Visualisation and Wittgenstein's "Tractatus"

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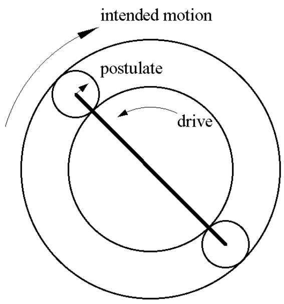
Abstract

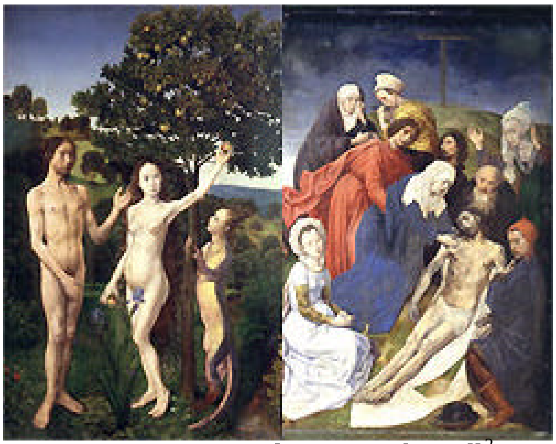
Wittgenstein developed what has become known as "the picture theory of meaning" in his Tractatus Logico-Philosophicus. This has been widely interpreted as a comparison between the way in which an engineering drawing is derived by means of projection from the object, and the way in which language and/or thought is derived from the world around us. Recent research into the intellectual history of graphical representation has shown that in addition to this kind of drawing, other forms of graphical representation were gaining in importance at the time. This paper uses graphical statics and dynamical modelling to argue that Wittgenstein's picture theory of meaning is not based on a simple analogy of depiction, but on the contrary seeks a mode of representation by which performance and action can be calculated. This interpretation explains why the picture theory may be relevant to Wittgenstein's interest in ethics and the mystical, a matter on which Russell remained completely baffled.

It is something of a surprise to find, at the end of Wittgenstein's Tractatus, that having constructed an elaborate account of how language has meaning, "the problems of life remain completely untouched" (§6.52). This conclusion was so much of a surprise to Bertrand Russell that in his introduction to the book he said it left him "with a certain sense of intellectual discomfort" (p.xxi).[1] It is also a surprise to find that if this was what Wittgenstein really wanted to write about, why then did he apparently take as his paradigm a system of representation from classical mechanics? After all, if one constructed a picture theory of meaning using a more artistic paradigm of picturing, one might feel particularly well equipped to say something about ethics and conceptions of the right way to live, etc., but nothing at all about the questions of science, e.g. Hugo van der Goes, The Fall.

[1] Wittgenstein accordingly thought the introduction was "superficial and full of misunderstanding" (correspondence in McGuinness & von Wright, 1997, pp.153-155).



Wittgenstein, 1974, p.225
(forthcoming graphical revision)



Hugo van der Goes, The Fall[2]

Although the Tractatus is a difficult book, it is fairly easy to understand the visual analogy of the picture theory of meaning.[3] It appears to be principally based on how a drawing is constructed in descriptive geometry or engineering, and makes the analogy that language has a similar relationship to the world that it describes. The reason why one can call this an analogy, a term that Wittgenstein does not himself use to describe this relationship in the Tractatus,[4] is because the concept has the four-term structure of an analogy.

Hertz's Principles of Mechanics (1899, p.1) is commonly taken as a source of these remarks in the Tractatus.

> We form for ourselves images or symbols of external objects; and the form which we give them is such that the necessary consequents of the images in thought are always the images of the necessary consequents in nature of the things pictured.
>
> The images which we here speak of are our conceptions of things. With the things themselves they are in conformity in one important respect, namely, in satisfying the above-mentioned requirement. For our purpose it is not necessary that they should be in conformity with the things in any other respect whatever. As a matter of fact, we do not know, nor have we any means of knowing, whether our conceptions of things are in conformity with them in any other than this one fundamental respect.

Hertz's analogy is anti-Realist and does not require that the world is necessarily like the representation just because we can map one onto the other. Boltzmann, a contemporary of Hertz, is explicit about analogous relationships. He draws attention to his use of the term when describing the theory of gases as a mechanical analogy (Blackmore, 1995, p.49). He says "the choice of this word [shows] how far removed we are from that viewpoint which would see in visible matter the true properties of the smallest particles of the body".

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[2] The author acknowledges the permsission of the Kunsthistorisches Museum, Vienna to reproduce this image.
[3] This comment is meant as an encouragement to the general reader. Wittgenstein himself came to think that the concept of picturing was "vague" (Moore, 1959, p.263), and his later philosophy can be read as a critique of his earlier position (cf. Wittgenstein, 1974, p.212).
[4] He does use it several times in the antecedent Notebooks 1914-1916 (pp.38, 99, 113) and elsewhere.

The possibility of an analogous representation has its base in an isomorphism (Wittgenstein uses the term "logical multiplicity", §4.04), which ensures that aspects of the object can be mapped onto aspects of the representation, and vice versa. But Wittgenstein wants to do more than depict reality. He wants to be able to operate within the model and draw conclusions about properties in the world. Such a requirement to calculate rather than to depict, moves us from types of representation such as descriptive geometry and engineering drawing, to those of graphical statics and dynamical models. Perhaps, if this method of calculation could be applied to language, we might find a method with which to make decisions about ethics, etc.

THE DEPICTION OF APPEARANCE

Engineering drawing is a particularly good way of representing the appearance of a three-dimensional object. It can do this because lines of construction are projected in three-dimensional space from visible points on an object to the picture plane. It is more effective at recording form and less effective at recording colour and texture, etc. It is not effective at all at recording our responses to the appearance of the object, etc. It is a branch of descriptive geometry in which the form of an object can be specified. The basic isomorphism of an engineering drawing is the object's three-dimensionality. The description of a three-dimensional form would normally require three orthographic views although there are, of course, objects that cannot be completely disambiguated without additional views. Nonetheless the basic principle is that the number of views corresponds to the number of dimensions to be recorded.

One can regard the concept of dimension in a number of different ways. Certainly what is more useful is to adopt the mathematical concept of dimension rather than the everyday one. The mathematical concept is that there is one dimension per quality to be recorded. In this notation if we record the three-dimensional position of a point and its colour we have four dimensions. If we record its material it would add a fifth dimension, etc. This is not the everyday use of the word dimension, which starts with length, width and breadth, and adds time as a possible fourth dimension, but rarely goes further. Our everyday concept includes an implicit visualisation which limits the number of dimensions to those of everyday experience. The mathematical dimensionality of a representation allows us to record qualities and to satisfy Wittgenstein's principal objective to be able to reconstruct the object. This reconstructive purpose is emphasised in his examples in the Tractatus which are not just restricted to three-dimensional objects. He gives us other examples, e.g. the gramophone record and the musical score. The gramophone record allows us to reconstruct the sound of a piece of music by decoding it.

> There is a general rule by means of which the musician can obtain the symphony from the score, and which makes it possible to derive the symphony from the groove on the gramophone record, and, using the first rule, to derive the score again. That is what constitutes the inner similarity between these things which seem to be constructed in such entirely different ways. And that rule is the law of projection which projects the symphony into the language of musical notation. It is the rule for translating this language into the language of gramophone records. (Tractatus §4.0141)

The coding and decoding processes are mirror images of one another but of course, the dimensionality and isomorphism of the gramophone record does not include an image of what the orchestra looked like when they were playing the music. Thus we could say that today's DVDs have a greater logical multiplicity or mathematical dimensionality than gramophone records. Digital techniques make it easy to record very large amounts of information about an object but this does not altogether avoid the need for selectivity. When one is recording an event one must still decide what it is that one wishes to record and therefore the number of dimensions that are required. This has been reflected in the recent project to digitise Wittgenstein's Nachlaß. The project began with facsimiles of Wittgenstein's hand-written manuscripts etc. and a decision had to be made about what was important to record. Naturally, the orthographic types were of prime importance, but how important were spelling mistakes; what about the graphologist who attributes meaning to the shape of individual letter forms? What about the line breaks and page breaks? The mathematical dimensional problem becomes quite explicit if the encoding language is XML because each event requires a tag to be defined. The total number of tag-types is related to the dimensionality of the representation.

THE DEPICTION OF PERFORMANCE

Wittgenstein's paradigm is the ability to reconstruct an object from its representation, to reconstruct a thought from a sentence, etc. The basic model appears to be from classical mechanics, three-dimensional objects in three-dimensional space in mechanical relationships to one another: "aRb". But Wittgenstein was familiar with other forms of graphical representation. For example, graphical statics is a system for the diagrammatic representation of structures by which their performance can be calculated. There is sometimes an iconic aspect to the drawing but it is principally a method of representing forces using vectors. It is therefore at best a schematic representation of what the object might look like. Here the notion of representation is one of function rather than appearance. Stenius, in his commentary on the Tractatus, calls these "unnaturalistic pictures" (1960, p.113).

Hamilton has recently published a paper (2001) that discusses various modes of engineering representation: descriptive geometry, graphical statics and dynamical models. However, the present paper disagrees with the role attributed to each. Indeed, even the title "Wittgenstein and the Mind's Eye" seems unfortunate because the mind's eye is something explicitly rejected by Wittgenstein in the later Blue Book (1958, p.4). This common interpretation of the Tractatus is described by Stenius as a misunderstanding (1960, p.113). Hamilton is writing about the early Wittgenstein and of course is not obliged to be a Wittgensteinian. Other commentators have preferred Hamilton's expression "engineering mind set" (Hamilton, 2001, p.73; cf. Sterrett, 2002 and Seekircher, 2002). However, the concepts of the mind's eye or a mindset are unnecessary for the argument of the present paper. It argues against Hamilton's emphasis on representation as the description of appearance rather than as the description of performance. For example, the opening quotes of Hamilton's article (2001, p.53) emphasise visualisation and, later, the logic of depiction (2001, p.88).

It is not necessary to posit visualisation as an underlying activity in order to discuss the importance of Wittgenstein's engineering training on his philosophical development. Certainly engineering drawing as a system of representation is significant in engineering training, but Wittgenstein's mention of Hertz and Boltzmann provide the clue. Both of these emphasise the role of models as ways of thinking about the world rather than the depiction of the world. Graphical statics and dynamical models enable one to infer the performance of real objects from vector diagrams or scale models, such as the behaviour of propellers. These techniques were very important at the time that Wittgenstein studied engineering (1906-1911) because they were being used to design aspects of the first flying machines. What a powerful endorsement of a graphic technique to be able to use it to calculate how to fly![5]

The first treatise on graphical statics was published by Karl Culmann in 1866[6] and although it was not translated into English, by 1888 his methods were widely used in British engineering schools (Maurer, 1998, p.247). Hamilton (2001, p.61) describes the move in German engineering education at the end of the nineteenth century from calculus towards more pragmatic graphical methods. Graphical statics is interesting in this respect because it is an applied method using graphical representation to facilitate calculation. Boltzmann's comments on models (1974, p.214) and Buckingham's on dynamical models (1914, p.356) reinforce the pragmatic aspect of this kind of calculation. Wittgenstein himself learned graphical statics from Stanislaus Jolles at the Technische Hochschule at Berlin-Charlottenburg. Wittgenstein studied there from 1906-1909 and also lodged with Jolles, with whom he continued occasional correspondence until 1921, after which he continued to correspond with his wife Adele Jolles until 1939. During Wittgenstein's time in Berlin in 1907, Jolles was made Professor of Descriptive Geometry.

Sterrett (2002) has also recently published on the theme of Wittgenstein's engineering background. She too has recognised the role of performance models in his thinking. What is significant is not that through language or another form of representation we are able to perform the practical manipulation of the world, but the very possibility of that manipulation. So here one may see a symptom of the change of interest from Wittgenstein's applied studies in engineering to mathematics and the foundations of mathematics which took him away from engineering to work with Russell in 1911. The Tractatus, which was written around 1918, reflects the idea that representation is more to do with possibility and functionality than physical appearance.

One conclusion that this paper draws from the availability to Wittgenstein of these three different forms of graphical representation: descriptive geometry, graphical statics and dynamical models, is that of an enhanced notion of the functionality of drawings. The simplest notion of the function of a drawing is its depictive function: drawings often look like what they represent. This is not a particularly important aspect, although Stenius thinks it is underestimated (p.207ff.). The notion of graphical calculation is more significant because it reveals that by changing the notation e.g. to vectors, one can manipulate the representation and come to conclusions about the performance of real objects. It is a very powerful capability and complementary to the anti-realist notions of Hertz and Boltzmann on models.

[5] The aeronautical pioneer Henri Coanda studied at TH Berlin-Charlottenburg at the same time as Wittgenstein. Both men designed innovative air-reactive (jet) propulsion systems.
[6] Culmann published an earlier work on graphical statics in 1864. See Maurer, 1998, pp.151-154.

In particular, to employ terminology from Wittgenstein's later work, when we move to an alternative form of notation, certain aspects become "perspicuous" (1997, §122).

There are, however, limitations to what can be recorded in a particular notation. Although Wittgenstein is seeking a perfect language, he is not seeking one with universal application but rather one that avoids misleading us. Thus when Hamilton (2001, p.56 reporting Schulte) refers to Wittgenstein's preference for "palpable, graphic forms of representation", Wittgenstein's preference should be interpreted not as a concentration on the merits of the graphical, but on the merits of the perspicuous. Different forms of graphical notation, and other forms of notation such as truth-tables and symbolic logic, each have the capability of rendering certain aspects more clearly than others. Wittgenstein's training did not so much indoctrinate him to graphical rather than non-graphical methods, as raise his awareness of the influence that notational systems as a whole have on our concepts and reasoning. As Hamilton says (2001, p.86):

> what he learned in his engineering education was not limited to a particular style of representation. It embodied principles that provided him with a deeply interconnected understanding of the principles behind all our modes of representation.

This leads us to the final issue: the limitations not of single representational systems but of any representational system. It is a key concept in the Tractatus that a representation cannot represent its own representational form (§2.173). To describe a representational form requires one to step outside it. Thus, if one did not understand English, no amount of reading the Oxford English Dictionary would help. Contrary to Hamilton (2001, p.85) the fact that a picture cannot depict its representational form is not a problem of what can be visualised as opposed to what can be verbalised, but what can be expressed in a particular form of representation as opposed to the representational relationship itself. The latter requires stepping outside of the language of the representation in order to describe it. If we are talking about the totality of all our forms of representation of the world, i.e. thinking, then this process of "stepping outside" becomes impossible. One could compare this to the limitation of a particular paradigm in Kuhn:[7] if the paradigm changes then all sorts of ideas become possible that were hitherto impossible or unthinkable. However, when a paradigm changes the world remains unchanged.

The fact that ethics cannot be put into words (Tractatus §6.421) is not a reference to the possibility that ethics could be put into pictures (Hamilton, 2001, p.85). We have two different modes of representation: language and pictures, and they can show two different things. Pictures are no more able to show their representational form than is language (Tractatus §4.121). Neither drawing nor language, to the extent that they represent thinking, can represent the relationship between thinking and the world, because that requires stepping outside thinking.

[7] Kuhn links his argument to a starting-point in Wittgenstein's *Philosophical Investigations* in the section "The Priority of Paradigms" pp.43-51.

CONCLUSION: SAYING, SHOWING, AND THE INCONCEIVABLE

In the Tractatus, Wittgenstein made an explicit distinction between what can be said and what can be shown. Unfortunately, at the same time he put forward what has become known as the picture-theory of meaning. This paper argues that this has caused a false association of what can be pictured and what can be shown. In particular, various writers discussing the role of imagery and picturing in Wittgenstein's engineering studies have argued to a greater or lesser extent that graphical representation could be an alternative to the limitations of language. On the contrary, this paper argues that the substance of Wittgenstein's distinction between saying and showing is not to do with the limitations of a particular form of notation but the general relationship of notation and conceivability. It has more to do with what later became known as a form-of-life (Wittgenstein, 1997, §23) than to do with the theory of picturing.

The so-called picture-theory is clearly described, if not named, in the Tractatus. A key feature of the picture-theory is that language or other forms of representation stand in a relationship to the objects that they represent, and this relationship is analogous to the relationship that subsists between pictures and objects. The term "pictures" incorporates a range of forms including the gramophone record, etc. and therefore it is false to assume that the comparison is principally between iconic images and that which is depicted.

Of the three types of graphical representation that have been discussed in this paper, engineering or projection drawing is the one that has hitherto received the most attention. It is the most familiar of the three, and the language that is used in the Tractatus to describe the representational relationship evokes this form of representation, e.g. references to projection. In addition the resultant drawings are easy to understand as pictures of what they represent. Admittedly the visual vocabulary used is less familiar to Western eyes than perspective, but nonetheless the objective of representing the form of the object is a recognisable aspect of what we commonly mean by picturing.

However, the other two forms of graphical representation discussed in this paper: graphical statics and dynamical models, can be shown to have a more important role as examples of the kind of relationship that Wittgenstein was describing in the Tractatus. These representational forms are not concerned to show the appearance of an object but are a form of representation that facilitates the calculation of performance. In these examples the representational relationship is more complex because although the resulting diagrams are visual, what they represent is non-visual, e.g. forces. It also clarifies why we need to understand the form of representation, and that all these modes simply represent different aspects of problems in physics.

Returning to the opening remark that if Wittgenstein had wanted to say something about ethics then it was strange that he analysed a form of representation that seems more appropriate to mechanics: what is revealed by concentrating less on engineering drawing and more on representations that enable one to calculate performance is that in ethics we want to be able to infer or calculate how we should live from the nature of the world. We do not simply want to imitate or depict the nature of the world. So perhaps the graphical models chosen are not so alien after all. In The Fall by Hugo van der Goes we must read off the meanings of the individual symbols and their role in the narrative that is alluded to, and we are also required to calculate the ethical message from the comparative relationship that is implied by the juxtaposition of the two panels of the diptych.[8] This kind of painting is designed to be read in way that is comparable to reading a diagram from graphical statics. In both cases the iconic message is subordinate to the symbolic one, and the reception of the full message is dependent not on a naïve depictive visual language, but on a symbolic graphical language that has the capacity to describe non-visual phenomena.

REFERENCES

Blackmore, J., Ed., 1995, Ludwig Boltzmann his later life and philosophy, 1900-1906. Kluwer Academic, Dordrecht.

Boltzmann, L., 1974, Models In: Boltzmann, L., Theoretical Physics and Philosophical Problems. Edited by Brian McGuinness. D. Reidel and Co., Dordrecht, 231-220. First published in: Encyclopædia Britannica. 10th edition, 1902, Vol. 30. A.C. Black, Edinburgh, 788-791.

Buckingham, E., 1914, On Physically Similar Systems: illustrations of the use of dimensional equations, Physical Review 4(4), 345-376.

Hamilton, K., 2001, Wittgenstein and the Mind's Eye. In: Klagge, J., Ed. Wittgenstein, Biography and Philosophy. Cambridge University Press, 53-97.

Hertz, H., 1899, The Principles of Mechanics. Translated by D.E. Jones & J.T. Walley. Macmillan, London.

Kuhn, T., 1970, The Structure of Scientific Revolutions. Second edition, enlarged. International Encyclopaedia of Unified Science, Vol.2, No.2. University of Chicago Press, London.

Maurer, B., 1998, Karl Culmann und die graphische Statik. Universität Stuttgart/GNT Verlag, Stuttgart.

McGuinness, B., and G.H. von Wright, Eds., 1997, Ludwig Wittgenstein: Cambridge letters. Blackwell Publishers, Oxford.

Moore, G.E., 1959, Philosophical Papers. George Allen and Unwin, London.

Seekircher, M., 2002, Wittgensteins technische Werkzeuge. Logische Formen und Sprachspiele: Wittgensteins "Werkzeugkasten". Miscellanea Bulgarica. Wien: Verlag Ostag [Forthcoming 2002].

[8] The online catalogue of the Kunsthistorisches Museum states "…The extreme stylistic contrast between the two panels is underlined by the differences between the lush paradise garden presented in "The Fall of Man" and the barren, desert-like hill of Golgotha in "The Lamentation". This contrast corresponds to the meaning of the diptych as a whole, mans salvation after his Fall from grace is achieved through the sacrifice and Crucifixion of Christ" (http://www.khm.at).

Stenius, E., 1960, Wittgenstein's "Tractatus". Basil Blackwell, Oxford.

Sterrett, S., 2002, Physical Pictures: Engineering Models circa 1914 and in Wittgenstein's Tractatus. In: Heidelberger, M. and F. Stadler, Eds. History of Philosophy of Science: New Trends and Perspectives. Kluwer Academic Publishers, Dordrecht, 121-135.

Wittgenstein, L., 1958, The Blue and Brown Books. Basil Blackwell, Oxford.

Wittgenstein, L., 1961, Tractatus Logico-Philosophicus. Translated by D.F. Pears and B.F. McGuinness. Routledge and Kegan Paul, London.

Wittgenstein, L., 1974, Philosophical Grammar. Edited by R. Rhees, translated by A. Kenny. Basil Blackwell, Oxford.

Wittgenstein, L., 1979, Notebooks 1914-1916. Second edition, edited by G.H. von Wright and G.E.M. Anscombe, translated by G.E.M. Anscombe. Basil Blackwell, Oxford.

Wittgenstein, L., [1953] 1997, Philosophical Investigations. Reissued second edition. Translated by G.E.M. Anscombe. Basil Blackwell, Oxford.