

# ‘The Mind’s Eye’: Visualizing the Non-visual and the ‘Epistemology of the Line’

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## ‘The Mind’s Eye’ and Planarity

We live in a three-dimensional world; and yet, within this world we are surrounded by two-dimensional planes. We encounter them as images, book pages, displays, maps, movie screens, and computer screens. The fundamental evolutionary logic of technical devices tends towards a ‘flattening out’; the end result of technological innovation is often the plane. Two-dimensional planes are ubiquitous; we are so familiar with them that we are hardly aware of the remarkable form of spatiality they constitute. *Surfaces* confront us as the outer skin of voluminous bodies; a ‘depth’ therefore always corresponds to a surface. A plane, however, is something extended *without* the dimension of depth. Indeed, we treat surfaces *as if* they were planes. We do this especially when the function of a surface consists in rendering images or inscriptions visible. Their importance in carrying out this latter action cannot be overestimated: could the invention of the inscribed surface, we are tempted to ask, perhaps have meant for the mobility and creativity of the mind what the invention of the wheel meant for the mobility and productivity of the human body?

What are the consequences for thought of introducing this artificial form of two-dimensional spatiality into the process of cognition? What does it mean for the acquisition and justification of knowledge?

Ever since the ‘iconic turn’<sup>1</sup> challenged the claim to absolutism of the ‘linguistic turn’, it has been widely understood that images initiate not only aesthetic

but also cognitive experience.<sup>2</sup> This symposium also attends to the debate on epistemic intuition and visual thought. However, our focus in this paper lies less on visuality and iconicity per se, and more on the idea that both are necessarily linked to *spatiality*.<sup>3</sup> We use spatial relations in order to depict epistemic, non-spatial states of affairs and to carry out palpable cognitive operations within those states. This offers a key to understanding the productivity of our thinking in terms of the 'extended mind'.<sup>4</sup> Thus, we must examine iconicity both *structurally*, that is, as it is deployed through planar *spatiality*, and *functionally*, which is to say, in regard to its perceptive-tactile *operativity*. The 'mind's eye' does not look *behind* appearances, it does not *penetrate* surfaces down to their hidden structures, but rather acts in cooperation with the writing and drawing hand *upon* the plane.

### The Cartographic Impulse

Within the spectrum of knowledge-generating forms of visualisation, ranging from the X-ray to computer simulations, one subset, comprising notations, lists, tables, diagrams, graphs and maps, belongs in a category we may term 'operative iconicity'<sup>5</sup>. We call this subset 'the diagrammatical'; we call its members 'inscriptions'. Its lowest common denominator is the inscribed plane that emerges from the interaction of point, line and plane. Out of this graphism arises what we will call the 'epistemology of the line'.<sup>6</sup> As we will see, this epistemology has important consequences for the subject at hand: the epistemic activity of the diagrammatical does not only characterise scientific knowledge, but also philosophy.<sup>7</sup> What remains so far absent from the literature on epistemology is a reconstruction of the explicit and implicit diagrammatical dimensions of philosophy, which are not restricted, as is often assumed, to Charles Sanders Peirce.<sup>8</sup> The following considerations are meant as a contribution to filling this absence. Their guiding hypothesis is that traces of a 'cartographic impulse' can be found even (or especially) within the tradition of philosophic reflection.

What, in turn, do we mean by 'cartographic impulse'? To clarify this question, let us consider the peculiar representational conditions of maps.<sup>9</sup> Through mapping, a three-dimensional territory that is largely difficult to view as a whole is translated into a readily comprehensible, two-dimensional plane. A real space of our lifeworld is transformed into the virtual space of

a topographical map.<sup>10</sup> To accomplish this, a number of conceptual steps must be taken: first, the mapmaker must examine his subject from a highly external point of view, one that makes an overview possible in the first place. Then, a method of projection as well as a scale must be chosen. The purpose of the map is to make an unfamiliar terrain accessible to a user as a space of movement and action. This is, however, only possible through indexicality: by means of indexicality, a real person, a user, can transform him- or herself into a virtual point on the map. Only when this latter condition is fulfilled does the map become not only a representational object, but also an instrument for orienting oneself for action.

We thus encounter a decisive difference between two modalities of space in the use of maps: the difference between a virtual *configurative space* and a real *action space*. The map itself is exemplary of a configurative space in which places are arranged by their topographical order and determined by their relations to other places. The synchronic, synoptic nature of a configurative space presumes that the user's position is outside of the configuration. But a map enables its users to act in the real space of the lifeworld. The action space comes into being by means of these activities, performed by the user, who has now also become a participant within the space. It is brought forth by the movements of actors and for its duration remains limited to the completion of these actions. Orienting oneself with maps using virtual, two-dimensional configurations makes real, three-dimensional spaces of movement accessible. The symbolic configuration space that a map provides is meant to be transformed into a real space of activity. This also means that something is a map only when it is in use, only as the means of transforming arrangements into movements. Otherwise, the map remains merely an image, a structural picture.

Thus, when we speak of a 'cartographic impulse' in philosophical and epistemic respects, we mean graphic arrangements that can be transformed into a space of intellectual activity. Cognition is thus conceivable as spatially-oriented movement. Hence Kant's provocative question: *What does it mean to orient oneself in thinking?*<sup>11</sup>

### **Epistemology of the Line**

How, then, do diagrammatical arrangements manage not only to represent space, but also to produce movements of thought within it? In order to answer

this question, we must clarify what 'epistemology of the line'<sup>12</sup> means. Let us recall that diagrammatical inscriptions, including notations, tables, graphs, diagrams, and maps, are based on the interaction of point, line and plane. In the following, we will concentrate on the line, although these considerations are also applicable to the phenomenon and concept of the point.

Considerable epistemic potential is already nested within the simple act of drawing a line. This potential reveals itself in two binary oppositions: it is at once sensual and non-sensual; it is both a dependent trace and a free design. These seeming paradoxes merit more detailed description:

- (i) **Perceptible/intelligible:** The stroke on the page is perceptible; it is virtually two-dimensional; the subtle individual characteristics of the line's course carry æsthetic weight. Yet within a schema of notation, diagram, or map, the stroke is *valued* as a one-dimensional line, representing a state that is therefore not perceptible, but rather only intelligible or ideal. *Idealisation and flattening out* are closely related. In the empirical stroke, we see a non-empirical line; in a phenomenon, we see a concept. The activity of the 'mind's eye'<sup>13</sup> depends upon this 'seeing-in'. It is connected with the tactile handling of the continuous line: perceptivity and tactility are combined.
- (ii) **Trace and Outline:** The stroke is the result of a gesture; the succession of a temporal action is carried over into the simultaneity of a spatial structure. As a trace of a gesture, the line has the potential to be determined and to become the image of something. At the same time, the stroke is always a free form with which a 'Not-Yet' can be conceptualised, plans can be made, or something unreal or even impossible can be drawn up. *Heteronomy and autonomy* are combined: transmission and creativity are intertwined in the line's productivity.

It is in embodying these functions that the line acquires its epistemic significance. In the tension between the hand that *does* and the eye that *sees*, the stroke constitutes the elementary action of operative iconicity. The plane of inscription creates a space for the movement of thought in which theoretical entities are made visible and thus manageable. The perceptual nature of this act may be described as suddenly being able to see a non-empirical state of affairs within empirical arrangements. With regard to tactility, it means that operations of configuring and reconfiguring graphical markings simultaneously carry out

ideal/intellectual operations. The interstitial world of planar inscriptions mediates between intuition and thought; it intellectualises intuition and sensualises thinking. In brief: *we think on paper*.

### Plato's Simile of the Divided Line

Let us put our theoretical considerations to a practical test by attempting to reconstruct the diagrammatical structure of some instances of philosophical thought. We will demonstrate that the cartographic impulse and the space produced diagrammatically for the movement of thinking are both operative phenomena within philosophy; we will show how they are put into place within the structure of thought. We shall begin with Plato and then proceed to Wittgenstein.

In the *Republic* (*Politeia*, 509d–511e), Plato develops what is known as the 'Simile of the Divided Line', in which Socrates orders the ontological structure of the world according to a relationship between original and image, further organizing this into sub-categories by degrees of knowability. To reproduce this structure, one must draw a line and divide it into two unequal sections, such that the smaller section depicts the visible and the larger section the intelligible. These two sections should then each be re-divided in the same proportion as the original division. A four-part division of realms of being is thus created, which at the same time embodies a series of levels of cognitive knowledge with a progressively increasing degree of theoretical clarity.

Within the region of the visible, the lowermost realm is comprised of images, shadows and reflections, which correspond to the epistemic state *eikasia*, that is, conjecture. The next section of the visible encompasses the originals of these copies, the objects, plants and animals. The cognitive activity corresponding to these is *pistis*, faith or belief. Together, these two levels form the domain of 'doxa', that is, opinion. In the third subsection, which opens up the realm of the intelligible and thus of the 'episteme', reside general concepts and mathematical objects. The form of knowledge here is *dianoia*, that is, reasoning. The fourth section, in turn, is concerned with ideas as true being understood through *noesis*, the act of pure reason, which for Plato constitutes the highest form of understanding.

We must now take a closer look at the third level, where Plato locates mathematical objects, for him the proto-form of all scientific objects. As Plato

characterizes this form of cognizance, mathematicians use visible objects as images representing invisible ideas: while mathematical speech and proofs necessarily refer to perceptible figures such as particular circles or numbers, they deal not with these concrete figures, but rather with the general concepts 'circle' or 'number', which are themselves not visible, but rather purely intelligible. The form of cognizance of *dianoia* treats the visible as the perceptible imaging of something that is purely intelligible. It is thus the distinctive feature of mathematical knowledge to depend indispensably on the sensory representation of its theoretical objects and at the same time always to remain conscious of the difference between the intuitive and the purely intelligible. This prevents images from becoming illusions.

In all modern editions, Plato's Simile of the Divided Line appears only in verbal description. But perhaps the oldest extant copy of the *Republic*, contained in a manuscript held in Paris,<sup>14</sup> does in fact contain a diagrammatic representation of Socrates' four divisions of knowledge.

Three aspects of Plato's use of images are instructive from a diagrammatic perspective.

- (1) *Iconicity as ontological principle*: In contrast to the hostility towards images often attributed to Plato, and to which philosophy's larger suspicion of images was casually able to attach itself, it must be noted that iconicity is in fact the inner principle of Platonic ontology and epistemology. For Plato, everything that is real is defined by its capacity to be depicted by images. Even the highest level of being—the Forms—are introduced as originals, and thus as templates, for pictorial copies. Degrees of reality are held up against the measuring stick of the original-copy relationship. Correspondingly, Plato first introduced to philosophy the term *theoria*, which originally meant 'viewing of a festive performance.'<sup>15</sup>
- (2) *Differentiation between the visible and the intelligible; bridging of this differentiation*: Plato differentiates categorically between the perceptible and the intelligible, and thereby introduces a distinction that was for 2000 years to form the lifeblood of philosophy. The Simile of the Divided Line inaugurates this differentiation. At the same time, however, it identifies an area of epistemic activity—*dianoia*, characteristic of mathematics and the sciences—in which this difference is intentionally bridged, in that sensory objects are recognized as depicting the non-sensory. Decisive here is the fact that the sensory objects deployed in thinking are neither a final product nor an end-stage, but rather are passed through en route to

that which is not perceptible, but rather only intelligible. The bridging function of this third level, conceived of as an 'interstitial world', is the enabling factor behind movements of thought.

- (3) *Spatiality of thinking*: Plato views cognizance as an activity characterized by an implicit spatiality. Thinking is directional; this direction is defined by the cartographically arranged space of the Simile of the Divided Line and can be characterized as an ascent, that is, a rise through ascending levels. Thus is the Allegory of the Cave in the next book of the *Republic* a continuation of the Simile of the Divided Line by other means:<sup>16</sup> it visualizes not abstract lines but rather the concrete situation of a cave, and knowledge is here imagined as an ascent out of the cave and into daylight. This inherent spatiality corresponds to the methodical manner in which Plato, in the act of applying his own approach, deploys configurations of lines to visualize his own philosophy.<sup>17</sup> In this regard, we can infer from the spatial-visual arrangement and extension of line segments their ontological and epistemic meanings. For Plato himself, the diagrammatic scene becomes the medium of philosophical insight. The diagram functions as an instrument for making evident a philosophical world-image.

### Possible Connections

It is no coincidence that Plato's visualisation of a philosophical world image is paralleled slightly later by the drawing of a geographical world image by the Greek mathematician, astronomer, and geographer Ptolemy. Ptolemy left a *Guide to Geography* ('Geographiké')<sup>18</sup> which is deeply instructive in its diagrammatics. It contains, for example, a map that depicts the entire known world from an external observational standpoint—an achievement made possible only by the innovative conical projection method Ptolemy himself developed. He also introduced lines of latitude and longitude to form a homogenising system of geographical coordinates. The majority of his Atlas was created from one table, which indicated the respective degrees of longitude and latitude for 8000 localities. The world was thus depicted as a planar distribution of places arranged in a numerically determinable relation to one another. As there was no reliable process for reproducing maps in antiquity, Ptolemy developed a 'do-it-yourself' method: he designed a rubric for travellers

to make their own maps. Based on his written table and innovative projection method, every reader was able, at least in theory, to draw a map corresponding to his desired itinerary. Ptolemy's work traverses various forms of diagrammatical representation: it is variously embodied in geometrical drawings, written-out tabulations of locations and pictorial maps. At the same time, his *Guide to Geography* does not simply embody an image of the world, but rather serves as an operation manual for producing world images.

The relationship between philosophy and geography has been little analysed. In passing we can briefly mention that placed next to the ancient parallel between Ptolemy and Plato, the Early Modern duo of Mercator and Descartes is no less instructive. It is unfortunately beyond the scope of this paper to explore the many correspondences between their work.

### Wittgenstein

We shall now jump across the centuries to Wittgenstein. Is there a cartographic impulse articulated in Wittgenstein's thought as well? And can its presence shed an instructive light on Wittgenstein's way of thinking?

Let us summarise a few relevant points already well-known to students of Wittgenstein's work. (i) Having studied engineering, Wittgenstein was conversant with technical drawing, and thus with the projection of the three-dimensional onto the two-dimensional.<sup>19</sup> Wittgenstein's training in drafting can be traced back to his schooldays.<sup>20</sup> (ii) There is a vast number of sketches, schemata, drawings, diagrams, and figures in his 'Nachlass'.<sup>21</sup> (iii) Concepts of the visual constitute his basic conceptual repertoire. He is widely considered to have been a 'visual thinker' who assigned the role of providing evidence to the pictorial; he always treated philosophical problems graphically.<sup>22</sup> (iv) His reflections have for many scholars formed the basis of a 'logic of the visual'.<sup>23</sup>

In brief: the extraordinary (indeed, eminent) role played by iconicity in Wittgenstein's thought has been explored in multiple ways. So what contribution can the identification of a cartographic impulse in his thinking add to all of this?

We assume that this impulse, understood in an epistemic sense, consists in transforming a graphic configurative space into a space for the actions of thinking. In fact, the relation between arrangements and intelligible activity

in Wittgenstein's philosophical work plays a role that we can roughly express like this: thinking takes place in operating with and looking at configurations. We shall explain the connection between 'seeing a configuration' and 'thinking' by means of two examples. The first refers to the relationship between seeing and thinking in the so-called change of aspect.<sup>24</sup> The second refers to the relationship between different periods of Wittgenstein's thinking.

- (1) **Change of Aspect:** By famously invoking the duck-rabbit optical illusion, Wittgenstein is not attempting anything as ambitious as explicating a theory of perception. Instead, he wishes to show how complex our use of the word 'see' is: for that which occurs during aspect seeing is "half visual experience, half thought."<sup>25</sup> There are many versions of this duck-rabbit figure; Wittgenstein uses a simple line drawing derived from Jastrow. The drawing is not altered during the changing of aspect. But what is crucial here is that as the observer turns the figure over, he or she is connected to a *reconfiguration of its spatial orientation*. As a duck-schema—following the direction of the beak—the picture is oriented to the left: the point that marks the duck's eye looks out to the left margin. As a rabbit-schema, the beak becomes the ears and the alignment is precisely the opposite: the point of the rabbit's eye points to the image's right margin. The change in aspect draws upon the fact that the inscribed surface contains in each case the alignment's opposite orientation. For Wittgenstein, the role of thinking is embodied during the change of aspect by the moment of its *transfiguration*. This turning over is that which we cannot quite *see*; rather, we slip into the invisible domain of thought. Thinking is analogous to the act of spatially re-orienting the two-dimensional space of optical illusion. Could we perhaps say that philosophical thinking is analogous to the act of re-orienting oneself?

We thus see that Wittgenstein's schema—functioning as a visual alignment inserted into the flow of his text—opens up a space of intellectual operation in which the reader can perform a distinct cognitive act: we see the aspect, but we perform the change of aspect without actually *seeing* the change. For this reason, the flip-flop-picture is more than an explanation of 'seeing-as'. In addition, it evokes an epistemic 'seeing-in'.<sup>26</sup> The reader should experience in the drawing the insight that seeing and thinking are connected and thus understand the complexity of the grammar of 'seeing'. We see *in*

the optical illusion an ambiguous drawing, which should make evident the impossibility of being able to see the change of aspect itself. As paradoxical as this appears to be, Wittgenstein demonstrates with his duck-rabbit figure what cannot be rendered visible—and this is precisely what is characteristic of the epistemic handling of diagrammatic inscriptions that we have specified as a 'seeing of the conceptual in graphical configurations.' Incidentally, in his Simile of the Divided Line, Plato has already named this 'making visible of the invisible': it is the epistemic device '*dianoia*', which is put into place when, for example, the mathematician sees an inextensible point represented within an empirical one.

(2) **The Relationship of the Early and Later Wittgenstein.** The Wittgenstein of the *Tractatus* behaves like a logical cartographer of the world. With the aid of the picture theory of the proposition<sup>27</sup> and nourished by an internal inclination toward a structure in which thought, proposition, and world intersect, he gives us the world as an intuited—albeit limited—whole.<sup>28</sup> The spatial positioning is in this case the *vertical*; it embodies that *one* correct perspective in which the world and our model of the world become congruent.

In contrast, the Wittgenstein of the *Philosophical Investigations* behaves like an ethnographer of our forms of life; he only reaches insights when he exchanges his standpoint as an observer for a participatory perspective. The spatial positioning is in this case the horizontal, in which the world is encountered as a multitude of heterogeneous language games and life forms, which amongst themselves cannot be hierarchically ordered.<sup>29</sup> They can only be represented as a synoptic plurality—'sketches of a landscape' that come into the world on 'these long and meandering journeys'.<sup>30</sup> In the *Tractatus*, model and world coincide; in the *Philosophical Investigations*, the 'sketches of landscapes' cannot be made congruent amongst themselves. Thus it only remains to order them in the form of an 'album'.<sup>31</sup> The world becomes a continual change of aspect between various two-dimensionally ordered world images.

This distinction between Wittgenstein's early vertical perspective and his later participatory, horizontal perspective is illuminating. Nevertheless, it is apparent that Wittgenstein, in describing representations that depend upon the participatory perspective within an action space, always returns to the idea of 'sketches of landscapes' that must be arranged as an 'album'. It is

thus our assumption that Wittgenstein never broke away from the diagrammatical<sup>32</sup> synopticity<sup>33</sup> that was the nucleus of his interest in the pictorial. His debt to the spatiality of the planar, which we can understand as the phenomenology of everything pictorial, manifests itself as a diagrammatical trace in Wittgenstein's pronounced philosophical renunciation of 'depth'.

We wish to clarify Wittgenstein's renunciation of the dimension of depth using two examples: first, his concept of the 'perspicuous representation' (*übersichtliche Darstellung*) and secondly, his approach to formalism.

- (i) Wittgenstein favours the idea of 'perspicuous representation'<sup>34</sup> as well as that of morphological procedure.<sup>35</sup> Descriptions take the place of explanations<sup>36</sup> because phenomena are synoptically aligned and therefore their relationship can only be visualised by the gradual appearance among them of a figure, form or pattern. In other words, to describe is to make visible by way of alignment. Hence Wittgenstein's injunction: 'don't think, but look!'<sup>37</sup> Certainly, there are different kinds of groupings and—returning to Goethe—Wittgenstein assumes that one possibility for alignment consists in finding a standard of comparison or paradigm in relation to which all remaining phenomena can be ordered according to their similarity or dissimilarity. The scale of the ideal against which all other phenomena are measured is thus not independently inferred, but rather stems directly from the circle of appearances. *Which* morphological relationship is produced depends upon which phenomenon is chosen as a standard of comparison. Clearly, on the horizon of this morphological process, there is no longer any gradation between essence and appearance, between ideals and realisations, between surfaces and deep structures. Wittgenstein cites Goethe approvingly: 'Don't look for anything behind the phenomena; they themselves are the theory'.<sup>38</sup>
- (ii) A recurring impulse in Wittgenstein is the renunciation of hierarchisation.<sup>39</sup> It is present in his rejection of Bertrand Russell's theory of types, insofar as this theory falls back upon the linguistic hierarchy of languages. It also appears in his critical discussion of Gottlob Frege's concept of 'meaning': for Wittgenstein, the meaning of a sign does not exist as an entity beyond or behind the sign, but rather lies exclusively in its use.<sup>40</sup> Above all, the paradigmatic orientation toward planarity manifests itself in its relation to mathematics, which he interprets in terms of sign-games<sup>41</sup> which are nonetheless embedded, applicable, and useful in everyday life; they mani-

fest themselves in his dismissal of the descriptive character of mathematical language, which he notably interprets as normative.<sup>42</sup> All computation and proof is based on procedures of sign-transformation, which are made visible as planar configurations of figurative character.<sup>43</sup> Proofs are reproducible pictures whose notable feature is in turn their 'perspicuity'.<sup>44</sup>

The rejection of the dimension of depth and hierarchisation represents Wittgenstein's proximity to formalism;<sup>45</sup> and this proximity does not only relate to mathematics, but also reveals a main feature of his *entire* philosophy. Wittgenstein is a thinker of *flat ontology* and *planar epistemology*; this is perhaps the most radical form of realizing the 'cartographic impulse' within philosophy.

### Summary

(i) Diagrammatic inscriptions in the form of notations, tables, graphs, diagrams, and maps belong to the domain of visual language. They are as significant for the working of the 'extended mind' as auditory language. Epistemic connections are 'translated' into spatial relations and constituted at the same time. 'Mind' comes into being in the interaction of eye, hand and brain.

(ii) Point, line and plane constitute the elementary repertoire of graphematics. They produce a two-dimensional configurative space that can be implemented as a space for the movements of thought. Cognition is oriented by thinking on paper. Diagrammatic inscriptions serve not only to represent and communicate epistemic states of affairs, but also to produce and explain them.

(iii) The epistemology of the line is based upon the double life of the line: the empirical stroke is perceptible, the one-dimensional line is merely conceivable. Based on this dual character of the sensual/intelligible, the lines of two-dimensional planes become the 'place' in which the difference between intuition and thought are both produced and bridged.

(iv) The metamorphosis of configurative spaces into movement spaces is called a 'cartographic impulse'. The conversion of graphematic structural

spaces into spaces for the activity of thought is a central aspect of our reasoning acts. While the role of notational and graphical inscriptions in the sciences has been repeatedly explored both historically and systematically, a diagrammatological reconstruction of philosophy—with the exception of Peirce—is still needed. Plato, Aristotle, Nicholas of Cusa, Descartes, Leibniz, Lambert, Kant, Peirce, Wittgenstein and Deleuze, among others, will be crucial for this reconstruction.

(v) With his Simile of the Divided Line (*Politeia*, 509d–511e), Plato demonstrates the epistemic signature of his ontology by means of a proportioned line. Cognition is specified in terms of spatial ascent. Although Plato's philosophy locates the essential *beyond* appearance, his Simile of the Divided Line imagines the perceptible and the intelligible by means of the homogeneous line *on one* plane, allowing the gap between them to be bridged by '*dianoia*'—scientific understanding that uses the visible as an image of the intelligible. The cartographic impulse takes Plato 'beyond Plato'.

(vi) Wittgenstein is an anti-Platonist: for him there is no difference between essence and appearance. Wittgenstein's ontology is 'flat'; his representation is pervaded by characteristics of visual-projective thought, which he had first encountered in his engineering studies. For him, 'cognition' is the way in which phenomena are ordered and depicted via projection and arranged in perspicuous representations. Nevertheless, he concedes in his remarks on the optical illusion of the duck-rabbit that cognition is associated with that which remains invisible—in this particular case, the moment of the change in aspect itself. To articulate it paradoxically: within the diagrammatic scene, Wittgenstein makes visible not what is invisible, but rather an *invisibility*.

## Notes

- 1 Boehm 2001; Mitchell 2008.
- 2 Earnshaw 1992; Heintz/Huber 2001; Lynch 1998; Tufte 1997.
- 3 Châtelet 2000, 38 ff.; Summers 2003, 43 ff.
- 4 Clark/Chalmers 1998; Clark 2008.
- 5 Krämer 2009, 114–115.
- 6 Krämer 2010.
- 7 Gehring/Keutner et al. (eds.) 1992.
- 8 On Peirce: Sjernerfelt 2000; Sjernerfelt 2007.
- 9 Krämer 2008, chapter 18: Karten, Kartieren, Kartographie 298–337.
- 10 'Real space is the space we find ourselves sharing with other people and things; virtual space is space represented on a surface, space we "seem to see".' Summers 2003, 43.
- 11 Kant 1977.
- 12 See Krämer 2010.
- 13 Krämer (forthcoming) 'The eye of the mind'.
- 14 Information by Dieter Harlfinger, Director of the Aristotle Archive, Freie Universität Berlin. Reference to the manuscript: Cod. Gr. 1807, f22r.
- 15 'Theoros' originally means: The envoy of the polis to take part in religious celebrations and oracles: König 1998, 1128.
- 16 Platon, *Republica* VII, 514–519.
- 17 See also: *Menon* 82b–84c und 86e–87a, *Theaitet* 147c–148d, *Politikos* 266b.
- 18 Ptolemaios 2006.
- 19 König 2000.
- 20 Hamilton 2001.
- 21 Wittgenstein 2000; Nyíri 2004.
- 22 Blich 1987, 284f.; Gessmann 2009, 157 ff.; Mersch 2006, 925; Nyíri 2004, 110 ff.; Kunzmann 1998, 126 ff.
- 23 Mersch 2006; Mersch in *Image and Imaging in Philosophy, Science and the Arts*, volume 1, Proceedings of the 33rd International Ludwig Wittgenstein Symposium, edited by Richard Heinrich, Elisabeth Nemeth, Wolfram Pichler and David Wagner (Frankfurt: ontos Verlag, 2011), 257–287.
- 24 Krämer 2009, 114–115.
- 25 Wittgenstein 1984, I, 524. But also: 'Kann ich beim Aufleuchten des Aspekts ein Scherlebnis von einem Denkerlebnis trennen? – Wenn Du es trennst, dann scheint das Aufleuchten des Aspekts verloren zu gehen.' Wittgenstein, 1984, VII, § 564, 423.

- 26 To the 'seeing in': Wollheim 1982, 205–226; Seel 2000, 284.
- 27 Stenius 1969; Stenius 1975.
- 28 Wittgenstein 1984, I, *Tractatus* 6.45.
- 29 Krämer 2001, 111–121.
- 30 Wittgenstein 1984, I, *Philosophische Untersuchungen*, Vorwort, 231 f.
- 31 Wittgenstein 1984, I, *Philosophische Untersuchungen*, Vorwort, 232.
- 32 To this 'diagrammatical character' of Wittgenstein's picture theory: Mersch 2006; Schneider 2005.
- 33 For the 'synopticity': Plaud 2010a, 256–257.
- 34 Wittgenstein 1967; Wittgenstein I, *Philosophische Untersuchungen* § 122, 302. See: Hacker 2004; Puhl 2001; Puhl 2006; Schulte 1989, 108–112.
- 35 To the morphological method and Wittgenstein's relation to Goethe: Krämer 2001, 111–114; Plaud 2010b; Rowe 1991; Schulte 1984.
- 36 'Und wir dürfen keinerlei Theorie aufstellen. Es darf nichts Hypothetisches in unsern Betrachtungen sein. Alle Erklärung muß fort, und nur Beschreibung an ihre Stelle treten.' Wittgenstein 1984, I, *Philosophische Untersuchungen* § 109, 298f.
- 37 Wittgenstein 1984, I, *Philosophische Untersuchungen* § 66, 277.
- 38 Wittgenstein 1984, VII, *Bemerkungen über die Philosophie der Psychologie* § 889, 163.
- 39 Wittgenstein 1984, I, *Philosophische Untersuchungen* § 89, 291.
- 40 Wittgenstein 1984, VI, *Bemerkungen über die Grundlagen der Mathematik*, Teil I, §§ 19 ff.; Teil V §§ 2, 257 ff.
- 41 'Wenn wir jedoch irgendetwas, das das Leben des Zeichens ausmacht, benennen sollten, so würden wir sagen müssen, daß es sein Gebrauch ist.' Wittgenstein 1984, V, *Das Blaue Buch*, 20.
- 42 'In der Mathematik ist alles Algorithmus, nichts Bedeutung.' Wittgenstein 1984, IV, *Philosophische Grammatik*, 468. To the normativity of mathematical language: Kroß ed. 2008; Ramharter/Weiberg 2006; Weiberg 2008.
- 43 'Der Beweis [...] ist *eine* Figur, an deren einem Ende gewisse Sätze stehen und an deren anderen Ende ein Satz steht (den wir den »bewiesenen« nennen).' Wittgenstein 1984, VI, *Bemerkungen zu den Grundlagen der Mathematik*, I, § 28, 48.
- 44 'Ein mathematischer Beweis muß übersichtlich sein.« »Beweis« nennen wir nur eine Struktur, deren Reproduktion eine leicht lösbare Aufgabe ist. [...] Der Beweis muß ein Bild sein, welches sich mit Sicherheit genau reproduzieren läßt.' Wittgenstein 1984, VI, *Bemerkungen zu den Grundlagen der Mathematik*, III, § 1, 143.—To the surveyability and formalism of proof: Mühlhölzer 2005.
- 45 Mühlhölzer 2008.

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