

Visual Reasoning: I see what you mean

Michael A R Biggs

Abstract. This paper is a study of examples of visual reasoning from Wittgenstein. There are two key issues. First, to what extent are some lexical concepts predicated on visual examples? Cases of ostensibly defined nouns such as 'red' are less interesting in this context than cognitive terms such as 'to show' [proof]. Second, I identify examples where an unclear relationship subsists between the visual and the lexical, including visual concepts with fuzzy boundaries that are normally supposed to be the province of lexical concepts. The target is the preconception that concepts may be comprehensively described either visually or lexically and to problematize the discrimination between metaphorical and non-metaphorical communication.

Visual reasoning: I see what you mean

Some terms are defined in words, for example 'bachelor' is defined as 'unmarried adult male'. There are examples of 'bachelors' to which we can point. These examples alone would not suffice to define the term bachelor since it is one particular attribute of the example to which we wish to draw attention. Other lexically defined terms may not have corresponding examples in the world of experience, for example 'unicorns'. The lack of concrete examples does not affect our ability to clearly define such terms.

Some terms cannot be defined lexically, for example 'red'. These terms may be defined by reference to samples. The paradigm is ostensive definition, in which we point to a sample and utter the phrase '*this* is red'. The phrase takes the function of attaching the name to the sample and the composite action may constitute a definition. Not all ostensive acts constitute definitions, for example '*this* is a bachelor'. In particular, ostensive definitions are used with regard to first-person phenomenological experiences such as colour experiences.

Some terms can be defined lexically, but have their roots in practice and hence in phenomenological experience, for example 'proof'. I could use the rules of arithmetic or logic to prove that $2+3=5$,¹ but I might prefer to show you that $2+3=5$ by using beans or groups of lines on a page. This paper examines how diagrams are used in relation to terminological definition, and concentrates on this last group as symptomatic of terms with phenomenological foundations.

¹ cf. Russell and Whitehead *Principia Mathematica*.

Definitions

I want to differentiate between two uses of diagrams: illustration and demonstration. The first is characterised by a passive role. When a diagram is used to illustrate something that is also described in an accompanying text, the diagram can be removed without making the document incomprehensible. A paradigm is Euclid's *Elements*. This comprises a series of proofs or demonstrations of geometrical theorems. Although the standard text includes diagrams, and the demonstrations contain geometrical constructions, it is not the case that the diagrammatic constructions prove the theorems. In order to refute Euclid one would have to refute the reasoning that is contained in the text, not the appearance of the diagram. The diagrams illustrate what is logically demonstrated, albeit in a complex form, in the text. The theorems of Euclid establish the logic of space, not the phenomenology of space.

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Stepping beyond the lexical

The verbal definition, as it takes us from one verbal definition to another, in a sense gets us no further. In the ostensive definition however we seem to make a much more real step towards learning the meaning.²

Ostension is a combination of a visual practice, i.e. pointing to a phenomenon, and a lexical or verbal practice, i.e. uttering the phrase '*this is X*'. This combination appears to offer a route into the world of phenomena and experience. Unfortunately, there is a fundamental criticism of this practice as constitutive of a definition. The criticism is that the practice begs the question, that is, one has to adopt a tacit definition of that which is to be defined in order to perform the ostension. Let me unpack this further.

Before the ostensive act can be performed a judgement must first be made as to, for example, the redness of the sample. This judgement is the judgement of similarity of colour. But how are we to determine what is similar if we are in genuine need of the ostensive definition of the word 'red'? First, it is necessary in the ostensive definition to know what category of object is being defined. In the definition of the word 'red' by using a red patch as a sample, it must be understood that it is the colour and not, for example, the form of the patch which is being defined. Second, the abstract concept of colour is required to be

² Wittgenstein *The Blue Book* p.1.

understood if this distinction is itself to be understood. But how is the abstract concept of colour to be communicated if it is a clarifying concept for the communication of a substantive such as 'red'. It is not clear whether an understanding of the abstract must precede or necessarily succeeds the ostensive definition. The abstract must be lexically defined as an inference from otherwise ostensively or phenomenologically defined elements. However, as we have seen, an understanding of those elements requires an understanding of the abstract which describes the category being ostensively defined. The argument is circular.

This circular argument occurs in what has become known as the Paradigm Case Argument. What is assumed to indicate the category of that which is being defined is the accompanying gesture. This gesture can indicate in a number of ways. In the paradigm case of colour-word definition, the red patch is pointed at during the process of definition. The deictic gesture has a spatio-temporal component and so has the red patch, but which of the spatio-temporal elements is being indicated? This ambiguity is recognised by Wittgenstein³ but it is also conceded that the definition need not be misunderstood on that account⁴. But gesturing, if not ostensive definition, often accompanies definitive statements. Consider a musician raising a finger during a piece of music and saying 'that is high-C'.⁵ This is an example of a spatio-temporal gesture of pointing to an intangible 'object'. In these examples we see not only the logical limitations, but the extent to which the phenomenally substantiating gesture can encompass metaphorical 'pointing'.

Visual paradigms

The part-visual approach of ostensive definition may be contrasted with fully visual diagrammatic demonstration. Thus we might demonstrate that $2+3=5$ by drawing groups of lines on a page. Wittgenstein uses this technique to reconsider aspects of mathematical proof. He suggests that a proof is 'a single pattern'.⁶ and that 'the proof serves as a picture of the experiment'.⁷

³ *Philosophical Investigations* §28.

⁴ *ibid.* §87.

⁵ Waismann *The Principles of Linguistic Philosophy* 105.

⁶ *Remarks on the Foundations of Mathematics-I* §28.

⁷ *ibid.* I §36.

A rectangle can be made of two parallelograms and two triangles. Proof.⁸



In such a fully visual case it would be sufficient to add QED to the illustration.

Categorical ambiguity

How can we point to the colour of a book rather than its shape? In a particular circumstance we might change the accompanying form of words, 'this *colour* is red' or 'this *shape* is a rectangle'. It may be obvious from the employment of a colour-word such as 'red' that it is the colour which is being pointed at, rather than the shape. But both of these examples suppose an understanding that 'red' is a colour-word or that the employment of a colour-word signifies the exclusion of shape descriptors. It would be tempting to assume that what determines the quality being pointed at is some form of intention on the part of the speaker. For the person learning from the definition this will involve a certain amount of guessing, or for the definer, of meaning something or attending to something.⁹ But an accompanying intention or meaning is Wittgenstein's target.

'I meant something definite by it, when I said...' 'Did you mean something different when you said each word, or did you mean the same thing throughout the whole sentence?' It is strange, though: you can mean something by each word and the combination of them can still be nonsense!¹⁰

The temptation to look for an accompanying meaning in the ostensive definition cannot be denied. It must be massaged away like so many other philosophical puzzlements. The essence, as Baker and Hacker say, is that

pointing North and saying 'That is North' is a correct explanation of North.¹¹

⁸ *ibid.* I §50.

⁹ *Philosophical Investigations* §32.

¹⁰ *Philosophical Grammar* §I-66.

¹¹ *An Analytical Commentary on Wittgenstein's Philosophical Investigations* 88.

What emerges is not that there is any explicable accompaniment to an ostensive definition. Rather the ways in which the definition might be validated, together make criteria or a practice for the application of words. Thus if we wish to explain the use of the word 'red' we can point to a pillar-box or to a colour sample and we can say 'this is red' or 'this, and things of this colour, are called red'. That the group of users agree that such an action counts as a criterion of understanding of the use of the word red constitutes the definition, and nothing else. What is the same colour, or what it is about the pillar-box that is red, is not contained in the ostensive definition. The judgement of similarity itself is not as self-evident or inevitable as is commonly supposed.

Our mistake is to look for an explanation where we ought to look at what happens as a 'proto-phenomenon'. That is, where we ought to have said: this language-game is played.¹²

In contrast to the part-visual example of ostension, a fully-visual example has no implication of further hidden explanations. Wittgenstein saw numerical proof being essentially visual or a graphical activity. The issue about number is not *whether* $2+3=5$, but if we wanted to *prove* it, what sort of thing would we do that would provide some sort of ultimate demonstration. This is where Wittgenstein had an extended notion of a
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paradigm which was not just a typifying example but a normative model [Bild].¹³ It is normative because the visual demonstration is a comprehensive response to the question 'does $2+3=5$?' Arithmetic proof is fully-visual.

Visual methods

The lack of a prescriptive diagrammatic grammar for fully-visual examples alters the range of methods available for interpretation. In particular, close reading is modified. In textual analysis, close reading involves the detailed scrutiny of individual words and other forensic clues in the text. This is possible because the text itself is written in a natural language and terms can be de-contextualised so that all possible interpretations of them are brought to bear, thus broadening previous interpretations of the scope of the text in question.

¹² *Philosophical Investigations* §654.

¹³ cf. Biggs, M. 'Interpreting Wittgenstein's Graphics'

A rare application of close reading to diagrams can be found in the interpretation of engineering drawings that conform to standardised specifications. In these cases, close reading might identify a line type as signifying one of several qualities and an outline figure appearing in several views might indicate flat or curved surfaces, etc. Indeed close reading is the only technique appropriate to reading a previously unseen drawing, and in particular for solving ambiguous representational problems such as those presented in examinations to engineering students.

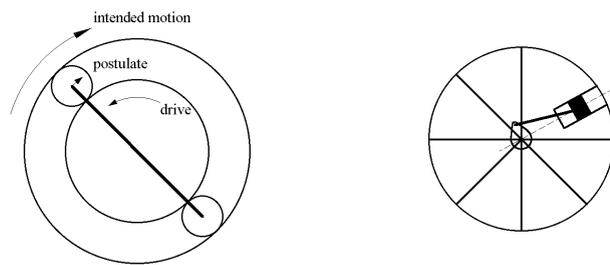
The close reading method may be contrasted with the contextual reading method. In the latter the reader's experience of the author's other works leads to a preferential interpretation of words, phrases and diagrams. The contextual method does not solve the problem of new use or establishing a first use that later influences contextual reading elsewhere, i.e. how does one establish the interpretation of a first occurrence? However in the majority of cases of diagrammatic interpretation, contextual reading is an essential method.

Saying and showing

Wittgenstein used the close reading method to identify a part-visual explanation of meaning. In *Tractatus Logico-Philosophicus*, he introduces, and differentiates between, the concepts of saying and showing.¹⁴ These terms are used in relation to logical propositions. What a proposition says is what it asserts about its contents, e.g. 'it is raining'. What it says might therefore be either true or false. What the proposition shows is the possibility of what it asserts. Therefore a grammatically well-formed proposition shows that there is a possibility of the assertion independently of whether the proposition is true or false. Propositions that are not well-formed show this when compared to syntactic rules. Wittgenstein hoped that a systematic analysis of the form of propositions would reveal whether they were able to show anything. However to be useful the method would apply to the analysis of content rather than form because it is possible to create well-formed but meaning less propositions and these are the misleading propositions in ordinary language. This is one of the main differences between *Tractatus Logico-Philosophicus* and the later *Philosophical Investigations*, in that in the early work there is a confidence that a form of analysis will reveal the lack of content whereas in the later work it is recognised that meaning is socially determined.

¹⁴ *Tractatus Logico-Philosophicus* §§4.12-4.1212

The implementation of the analysis of showing and saying to visual reasoning is most easily demonstrated in representational diagrams. In these there needs to be sufficient visual cues to indicate that the diagram represents a three-dimensional externally existing object and to overcome any categorical ambiguity. This introduces syntactic rules that facilitate close reading.



What these sample figures ¹⁵ show are rigid mechanisms and thereby what they are able to say is, given the disposition of these rigid parts there would be a resultant movement of some kind. The first is used to describe the function of an hypothesis by analogy to gears. The second is used to describe how a sentence may appear to have meaning but in practice does not, by analogy to a mechanism that appears to function but does not.

Close reading reveals that there are two levels to the concept of showing. The first is that both form and content are relevant to lexical and visual constructions. The second is that meaning-content cannot be inferred from well-formedness. One outcome of this analysis in relation to visual reasoning is the discrimination of form from content and within that to discriminate two types of content. This is novel because in the normal discrimination of form from content, only one type of content is assumed, i.e. positive content. However, the sample figures say that non-content could also come from well-formedness. In other words, in visual reasoning, well-formedness is assumed to be an indicator of meaningful content.

	<i>meaningful content</i>	<i>meaningless content</i>
<i>well-formed</i>	true	true
<i>not well-formed</i>	false	true

One difficulty with the concept of showing is how something shows. The lexical concept of a proposition showing its logical possibility is a matter of understanding the grammar, which is why it functions well in relation to the strictly regular form of logical propositions. There is a similar clarity of the use of conventions in three-dimensional visualisations where notions of perspective might be seen as equivalent to syntax. In less conventionalised diagrammatic representations an interpretational framework may have to be inferred from a contextual reading. Without a socially determined framework, we can only postulate a metaphorical connection between the diagram and the interpretation. By metaphor I here mean that the expression/diagram may not mean literally what it says/depicts. The relationship between well-formedness, metaphor and

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meaningful content remains to be clarified.

Case Study



this fits this.

This sample expression¹⁶ is an assertion. The assertion relates to the particular instance of these two fork shapes. The key concept is one of 'fitting'. It could be regarded as either a practical demonstration that X fits Y or an ostensive definition by example that 'fitting' is what these shapes do. We will use our visual judgement to determine whether they do or do not fit.

'Fit' is here a somewhat loose concept since it normally requires a degree of controlled contiguity. Thus in engineering we speak of degrees of fitting corresponding to the degree of tightness or looseness. Wittgenstein's example does not seem to require such specificity and could only result in an approximate congruity. The assertion of fit may therefore be metaphorical.

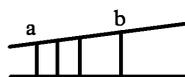
¹⁵ Wittgenstein *Philosophical Grammar* pp.225 & 194.

¹⁶ Wittgenstein *The Bergen Electronic Edition* Oxford University Press, 1999, MS159 31v. First published in: *Ursache und Wirkung: Intuitives Erfassen / Cause and Effect: Intuitive Awareness' Philosophia* 6, 441. Reprinted in: Wittgenstein *Philosophical Occasions 1912-1951* Cambridge: Hackett, 1993, 422.

What we have is a situation where, if the images could be brought together in a particular orientation and overlapped we could establish minimum conditions for the use of the word 'fit'. The extent to which this can be made specific is the extent to which this example becomes less metaphorical. It allows for a fuzzy boundary to which additional conditions might be necessary before further cases can be identified. It is not therefore definitive although it may be paradigmatic, that is, 'fit' may be a concept with foundations in fully-visual practice.

This use of visualisation is unusual. Visual language is commonly regarded as being ill equipped to express fuzzy concepts. In particular, modifiers such as logical constants and conditionals, e.g. *some X do not fit Y*, are not available. Visual conventions for expressing negatives, such as crossing-out, are used, e.g. road signs on leaving French towns, but the syntactic combination of signifiers is rare or limited. However, the example from Wittgenstein offers further scope for investigation of the relationship between the diagram and the concept of visual reasoning or explanation.

We use a paradigm as an exemplar but not as a definition. This introduces a certain generality to the content-model that is a feature of concept like 'red' but not of the concept 'one metre in length'. The philosophical, rather than commonplace, problem of generality finds expression in everyday concepts such as 'getting noticeably longer'.¹⁷ The problem only becomes a philosophical one when we seek specific boundaries to the transition from quantity **a** to quantity **b**.



It is not the case that the logic of mathematical concepts is defined by diagrams but that these examples show the fundamentally phenomenological foundations of our mathematical grammar. They show what we mean by correct inference, which is in turn bound up with our concept of the continuity of physical objects.

¹⁷ Wittgenstein *Philosophical Grammar* 237.

This is how our children learn sums; for one makes them put down three beans and then another three beans and then count what is there. If the result at one time were 5, at another 7... then the first thing we said would be that beans were no good for teaching sums.¹⁸

This comparison with practice is reinforced by Wittgenstein's thought-experiment of the tribe who calculate the price of a heap of wood by the area covered by the heap rather than the volume of wood.¹⁹ In other words they ignore the height. We would say they do not calculate consistently, but our concept of accuracy is bound up with our concept of three-dimensionality and value according to quantity. However, we do not always apply such a framework of calculation to monetary value. For example, we often calculate salaries not on the basis of quantity of work done (e.g. wood stacked), but on the basis of hours consumed or the age or gender of the worker.

So how does this generalised content-model of a paradigm affect our interpretation of diagrams in relation to text? Appropriately chosen paradigms give us the opportunity of seeing connections, of having perspicuous representations of our concepts. Seeing connections is fundamental.²⁰ It readily contributes to contextual reading which is the principal method of diagrammatic interpretation. Given the generality of the paradigm: that it is a particularly apposite example but not itself constitutive of a definition. It allows us to see beyond the ostensive definition provided by the sample, to the broader way in which visualisation might act normatively for further applications. That which is exposed as metaphorical is the relationship between words and concepts in cases where we would illustrate our interpretation with a diagram, but would need to say or write something too. The ability to demonstrate without words shows us something about the nature of such concepts.

Summary

One test for the fundamentally visual nature of a concept is to differentiate between diagrammatic explanations that are illustrations and diagrammatic explanations that are demonstrations. All ostensive definitions would count as trivial examples of demonstration since they are incontestably visual, not because the concept being described is necessarily visual, but because the ostensive method is partly-visual, i.e. the deictic gesture.

¹⁸ *Philosophical Investigations* §37.

¹⁹ *Ibid.* §149.

²⁰ *Ibid.* §122.

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Of greater consequence is the identification of fully-visual concepts. These do not require conventionalised representational grammars such as engineering drawing to facilitate their interpretation. They are unusual because they can be reliably interpreted by contextual reading. They demonstrate fuzzy boundaried concepts and generality. As a result, they expose the inability of ostensive definition to function normatively.

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