

## Designing a Graphical Index to Wittgenstein's Nachlaß

There are no established conventions for, and few examples of, indexing visual material on the basis of its form. Most image databases use keywords to describe the form or function, and access data by text-based retrieval of these keywords. An image-based approach would order the data by appearance, e.g. Shepherd (1971) and Dreyfuss (1972). A taxonomy must be created in order to apply this technique to a new data set. Previous applications have been aided by certain limiting factors on the possible range of images indexed thus providing the key to a taxonomy, e.g. international pictorial signs in Dreyfuss. A fundamental principle which may be inferred from these studies is that the taxonomy needs to be related to the needs of the user, and not solely to abstract features of design. This is reflected in guidelines issued by the UK organisation The Society of Indexers. The studies also suggest the need for several approaches to classification within the same data set, e.g. Dreyfuss, in which signs are located under more than one heading.

A system including graphic, semantic and bibliographic classification is suggested by B. Fischhoff et al (1987). A number of experiments were conducted at University of Reading based on this system and in collaboration with The British Library, cf. Dyson (1992). Although the outcomes were inconclusive in terms of the reliability of any system employed by individuals, this general approach is supported. The three divisions allow approaches to classification to be tailored to user perceptions which may not be reconcilable across such divisions, for example, users may identify similar graphical characteristics in signs which have diverse semantic functions. In this paper I propose to discuss the graphic and semantic classes in relation to the project to develop a graphical index to the images contained in Wittgenstein's Nachlaß.

Dyson (p.67) identifies five typical search strategies which might be employed in an index of symbols, that for the moment I will interpret as a sub-set of graphics in which certain graphical features have been formalised and to which specific semantic references have been attributed. Using my own terminology with reference to her enumerated list, the five typical strategies are: to retrieve a symbol by semantic reference [depict a symbol for a given signification] (1); to retrieve a symbol by graphical reference [name an unknown symbol] (5); to retrieve semantically related symbols [groups by reference] (2a); to retrieve graphically related symbols [groups by appearance] (3 & 4); and to retrieve symbols which are both graphically and semantically related [information upon which to base the design of new symbols] (2b). A terminological refinement of Dyson's broad list would be to distinguish (a) graphical indexing and searches for individual and grouped appearance, from (b) semantic indexing and searches for individual and grouped reference, and finally (c) searches which combine semantic and graphical characteristics.

### (a) Graphical Indexing

The differentiation of graphics may be performed by two distinct methods applied to the appearance of the figure. The first is the description or

naming of the figure, e.g. "triangle". This naming may refer to an outline or envelope, or it may refer to the "overall" or "dominant impression" given by a figure.

the overall impression is a perceptually salient aspect of the symbol (Dyson p.75).

The identification of the envelope is not always possible, or reliably applied. For example, there are three clear difficulties of using this approach: (1) the description of the overall impression and the envelope may contradict one another, e.g. a bold triangle on a circular background [cf.  $\delta$ 1212 below]; (2) there may be more than one apparent envelope, e.g. an outline triangle overlapping an outline circle; (3) irregular figures may not have names. Advantages therefore comprise the holistic or macroscopic description of the image whilst the disadvantages comprise the limitations of the lexical description of images.

The second is the microscopic description of the graphical elements from which the figure is constructed, e.g. line type, density, etc. This description would be useful for the assessment of reprographic requirements. The advantages of this approach comprise the employment of a widely used set of lexical descriptors whilst the disadvantages comprise an inattention to the image content. Such macroscopic features may not depend on semantic characteristics.

The experiments conducted at Reading showed the utility of description by "overall impression". When this impression was strong, i.e. both universally recognised and capable of being named, this approach resulted in considerable reliability amongst users. This agreement was assessed by an ability to recreate the figure on the basis of the description. However, figures which did not present a strong overall impression failed this assessment. From this it may be concluded that the application of this method, i.e. indexing by overall impression, may only be employed where there is either a common descriptor available, or when the data set employs a limited vocabulary of specialist figures.

In Wittgenstein's Nachlaß examples may be found where differentiation at these two levels may be applied; microscopic typographical description, and macroscopic graphical description or overall impression. The following are examples: ( $\delta$  references are to the catalogue of diagrams contained in Biggs and Pichler, pp.91-143) [Footnote: Copyright of the following images from Wittgenstein's Nachlaß belongs to his Trustees, whose permission to reproduce them here I gratefully acknowledge].

#### Microscopic Description:

[BIGGS1.PCX]  $\delta$ 1455 in MS 137: a line figure

[BIGGS2.PCX]  $\delta$ 1436 in MS 135: a hatched figure

#### Macroscopic Description:

[BIGGS3.PCX] δ1455 in MS 137: a square

[BIGGS4.PCX] δ1453 in MS 137: a triangle

#### Description by Overall Impression:

[BIGGS5.PCX] δ1020 in MS 114-II: a right arrow

[BIGGS6.PCX] δ1343 in MS 159: a left fork

An example of an ambiguous overall impression may also be found:

[BIGGS7.PCX] δ1212 in MS 113: ambiguity between circle and triangle

#### Sample Comparisons using Various Approaches

If microscopic graphical description is followed, a set of "family resemblances" may be identified by the use of the index:

[BIGGS8.PCX] δ1436 in MS 135: a partially hatched figure

[BIGGS9.PCX] δ1033 in MS 144: a partially hatched figure

However, macroscopic description groups the following together:

[BIGGS10.PCX] δ1002 in MS 104: an "eye" or "balloon figure"

[BIGGS11.PCX] δ1084 in MS 103: an "eye" or "balloon figure"

Finally, overall impression would group these together:

[BIGGS12.PCX] δ1266 in MS 112: a face

[BIGGS13.PCX] δ1302 in MS 115: a face

#### User Approaches

Instructions to the user about the classification system may be made in an introductory text, or may be implied by the arrangement of an alternative index, such as the arrangement employed by Dreyfuss (pp.166f.). Dreyfuss uses a second index of macroscopic graphical description, in which ellipses are related to obliquely viewed cylinders but not to circles. This graphical synopsis permits the user to group orthogonally viewed discs under "circles" (e.g. bicycles p.174) and obliquely viewed discs under "ellipses" (e.g. rotating work tables p.176). This graphical index, which is the most significant contribution of this book to the problems of indexing, complements the first index which is arranged semantically.

The most difficult of the graphical approaches to employ as a reliable basis for indexing is "overall impression". Dyson uses the example below to discuss the conflict between the perceptually significant white cross, and the graphically significant black shapes (p.72). The subjective contour is particularly difficult to communicate when it is used to generate or recreate the image. In this respect it would present particular difficulties in the search strategy to retrieve graphically related symbols. In this instance the subjective contour of the white cross is particularly hidden as it does not correspond with the external or envelope features of the image. Therefore, in practice, different users would place the image under different "overall impression" indices.

[BIGGS14.PCX] from Dyson p.73 item "a"

If the requirement for reliability is adopted as a prerequisite, that is the need for users to approach the index in the same way as the creator, and on a repeatable basis, then "overall impression" must be rejected. However, the experimental results obtained by Dyson indicate that a macroscopic rather than a microscopic description is more appropriate for graphical retrieval. It is to be inferred from Dyson's study that microscopic description of typographic or reprographic characteristics is more appropriate for graphical taxonomy, In this respect Twyman's proposed taxonomy (1980) based on reading is an example of a similar application of technical or specialist considerations which lie outside the classification of graphical symbols by appearance or signification. Twyman's taxonomy, for example, would have a particular application in determining the method for the storage of images by computer, and for strategies regarding text encoding and the integration of linear and non-linear material, i.e. textual and pictorial material.

Macroscopic description can be accomplished by the description of the principal geometric features of the image independent of its semantic content, such as the "graphical form" index of Dreyfuss. A degree of overlap occurs where the principal shapes have broken outlines resulting in an overlap with the broader classification of "overall impression" which was criticised above, e.g.  $\phi$ . This certainly requires a "reading" of the shape in terms of overlap and interpenetration, and the assumption of certain visual cues regarding the pictorial structure and convention (cf. Twyman 1985 p.301). This identification of the principal outline is to this extent culturally or contextually dependent. Four difficulties remain in this approach to graphical indexing:

- 1 Noticeable shapes may include the overall envelope, the main shape in the design, or a basic shape which has been modified. These shapes normally have names, e.g. circle, spiral, etc.
- 2 The same envelope, e.g. rectangular, may include a wide variety of different graphical information.
- 3 There may not be one main shape in the design, or shapes may not have names and therefore be more difficult to recognise.
- 4 Modified shapes [cf. 1 above] are unreliable as they require users to perceive a shape which is not there. Not all users will imaginatively

reconstruct the same shape.

(b) Semantic Indexing

Semantic differentiation is wholly contextually dependent. Morris (1938) asserts that signs signify when an interpreter reacts to their appearance as though he/she had interpreted the semantic content. This is a behaviouristic account of the sign-interpreter-signified communication triangle. It shows that the only connection between the appearance of the sign and its semantic content is the production of behaviour, and is therefore dependent on the culturally determined disposition of the interpreter. The only means by which we may assess whether communication at the semantic level has taken place is this behaviour. We cannot therefore assert an absolute semantic content. This account diminishes Peirce's distinction between Icon and Symbol, and such a diminution is important for the present account because it presents graphical differentiation as the primary structure for indexing. For Peirce an Icon represents its object mainly by its similarity to that object, whereas a Symbol is connected to its object only by habit or by a law, such as the rules governing the application of words to objects in natural languages [Footnote: Collected Papers ¶¶2.274-2.302].

If a graphical index is to be prepared on the basis of the semantic relationship we must first distinguish the ways in which meaning is connected to the appearance of signs. This was Peirce's task when he distinguished Icons from Symbols. More fully, he distinguished a primary tripartite division of Signs, each member of which was further divided: Icons [Qualisigns, Iconic Sinsigns, Iconic Legisigns, Rhematic Indexical Sinsigns], Indices [Dicent Sinsigns, Rhematic Indexical Legisigns, Dicent Indexical Legisigns], Symbols [Rhematic Symbols, Dicent Symbols, Arguments]. Adopting Peirce's taxonomy we would have ten classes each of which contains signs which signify, or are connected to their object, by the same semantic relationship.

However, none of these classes may be differentiated on the basis of the behaviour of the interpreter. Indeed it may be inferred from Morris that the behaviour of the interpreter will be unaffected by any such differentiation. They must be differentiated a priori. If the most iconic of the classes (Qualisigns) cannot be differentiated from the most symbolic class (Arguments) then we must conclude that Morris is not only correct in overlooking such differentiation, but that such differentiation is meaningless.

Peirce describes the redness of a red sign as the quality communicated most directly and as a consequence of an essential (rhemic) connection between the sign and its object. However, if we assert the red semantic content as the meaning of the red-seeming sign, we are either using the red-seeming sign for the ostensive definition of the meaning of the word "red", or we are using the red-seeming sign as a sample of the appearance to which we attach the semantic label "redness". Although we can ostensibly define the meaning "red" when presenting the red-seeming sign we could just as easily assert some other meaning, such as "blue". The only defence against this would be the counter assertion that we do not normally correctly assert the meaning "blue" with this

appearance (cf. Wittgenstein Philosophical Investigations ¶28f). There is a culturally determined agreement that this assertion would be incorrect. Alternatively, if we use the red-seeming sign as a sample we simply make an undefended assertion; "this is what I shall call red"; like the standard metre in Paris, of which it makes no sense to say "Oh no it isn't" (cf. Wittgenstein Philosophical Investigations ¶50). There is a culturally determined agreement that this assertion would be meaningless.

In this brief summary I have attempted to remove the distinction between Peirce's Qualisigns and Arguments. For Peirce defines arguments thus:

a sign whose interpretant represents its object as being an ulterior sign through a law, namely, the law that the passage from all such premises to such conclusions tends to the truth

[Footnote: *ibid*]

Comparing this to the examples above, we can see that using the Qualisign as an ostensive definition (the sign as Argument) leads to a conclusion that the signification is culturally true for a given group of users, and using the Qualisign as a sample leads to the conclusion that the signification is necessarily true. Thus both uses of the Qualisign make it indistinguishable from its use as an Argument.

By rejecting the a priori differentiation of icons from symbols we are left only with the behaviour of the interpreter on which to make any attempt at differentiating, and therefore indexing, the semantic level. However, it is my inference from Morris, that the behaviour of the interpreter only indicates communication of the meaning by the sign, not how that communication was effected.

## Conclusion

A useful classification system for images has been proposed which distinguishes graphical, semantic and bibliographical levels. In the case of a graphical index to Wittgenstein's Nachlaß I shall propose that its purpose is to facilitate research into the semantic function of graphically similar signs. It therefore remains to group the index graphically. As discussed above, the graphical level may be sub-divided between microscopic description, macroscopic description or naming, and overall impressions. The first was recommended for identifying reprographic resources for the images and for approaches to taxonomy which necessitate reliable implementation. The second was recommended where the data includes figures with names or a limited specialist vocabulary of figures. The third was recognised for its utility during testing but rejected for its unreliability.

The semantic level offers the opportunity to index signs by the way in which they are related to their objects. However, the modes of semantic operation cannot be differentiated a priori, and the behaviour of the interpreter does not inform us of the manner in which the communication

of the semantic level has been effected. This results in an arbitrary attribution of the semantic level at this stage which would render it unreliable.

The approach adopted below is therefore to identify macroscopic graphical features made possible by the limited data set of images in Wittgenstein's Nachlaß, and the relative similarity of their microscopic features. The index is structured on three axes of differentiation: (1) the basic envelope by degrees of complexity [linear precedes planar], (2) degrees of departure from the basic envelope [envelope with caveat], (3) repeated elements if necessary [complexity introduced by the repetition of a simpler element] [Footnote: not shown in the table below]. This creates a three-dimensional framework by which to structure a graphical index.

#### Proposal for Wittgenstein's Images

The principal approach is the macroscopic description of structure. The taxonomy is arranged according to the level of complexity of the image. This assessment derives from the organisation of characters in a Chinese dictionary: using the number of brush strokes necessary to create the radical. Thus a single-line figure precedes a multi-line figure. These "radicals" are arranged along the horizontal axis. In a manner which is also comparable to the dictionary, augmented radicals, or figures which are deviations from the basic figure, are arranged after their respective radical. In the index these are arranged along the vertical axis. There is the opportunity to create a third axis in which multiples of the figure are used as a single image, for example one image containing a pair of identical triangles.

Dreyfuss puts multiple images, e.g. squares, after all manifestations of single instances, including the three-dimensional development of the figure into a cube (p.166). The proposed index differentiates between groups of similar but not identical figures, which occur at the bottom of the vertical axis [e.g. under "quadrilaterals"]; and repeated figures, which would occupy the third axis [not shown here]. Three-dimensional figures are treated as complex multi-line radicals appearing near the end of the horizontal axis.

[BIGGS15.PCX] Wittgenstein's Graphical Set: an iconic reference system

#### Complete Keyword List Arranged Hierarchically

This is a three-dimensional structure giving a lexical description to each address. The x-axis represents a primary keyword; the y-axis represents a secondary keyword, based on orientation or variation; the z-axis would represent a tertiary keyword or number which expresses quantity.

#### AddressDescription

Linien

0101 Morsealphabet (kurzes Signal)  
0102 Morsealphabet (langes Signal)  
0103 Morsealphabet (verschiedene Signale)  
0104 Strichnotation  
0105 schräg Strichenotation (rechts genügt)  
0106 schräg Strichenotation (links genügt)  
0107 verschiedene Orientierung

#### Klammer

0201 Klammernotation (einmal oben)  
0202 Klammernotation (vielmals oben)  
0203 Klammernotation (einmal unten)  
0204 Klammernotation (vielmals unten)  
0205 Klammernotation (verschiedene)

#### Pfeile

0301 nach rechts  
0302 nach links  
0303 nach unten  
0304 nach oben  
0305 nach oben-rechts  
0306 nach unten-rechts  
0307 nach unten-links  
0308 nach oben-links  
0309 im Uhrzeigersinn  
0310 entgegen dem Uhrzeigersinn  
0311 verschiedene Orientierung

#### Gabeln

0401 Zinke nach rechts  
0402 Zinke nach links  
0403 Zinke nach unten  
0404 Zinke nach oben  
0405 verschiedene Orientierung

#### Kreuze

0501 Kreuz: orientiert +  
0502 Kreuz: orientiert x  
0503 Kreuz: überlappen

#### Zeichen

0601 Schriftzeichen  
0602 Ziffern  
0603 Schnörkel  
0604 Symbol  
0605 Handschrift  
0606 Gekriztel  
0607 Struktur

#### Musik

0701 Notation  
0702 Noten ohne Liniensystem  
0703 Noten mit Liniensystem  
0704 nicht konventionell

Schema  
0801 ohne Linien  
0802 mit horizontalen Linien  
0803 mit vertikalen Linien  
0804 mit horizontalen und vertikalen Linien  
0805 Pfeile  
0806 Pfeile mit anderen Zeichen

Faden  
0901 ungeteilt  
0902 zweigeteilt  
0903 dreigeteilt  
0904 viergeteilt  
0905 mehrfachgeteilt

Dreiecke  
1001 Eckpunkt oben  
1002 Eckpunkt rechts  
1003 Eckpunkt unten  
1004 Eckpunkt links  
1005 verschiedene Orientierung

Vierecke  
1101 Quadrat  
1102 Quadrat mit Punkt oben  
1103 horizontales Rechteck  
1104 vertikales Rechteck  
1105 schiefes Rechteck (nach vorn)  
1106 schiefes Rechteck (nach hinten)  
1107 verschiedene Orientierung

Vielecke  
1201 Fünfeck  
1202 Sechseck  
1203 Vieleck  
1204 Stern mit fünf Punkten  
1205 Stern mit sechs Punkten

Polyeder  
1301 Tetraeder  
1302 Pyramide mit quadratischer Grundfläche  
1303 Würfel  
1304 Oktaeder

Kreise  
1401 Kreis  
1402 Halbkreis  
1403 Sektor  
1404 Ellipse (horizontal orientiert)  
1405 Ellipse (vertikal orientiert)  
1406 Auge  
1407 Fleck

Kurven  
1501 Kurve

- 1502 Kurve mit Tangente
- 1503 Kurve mit Normallinien
- 1504 Kurve mit andere Notation
- 1505 Spirale rechts (Uhrzeigersinn aus Zentrum)
- 1506 Spirale links (entgegen den Uhrzeigersinn aus Zentrum)
- 1507 Spirale rechts mit Linien (Uhrzeigersinn aus Zentrum)
- 1508 Spirale links mit Linien (entgegen den Uhrzeigersinn aus Zentrum)

#### Technische Darstellung

- 1601 geometrischer Beweis
- 1602 geometrischer Beweis mit Notation
- 1603 graphische Darstellung
- 1604 graphische Darstellung mit Notation
- 1605 Maschine

#### Bild

- 1701 Mensch(en)
- 1702 Gesicht(er)
- 1703 H-E-Kopf(Köpfe)
- 1704 Flasche(n)
- 1705 Köhler
- 1706 unbekannt

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