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# OSCILLATIONS AND INCOMMENSURABLE DECISIONS

On the Multistable Use of Multistable Figures

Christoph F. E. Holzhey<sup>1</sup>

The children's book *Duck! Rabbit!* dramatizes the lesson that just because one is right, others don't have to be wrong.<sup>2</sup> An endless dispute is quickly settled once the quarrellers experience an aspect change or gestalt switch and thereby realize that the same picture can be seen in different ways. This simple scenario offers an intriguing model for arbitrating between conflicting positions not by approaching them, dissolving differences or reaching a higher synthesis, but by going back and forth between different aspects and thereby realizing that conflicting accounts can be equally valid. However, multistable figures like the Necker cube, the Rubin vase, or the duck-rabbit can also function in quite a different way and problematize the very notion and possibility of perception, objectivity, and rational agreement. In Thomas Kuhn's *The Structure of Scientific Revolutions* (1962), for instance, multistable figures do not stand for the possibility of settling disputes, but have rather contributed to a fierce debate about fundamental questions in the history and philosophy of science by giving plausibility to the idea that science progresses through irreversible, discontinuous shifts. Kuhn himself highlights that his particular use of multistable figures differs from that in gestalt-shift experiments insofar as 'the scientist does not preserve the gestalt subject's freedom to switch back and forth between ways of seeing'.<sup>3</sup> While one might wonder why he would then deploy the gestalt-shift metaphor at all, this article seeks to highlight how multistable figures combine different, orthogonal dimensions and movements in such a way that the use of these figures becomes itself multistable. The phenomenon of multistable figures indeed involves aspect changes not only between different visual perceptions, but also in relation to analytical categories such as reversibility and irreversibility, subject and object, freedom and determinism, epistemology and ontology. Like the visual aspects of the figure, these categories appear thoroughly intertwined without being confounded, making it possible to mobilize

multistable figures to explore them in isolation, but also within a larger conceptual space of potential coexistence.

Concerning ir/reversibility, in particular, one may note on the one hand that what is indeed irreversible is the first appearance of a (new) gestalt. Seeing the duck-rabbit image, one initially simply sees a duck *or* a rabbit. Or more precisely – to follow Ludwig Wittgenstein’s conceptual discussion of these figures – one initially simply sees a ‘picture-duck’ or a ‘picture-rabbit’:

That is to say, if asked ‘What’s that?’ or ‘What do you see here?’ I should have replied: ‘A picture-rabbit’. [...] I should not have answered the question [...] by saying: ‘Now I am seeing it as a picture-rabbit’.<sup>4</sup>

Only after the first experience of a gestalt switch or of what Wittgenstein calls a ‘change of aspect’ (‘Aspektwechsel’) do we speak of seeing-as and give this experience a time index: ‘*Now* I am seeing it *as* ...’. Henceforth, the perception may oscillate reversibly but the transition from seeing to seeing-as remains irreversible.

On the other hand, if the reversible oscillations have a beginning, they may also have an end. There are several ways in which one can imagine that the gestalt switches stop just as irreversibly as they started: one might forget that an object is a multistable figure, the object could change over time, or a particular context may select one of its aspects. These suggestions of putting an end to reversible oscillations no doubt require isolating some elements in the phenomenology of multistable figures while modifying others. Figures of the kind typically used to explore multistable perception have the remarkable characteristic that the repeated aspect change seems to be partially involuntary. While one can voluntarily bring about the change, one cannot permanently fix a single aspect – at least once one has knowledge of the reversibility.<sup>5</sup> This automatism helps convince us that competing descriptions are equally justified, and it leads to the expectation that others should agree; but the phenomenology of multistable figures is sufficiently rich that one can drop the automatism of aspect changes as a defining feature without compromising their metaphoric potential. By cautiously generalizing them beyond the rather specific domain of the physiology of visual sense perception, multistable figures can in fact also provide models for taking decisions that are truly free, precisely because there is nothing in the object and situation that on a purely cognitive level would determine a choice between equally possible and valid alternatives. Different

kinds of decisions are imaginable here: committing to one aspect at the expense of others, but also deciding whether to engage in such a forced choice at all rather than suspend the oscillation or move in an altogether different direction. In exploring such distinctions a larger question will also come to the fore: To what extent does modelling decisions in terms of multistable figures stay bound to an ultimately immaterial subjective experience of perception or also allow for the kind of political, ethical, and aesthetic import that the metaphor of (scientific) revolution evokes?

### I. THE MIND'S EYE

The duck-rabbit image entered scientific discourse in 1899, when the American psychologist Joseph Jastrow reproduced it, together with other multistable figures, in his article 'The Mind's Eye'. Despite itself, the article already contains some of the different ways in which multistable figures can function. For Jastrow, these 'illustrations show conclusively that seeing is not wholly an objective matter depending upon what there is to be seen, but is very considerably a subjective matter, depending upon the eye that sees'.<sup>6</sup> That such a demonstration is not to be understood as a loss of objectivity becomes manifest when the article is included in Jastrow's book *Fact and Fable in Psychology*, which appeared in the same year as Sigmund Freud's *Interpretation of Dreams* (1900) and sought to separate 'fact and fable' in a battle to establish 'what is authentically scientific' against 'what is but the embodiment of unfortunate traditions, or the misguided effort of the dilettante, or the perverse fallacy of the prepossessed mystic'.<sup>7</sup> Multistable figures here help identify and isolate a subjective component of seeing – or what Jastrow calls, quoting from *Hamlet*, the 'mind's eye' – and thereby further the cause of scientific objectivity.

The basic mechanism is easily understood: multistable figures are typically two-dimensional diagrams that are seen as three-dimensional objects because 'we are accustomed to interpret lines, whenever we can, as the representations of objects. [...] So strong is this tendency to view lines as symbols of things, that if there is the slightest chance of so viewing them, we invariably do so' – even if there are several ways of making this extrapolation to other dimensions.<sup>8</sup> For Jastrow, the diagrams eliciting multistable perception thus

illustrate the principle that when the objective features are ambiguous, we see one thing or another according to the impression that is in the mind's eye; what the objective factors lack in definiteness the subjective ones supply, while familiarity, prepossession, as well as other circumstances influence the result.<sup>9</sup>

The different influences here indicated foreshadow a whole research programme. Indeed, multistable figures continue to be rewarding research objects for the sciences of visual perception to this date.<sup>10</sup> They provide a privileged avenue for highlighting and isolating the subject's activity in perception and making it amenable to scientific exploration. The insights obtained in this way are not limited to the perception of multistable figures but extend also to ordinary perception.

Jastrow concludes his short essay by shifting from the reversible impressions of one observer to the way in which 'different observers derive very different impressions' from the same 'objective experience'.<sup>11</sup> However, when he finally moves to spiritualistic séances and other examples where 'the mind's eye eke[s] out the imperfections of physical vision', it is clear that the lesson drawn from multistable figures is not the equal validity of different accounts: 'The mental predisposition here becomes the dominant factor, and the timid see as ghosts what their more sturdy companions recognize as whitewashed posts.'<sup>12</sup> Indeed, his preface reads as if it were written against using multistable figures to mediate conflicting accounts:

These essays take their stand distinctively upon one side of certain issues, and as determinately as the situation seems to warrant, antagonize contrary positions [...]. They further aim to illustrate that misconceptions in psychology, as in other realms, are as often the result of bad logic as of defective observation.<sup>13</sup>

Multistable perception thus draws attention to visual perception as a double process and allows for a separation of its subjective and objective components, but it would seem that the reversible seeing of aspects can ultimately be relegated to the merely subjective and is to be dismissed in favour of what can be ascertained objectively.

However, the first section of the essay in question begins with another understanding of seeing, emphasizing that it is neither possible nor desirable to eliminate the activity of the 'mind's eye': 'True seeing, observing, is a double process, partly objective or outward [...] and partly subjective or inward'.<sup>14</sup> It involves detecting resemblances or

what one may call aspect-seeing in reference to Ludwig Wittgenstein's *Philosophical Investigations*. Often we need to be told what to look for in order to identify resemblances, be it in everyday life or in the science lab. The use of microscopes, for instance, must be learned through training, which is 'distinctly aided by consulting the illustrations in the text book, for they enable [the] mental eye to realize the pictures which it should entertain.'<sup>15</sup> There is the risk of being too influenced by what one expects to see, but Jastrow takes this problem to be manageable through 'training in correct and accurate vision', for which 'it is necessary to acquire an alert mental eye, that observes all that is objectively visible, but does not permit the subjective to add to or modify what is really present'.<sup>16</sup>

This concludes the essay's first section, which has not yet addressed optical illusions or multistable figures, but only aspect-seeing. Optical illusions plausibly help in acquiring an 'alert mental eye'. As already indicated, they also further the project of science and enlightenment by facilitating the identification, isolation, objectification, and empirical exploration of subjective vision. At the same time, this project ultimately relies on another distribution of seeing, where 'true seeing' includes 'subjective seeing'. As Jastrow shifts back and forth between these distributions (Fig. 1), the possibility of optical illusions and especially of multistable figures – where different resemblances alternate and compete with each other – becomes more problematic and threatens to undermine his scientific project.<sup>17</sup> Indeed, optical illusions are arguably fundamentally ambiguous in their function: not only do they bifurcate into enlightening and mystifying uses, but self-confidently engaging in the former also uncannily risks falling prey to the latter, as readers of the Romantic fantastic will know. In particular, they function rather differently when the outside, third-person perspective onto perception is abandoned in favour of an internal, first-person perspective without independent recourse to the types and lines of distribution that may apply. In the next section, I will briefly pursue the first branch and sketch how multistable figures can provide a privileged way to explore the multistable dynamic of material systems before then concentrating on a more internal perspective that questions the dichotomy between subjective and objective seeing without reducing the complexity of seeing.

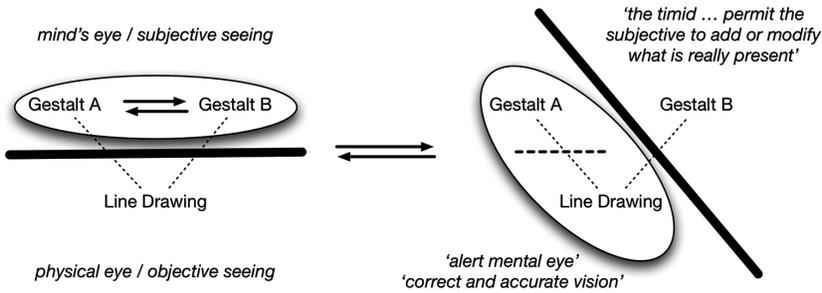


Fig. 1. 'Subjective Seeing' vs 'Accurate Vision'.

## II. MULTISTABLE SYSTEMS

The issue of ir/reversibility and im/material decisions is to some extent only a question of scale. To speak of a period of reversibility having an irreversible beginning and end, means to take irreversibility not in a strict, absolute sense, but relative to the frequency of the reversible aspect changes. Furthermore, also during the period of reversibility, decisions keep being made and maintained for some time until a new switch occurs. For cognitive scientists interested in multistable perception, these decisions correlate with physical processes in the brain, and these processes are quite generally those of a multistable system – regardless of whether they pertain to the perception of ambiguous figures, to other mental activities, or the execution of motor actions.

In their article 'Enduring Interest in Perceptual Ambiguity: Alternating Views of Reversible Figures', Gerald M. Long and Thomas C. Toppino propose to organize the large literature of experiments with multistable figures by distinguishing whether the focus lies on 'ambiguity' or 'reversibility'.<sup>18</sup> In the first case, the primary concern is how the visual system solves the 'ambiguity problem', that is, the fact that the same physical stimulus can produce more than one cognitive interpretation or percept. Questions that are asked include: which aspect is seen first; to what extent can this be influenced by priming the observer through instructions or by beginning the experiment with a non-ambiguous version of the figure; or, what role do past experience and knowledge of ambiguity play? In experiments focussing on 'reversibility', by contrast, the basic question of interest is 'why the system essentially "abandons" the perceptual interpretation [...] first reached after it has

solved the ambiguity problem'.<sup>19</sup> Here, one asks, for instance, how long are aspects maintained, how does the reversal frequency increase with time, to what extent is the increased frequency reset by changing the orientation of the object, but also whether the frequency can be changed through instructions to fix an aspect, to switch as quickly as possible, or to simultaneously perform a completely different cognitive task.

Long and Toppino's distinction of ambiguity and reversibility seeks to account for the enduring competition between contrary ways of modelling multistable perception. Another, partially overlapping, way to organize the literature on multistable perception is indeed in terms of whether passive, sensory, bottom-up processes or active, cognitive, top-down processes are favoured to account for multistability. Even if both types of processes ultimately need to be included for both ambiguity and reversibility, it would seem that bottom-up processes – such as the interplay of excitatory and fatigue-like processes or of activation and satiation processes – play a stronger role for reversibility, while top-down processes predominate in the resolution of ambiguity.

Bottom-up processes especially are no doubt quite sensitive to the physiological details of sense perception. However, it would be misleading to think that cognitive science directly relates top-down processes to consciousness or free will. Instead, the brain here is modelled as a complex system and the two types of processes refer to different levels of organization, for instance, to 'whether processing is driven, respectively, by lower order or by higher order information'.<sup>20</sup> Within such an approach, multistable perception turns the brain into a multistable system. Yet, the scope of multistability is much broader and need not be limited to perception. By design, experiments of multistable perception are highly constrained, and what attracts interest is that the same stimulus can lead to different responses and that a decision – a particular resolution of ambiguity – is revised after some time even though the external stimulus has not changed. However, the perceptual decision can also be followed by an action, such as pressing a button to signal what one is seeing or, in contexts beyond the science lab, fleeing from the perceived object. In this case, only the resolution of ambiguity would matter and not reversibility, but the processes are still those of a multistable system.<sup>21</sup>

Multistability is a prominent concept in the analysis of complex dynamic systems, in particular of non-linear systems with chaotic

behaviour. Here, it is not perception, but the material evolution of a system that is at issue, and multistability refers to the possibility not of perceiving and describing the same object in different, equally valid and justified ways, but of the system having several (relatively) stable configurations in which it can settle. That is, the stable states can be identified with having different visual experiences, but also with different scenarios of action or different potential realities.<sup>22</sup> One might think of the six sides of a die, of the thirty-seven grooves in a roulette wheel, or of the different ways in which ferromagnetic material ends up being magnetized when cooling down. Indeed phase transitions such as condensation or crystallization form a good model for multistability: as the system cools down it starts to settle in one of its stable states, and the ‘decision’ would be permanent were it not for additional influences such as noise or thermal energy that still allows the system to switch between the different possibilities. A more inherently dynamic multistability is characteristic of chaotic, open systems that are sustained by a continuous energy flux. Here, one can have what are called ‘strange attractors’ towards which the system tends to move without permanently remaining there.<sup>23</sup> Such a system moves between several – materially different – configurations quite like the multistable figures flip in perception.

In this view, multistable perception is only a very special case of multistable systems, but one that is privileged insofar as one not only observes multistability from the outside, but can also experience it from the inside; it is as if one experiences condensation or crystallization as a gestalt takes shape, for instance. In other words, multistable figures provide a hinge connecting third-person observations and first-person experience: when a subject is presented with an ambiguous figure, its brain engages in a particular, well-constrained multistable dynamics, which one can imagine exploring and measuring much like that of any other multistable system; but in this case, the processes of crystallization and of being attracted by multiple strange attractors can also be experienced from within. In this constellation, there is multistability in more than one dimension: subjective oscillations on a conscious, perceptual level; objective oscillations on a material, ‘ontological’ level; and a switching back and forth between these two descriptions, that is between first-person and third-person accounts.

Before leaving these hints about some possibilities of exploring multistability in physical systems, I should emphasize that while modelling the brain as a highly complex multi- and metastable system seeks to

give a material, causal account of its functioning, my use of models in this article is rather different. If multistable figures are said to provide a model in domains beyond the visual perception of duck-rabbit images and the like, the point is to extend multistability beyond perception and use it to think about decision-making or the mutual constitution of subjects and the social order, for instance. However, instead of suggesting a material, causal continuity, the idea is to identify homologies on a more conceptual or topological level, in particular on the level of temporal structures. The approach is in this respect closer to Wittgenstein's, who writes about the experience of 'noticing an aspect', through which he introduces his interest in multistable figures: 'Its *causes* are of interest to psychologists. We are interested in the concept and its place among the concepts of experience.'<sup>24</sup>

### III. ASPECT-SEEING AND AHA-EXPERIENCES

One way to understand the multiple, seemingly contradictory uses in which multistable figures can be employed is precisely in terms of Wittgenstein's analysis of aspect-seeing. The difference between seeing and seeing-as is perhaps most dramatically recognized through multistable figures, but it is not bound to them. Wittgenstein's discussion also includes suddenly seeing the solution of a puzzle-picture or suddenly recognizing an acquaintance that one henceforth sees with the old face in the altered one.<sup>25</sup> The 'flashing' or 'dawning of an aspect' is an element of, but also logically distinct from, the gestalt switch of multistable figures, and both are different again from 'the "continuous seeing" of an aspect'.<sup>26</sup> One could say that the dawning of an aspect involves a movement in a direction orthogonal to the reversible oscillation between different aspects, figures, or gestalten – a direction that may be considered vertical in contradistinction to the horizontal movement between equally valid and valued aspects or figures. It is with this vertical direction that an irreversible temporality may be associated. If a gestalt was already seen before, a gestalt *switch* is induced on a horizontal level, but what is more fundamentally at stake is a vertical transition from seeing to seeing-as, that is, the dawning of an aspect – such as the emergence of a picture-duck from a line drawing that was previously seen only as a picture-rabbit (Fig. 2).

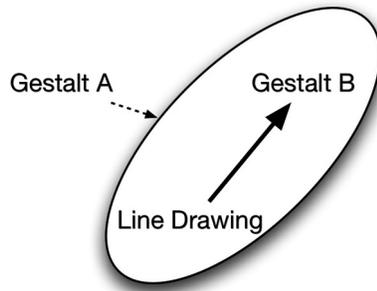


Fig. 2. Aha-Experience: Dawning of a (New) Aspect.

One may think of such a dawning of an aspect as a eureka moment or an aha-experience, and thereby not only underline the irreversibility of a sudden insight resolving a previously obscure situation, but also situate it beyond a solely cognitive register within a field of pleasurable experience, which tends towards exclamation. From such an ‘*Aha-Erlebnis*, which Köhler considers to express [...] an essential moment in the act of intelligence’,<sup>27</sup> Jacques Lacan famously constructs a decisive ‘stage’ in and for the development of infants – ‘the striking spectacle of a nursling in front of a mirror’.<sup>28</sup> The comical contrast that Lacan creates between the infant’s ‘motor impotence’ and ‘jubilant activity’ targets the perceptual integration of fragments into a gestalt less than the instauration of a directed, irreversible temporality in the infant. According to Lacan, the ‘jubilant assumption [*assomption*] of his specular image [...] seems [...] to manifest in an exemplary situation the symbolic matrix in which the *I* is precipitated in a primordial form’:

This form situates the agency known as the ego, prior to its social determination, in a fictional direction that will forever remain irreducible for any single individual or, rather, that will only asymptotically approach the subject’s becoming [...]. For the total form of his body, by which the subject anticipates the maturation of his power in a mirage, is given to him only as a gestalt [...] [T]his gestalt – whose power [*prégnance*] should be considered linked to the species [...] – symbolizes the *I*’s mental permanence, at the same time as it prefigures its alienating destination.<sup>29</sup>

One could say that the gestalt as which the infant sees itself is a potential, but unattainable future with respect to which the subject will always be seen as deficient and fragmented. By seeing itself as gestalt,

the subject enters a directed, irreversible temporality that simultaneously produces fantasies of totality and fragmentation, the former in anticipation and the latter retroactively:

The mirror stage is a drama whose internal pressure pushes precipitously from insufficiency to anticipation – and, for the subject caught up in the lure of spatial identification, turns out fantasies that proceed from a fragmented image of the body to what I will call an ‘orthopedic’ form of its totality – and to the finally donned armor of an alienating identity that will mark his entire mental development with its rigid structure.<sup>30</sup>

It is not necessary to accept all the empirical, psychological evidence adduced by Lacan,<sup>31</sup> nor his psychoanalytic framework, in order to recognize in the strong temporal directionality of the aha-experience one avenue in which aspect-seeing is not limited to the psychology of visual perception or subjective experience, but can be a powerful element in models of behaviour and action in a larger sense. If a future is what is seen in a gestalt, what is at stake is not its factual accuracy, but the success or failure in realizing a different world. In other words, a performative dimension of aspect-seeing comes here to the fore, which becomes political or ethical once there is a choice between different formative forms or constituting gestalten.

This brings us back to multistable figures and to the suggestion that their gestalt switches combine two orthogonal movements. The first experience of an aspect change could be said to produce a double aha-experience. Seeing the dawning of a new aspect repeats the vertical movement from a meaningless line drawing to a gestalt. At the same time, the horizontal switch from one gestalt to another not only involves the disappearance of a gestalt, but also destroys the self-evidence of the gestalt.<sup>32</sup> Henceforth, we can no longer say that we simply see a picture-rabbit, but only that we *now* see the image *as* a picture-rabbit. In addition to the aha-experience of seeing a new aspect, there is thus also the more ambivalent aha-experience linked to the recognition that seeing (a picture-rabbit) was always already a seeing-as – at least ever since a first recognition that has meanwhile been forgotten.

We might say that multistable figures repeat the mirror stage and turn it into its opposite: if the jubilant assumption of the mirror image involves not only the promise of a future integrity, but also retroactive fantasies of fragmentation, the experience of an aspect change leads to a doubling or fragmentation of the image and to retroactive fantasies of a

self-evident integrity henceforth lost. With a different emphasis, this loss of self-evidence could also be seen as a liberation from the grasp of a particular constituting gestalt. In some contexts, this may provide a metaphor for choosing between different forms of the future to be achieved rather than already actualized, where each form may be considered as equally whole and justified by the present. If any such choice re-engages in the (relatively) irreversible identification with formative forms, yet another emphasis may highlight the fascination of reversible gestalt shifts, which recalls the fort-da game that Freud analyzes in *Beyond the Pleasure Principle* and that Lacan links to the human entry into the symbolic order of language. By combining movements in orthogonal directions, multistable figures allow for a repeated experience of the dawning of aspects along a vertical axis (Fig. 3). They thereby keep reproducing the aha-experience that is otherwise destined to fade, precisely because it is irresistibly irreversible and leads to a conflation of seeing and seeing-as such that seeing-as is mistaken for seeing.<sup>33</sup>

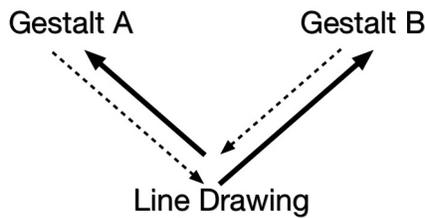


Fig. 3. Repeated Aha-Experiences.

#### IV. ASPECT-BLINDNESS

Wittgenstein highlights the logical separation and complex intertwining of the phenomena of aspect-seeing and aspect-changes by imagining a curious condition of ‘aspect-blindness’. He introduces it with the questions: ‘Could there be human beings lacking in the capacity to see something *as something* – and what would that be like? What sort of consequences would it have?’ This manner of asking is characteristic of Wittgenstein’s conceptual investigation that seeks to understand what subtly different modes of experience would ‘be like’ while insisting on consequences in communication and action rather than succumbing to specu-

lations about psychological causation or the ineffable solipsism of first-person experience. He immediately clarifies his definition of aspect-blindness with two specifications. On the one hand, the ‘aspect-blind man is supposed not to see the aspects A change’.<sup>34</sup> On the other hand, the aspect-blind would nonetheless see the different aspects of multistable figures: that is, when shown a set of figures and asked to identify the figure of a duck, they could point to a duck-rabbit figure, but they would not say that they *now* see it *as* a duck.<sup>35</sup> One can thus conclude that when seeing the duck-rabbit figure, the aspect-blind might at times see a picture-rabbit and at other times a picture-duck, but they would neither see the switch from one to the other, nor, for that matter, the dawning of an aspect. They see aspects but do not see them *as* aspects: they simply see them (Fig. 4).

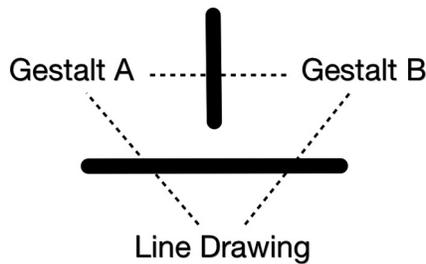


Fig. 4. Aspect-Blindness.

Wittgenstein quickly extends the hypothetical condition of aspect-blindness to ‘the lack of a “musical ear”’ and to ‘the connexion between the concepts of “seeing an aspect” and “experiencing the meaning of a word”’.<sup>36</sup> The peculiar notion of aspect-blindness and meaning-blindness arguably has a profound role for his late thinking and understanding of how human beings can have meaningful experiences and acquire language, and accounts perhaps for his interest in multistable figures in the first place.<sup>37</sup>

In my reading, aspect-blindness is also a central issue in Kuhn’s mobilization of multistable figures in *The Structure of Scientific Revolutions*. As Ian Hacking observes, Kuhn’s book succeeded in producing a ‘decisive transformation’ in the image of science and ‘unintentionally inspired a crisis of rationality’.<sup>38</sup> Hacking notes that the thought of scientific revolution is quite old and that even the idea of perpetual revolution suggested by Kuhn would not make scientific development irra-

tional.<sup>39</sup> Nor does the idea that science operates with what Kuhn calls ‘paradigms’ and that it switches between them during revolutions question scientific rationality. Little does it matter here on which of the two principal meanings of the notoriously diffuse notion of ‘paradigm’ one focuses: on ‘paradigm-as-achievement’, that is, on an exemplary solution to a problem that serves as a model for approaching other problems, or on ‘paradigm-as-set-of-shared-values’, that is, on a ‘shared set of methods, standards, and basic assumptions’ within scientific communities.<sup>40</sup> Rather, Hacking asserts that the ‘threat to rationality comes chiefly from Kuhn’s conception of revolutionary shift in paradigms’ in terms of a comparison ‘to religious conversion, and to the phenomenon of a gestalt-switch’.<sup>41</sup> In other words, the threat comes from exposing aspect-blindness in the traditional image of scientific progress.

To determine the precise relationship between paradigm shifts and gestalt switches is as tricky as the distinction between seeing and seeing-as or the notion of aspect-blindness. When Kuhn speaks of revolutions as ‘changes of world view’, he is not merely using a visual metaphor for paradigm shifts in the sense of a change in values, methods, and basic assumptions. Instead, a scientific revolution involves quite literally a ‘perceptual switch’ that is linked to a paradigm change without being identical to it. Early in the chapter ‘Revolutions as Changes of World View’, Kuhn writes, for instance: ‘Led by a new paradigm, scientists adopt new instruments and look in new places’, but then he immediately adds:

Even more important, during revolutions scientists see new and different things when looking with familiar instruments in places they have looked before. It is rather as if the professional community had been suddenly transported to another planet where familiar objects are seen in a different light and are joined by unfamiliar ones as well. Of course, nothing of quite that sort does occur [...]. Nevertheless, paradigm changes do cause scientists to see the world of their research-engagement differently. [...] It is as elementary prototypes for these transformations of the scientist’s world that the familiar demonstrations of a switch in visual gestalt prove so suggestive. What were ducks in the scientist’s world before the revolution are rabbits afterwards.<sup>42</sup>

As ‘elementary prototype’ the gestalt switch phenomenon here appears quite explicitly as a paradigm – in the sense of an exemplary model – for paradigm shifts. At the same time, Kuhn continues to insist on the ‘shifts of vision’ or ‘perceptual switches’ that can *accompany* paradigm

changes without registering with scientists: ‘if perceptual switches accompany paradigm changes, we may not expect scientists to attest to these changes directly’ (p. 115). Understanding the blindness – or at least the indifference – towards shifts in vision is among Kuhn’s major concerns, and interestingly he offers explanations going in opposite directions. On the one hand, he seems to blame scientists and their historians for disguising perceptual switches by rewriting the past with a ‘persistent tendency to make the history of science look linear or cumulative’ (p. 138). Questioning the image of science as an ‘enterprise’ that would ‘move steadily ahead in ways that, say, art, political theory, or philosophy does not’ (p. 159), he approaches the natural sciences to other disciplines characterized by contingent historicity rather than necessary, cumulative progress. On the other hand, Kuhn also seems to affirm the particular status and irreversible evolution of science by highlighting that the ‘parallel’ between scientific revolutions and gestalt shifts ‘can be misleading’: ‘Scientists do not see something *as* something else; instead, they simply see it. [...] In addition, the scientist does not preserve the gestalt subject’s freedom to switch back and forth between ways of seeing’ (p. 85). It would seem here that scientists are necessarily or by definition aspect-blind.

In the remainder of this article, I will successively explore these two approaches towards science’s aspect-blindness and argue that they are orthogonal rather than opposed. In the first case, the issue is foremost a horizontal movement that is stabilized through an additional upward direction but can be mobilized again through the notion of incommensurability. In the second case, a downward, reductive movement to a common material basis underlying the horizontal shifts predominates. I will conclude by indicating how a notion of complementarity may question these ways out of reversible shifts between incommensurable positions. It should be noted that this close engagement with Kuhn’s highly influential and much debated text is not concerned with re-evaluating its general framework, nor with taking a position on its applicability to the historiography of science. My main aim is rather to explore how multistable figures intertwine orthogonal movements of different temporalities and allow for multiple – or indeed multistable – forms of analysis and intervention, and thereby enlarge the space of conceivable kinds of decision.

## V. STABILIZED ASPECTS

One way to illustrate Wittgenstein's peculiar notion of aspect-blindness, which imagines the possibility of seeing different aspects without seeing them switch or seeing them as aspects, may be in terms of the antelope-bird figures in Fig. 5: looking at the two pictures we may well be blind to the fact that it is the same figure that we are seeing in one picture as a bird and in the other as an antelope.<sup>43</sup> In order to recognize this, we have to abstract from the context and concentrate on the single figure in the lower right-hand corner. The context that stabilizes an aspect and impedes aspect changes can also be formed by memory and expectation. In Fig. 6, for instance, we are likely to see the central figures just as a man's face when coming from the left and just as a kneeling woman when coming from the right. Combining both effects, we can imagine the scenario of coming from a world of antelopes, looking at the right-hand picture in Fig 5, and seeing at first an antelope surrounded by strange creatures until we suddenly recognize them all to be birds. The switch may be as sudden and as involuntary as during the repeated aspect changes of multistable figures, but it will be an irreversible switch that leads to the sense of seeing properly rather than of aspect-seeing. In other words, aspect-blindness here appears as the result of adding a fitting context to a figure that in isolation would elicit multistable perception.



Fig. 5. Antelope-Bird.



Fig. 6. Perceptual Hysteresis.

Highlighting the role of context, Norwood R. Hanson's *Patterns of Discovery* (1958) discusses the antelope-bird picture and some other multistable figures in order to argue for a sense 'in which seeing is a "theory-laden" undertaking'.<sup>44</sup> Referring to the same picture, Kuhn credits Hanson for making the parallel between paradigm change and gestalt switch (p. 85). Without equating it with 'theory', his notion of 'paradigm' can indeed be thought of as providing the context that stabilizes aspects, keeps them from oscillating reversibly, and makes them imperceptible as aspects. If 'something like a paradigm is prerequisite to perception itself' (p. 113) and if perception must be learned through training within a paradigm, as Kuhn asserts as if to recast the somewhat misleading notion of 'theory-laden seeing',<sup>45</sup> a paradigm can indeed be expected to produce hysteresis and aspect-blindness. Referring to Fig. 2 for aha-experiences, one could say that the process of training perception involves moving in a vertical direction from lines to gestalt, but it does so in slow motion in a particular context (paradigm) that helps identify and select a particular gestalt. As a result, to change world views in a 'horizontal' direction is neither as fast nor as reversible as it is in gestalt experiments, but it happens with a certain inertia, requiring unlearning and re-learning within a new context or paradigm. This is not to say that everything happens in a continuous fashion and that there are not also the kind of sudden, global shifts that one associates with aspect changes. Rather, the point is that longer periods of confusion and puzzlement precede the sudden moments of (re)cognition that happen with some delay. In other words, as in the hysteresis example, the slow, mostly horizontal (un)learning process is punctuated by sudden aha-experiences.

As Kuhn notes a couple of decades after writing *The Structure of Scientific Revolutions*, his use of the gestalt switch metaphor came foremost from the congruence between his own aha-experiences as a historian and those reported by scientists. While he is now especially concerned with the 'transfer of terms like "gestalt switch" from individuals to groups' and the 'clearly metaphorical' and 'damaging' character of this operation, I would like to highlight his close alignment of aha-experiences and gestalt switches:

For the historian, the period of wrestling with nonsense passages in out-of-date texts is ordinarily marked by episodes in which the sudden recovery of a long-forgotten way to use some still-familiar terms brings new understanding and coherence. In the sciences, similar 'aha experiences' mark the

periods of frustration and puzzlement that ordinarily precede fundamental innovation and that often precede the understanding of innovation as well. The testimony of scientists to such experiences, together with my own experience as a historian, was the basis for my repeated reference to gestalt switches, conversion experiences, and the like.<sup>46</sup>

The emphasis is on the moment of an irreversible aha-experience when the gestalt of a solution suddenly appears in an obscure, puzzling situation or when an old text suddenly makes sense. However, this moment is also closely associated not only with conversion experiences but also with presumably reversible 'gestalt switches'. At least for the historian, this is indeed quite plausible and one can see how the two orthogonal movements and their temporalities separate: the historian's sudden understanding rests on seeing 'some still-familiar terms' under a new – or rather, long-forgotten – aspect; although the historian will henceforth know how to read older texts, there is no reason that she should forget or abandon current ways of using familiar terms. That is, with some practice she can switch back and forth between different usages of terms, and despite the irreversible aha-experience of understanding older texts she may continue to prefer the modern usages of the same terms.

For the scientist involved in a scientific revolution, the process of discovery is reversed and also different: it is not that another use of terms has been forgotten, but rather that it does not yet exist. According to Kuhn, a paradigm starts as a 'promise of success discoverable in selected and still incomplete examples. Normal science consists in the actualization of that promise' (p. 24). When the promise is frustrated through the encounter of anomalies this can lead to a crisis that cannot be solved within the 'normal science' of puzzle-solving, but instead requires a larger, abrupt re-arrangement:

anomalies and [...] crises [...] are terminated, not by deliberation and interpretation, but by a relatively sudden and unstructured event like the gestalt switch. Scientists then often speak of the 'scales falling from the eyes' or of the 'lightning flash' that 'inundates' a previously obscure puzzle, enabling its components to be seen in a new way that for the first time permits its solution (p. 122).

The emphasis here lies again on an irreversible aha-experience, but the two movements remain intertwined: when the same components are 'seen in a new way', they undergo a gestalt switch that is horizontal and

reversible on the level of the individual components (just like the isolated antelope-bird picture would be). The bias for one aspect happens on another level, namely through the solution it permits for the previously puzzling relationship among the components. If the first appearance of an aspect shift in a multistable figure involves a double aha-experience – where a new gestalt appears for the same components, which turns the initial seeing into a reversible seeing-as – here we have a triple one; but the additional aha-experience – where, when seen under the new aspect, the components form part of a solution – dominates the situation and stabilizes it (Fig. 7). For the scientists intuiting the solution, the process may therefore well be an irreversible ‘conversion’. No doubt, they may attest to a change of perception that can be understood as the dawning of an aspect. However, speaking of ‘scales falling from the eyes’ or of a ‘lightning flash’ illuminating a previously obscure puzzle is also consistent with aspect-blindness, insofar as a dramatic sense of progress invalidates earlier perception such that it no longer seems possible to see as one used to see. Kuhn indeed takes statements of conversion as ultimately serving to ‘disguise a shift of scientific vision’, for instance when the ‘convert to Copernicanism’ says: ‘I once took the moon to be (or saw the moon as) a planet, but I was mistaken’ (p. 115).

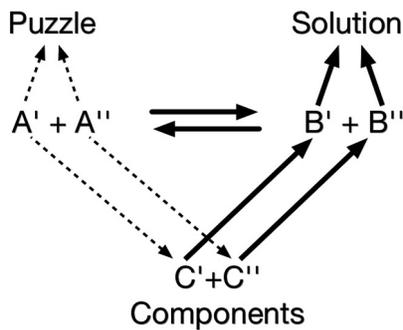


Fig. 7. Aha-experience: Solving a Puzzle.

## VI. DECISIONS UNDER CONDITION OF INCOMMENSURABILITY

To speak of aspect-blindness when new ways of seeing entirely displace earlier ones, helps to put pressure on the assumption of irreversible cognitive progress. Although such a shift may impose itself on account of

the solutions it allows for a previously obscure puzzle, the solution may only be local: requiring a different use of components, it compromises what the previous paradigm had achieved in other domains. If paradigm B offers a solution to puzzle B facing paradigm A, it undoes the solution to puzzle A that was the basis for paradigm A (Fig. 8.) If this is the case, the new insight does not participate in a cumulative progress of knowledge, but rather marks the beginning of the kind of process that Kuhn analyses as a revolution.

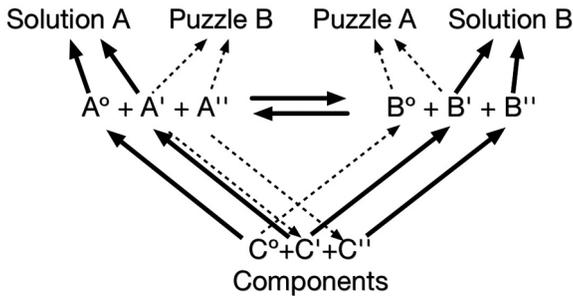


Fig. 8. Incommensurability – Local Solutions.

Kuhn explicitly models scientific revolutions upon political revolutions and conversion experiences (pp. 92–94, pp. 149–50). The parallels lie not only in the necessary leap that ‘must occur all at once [...] or not at all’ (p. 149), but also in the absence of a rational procedure and justification for the transition. During political revolutions, ‘political recourse fails’ and ‘the techniques of mass persuasion, often including force’ are the only options once society is polarized and divided into competing camps that disagree about the framework of political institutions and the very rules of politics (pp. 93–94). Kuhn theorizes scientific revolutions in a similar vein. Here, the ‘evaluative procedures characteristic of normal science’ simply do not apply, as they partially depend on a particular paradigm, making all argument necessarily circular (p. 94). The ‘competition between paradigms is not the sort of battle that can be resolved by proofs’ (p. 147), which is not to say that arguments are wrong or irrelevant (p. 151), but rather that one must recognize that the ‘claim to have solved the crisis-provoking problem is [...] rarely sufficient by itself’ (p. 153). Circumstances during scientific revolutions are such that the ‘decision between alternate ways of practicing science [...] must be based less on past achievement than on future promise’ (p. 156) and can ultimately only be made ‘on faith’ (p. 157).

This central point may be conceptualized by considering pre- and post-revolutionary paradigm-based practices as what Kuhn calls ‘incommensurable’, that is, as having no common measure that would allow for a comparison establishing the superiority of one paradigm over the other. ‘Proponents of competing paradigms [...] fail to make complete contact with each other’s viewpoints’ because they disagree over the problems to be solved, over their standards or definitions of science, and over their use of similar terms and concepts (p. 147). In short, they have different world views and may be said to ‘practice their trade in different worlds’ (p. 149).

One of the reasons that the thesis of incommensurable paradigms has been much contested is that it would seem to make the course of science appear as necessarily irrational, that is, as incapable of being based on rational choices. The issue is not merely that one has to allow for error, deceit, and extra-scientific contingencies that obstruct the progress of science; rather, it is the very possibility of correcting errors and thus making scientific knowledge progress in a cumulative, asymptotic manner that is in question. At the same time, one could also say that the scenario of interlocutors disagreeing on whether they are seeing a duck or a rabbit offers a model not only for incommensurability, but also for dealing rationally with irrationality: if incommensurability makes a rational decision in favour of one gestalt over another impossible, the rational thing to do is to settle the dispute by accepting, at least provisionally, both of them as equally valid and justified. However, such a conclusion seems difficult to accept, and especially – but not only – in science the tendency is rather to reject at least one alternative as mistaken.

Experience with multistable figures may help to ward off the temptation to rush from an initial success to the elimination of alternatives, rather than recognize the adoption of a paradigm as a choice that may have to be revised or that is constitutive of a particular (sub)discipline that can coexist with others. The thesis of incommensurability does not discredit paradigm-constituting achievements – either past or promised for the future – but it does relativize them; it challenges the seemingly self-evident irreversibility of the third aha-experience and restores reversibility to the horizontal gestalt switches of the puzzle’s components. It thereby makes the adoption of a paradigm recognizable as a matter of choice, that is, as a decision that interrupts a potentially endless reversal of aspects corresponding to incommensurable paradigms.

In fact, thinking of the reversibility of multistable figures, incommensurability can be seen as the condition for a scientific decision that is truly free insofar as it is not determined by scientific knowledge: with either alternative being equally consistent within the currently available knowledge, multifaceted personal contingencies and aesthetic factors can play a role in decision-making, as can political and economic considerations raising ethical questions, especially when it is a question of which problems and which solutions are considered more pressing and relevant.

At the same time as providing a condition for a free decision, multistability arguably also demands a decision for there to be a praxis. This need not be taken as a normative claim favouring the establishment of 'normal science', but could rather be used to define paradigms as the context that is at least implied when engaging in a praxis. However, insofar as the praxis persists, the ultimately contingent and perhaps also unwitting decision will stabilize itself and become irreversible because it will involve further changes in perception and conceptualization. And within a growing community of followers initiated in a particular way of seeing and thinking, alternatives may well be excluded or simply forgotten.

Kuhn suggests that the sciences are perhaps 'unique among creative disciplines in the extent to which they cut themselves off from their past'.<sup>47</sup> More precisely, they reconstruct the work of their predecessors in terms of current ways of seeing and conceptualizing, thereby generating an image of cumulative scientific development that misrepresents the past. Historical, interdisciplinary, and intercultural analyses here have a critical potential in questioning ideologies of teleological progress by re-opening possibilities and revisiting choices that can only be recognized and evaluated as such when a situation of multistable reversibility between different alternatives is reconstructed. In other words, they can offset aspect-blindness, which all-too-easily grows with tradition, differentiation, and specialization, and which envelops what is seen with a sense of brute facticity and necessity without historicity and contingency. Re-activating reversible aspect changes between incommensurable alternatives counters aspect-blindness without necessarily objecting to the decisions that were taken, let alone to the fact that a decision was taken. Instead, the critical intervention lies in making decisions recognizable as decisions, that is, in making them accountable and susceptible to reevaluation.

## VII. ORTHOGONAL SHIFTS AND COMPLEMENTARITY

When the sciences are claimed to undergo revolutions that are conceived in terms of shifts between incommensurable alternatives, they lose their privileged status of being a model for linear, teleological progress. Their dynamic appears to be just as subject to historicity and contingency as that of other social and cultural systems in which the importance of rhetoric, politics, and aesthetics is more apparent. Yet, Kuhn, whose name is readily associated with such a demystification of scientific progress, does not quite exclude the possibility of progress, and ultimately reasserts a specificity of science in this respect. His final chapter, 'Progress Through Revolutions', highlights that scientific productivity comes from 'very special communities' and is mostly 'a product of Europe in the last four centuries' (p. 167). He observes that within such communities oriented towards 'normal science' the perception of progress even across revolutions 'is, in an important respect, self-fulfilling' (p. 168). However, his intervention lies not here but in rejecting a teleological view of science progressing *towards* a goal – such as approaching 'a permanent fixed scientific truth' (p. 172) – in favour of a 'process of evolution *from* primitive beginnings' (p. 169) 'marked by an increase in articulation and specialization' (p. 171). The difference between rejecting only teleology and rejecting progress as such, arguably maps onto the different lessons that the history of science and science studies drew from Kuhn's work.<sup>48</sup> Although Kuhn seems to clarify his position in this respect in the final chapter, multistable figures may help to think through an ambiguity that remains and pertains also to the notion of incommensurability.

Kuhn's account of why scientists cannot be expected to attest directly to perceptual switches accompanying paradigm changes indeed goes beyond what could be understood as a critique of an ideology of scientific progress or of a continuous rewriting of history from the winner's perspective. He suggests that it is not only due to hindsight or to an unwillingness to un-learn and re-learn ways of seeing that the sciences are effectively aspect-blind and can at best recognize corrections in perception and conceptualization, but not reversible aspect changes. Referring to Fig. 4, the issue is also that the vertical dimension implied in a gestalt switch is not fully available in scientific observation. Kuhn's account for how the multistable figures in gestalt experiments differ from scientific observation is worth quoting at some length because it

not only makes the recognition of a (horizontal) aspect change dependent upon an orthogonal movement, but interestingly also highlights the process of learning *not* to see a gestalt or figure:

The subject of a gestalt demonstration knows that his perception has shifted because he can make it shift back and forth repeatedly while he holds the same book or piece of paper in his hands. Aware that nothing in his environment has changed, he directs his attention increasingly not to the figure (duck or rabbit) but to the lines on the paper he is looking at. Ultimately he may even learn to see those lines without seeing either of the figures, and he may then say (what he could not legitimately have said earlier) that it is these lines that he really sees but that he sees them alternately as a duck and as a rabbit (p. 114).<sup>49</sup>

Once again, we here have a description of a double movement in multistable figures: on the one hand, the reversible gestalt shift between the two figures, and on the other hand, the movement between seeing-as or between seeing lines and figure (Fig. 9). I have sought to suggest that these two movements correspond to the different ways in which multistable figures can function metaphorically: the latter, vertical movement lies at the core of multistability as a metaphor for an irreversible, revolutionary temporality. It is orthogonal to the first and involves the emergence or destruction of a gestalt, rather than a reversible shift between figures.

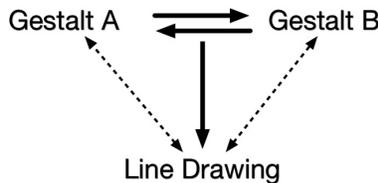


Fig. 9 Double Movement.

Kuhn continues by arguing that '[w]ith scientific observation, however, the situation is exactly reversed. The scientist can have no recourse above or beyond what he sees with his eyes and instruments' (p. 114). That is, as he remarked before: 'Scientists do not see something *as* something else; instead, they simply see it.' This does not mean that they see reality as it is, but on the contrary that they are limited to what they see and therefore cannot say that it is some underlying object that they 'really see' while seeing it alternately as one thing or another. It

would seem that scientists are necessarily aspect-blind: they cannot know that their perception has shifted if by this we mean that the same object is seen in different ways, for this would require that the identity of the object be ascertained in the first place. In other words, the change of perception during a scientific revolution has some resemblance with the horizontal gestalt switch of multistable figures, but it is generally unclear to what extent the change is due to a switch in perception or to other changes, such as looking elsewhere with other methods and different concepts. It is only if one can reversibly move back and forth without changing anything else in one's 'environment' that one can imagine settling disagreement between different perceptions and descriptions by resorting to the model of multistable figures. This seems to lead to the paradox that multistable figures provide a model for the undecidability between incommensurable paradigms only when one can affirm a common measure: that is, only once one has ascertained the identity of the underlying object.

The paradox can be resolved in different ways.<sup>50</sup> One could, for instance, limit incommensurability to the higher level of approaches, questions, and selective attention – that is, to an epistemological level – and distinguish it from an independently existing ontological level that provides a common measure for all perception. Such a (realist) view guarantees the possibility of progress while also allowing for incommensurability as long as understanding is not complete. However, what is ultimately misleading about the parallel of gestalt demonstrations and scientific observation is perhaps not so much the conflation of paradigm and accompanying perception, but rather the idea that perception involves the interpretation of some raw data and that one could generally resolve conflicting perceptions and descriptions by referring them to a raw perception that could be neutrally described so as to either correct the interpretations or accept them as equally justified.

Starting not with an object but with conflicting accounts, it may in most cases remain an open question as to whether the model of multistable figures is at all applicable. Nevertheless, allowing for this possibility carries a productive and critical potential that is missed by the assumption that a decision for one of the gestalten must be taken in the expectation that the solution it promises can be actualized. Kuhn's point about highlighting the difference between scientific observation and gestalt experiments was certainly not to rule out the possibility of identifying a common underlying object for scientific observation, but

rather that with such an identification the aspect changes would become a psychological problem of sense perception while the original scientific interest would now be directed at this underlying object (p. 114). That is, if competing aspects can be recognized as forming a multistable figure in this manner, the crisis would already be solved through a paradigm change in a direction orthogonal to that of the changing aspects.

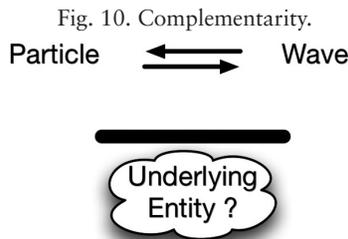
What may seem odd here is that although the recognition of a common underlying object can well be imagined to produce an aha-experience and to proceed in a vertical direction orthogonal to the competing aspects, the shift appears to involve the (partial) destruction of a gestalt, rather than its emergence. That is, it proceeds in a downward direction from which a negative aha-experience – a disillusion or demystification – could be expected, rather than the shift to a new gestalt. With scientific observation, the situation is thus indeed exactly reversed with respect to gestalt-switch experiments. At the same time, the disintegration of gestalten into its components also coheres well with a reductionist scientific programme aiming at a unified world view with ever more elementary constituents and interactions. This double reversal points to what may be a better way of thinking about the relationship between seeing and aspect-seeing: after all, why not say, once we manage to see the line drawing without seeing either of the figures, that we see the picture-rabbit *as* a line drawing? Seeing something as something else could indeed be taken as a symmetrical relationship that does not imply that one is the interpretation of what is ‘really seen’. This questions the sense of an epistemological hierarchy that I have thus far encouraged by using the value-laden image of verticality. Yet, it does not affect the orthogonality of movements nor their connection to different temporalities. Even staying within three dimensions, one can have orthogonal movements that are equally horizontal, and the paradigms that stabilize each of the horizontal movements can be in the same plane but orthogonal to each other.

In order to illustrate the exact reversal in scientific observation, Kuhn invokes an example of both reversible and irreversible movements within the history of science. These would seem to correspond, respectively, to a period of crisis within one paradigm and to a revolutionary shift towards another paradigm: ‘if the scientist could switch back and forth like the subject of the gestalt experiments’ this would indicate a crisis, which Kuhn situates entirely in the old paradigm preceding a revolutionary paradigm shift that resolves it:

The period during which light was ‘sometimes a wave and sometimes a particle’ was a period of crisis – a period when something was wrong – and it ended only with the development of wave mechanics and the realization that light was a self-consistent entity different from both waves and particles (p. 115).

This resolution of the wave–particle duality seems to relate precisely to learning to see the lines without seeing either of the figures, recognizing that one sees them alternately as a duck and as a rabbit. Again, this means associating a scientific revolution – the development of quantum mechanics, which is here invoked without being developed – with the dissolution or destruction of gestalten into something more elementary, rather than to the appearance of a new gestalt.

However, this is perhaps the most striking example of a multistable figure that is arguably irreducible and irresolvable because a shift of focus to an underlying object is barred. For it seems inaccurate to say that what one ‘really saw’ was light as ‘a self-consistent entity’ and that one saw it sometimes as a wave and sometimes as a particle. There is no raw data that is interpreted differently – if anything, there is something like the dawning of new aspects in the formalism of quantum mechanics, be it in the guise of Schrödinger’s wave equation or in Heisenberg’s matrix formulation. While Kuhn seems to imply that seeing a wave or a particle was equally wrong – as light is an entity different from both – Niels Bohr’s principle of complementarity suggests that both perceptions have to be accepted as equally right and necessary for a complete description, even if they ‘stand in such a state of mutual exclusion that they cannot be visualized in a single picture’.<sup>51</sup> In Bohr’s view it cannot be said what light really is, since it can only be seen under an aspect, and the aspect under which one decides to ‘see’ (or rather, measure) it determines what it is (Fig. 10).



This is not the place to go into the details of the different interpretations of quantum mechanics, which continue to be subject to much debate. The point of engaging in some details with Kuhn's analysis was not to re-evaluate its applicability to the history of science, but rather to illustrate how multistable figures with some small variations can provide a powerful and complex model to help identify and think through different temporalities and topologies of decision-making.

As long as things are seen in only one way they are simply seen and there is no question of making a decision. Once another aspect dawns, the question arises as to whether one aspect is to be favoured over another – for being more accurate or in some other ways preferable, such as aesthetically, politically, morally, ethically, or religiously. Provided that the aspect changes are not fully involuntary, an unwitting decision – as the initial state of seeing is retroactively recognized – can thereby give way to a more reflective decision, for which one can seek to provide reasons and motivations. However, the model of multistable figures also allows for other possibilities. For instance, one could decide to keep the alternatives in suspense or continue to engage in reversible aspect changes, enjoying perhaps the aesthetic intensity or investing in the political potential of undecidability or of recurring aspect-dawnings. Furthermore, performing a shift in an orthogonal direction, one might see a common object in the different aspects and decide to focus all attention on it. The conflicting aspects may be regarded as epiphenomena, as merely subjective, equally insufficient and ultimately wrong interpretations, and the choice between them could be considered as the result of a questionable ontology, epistemology, or ideology. Or, one might insist that the conflicting aspects are more elementary, cannot be combined into a single coherent object, and should be taken as the expression of an unmediated duality, a fundamental rupture, or ineluctable gap. Here, too, one might then decide to keep the alternatives in suspense rather than engage in one-sided reductions, but one might also take them as equally possible alternatives of actualization. While this brings us back to a decision between conflicting alternatives, they now stand for different actualizations of potentials on an ontological level, rather than for an object's perceptual aspects on an epistemological level. While there is no reason to believe that any of these decisions can be taken once and for all, multistable figures provide a figure of thought that gives them a space and makes it possible to think them through in specific contexts.

## NOTES

- 1 This paper benefited greatly from reading the papers collected in this volume at various stages of their writing and from discussions on multistable figures at the ICI Berlin in 2010–11. I am indebted to all members of the ICI colloquium and would like to thank in particular Manuele Gragnolati for his comments on earlier versions of this paper and his enduring support.
- 2 Amy Krouse Rosenthal and Tom Lichtenheld, *Duck! Rabbit!* (San Francisco: Chronicle Books, 2009).
- 3 Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 4th edn (Chicago: University of Chicago Press, 2012), p. 85.
- 4 Ludwig Wittgenstein, *Philosophical Investigations (Philosophische Untersuchungen)*, trans. by G. E. M. Anscombe, reissued 2nd edn (Oxford: Blackwell, 1997), p. 194.
- 5 For the importance of the subject's knowledge of reversibility in experiments on the visual perception of ambiguous figures, see e.g. Irvin Rock, Susannah Hall, and Janet Davis, 'Why Do Ambiguous Figures Reverse?', *Acta Psychologica*, 87 (1994), pp. 33–59.
- 6 Joseph Jastrow, 'The Mind's Eye', in *Fact and Fable in Psychology* (Boston: Houghton Mifflin, 1900), pp. 275–95 (p. 294).
- 7 *Ibid.*, p. viii.
- 8 *Ibid.*, pp. 285–86.
- 9 *Ibid.*, p. 294.
- 10 See for instance Gerald M. Long and Thomas C. Toppino, 'Enduring Interest in Perceptual Ambiguity: Alternating Views of Reversible Figures', *Psychological Bulletin*, 130.5 (2004), pp. 748–68 and the Theme Issue *Multistability in Perception: Binding Sensory Modalities*, ed. by Jean-Luc Schwartz et al., *Philosophical Transactions of the Royal Society B: Biological Sciences*, 367.1591 (2012), pp. 896–1012.
- 11 Jastrow, p. 294.
- 12 *Ibid.*, pp. 294–95.
- 13 *Ibid.*, p. viii–ix.
- 14 *Ibid.*, p. 276.
- 15 *Ibid.*, p. 278. Microscopic techniques have played an important role in problematizing scientific observation and seeing. See, for instance, Norwood Russell Hanson's *Patterns of Discovery: An Inquiry into the Conceptual Foundations of Science* (Cambridge: Cambridge University Press, 1958), which begins with the different answers microbiologists may give when looking at a prepared slide (p. 4), and famously proposes that 'seeing is a "theory-laden" undertaking' (p. 19); or Ian Hacking's *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science* (Cambridge: Cambridge University Press, 1983), which criticizes the catchword of 'theory-loaded seeing' (chapter 10: 'Observation', pp. 167–85) before engaging in a subtle analysis of seeing with microscopes (chapter 11: 'Microscopes', pp. 186–209).
- 16 Jastrow, p. 279.

- 17 It is beyond the scope of this article to situate Jastrow's oscillation in the history of objectivity, which in the nineteenth century shifted, as Lorraine Daston and Peter Galison showed, from a commitment to 'truth to nature' to 'mechanical objectivity', but at the same time ended up with a modern objectivity that 'mixes rather than integrates disparate components, which are historically and conceptually distinct'. See Lorraine Daston and Peter Galison, 'The Image of Objectivity', *Representations*, 40 (1992), pp. 81–128 (p. 82). Let me just note that while Jastrow's book fits well with Daston and Galison's association of mechanical objectivity with a 'profoundly moralized vision' of scientific work, his account of the 'Mind's Eye' and especially of multistable figures also problematizes the 'preache[d] asceticism' where the 'temptations and frailties had less to do with [...] standard sins than with seeing *as* rather than seeing *that*' (ibid., p. 83; italics in the original).
- 18 Long and Toppino, pp. 760–61.
- 19 Ibid., p. 761.
- 20 Ibid., p. 749, n 3.
- 21 See, e.g., David A. Leopold and Nikos K. Logothetis, 'Multistable Phenomena: Changing Views in Perception', *Trends in Cognitive Sciences*, 3.7 (1999), pp. 254–64, who point to '[m]uch evidence [that] suggests that perceptual reversals are themselves more closely related to the expression of a behavior than to passive sensory responses' (p. 254).
- 22 More generally and abstractly, the relatively stable states are points in a system's configuration space that are privileged insofar as some global function – such as the system's energy – has a local minimum there.
- 23 The literature on chaos and complexity theory is too large to cite here, but for a recent discussion of modelling the brain as multi- and metastable systems, see J. A. Scott Kelso, 'Multistability and Metastability: Understanding Dynamic Coordination in the Brain', *Philosophical Transactions of the Royal Society B: Biological Sciences*, 367.1591 (2012), pp. 906–18 and references therein.
- 24 Wittgenstein, *Philosophische Untersuchungen*, p. 193.
- 25 Ibid., pp. 196 and 197.
- 26 Ibid., pp. 197, 212, and 194. On the distinction and intertwining of the structural aspects of multistability and the phenomenon of aspect shifts, see also Section 3 of Beau Madison Mount's chapter in the present volume.
- 27 Jacques Lacan, 'The Mirror Stage as Formative of the Function of the I As Revealed in Psychoanalytic Experience', in *Écrits: The First Complete Edition in English* (New York: Norton, 2006), pp. 75–81 (p. 75).
- 28 Ibid.
- 29 Ibid., p. 76.
- 30 Ibid., p. 78.
- 31 Michael Billig, 'Lacan's Misuse of Psychology: Evidence, Rhetoric and the Mirror Stage', *Theory, Culture & Society*, 23.4 (2006), pp. 1–26.
- 32 For a thorough analysis of this moment of relativization in multistable figures, see Luca Di Blasi, 'Splitting Images: Understanding Irreversible Fractures through Aspect Changes', in this volume.

- 33 In this sense, reversible figures might provide an antidote to the ‘function of misrecognition [*méconnaissance*] that characterizes the ego in all its defensive structures so forcefully articulated by Anna Freud’ (Lacan, ‘The Mirror Stage’, p. 80).
- 34 Wittgenstein, *Philosophische Untersuchungen*, p. 213; emphasis in the original.
- 35 Ibid., p. 213. I have here adapted Wittgenstein’s double-cross example to the duck-rabbit figure.
- 36 Ibid., p. 214.
- 37 See, e.g., Sara Fortuna, *Wittgensteins Philosophie des Kippbilds: Aspektwechsel, Ethik, Sprache* (Vienna: Turia + Kant, 2012); William Day, ‘Wanting to Say Something: Aspect-Blindness and Language’, in *Seeing Wittgenstein Anew*, ed. by William Day and Victor J. Krebs (Cambridge: Cambridge University Press, 2010); or the beginning of Section 3 of Beau Madison Mount’s chapter in the present volume.
- 38 Hacking, *Representing and Intervening*, p. 2.
- 39 Ibid., pp. 8–9.
- 40 Ibid., pp. 10–11.
- 41 Ibid., p. 11.
- 42 Kuhn, *The Structure of Scientific Revolutions*, pp. 111–12. Further references to this book are given after quotations in the text.
- 43 In a different context, Wittgenstein refers to a similar situation: ‘I see two pictures, with the duck-rabbit surrounded by rabbits in one, by ducks in the other. I do not notice that they are the same’ (*Philosophische Untersuchungen*, p. 195). The antelope-bird figure is taken from Hanson, *Patterns of Discovery*, pp. 13–14.
- 44 Hanson, *Patterns of Discovery*, p. 19.
- 45 Cf. also ‘Looking at a contour map, the student sees lines on paper, the cartographer a picture of a terrain. Looking at a bubble-chamber photograph, the student sees confused and broken lines, the physicist a record of familiar subnuclear events. Only after a number of such transformations of vision does the student become an inhabitant of the scientist’s world, seeing what the scientist sees and responding as the scientist does’ (p. 112). For a critique of the claim that all observation is ‘theory-loaded’, see e.g. Hacking, *Representing and Intervening*, chapter 10 ‘Observation’. Hacking is as critical of over-stressing (e.g. in a positivist vein) the distinction between theory and observation as of denying it altogether. Part of the issue is, of course, what is meant by theory. Hacking thus remarks: ‘Of course if you want to call every belief, proto-belief, and belief that could be invented, a theory, do so. But then the claim about theory-loaded is trifling.’ While the notion of ‘paradigm’ could be regarded as providing such an extension of ‘theory’, the claim is ‘trifling’ only if one takes it for granted that ‘everything is constructed’ and is interested in distinguishing different degrees and forms of construction, e.g. through practices rather than mathematical theories.
- 46 Thomas S. Kuhn, ‘Possible Worlds in History of Science’, in *The Road Since Structure: Philosophical Essays, 1970–1993, with an Autobiographical Interview* (Chicago: University of Chicago Press, 2002 [1986]), p. 88.

- 47 Ibid., p. 87.
- 48 See Lorraine Daston, 'Science Studies and the History of Science', *Critical Inquiry*, 35 (2009), pp. 798–813 (p. 802).
- 49 Cf. also W. J. Thomas Mitchell, *Picture Theory* (Chicago: University of Chicago Press, 1994): 'Most multistable images [...] display the phenomenon of "nesting," presenting one image concealed inside another image, but [...] they tend to make the boundary between first- and second-order representation ambiguous. They [...] employ a single gestalt to shift from one reference to another. The ambiguity of their referentiality produces a kind of secondary effect of auto-reference to the drawing as drawing, an invitation to the spectator to return with fascination to the mysterious object whose identity seems so mutable and yet so absolutely singular and definite' (p. 48).
- 50 Cf. e.g. Hacking's distinction between different kinds of incommensurability: 'topic-incommensurability, dissociation, and meaning-incommensurability' (*Representing and Intervening*, p. 67).
- 51 Niels Bohr, 'On the Problem of Measurement in Atomic Physics (1946)', in: Niels Bohr, *Causality and Complementarity: Supplementary Papers*, ed. by Jan Faye and Henry J. Folse (Woodbridge, CT: Ox Bow Press, 1998), pp. 122–25 (p. 125).

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