you approach the exit, the pull of gravity switches and throws you upwards, right into a turning buzz saw. And there you painfully die once more, just to awake again where you stood seconds ago. What should you do now? Which idea comes to your mind? How many more failures will it take to find the solution? For one last puzzle, the award-winning video game *Limbo* is teasing out your wits. But after several attempts, you've figured it out and float into the light.

Change of scene. You're a graduate student in need of quick money. You register for an experiment at the department of psychology. There, the team of scientists ask you to sit down in a room and place a sheet of paper in front of you. On it, there are nine dots in a 3×3 pattern, with only one instruction: 'Please connect the dots with no more than four straight lines and without lifting your pen'. Initially, you think it's easy. You try it. You fail. You try and fail again and again. Is this possible at all? Are they actually testing your frustration tolerance and not your finding of the solution? Did they forget to give you more information? After a while, you suddenly realize that they gave you all the information you needed. The misleading factor was only part of your own mind.

And at last you're a lieutenant, riding on a horse and being part of a caravan that is travelling in the desert. Next to you is another lieutenant on a horse, and in front of you an oasis comes into sight. The wealthy master of the caravan tells you and your colleague: «To that one of you whose horse reaches the oasis *last*, I will donate this donkey laden with gold» (Wertheimer 2010, 55). Both of you ride towards the oasis, but you continuously slow down and finally wait in the shadow, reluctant to enter the oasis before the other does. You don't know how to win this challenge. After a while, a wise man from the caravan comes to you and realizes the problem. He whispers something to both of you, two words only, and suddenly you both jump on the horses and race as fast as possible to enter the oasis. What did the wise man say? Which idea did he invoke in you? How could you fail to cognize the requirements for mastering the situation?

These are typical examples of how a person struggles with a problem and how, seemingly out of a sudden, he/she gains an insight that ideally leads to a possible solution. Although such Aha!-moments are familiar phenomenological experiences in which the problem solver's level of happiness and motivation rises due to an increased dopamine production in the brain (cf. Tik et al. 2018), the cognitive and philosophical explanation of how and why an insight comes into being is still unclear (cf. Davidson 1995, 125; Mayer 1995, 10). In this paper, I want to address the question of whether or not we should regard insight as an emergent phenomenon in the epistemological and/or ontological sense of emergence. In particular, I focus on the notion of insight as it was described in the classical Gestaltist literature on problem solving and productive thinking. This can be a starting point for further investigations into more recent conceptions of insight and their relation to emergentism.

To do so, it is first of all important to explain what the notion of insight amounts to in Gestalt psychology, which I show using the example of K. Duncker (2). Then I turn to the current debate on epistemological and ontological emergence and

its implications for our understanding of reality as being ontologically 'flat' or 'hierarchical' (3). In the third section, both approaches are combined in the question of whether the phenomenon of insight should be interpreted as being ontologically and/or epistemologically emergent (4). Finally, I conclude by suggesting a Gestalt-inspired model that could avoid both options. This model involves a rethinking of insight as an interface between problem and problem solver, i.e. by understanding insight as 'intersight' (5).

II. The phenomenon of Insight in Gestaltist Problem Solving

The second example above-mentioned describes the famous nine-dot problem, which is a typical insight problem. Unlike transformation problems like the Rubik's Cube that can be solved by following a sequence of steps towards a goal state of which we have a clear image from the beginning, here we have to literally think 'outside the box' and extend the straight lines we draw beyond the position of the dots. Thus the correct solution of an insight problem is «initially not visible or imaginable» (Weller 2011, 424). Only due to a seemingly spontaneous insight we can connect the dots according to the given instructions, which is all but obvious in the beginning. In other words,

> [...] difficulty arises because people make an incorrect assumption (adopt an inappropriate interpretation) – namely, that lines should begin and end on dots (i.e., that lines should be confined to the area defined by the dots). The problem cannot be solved with this constraint. Solving this type of problem may require doing something novel [...]. (Dominowski et al. 1995, 43)

There are different kinds of insight problems. Apart from *spatial insight problems*, to which also the nine-dot problem belongs, there are *object-use problems*, which «typically involve multiple objects and require one object be used in a relatively novel manner to achieve the goal (which might be arbitrary itself)» (Dominowski et al. 1995, 43). An example would be the above-mentioned puzzle in *Limbo*, where the player has to use the shifting forces of gravity and in so doing activate an arrow board while falling down to finish the game. Furthermore, there are *verbal insight problems*, i.e. problem situations that more or less depend on the way they are presented and the concepts we (fail to) activate to solve them (Dominowski et al. 1995, 43f.). The third example from the introduction is of this type: the master explicitly stresses that *the horses* should reach the oasis last, not the riders. So what is the two-word suggestion of the wise man? 'Change horses!' of course. To these types we can add everyday insight problems, i.e. problems that are not created for a specific setting like a laboratory experiment or a game, but encountered in real life (cf. Ericsson et al. 1994), such as finding ideas for a project, inventing something, or the moment we come to understand why a person acts in a specific way. Regardless of the type, however, there are major experiential characteristics that make it possible to identify insight as an emergent phenomenon. Among others, it involves

> (1) *suddenness*, wherein insight seems to happen abruptly through a quantum leap of understanding instead of some gradual incremental process; (2) *spontaneity*, wherein insight seems to happen internally of its own accord without the intention or effort of an instigating agent; (3) *unexpectedness*, wherein insight happens by surprise and without warning; and (4) *satisfaction*, whereby insight elegantly fulfills a previously unresolved need, culminating in a triumphant 'Aha!' experience. (Seifert et al. 1995, 67)

Characteristics like these legitimate the question if and how insight is classifiable as being epistemologically or even ontologically emergent. Prior to this, however, it is worthwhile to take a closer look at the psychological school that heavily influenced later discussions of this notion in cognitive psychology, problem solving and beyond: the pre-war Berlin school of Gestalt theory (cf. on its history Ash 1995). Gestalt theoretical research back then was and still is primarily focused on human perception, in particular on the relations between parts and wholes (based on principles/laws that make a whole – the Gestalt – determine the function and appearance of its parts) as well as figure and ground. Whereas in the conclusion I suggest to rethink the phenomenon of insight as 'intersight' inspired by figure-ground research, it is mainly the first relation that has been transferred by Gestalt theory from the field of perception to the field of problem solving. As Bassok (2012, 416) puts it,

> The Gestalt psychologists extended the organizational principles of visual perception to the domain of problem solving. They showed that various visual aspects of the problem, as well the solver's prior knowledge, affect how people understand problems and, therefore, generate problem solutions. The principles of visual perception (e.g., proximity, closure, grouping, good continuation) are directly relevant to problem solving when the physical layout of the problem, or a diagram that accompanies the problem description, elicits inferences that solvers include in their problem representations.

Thus one of Gestalt theory's central axioms for problem solving is that our mental representation of a problem is similar to a (Gestalt-)percept from an empirical origin. Both are governed by the same principles or laws. The visualization of a problem and the cognitive acts with which we operate on this visual representation can lead to insights concerning the solution for a problem. This axiom is clarified, for example, in K. Duncker's seminal work on problem solving. Like many researchers after him, Duncker defines a problem as a path or trajectory that begins with a given situation and ends with a desired situation (the goal). The transition from what is given to what is desired takes place via one or more actions.

> For, to solve a problem involves making what is given serviceable to what is demanded. That I must know what is given, in order to operate with it, and must also know what is demanded, in order to operate toward it, this in turn follows analytically from the nature of action. For action means acting, guided by knowledge of the purpose and of the means. (Duncker 1945, 60)

However, if we don't know which actions we should take to reach the goal (because the goal can be unknown, or the given situation unclear, or the path is blocked), then we have to resort to «recourse to thinking» (Duncker 1945, 1). The type of thinking Duncker and with him other members of the Gestalt school advocate does not or not primarily associate earlier problem situations with the given situation. Instead, thinking through a given problem situation should ideally and in many cases grasp the demands and requirements of the situation at hand so that our mind produces (via an original insight) instead of reproducing (via prior knowledge) a possible solution (cf. Duncker 1926, 656f.; 697). In other words, if we want to come up with a creative solution to a specific problem and not just repeat earlier actions and ideas related to similar problems in the hope that they will suffice, then first we have to fully understand the singularity of the given situation:

> [...] in seeking a solution, one must bring the given problem-situation as clearly as possible into focus. He who merely searches his memory for a 'solution of that such-and-such problem' may remain just as blind to the inner nature of the problem-situation before him as a person who, instead of thinking himself, refers the problem to an intelligent acquaintance or to an encyclopedia. (Duncker 1945, 20)

Being confronted with a problem situation is like perceiving a Gestalt, i.e. a holistic structure composed of several parts, whose function and appearance depend on the whole and the laws it wields over its parts. Although or perhaps because the instantiations of these laws are individual for each problem, it is only in seeing their generality that an insight into the nature and solvability of the problem in question can be gained. Gaining an insight is thus to see the problem situation and its context as a whole, and then to 'penetrate' (cf. Duncker 1926, 668) the whole so that its parts - their functions, interrelations and in particular their conflicts - become visible for our thinking mind, i.e. accessible for our visualizing mind. «To each solution corresponds a ground of conflict present in the situation. Analysis of the situation is therefore *analysis of conflict*». (Duncker 1945, 21) In addition to conflicting parts («"What is wrong here? What must I change?"», Duncker 1945, 21), an analysis of the situation also reveals 'material' parts («'What must I use?'», Duncker 1945, 21) that might be adjuvant for solving the problem. Insight means to become aware of these parts by firstly grasping the problem as a whole and then by analyzing the singular parts as displaying a general structure of conflicting and heuristic relations. Insight is thus exactly not the learning of arbitrary connections between elements via repetition, trial-and-error methods and the reproduction of associations, but «to single out from a particular case the general relationship» (Duncker 1926, 661).

Once we develop the internal representation of the given situation in terms of grasping its general structure that consists of conflicting and material elements, we are able to rearrange or 'restructure' these elements in such a way that a number of actions are feasible to reach the desired situation. We thus change the function of those parts that are preventing the achievement of the goal. We also grasp the actual usefulness of a given part, for example by detaching it from another part to which it has been 'functionally fixed' (e.g. by separating horse from rider in the third example). The thorough analysis of the situation makes already evident which parts have to be restructured. This means that the process of restructuration is already happening and going along with the state of insight. «Insight is in fact a seeing, a becoming evident of something [...]. Evidence, then, is the objective aspect of what in a more subjective sense is called insight» (Duncker 1945, 52). The ideal penetration of the problem situation is thus more than just a grasping of what is there: it is at the same time a grasping of how the situation can be changed for the solution to be reached. The problem includes its solution from the outset. It is the task of our thinking mind to become aware of the evident solution by seeing what is not yet directly present via a variation of the given parts or aspects. «What is read off must represent an aspect which is new in contrast to the original phenomenal aspect – not of course new in the sense of added material such as may be discovered by more exact observation» (Duncker 1945, 56). In the context of visual perception, this process of reading off unseen aspects from a percept is called 'amodal completion,' (cf. Metzger 2006, 135).

It is exactly by means of visualizing and thus understanding how (some of) the given parts have to be restructured that the path to the goal can be cleared: «a solution always consists in a variation of some crucial element of the situation» (Duncker 1945, 20). Some parts might at first glance be hidden or play a minor role,

but need to be found and highlighted. Also, the functions of parts can be changed: first we perceive gravity as an obstacle in the *Limbo* example, but on closer inspection we realize that it is the driving force that pushes us out of the level. Furthermore, «[p]arts of the situation which were formerly separated as parts of different wholes, or had no specific relation although they are parts of the same whole, may be united in *one* new whole» (Duncker 1945, 29). In any case, «the moments of sudden comprehension, of the 'Aha!,' of the new, are always at the same time moments in which such a sudden restructuring of the thought-material takes place, in which something 'tips over'» (Duncker 1945, 20). What is important for such a restructuring to take place and thus for having an insight is firstly to not only concentrate on the given situation, but also to envision the new, desired structure in the given one. In other words, «[t]he most radical shifts of function within a system are often carried out without any difficulty, if one already knows what proposition is to be employed and therefore what sort of structure is to be sought in the given material» (Duncker 1945, 109) And secondly, as every part can contribute to the finding of a creative solution, «the subject must be so much better off, the more and the more varied aspects he/she is able to command at one glance, i.e. without tedious "work of explication"» (Duncker 1945, 39).

Other Gestalt theorists generally share Duncker's conception of insight as a mental state or process. It involves a representation of a particular problem situation in terms of 'seeing into' or 'penetrating' it in order to 'read off' its general traits and at the same time to grasp the variability of the parts in order to restructure (some of) them. What is also shared are Duncker's rather critical yet not categorically denying stance towards associationist theories of past experience and his application of perceptual Gestalt laws of part-grouping to the domain of problem representation. M. Wertheimer (1959, 235), for example, claims that thinking through a problem «consists in envisaging, realizing structural features and structural requirements; proceeding in accordance with, and determined by, these requirements, thereby changing the situation in the direction of structural improvements [...]». The way we change and improve the situation is exactly by modifying, i.e. separating, combining, relocating, or highlighting and ignoring some parts (cf. Wertheimer 1967, 180). An insight doesn't often happen in an immediate flash, but «the flash may occur after a lot of brooding and perplexity» (Luchins 1970, 340). To a certain degree, this also holds true for higher forms of animal intelligence, as W. Köhler (1973) found out in his famous experiments with chimpanzees. A good summary of the early Gestaltist understanding of insight is given by Wertheimer (2010, 50):

> Crucial in productive thinking is grasping the core or essence of the problem, understanding its key features, developing insight into its genuine nature, and not being distracted by irrelevant or superficial characteristics. When such reorganization occurs, when the solution "clicks" for the thinker, when the nature of the problem has been fully grasped, there typically is a satisfying "Aha!" experience; a previously murky, confused conception of the problem situation is transformed into a clear, simple, often elegant recognition of the true organization of the problem's structure and its solution.

More formally, we can define insight in this classical context, i.e. in disregard of later studies on this subject, as follows: *Insight is an experiential state or process that occurs when we mentally represent and understand a problem as a whole w1 (the given situation) with a variable and partly conflicting constellation of parts p1, such that due to an adequate representation and understanding of w1 and p1 a novel*

whole w2 (the desired situation) and the restructuration of p1 into p2 that is required to reach w2 become evident and feasible. Such a definition, of course, is not only inchoate like every other definition, but also provokes many questions. One of them sounds as follows: is an insight, similar to what *could* be claimed about consciousness and freedom, something that comes into being as a novel entity which, once emerged, is autonomous from the given problem situation w*1* with p*1* and able to 'downwardly' cause w*1* and p*1* to turn into w*2* and p*2*? Or is it nothing more than an epiphenomenon that is necessitated by w*1* and p*1* in order to reach w*2* with p*2* but without 'life of its own,' like a tool that is only there to replace w*1*/p*1* with w*2*/p*2* in full accordance with the underlying laws of the situation? In other words: Should we classify the state of insight as being ontologically (strongly) or rather as epistemologically (weakly) emergent, and: *tertium non datur*?

III. On Epistemological and Ontological Emergence

In spite of this notion's long history, many philosophical and related disciplines have recently been experiencing a «re-emergence of emergence theories in contemporary thought» (Clayton 2006: 27). Different domains of reality, such as the ones studied by philosophy, physics, chemistry, biology, neurosciences, psychology and sociology (cf. Paoletti et al. 2017, 9), have been investigated under the aspect of whether and why they involve entities, properties, processes, states or any other signs of emergence, including questions about the nature and possibility of emergence itself. We can simply say that something is emergent when a number of interrelated physical or physiological parts compose a whole whose properties are not explainable just by the parts and their properties (cf. Hendry et al. 2019, 1). These emergent properties or states could be mental, like concepts, consciousness or the Aha!-state of gaining insight (cf. Robb 2019). Since the whole in question is not sufficiently explainable with regard to its parts, it's impossible to reduce the former to the latter. «Emergence is the opposite of reduction. Properties and behavior are emergent at higher levels with respect to the lower if they cannot be reduced to the properties and laws manifested by the lower-level objects» (Robinson 2009, 527).

In addition to irreducibility and the kind of autonomy this involves, emergent wholes or wholes with emergent properties are usually characterized by being the result of self-organizing processes among the parts (cf. Boi 2017, 182); by being able to causally or otherwise act 'down' on their parts; by showing some kind of novelty in relation to their parts; by being however initially dependent on their parts' existence because they are 'upwardly' causing the whole; and by coming into being in an unpredictable, often unexpected way (cf. Wong 2019, 179). Thereby the phrase 'coming into being' already provokes one of the main problems we face when we think about emergent phenomena: what is their actual ontological status, i.e. do they really come into existence as an addition to the ontological inventory of what is there, or are we just acting as if they had their own ontological status to facilitate the description of such phenomena? To apply this question to the phenomenon of Gestaltist insight in problem solving, it is necessary to see what both stances comprise in a nutshell.

Epistemological or epistemic emergence, often used synonymously with 'weak emergence,' is a stance that even radical reductionists for whom there is nothing but physical particles and their relations could agree with. This is because epistemological emergence does not make claims about the nature of reality as such. Therefore it doesn't claim that while wholes might indeed be causally dependent on their parts, they would also be ontologically independent of them. Instead, here

«emergence is merely an artefact of a particular model or formalism generated by macroscopic analysis, functional description or some other kind of 'higher-level' description or explanation» (Silberstein et al. 1999, 182). If we accept the framework of epistemological emergence, it would be fine, for example, to say 'this is all society's fault' or to ask 'why did you do that to this person'? Whereas the whole 'society' can be nothing but the sum of its individual members with their individual faults, which are in turn nothing but the sum of their bodies' and brains' cells and particles, it's still heuristically useful to say 'society' in order to describe these sums and to do as if a personification of them could make sense. The second question seems to imply the existence of free will, but in fact it may be just a rhetorical phrase that describes and judges bodily actions determined by chemical reactions in the brain. In many cases, it's hard or impossible to determine exactly which parts are responsible for the behavior of the whole, although it's undeniable that they are responsible to such an extent that no further attribution has to be made to the whole beyond the parts. Thus at least hypothetically, the whole as explanandum is fully understandable and explainable by the parts as explanans. As Silberstein et al. (1999, 186) have it,

> A property of an object or system is epistemologically emergent if the property is reducible to or determined by the intrinsic properties of the ultimate constituents of the object or system, while at the same time it is very difficult for us to explain, predict or derive the property on the basis of the ultimate constituents. Epistemologically emergent properties are novel only at a level of description.

While epistemological emergence has advantages like being «metaphysically innocent, consistent with materialism, and scientifically useful [...]» (Bedau 1997, 376), its counterpart, ontological emergence, «has the merit of preserving commonsense intuitions and corresponding to our everyday experience as agents in the world» (Clayton 2006, 27). If we claim that there are wholes whose properties are ontologically emergent, then we state that these properties indeed have been coming into being as an ontologically independent yet causally dependent effect of the parts and their respective compositions. Then such properties aren't just epiphenomenal features or resultant properties, i.e. qualities of the whole that are in fact non-attributable to the parts, but that nonetheless disappear as soon as the parts disappear. For example, a tomato's spherical shape and its power to roll might not be found in any of its parts. «Yet it does not seem that the tomato's shape is, in any interesting sense, an ontologically emergent property. The shape is just what you get when you put the tomato's parts together in a particular way». (Heil 2017, 45) We only speak of something being ontologically emergent when it has the capacity to causally act back or 'downwards' on its parts. This necessitates a kind of ontological independence from the parts and also presupposes a hierarchy of what is lower (the parts) and what ranks higher (the whole). In the epistemological emergentist framework, on the other hand, it's sufficient to postulate a 'flat ontology' where parts exist on the same level – just because there is nothing that is irreducible to them. While this goes strongly against a commonsense conception of reality and causes explanatory problems, for example concerning the existence of mental phenomena and the question of how far parts can be subdivided until they are finally atomic, also the vertical ontology of ontological emergence is not without difficulties. One of them concerns the infinite proliferation of entities taking place when not only parts and parts on the same level, but also wholes and parts, create novel wholes *ad infinitum* (cf. Husserl 2001, 37). Another difficulty is to conceptualize the hierarchy as a static,

layered pyramid, which would imply a tight parallelization of levels. As Emmech et al. (1997, 93) point out:

> One should avoid a parallelistic interpretation saying that one level is created out of another, and that it exists in parallel to the first level, as two separate levels without any further interaction. To exaggerate a little: if the parallel existence was true, as a human being you would not be one but several different entities on several different levels. Your physical body, your biological body and your psyche etc. – and it would seem rather miraculous that it always happened to be focused at the same point in space.

On the one hand, it's impossible to go into more details here on these interesting matters or to even develop a solid position. On the other hand, it's important to keep in mind this general background when returning now to the more special field of Gestaltist insight in problem solving. Do we find positions and arguments there that reflect the just delineated philosophical discussion on epistemological and ontological emergence? And is it thinkable to circumnavigate the respective dangers of a flat and a hierarchical conception of reality, the Charybdis and Scylla of emergentism?

IV. What Kind of Emergent Phenomena Are Insights?

The early Gestalt psychologists stood, among others for institutional reasons concerning faculty positions and funding, very close to philosophical ideas from disciplines such as phenomenology, ontology and natural philosophy (cf. Ash 1995). Nevertheless, to my knowledge the philosophical question concerning the ontological status and genesis of insight was not reflected upon. Although also in recent research the connection with the philosophical discussion about weaker and stronger forms of emergence has not been made explicit, we can broadly distinguish two views that seem to reflect this discussion. Both views deal with the fact that insights, like emergent phenomena in general, display certain characteristics like novelty and unpredictability that could make them qualify as additional entries to our ontological inventory. Insights appear to be ontologically independent, higher mental states or processes with which we causally influence the problem situation they result from by representing, restructuring and improving or solving (parts of) this situation. But insights could also be just epiphenomena reducible to already existing bits of prior knowledge. The view that resembles the stance of epistemological emergence and its principle of reducibility has been called the 'business-as-usual perspective,' the 'nothing-new view,' or the 'nothing-special view.' It «proposes that insight is merely an extension of ordinary processes of perceiving, recognizing, learning, and conceiving» (Davidson 1995, 127). This «nothing-new view of insight [is] the idea that insight is nothing but following a chain of preestablished associations» (Mayer 1995, 7). In other words,

> From the perspective of business as usual, insight per se is viewed as either relatively unimportant or even nonexistent as distinct cognitive phenomenon associated with reasoning, planning, problem solving, and so forth. Adherents to the business-as-usual perspective disavow using the term *insight* [...]. To the extent that they acknowledge insight's existence at all, they attribute it to normal mental processes such as memory search, hypothesis testing, and trial-and-error solution attempts based on past experience. (Seifert 1995, 68)

The alternative to this view is more in line with the traditional Gestaltist conception of insight as well as with ontological emergence in the philosophical context. This

view has been called the 'special-process view' (Davidson 1995, 126), the 'prepared mind perspective' (Seifert 1995, 74), or most often just something similar to the 'view of the Gestalt tradition.' It holds that insights are irreducible to other phenomena, be it the stimuli of the problem situation and its perception, or associations with prior experiences, or functions of the nervous system. Instead, it assumes «that insight is a researchable cognitive phenomenon [that] may emerge from a combination of information-processing phases whose joint interactions enable subconscious quantum leaps during the generation of new mental products» (Seifert 1995, 75). Classifying insight in this rather strongly emergent way has the benefit of accounting, for at least the experience of exactly this kind of incubation phase that occurs regularly during the development of insights (cf. Wallas 1926). After realizing what a particular problem is about and preparing our mind to solve it, we let it sink into unconsciousness until «there is an abrupt shift to the illumination phase, wherein a penetrating flash of insight about an appropriate satisfying resolution to the original problematic situation occurs unexpectedly» (Seifert 1995, 75). Whereas with a pre-established set of atomic memory bits we could theoretically figure out the correct solution to a problem just by recalling, recombining and then applying what we already know, it is this unpredictability which is typical of insights that prevents us from entering the illumination phase deliberately. Unlike in the case of recalling something from memory, even our gut feeling of approaching a correct solution for an insight problem is mostly misleading (cf. Metcalfe 1986). But adopting the special process view does not only allow us to demarcate what the Gestaltists called 'reproductive' (associative) and 'productive' (insightful) thinking. The analogy according to which insights are mental Gestalts also allows us to apply research on perceptual Gestalts as emergent phenomena to the mental domain of insights, thereby concluding a similar classification for the latter by analogy. A case in point would be Stadler et al.'s (1994) hypothesis on Gestalt theory being a precursor of synergetics, i.e. the study of self-organization in open systems:

> In Gestalt theory, the origin of coherent order out of the synergy of interacting elementary units was the explicit starting point for research. Gestalt qualities are defined as emerging phenomenologically from those interactions but not as reducible to them. [...] In Gestalt theory the order of the perceptual field emerges out of the perceptual elements and the Gestalts are the organizing force of the elements. (Stadler et al. 1994, 213)

Understanding insight as strongly emergent also enables similar analogies such as the one between problem solving and biological evolution. Perkins, for example, argues convincingly for a common classification of insights and evolutionary steps as 'general breakthrough events,' which are «episodes of sudden innovation that might appear in any creative system [...]» (Perkins 1995: 496). But this is exactly the problem of regarding insight as being ontologically emergent. There are still too many hypotheses, vagueness and research desiderata. Since too much has to be explained by drawing on analogies, metaphors and irreproducible experiences reported in anecdotes, the concept of insight is scientifically difficult to research. As a phenomenological experience, an insight may intuitively feel as if it is strongly emergent, which is why there are many anecdotes on this notion, often involving inventors, scientists and artists. But there are not only a number of empirical experiments with quite critical results concerning the Gestaltist depreciation (not: rejection) of past experience for insight problems (cf. Mayer 1995, 7). The fact that certain variables have to remain underdefined for something that is supposed to 'come into being' spontaneously and

creatively prevents any form of concrete empirical testing as well as any non-mysterious definition of insight as a novel mental state (cf. Davidson 1995, 127). Finally, a certain reading of the classical Gestaltist literature on problem solving might even relativize the general understanding of insight as something that suddenly emerges out of nothing. Why should insight be understood as a novel state through which we can causally influence a problem, if the problem already contains its own solution? As is Duncker states if, «*what is really done in any solution of problems consists in formulating the problem more productively*» (Duncker 1945, 9), because «a *solution always consists in a variation of some crucial element of the situation*» (Duncker 1945, 20). If our actions and the range of adequate ideas are thus determined by what is already contained in and required by the problem situation, then what is the genuinely novel property of an insight? How does the mental state of having an insight contribute to causally change the problem, if the problem is its pre-formed solution from the outset, i.e. if our mental representation of the problem is only a heuristic reproduction of the already existing solution?

V. Conclusion: Rethinking Insight As 'Intersight'

What we have learned so far is that the phenomenon of insight in theories on problem solving provokes questions and stances similar to the ones concerning entities with epistemological and ontological properties in recent philosophical debates. For future research it's worthwhile to relate these to fields closer to each other, so that arguments from one field can be applied to the other and vice versa. The empirical and phenomenological evidence of problem solving can thereby serve to verify or falsify some of the rather speculative and ontological statements in debates on emergentism. In addition, alternative conceptualizations of how we solve insight problems might enrich fundamental assumptions of theories on emergence. One of these assumptions consists in the already mentioned mereological approach that entails either a 'flattening-out' or a 'hierarchization' of reality. In both cases we think in mereological structures, either by making wholes ontologically reducible to and thus basically identical with their parts, or by making them rank higher in a hierarchy with an upwards direction of emergence and optionally a downwards direction of causation. But both cases are problematic for different reasons and therefore it would be welcome to find alternative approaches.

How Gestaltist research on insight can contribute to the debate on emergence is, among others, such an alternative. It draws on the fact that the mental representation and restructuring of insight problems is derived from the empirical perception of Gestalt-wholes and the principles of their internal organization. As we have seen, however, transferring only the perceptual part-whole patterns to problem solving results in issues similar to the mereological framework in emergence. But apart from part-whole structures, there is another important perceptual phenomenon studied by Gestalt theory: the one of multistability in ambiguous figures. The most famous are perhaps the duck-rabbit picture or reversible figure-ground patterns like Rubin's famous vase-faces drawing. In such figures, there are two or more layers of meaning that neither exclude nor include each other. If we imagine a reversible figure with two possible sides *A* and *B*, then either *A* is foregrounded and *B* is backgrounded or vice versa. What is interesting about this dynamic interaction between the two sides and what has already been noticed by Rubin himself is that *A* and *B* do not constitute an either/or relationship, but are respectively present even when backgrounded. Thus if *A* is foregrounded, there are still present traces of *B* in *A*,

because we precipitate and anticipate *B* even when *A* is directly given, and vice versa (cf. Rubin 1921, 33). Also, what is foregrounded has a higher degree of form, reality and perceptual meaning (Rubin 1921, 35, 45, 74). From this it can follow that the form, reality and meaning of what is now backgrounded is still amodally present in what is now foregrounded. The ongoing process of switching back and forth ontologically enriches the percept with and due to its two or more sides. Due to the mutual influencing and changing, there is no higher or lower in this relation of sides, but also no reducibility of one side to the other, because only in their being different, the phenomenon can keep its quality of being multistable and ambiguous.

To conclude admittedly vaguely, I think we could reconceptualize the phenomenon of insight by taking into consideration this bidirectional, perceptual process of backgrounding and foregrounding. Insight is not an emerging state or process that acts 'down' on the parts of the problem, but a hinge or switch that mediates between what is initially foregrounded (the given problem or initial state, w1) and what should be foregrounded (the solution or goal state, w2). With insight, thus understood as a function or a torsional moment, we do not only 'see into' a problem, but we also 'see into' the solution. Insight is thus a janiform perspective without ontological existence of its own. Instead, it enables the ontological status of the problem as problem and of the solution as being realizable through action, and thus it functions as an interface between the two. Insight as interface between interacting and mutually enriching sides is therefore rather an 'intersight' that carries form, reality and meaning from the problem to the solution and back in order to gradually concretize the initially only anticipated solution. Since from the beginning and according to the Gestaltist view, w2 is in a way latent (i.e. neither fully present nor fully absent) in w1, the act of intersight needs to take recourse to the parts p1 of w1 and turn them into p2: not for w2 to come into existence, because it already exists in w1, but to gradually give form, reality and meaning to the initially formless, latent and meaningless existence of w2. This is thus a weak form of ontological emergence that modifies what already exists (w1/p1) into an alternative version (w2/p2), which has always been there as a possibility inherent to w1/p1. One factor that might bring or keep the interchange of perspectives called intersight in motion are one or more bits of prior knowledge, one or more associations with earlier problem situations. But since with every turn of switching what is foregrounded appears in a new light due to the constant, mutual enrichment of problem and solution, we are always facing unique modifications and aspects of a problem, depending on what the solution demands.

This preliminary model of intersight, inspired by Gestalt research on ambiguous figures and multistability, could not only motivate future research on problem solving based on scattered comments in the literature, where restructurations are described as sudden figure-ground-reversals (cf. e.g. Bergius 1964). Future research could also investigate how to develop dynamic, non-hierarchical yet non-flat frameworks to re-conceptualize emergent phenomena. I think that the 'causal-transformative' model of emergence and 'demergence' recently developed by Anjum & Mumford's (2017) could be a good starting point. For the moment an elaboration of the just given suggestion has to remain the anticipation of a yet backgrounded paper.

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