

Running head: WITTGENSTEIN'S CHALLENGE

## **Wittgenstein and the Psychological Utility of Concepts**

Michael Ramscar  
Department of Psychology  
Stanford University

Abstract

It is axiomatic to many psychological theories of categories and categorisation that Wittgenstein demonstrated in the *Philosophical Investigations* that categories are not defined in terms of necessary and sufficient conditions, but are instead determined by ‘family resemblances.’ Here I present a new exegesis of Wittgenstein's account of categorisation, and claim that far from advocating a theory of ‘family resemblances’ for categories, Wittgenstein rejected the notion as an empty one, as indeed he rejected the theoretical utility of determinate psychological concepts and categories. I discuss the implications for the discipline of cognitive science.

## **Wittgenstein And The Psychological Utility Of Concepts**

66. Consider for example the proceedings we call “games”. I mean board-games, card-games, ball-games, Olympic-games, and so on. What is common to them all? - Don't say: “There must be something common, or they would not be called ‘games’” - but look and see whether there is anything common to all. - For, if you look at them you will not see something that is common to all, but similarities, relationships, and a whole series of them at that. To repeat, don't think, but look!  
Wittgenstein (1953, §66, p31).

### Wittgenstein, Concepts And Categories

Although we perceive the world through our senses, we do not perceive the world in terms of raw sense data, but rather in terms of “concepts.” We see objects and events—pages, screens, cars, people—rather than the patterns of activity in the retinal cells of our eyes.

Most, if not all, cognitive activities appear to involve a process of converting the mass of data we receive from our senses into ‘meaningful’ concepts. The process appears to work—in broad terms—by grouping, or clustering sense impressions into larger wholes (or representations), and imposing discontinuities on continuous inputs. For example, when sensory stimuli comprise two flashes of a dot in close proximity, what people ‘perceive’ is a smooth and continuous motion of the dot from the first position to the second position (Kolers, 1972; Kolers & Green, 1984). Similarly, continuous streams of sound are separated into individual words when a listener ‘hears’ sentences

‘Concepts’ appear to be an important aspect of cognition, and much cognitive science has made considerable investments in categorisation. Accounting for how the ‘stuff of experience’ is represented, manipulated and combined in the mind is a central concern of many researchers in the field. Moreover, as can be quickly gleaned from even the most casual perusal of the relevant cognitive science literature, Wittgenstein’s analysis of concepts and categories in the *Philosophical Investigations* (PI; 1953) has had a great influence on the approaches taken in this area.

Much effort has been expended on the cognitive modelling of categorisation, yet few tangible results have been obtained (see Medin, 1989 and Komatsu, 1992 for reviews). In this paper, I attempt to lay out a theoretical framework within which to address the question of what is to be modelled in the cognitive modelling of concepts and categories. This framework is based on my analysis of concepts and naming presented by Wittgenstein in the *Philosophical Investigations* (1953).

In spite of the powerful influence of Wittgenstein’s analysis, no clear statement of his position appears in the cognitive science literature. It is worth noting that the relevant sections of the *Philosophical Investigations* have been little discussed in the philosophical literature (Backer and Hacker’s (1980) fine, albeit slightly impenetrable exposition excepted). Indeed, a recent guide to the *Philosophical Investigations* aimed at academic philosophers (M. McGinn, 1997) completely ignores these sections altogether. For the record, ‘concepts’ and ‘categories’ as they are studied in cognitive science were not the focus of Wittgenstein's investigation; rather, Wittgenstein’s concerns ran somewhat parallel to those of cognitive science’s in this regard. However, I endeavour to show that Wittgenstein would have rejected the conception of concepts that he is commonly held to have put forward, as indeed he would have rejected the very conception of ‘concepts’ as they are generally treated in cognitive science. Therefore some elaboration will be required in order to bring these two views of concepts together so that they might be compared and contrasted.

Wittgenstein is often presented as an opaque, difficult to interpret, and rather obscure philosopher, which sometimes leads to the *Philosophical Investigations* being seen and treated as a philosophical pick ‘n’ mix; a series of gnomic quotables to be plundered in support of a thesis. As a philosopher, Wittgenstein can be seen as a mirror, in whose writing a reader can see what he wishes to see. I endeavour to show, by examining in detail the arguments that Wittgenstein presents, that PI sections §65 to §82 lay out a clear—if intricately connected—series of arguments, which, with a certain degree of elucidation, can be seen to systematically detail Wittgenstein’s theoretical treatment of categories and categorisation in a fairly straightforward manner. What emerges from the close reading of Wittgenstein’s text that I present is at considerable variance with the account of Wittgenstein’s position that has been generally accepted in the literature.

There are a number of reasons for this, perhaps the most important being that while Wittgenstein is often cited as a founding influence in cognitive approaches to concepts and categorisation, his concerns—and more importantly his methods—were markedly different to those of researchers in the modern cognitivist tradition. While much categorisation research has been concerned with category representation—the encoding and structuring of objects together in some form of internal representation system (see e.g., Komatsu, 1992)—Wittgenstein was more concerned with word *use*, with the way that labels are used to pick out objects in the world as a part of the process of communication. In doing so, Wittgenstein was trying to specify the way in which the use of concepts and categories in communication imposes constraints on theoretical accounts regarding their nature.

‘Repeat, don’t think, but look!’ (in §66, quoted at the head of this chapter) strongly emphasizes the need to fully understand the problem before tackling any solution to it:

‘We talk of processes and states, and leave their nature undecided. Sometime perhaps we will know more about them - we think. But that is just what commits us to a particular way of looking at the matter.’ (Wittgenstein 1953, p102).

Wittgenstein was at pains in the *Philosophical Investigations* to start from as theoretically neutral a position as possible in his pursuit of an account of categorisation. To examine categorisation from a standpoint which assumes stored conceptual representations, and processes of matching stimuli to them—as many cognitive scientists do—is to examine categorization with an *a priori* commitment ‘to a particular way of looking at the matter.’ In the *Philosophical Investigations* Wittgenstein doesn’t simply present some theoretical insights into human categorisation. Buried in his arguments is a thorough critique of the phenomena under examination: human concepts and categories, and the way words are attached to these, and the constraints that this critique imposes on any methodology for their study.

What follows, then, is an attempt to elucidate those arguments in Wittgenstein’s *Philosophical Investigations* relevant to the study of concepts and categories, and outline the constraints on the concept of *concept* that these investigations yield. The account developed will then be contrasted with the commonly held view of Wittgenstein’s position in the cognitive science literature. I do not claim that the position I establish *is* Wittgenstein’s: as I acknowledged above, the questions asked by researchers in cognitive science are markedly different from those considered by Wittgenstein (for an excellent ‘straight’ exegesis of Wittgenstein’s arguments, see Baker & Hacker, 1980). Rather, my claim is firstly, that the position established here is consistent with the overall thrust of Wittgenstein’s arguments; and secondly, that an analysis based on these arguments has much to offer contemporary debates regarding categorisation.

### What Family Resemblances Are Not

The accepted interpretation of Wittgenstein's account of concepts and categories in cognitive science is nicely summarised by Lakoff (1987; though accounts which broadly concur with this can be found in Khatchadourian, 1966; Rosch and Mervis, 1975; Johnson-Laird, 1983; Holland, Holyoak, Nisbett and Thagard 1986; Komatsu, 1992). Lakoff acknowledges Wittgenstein as the first theorist to notice what he terms a major crack in classical theories (e.g. Katz, 1972) of concepts and categories. These classical theories maintain that categories have clear boundaries, and that they are defined in terms of common properties amongst a category's members, with these definitions couched in terms of *necessary and sufficient* conditions for the determination of category membership. (That is, possession of properties X, Y and Z are both necessary and sufficient for an object to be considered an example of category N).

Lakoff notes that in PI §66, Wittgenstein argues that categories such as *game* cannot be accounted for according to the classical theory because there are no common properties that are shared by all games:

66. Consider for example the proceedings we call "games". I mean board-games, card-games, ball-games, Olympic-games, and so on. What is common to them all? - Don't say: "There *must* be something common, or would they not be called 'games'?" - but *look and see* whether there is anything common to *all*. - For, if you look at them you will not see something that is common to all, but similarities, relationships, and a whole series of them at that. To repeat, don't think, but look! - Look for example at board games, with their multifarious relationships. Now pass to card-games; here you find many correspondences with the first group, but many common features drop out, and others appear. When we next pass to ball games, much that is common is retained, but much is lost. - Are they all 'amusing'? Compare chess with noughts and crosses. Or is there always winning and losing, or competition between players? Think of patience. In ball games there is winning and losing; but when a child throws his ball at a wall and catches it again, this feature has disappeared. Look at the parts played by skill and luck; and at the differences between skill in chess and skill in tennis. Think now of games like ring-a-ring-a-roses; here is the element of amusement, but how many other characteristics have disappeared! And we can go through many, many other groups of games in the same way; can see how similarities crop up and disappear. And the result of this examination is: we see a complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail.

67. I can think of no better expression to characterise these similarities than "family resemblances"; for the various resemblances between members of a family: build, features, colour of eyes, gait, temperament, etc. etc. overlap and criss-cross in the same way. - And I shall say: 'games' form a family. And for instance, the kinds of number form a family in the same way. Why do we call something a "number"? Well perhaps because it has a - direct - relationship with several things that have hitherto been called number; and this can be said to give it an indirect relationship to other things we call the same name. And we extend our concept of number as in spinning a thread we twist fibre on fibre. And the strength of the thread does not reside in the fact that some one fibre runs through its whole length, but in the overlapping of many fibres. But if someone wished to say: "There is something common to all these constructions - namely the disjunction of all their common properties" - I should reply: Now you are only playing with words. One might as well say: "Something runs through the whole thread - namely the continuous overlapping of those fibres." (Wittgenstein 1953, p31-2).

Lakoff draws two key theses from these passages:

1. "Games, like family members are similar to one another in a variety of ways." "That [family resemblances], and not a single well defined collection of common properties is what makes game a category" (Lakoff, 1987, pp 16-17)

From a close reading of §66 and §67, 1) would appear to be a fair statement of Wittgenstein's views. However, it is difficult to reconcile interpretation 2) with what Wittgenstein actually says. In §66 Wittgenstein explicitly states that 'you will not see something that is common to all [games].' Indeed, he argues that what games have in common is the now notorious family resemblances:<sup>3</sup> 'a complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail.' Lakoff—and cognitive science literature in general—take this to be Wittgenstein's characterisation of what a category *is*. Consistent with Lakoff's position, Rosch and Mervis (1975) describe family resemblance relationships as consisting of a set of items in which—

each item has at least one, and probably several, elements in common with one or more other items, but no, or few, elements are common to all items... Members of a category come to be viewed as prototypical of the category as a whole in proportion to the extent to which they bear a family resemblance to (have attributes which overlap those of) other members of the category. Conversely, items viewed as most prototypical of one category will be those with least family resemblance to or membership in other categories. (Rosch and Mervis, 1975, p. 575)

This description does appear to capture an important aspect of Wittgenstein's description of 'categories': however, what escapes Lakoff, Rosch, Mervis and other interpreters is the extreme negativity of this characterisation.<sup>4</sup> In PI §67 Wittgenstein explicitly condemns accounts like this as a false characterisation of concepts or categories. On Wittgenstein's view, stating that the common theme that runs through a category is the continual overlap of family resemblances, is analogous to stating that the common thing that runs through a thread is the continuous overlapping of the fibres that make up the thread. Wittgenstein dismisses both of these accounts as empty gestures: 'Now you are only playing with words.' There is, he says, no *thing* that runs through a thread in the form of overlapping fibres: a thread simply *is* a series of overlapping fibres. Or, as Baker and Hacker (1980) note, saying that the continuous overlapping of fibres is something running through a thread, makes the contrast between there being and there *not* being a thing running through the thread unintelligible.

Wittgenstein does not claim that family resemblances are what make 'game' a category; rather, he attempts to show how empty this view is as a definition. His view here then suggests a serious challenge to—rather than an endorsement of—Lakoff's formulation. If family resemblances are the common thing that run through a concept, just as overlapping fibres are the common thing that run through a thread, then what is this thing—this family resemblance—supposed to be?<sup>5</sup> How is it supposed to do whatever it is it is supposed to do?

*How long, Wittgenstein would appear to ask, is a piece of string?*

---

<sup>3</sup> 'Family resemblances' may well evoke something different in late twentieth century commentators than perhaps it did in Wittgenstein: it seems reasonable to assume that the product of a small nuclear family will have a different conception of family resemblance than someone from a complex, sprawling family unit whose numerous siblings embraced a wide range of diversities of age, taste, ability and even religion.

<sup>4</sup> "From the text it is obvious that the main thrust of this whole discussion is negative and critical" (Baker and Hacker, 1980 pp 327).

<sup>5</sup> Goodman makes a similar point with regard to the explanatory power of unembellished "similarity": he argues that saying that two things are similar without stating the *respects* in which they are similar is entirely vacuous. 'To say all *a*'s are alike in being *a*'s amounts simply to saying that all *a*'s are *a*'s. The words "alike in being" add nothing; similarity becomes entirely superfluous' (Goodman, 1973, pp 439).

The Length Of String: Categories And Boundaries

This question—‘how long is a piece of string?’—becomes important once the second part of Lakoff’s exposition is introduced. Wittgenstein, as Lakoff notes, argues that the boundaries of categories are not fixed.

68. “All right: the concept of number is defined for you as the logical sum of these individual interrelated concepts: cardinal numbers, rational numbers, real numbers, etc.; and in the same way the concept of a game is the logical sum of a corresponding set of sub-concepts.” - It need not be so. For I *can* give the concept ‘number’ rigid limits in this way, that is use the word “number” for a rigidly limited concept, but I can also use it so that the extension of the concept is *not* closed by a frontier. And this is how we do use the word “game”. For how is the concept of a game bounded? What still counts as a game, and what no longer does? Can you give the boundary? No. You can *draw* one, for none has so far been drawn. (But that never troubled you when you used the word “game” before.) But then the use of the word is unregulated, the ‘game’ we play with it is unregulated.” - It is not everywhere circumscribed by rules; but no more than there are any rules for how high one throws the ball in tennis, or how hard; yet tennis is a game for all that and has rules too. (Wittgenstein 1953, p32-3).

Lakoff seizes upon the discussion of the category *number*. Historically, says Lakoff, numbers were first taken to be integers, and then ‘numbers’ were successively extended to include rational numbers, real numbers, complex numbers, transfinite numbers, and all of the other numbers that mathematicians are wont to invent. But the concept of ‘number’ is not bounded in any natural way, and it can be limited or extended depending upon one’s circumstances and purposes. Lakoff says that in mathematics, intuitive human concepts like *number* must receive precise definitions; Wittgenstein’s point, he claims, is that different mathematicians give different definitions, depending upon their goal. Thus, although the category *number* can be given precise boundaries in many ways, ‘the intuitive concept is not limited in any of those ways; rather, it is open to both limitations and extensions’ (Lakoff, 1987, pp 17).

The question for Lakoff’s account thus becomes one of how those limitations and extensions are governed: what factors determine the boundaries of categories in given circumstances. Lakoff answers this question in relation to *game* by saying that *game*’s boundaries are governed by resemblance to previous *games* in appropriate ways: a new thing can be a *game* if it is suitably similar to previous *games*.<sup>6</sup>

Once again, subtle and not-so subtle discrepancies can be distinguished between Lakoff’s characterisation of Wittgenstein’s views and the content of Wittgenstein’s stated arguments. In §68, Wittgenstein says that one ‘*can* give the concept ‘number’ rigid limits in this way, that is use the word “number” for a rigidly limited concept,’ and Lakoff’s claim that in mathematics *number* must receive precise definitions appeals to this—‘but I can also use it so that the extension of the concept is *not* closed by a frontier.’ But here, Wittgenstein is not talking about the extensibility of borders, but something far more radical: ‘You can *draw* [a boundary], for none has so far been drawn.’ Wittgenstein isn’t talking here about the extensibility of boundaries; he is talking about their absence, a point developed in PI §69 to §73: categories do not have, or need, boundaries at all; the boundaries we might give them are arbitrary.

69. How should we explain to someone what a game is? I imagine that we should describe *games* to him, and we might add: “This *and similar things* are called “games.”” And do we know

---

<sup>6</sup> Lakoff gives the example of the introduction of video games in the 1970’s as a recent case in history where the boundaries of the *game* category were extended on a large scale.

any more about it ourselves? Is it only other people that we cannot tell exactly what a game is? - But this is not ignorance. We do not know the boundaries because none have been drawn. To repeat, we can draw a boundary - for a special purpose. Does it take that to make the concept usable? Not at all! (Except for that special purpose.) No more than it took the definition 1 pace = 75cm. to make the measure of one pace usable. And if you want to say “But still, before that it wasn’t an exact measure,” then I reply: very well, it was an inexact one. - Though you still owe me a definition of exactness. (Wittgenstein 1953, p33).

In §69, Wittgenstein is emphatic. One *can* draw a boundary, for a special purpose, but it is just that, a drawn boundary—important in the context of the special purpose, no doubt, but arbitrary to the concept or category in question. But we do not *need* to draw boundaries, because we can happily use concepts where none have been drawn; categories do not need boundaries to be usable. To further iterate this point, Wittgenstein considers the state of a user of a category who cannot specify that category’s boundaries: is the user ignorant of those boundaries? –No, he says, the user does not ‘know the boundaries because none have been drawn.’ Not knowing the boundaries of *game* is not a state of ignorance—it is reflective of the boundless state of *game*.

If §69 seems to offer little support for the ‘extensibility’ of boundaries; §70 serves only to reiterate and strengthen the case for boundlessness :

70. “But if the concept ‘game’ is uncircumscribed like that, you don’t really know what you mean by a ‘game’.” - When I give the description: “The ground was covered with plants” - do you want to say that I don’t know what I’m talking about until I can give a definition of plant? My meaning would be explained by, say, a drawing and the words “The ground looked exactly like this.” - Then were just *this* grass and *these* leaves there, arranged just like this? No, that is not what it means. And I should not accept any picture as exact in *this* sense. Somebody says to me: show the children a game. I teach them to roll die for money, and the other person says to me “I didn’t mean a game like that.” Did he, when he gave me the command have to have in mind the exclusion of a game of dice? (Wittgenstein 1953, p33).<sup>7</sup>

This section thus underlines the boundless point: one might draw a boundary (picture) in order to help understand a concept—to pin down a category—but this doesn’t tell us exactly what was meant, since the concepts to be understood aren’t fixed in that way. This point is crucial to Wittgenstein’s argument: understanding concepts involves *conceptual* understanding; it does not concern some ‘exact’ understanding of states of affairs in the world (whatever such an understanding might be).

At the end of §69, Wittgenstein commented that if one were to say to him that ‘a pace’ is not an exact measure, he would accept that it was an inexact measure, but he would also challenge his interlocutor for a definition of ‘exactness.’ In §70, he returns to this theme, saying that even if he drew a picture of what he meant by ‘the ground is covered with plants,’ and then said that what he was referring to ‘looked *exactly* like this,’ he would not mean by it looking ‘*exactly* like this’ that he meant that there was just *this* grass and *these* leaves, all arranged just like *this*. He would not accept any picture as being ‘exact’ in this sense. This is because he isn’t using—and we don’t use—‘exact’ in that way. Exact is just another concept (categorising ‘things that are exact’), which, whilst we can bound it in any

---

<sup>7</sup> Lakoff suggests that this last paragraph should be read as indicating that Wittgenstein is suggesting that some category members are more central than others (see also Rosch, 1978), the idea being that dice is not a very good example (is atypical) of game. A more natural reading of Wittgenstein's intentions here is not that he wishes us to think of dice as a particularly atypical game, but rather that it is not an appropriate game to teach children, and that there is nothing in ‘game’ that rules this notion of appropriateness either in or out. (Thanks to Ulrike Hahn for the translation of this paragraph.)

special way, is not itself thus bound. If we were to say, for example, that ‘a pace’ is not an ‘exact’ measure (defining exact in such and such a way), such a definition would not be what exact *is*. One might say, on the other hand, ‘my desk is exactly five paces from the door,’ which would be yet another example of exact; one in which ‘a pace’ is an exact measure (though in this case, of course, ‘exact’ is not *used* in the same way or with the same sense).

There is an instinctive temptation, of course, to think that because boundariless categories are not exact, they must therefore be problematic to use. In §69 and §70, Wittgenstein exploits this temptation, to demonstrate the ways in which we readily employ concepts without boundaries without any problem. Wittgenstein makes the point about *exact*, but one can make these points about *category* and *concept* as well. Wittgenstein’s family resemblances ‘definition’ of these concepts is analogous to his discussion of *exact* above: it amounts to a characterisation of how *category* and *concept* are used, rather than some theoretical definition that states explicitly what these terms can stand for. As Baker and Hacker (1980) observe, ‘it is explanation, not definition, that is the correlate of understanding’: that is, being able to explain what a concept like game *is* is a criterion of understanding it; but someone’s being unable to *define* a concept is not a criterion for determining that they do not understand it.’

This thesis—that categories don’t have boundaries—is vital to Wittgenstein’s position, as witnessed by his working through another formulation of it in §71:

71. One might say that the concept ‘game’ is a concept with blurred edges. - “But is a blurred concept a concept at all?” - Is an indistinct photograph a picture of a person at all? Is it even always an advantage to replace an indistinct picture by a sharp one? Isn’t the indistinct one often exactly what we need? Frege compares a concept to an area and says that an area without boundaries cannot be called an area at all. This presumably means that we cannot do anything with it. - But is it senseless to say: “Stand roughly there”? Suppose that I were standing with someone in a city square and said that. As I say it I do not draw any kind of boundary, but perhaps point with my hand - as if I were indicating a particular *spot*. And this is just how one might explain to someone what a game is. One gives examples and intends them to be taken in a particular way. - I do not, however, mean by this he is supposed to see in those examples that common thing that I - for some reason - was unable to express; but that he is now going to *employ* those examples in a particular way. Here, giving examples is not an *indirect* means of explaining - in default of a better. For any general definition can be misunderstood too. The point is that *this* is how we play the game. (I mean the language game with the word “game.”) (Wittgenstein 1953, p34).

Again, Wittgenstein’s rejection of boundaries is both clear and unambiguous. We don’t have to define boundaries in order to use concepts. These points can be further drawn out if we contemplate §71 in conjunction with §76:

76. If someone were to draw a sharp boundary I could not acknowledge it as the one that I too always wanted to draw, or had drawn in my mind. For I did not want to draw one at all. His concept can be said to be not the same as mine, but akin to it. The kinship is that of two pictures, one of which consists of colour patches with vague contours, and the other of patches similarly shaped and distributed, but with clear contours. The kinship is just as undeniable as the difference. (Wittgenstein 1953, p36).

Wittgenstein develops and expands the difference between the idea of an extensible boundary and the idea of no boundary throughout §72 to §83. The point that is consistently reiterated is that categories—concepts—do not have boundaries. By drawing boundaries we do not capture categories, we create something new; call them *bounded categories* which has some kind of kinship with our natural categories, such as *game*, but which is markedly and

importantly different from *game*. Thus, *using* concepts differs markedly from trying to form a theoretical view of them as constructs.

### Categories, Essences And Schemas

Another key thesis in Wittgenstein's account of categories was introduced in §71 above. Wittgenstein observes that in explaining what a game is, we give examples of instances of games, and we intend these examples to be taken in a particular way. What we do *not* do, in giving these examples, is to expect the person to whom we are explaining 'game' to, to see the common thing—whether it be a core, schema or essence—which we cannot actually see ourselves. It is true, says Wittgenstein, that when we give these examples our subject might see kinships between the examples, but these kinships are not in any way essential to what 'game' is. Giving these examples, says Wittgenstein, is not an indirect explanation; it *is* the explanation. We don't give a general definition, not because we can't think of one, but because there is none to give. This theme is developed in turn in §72, §73, §74, §75 and §76.

72. *Seeing what is common.* Suppose I show someone various multi-coloured pictures, and say: "The colour you see in all these is called 'yellow ochre.'" - This is a definition, and the other will get to understand it by looking for and seeing what is common to the pictures. Then he can look *at*, and point to, the common thing. Compare this with a case where I show him figures of different shapes all painted the same colour, and say: "What these have in common is called 'yellow ochre.'" And compare this case: I show him samples of different shades of blue and say: "The colour that is common to all these is what I call 'blue.'" (Wittgenstein 1953, p34).

Wittgenstein has already argued in §66, in respect to games, that if one looks at a category—that is, if one looks at 'games'—one will not see any single thing that they have in common. Here, he questions the way that 'commonalities' are supposed to be arrived at in the first place. In the first example, the commonality is easy to spot: provided the only common colour in the pictures was yellow ochre, and provided that the subject had grasped the meaning of colour, then she will be able to grasp what yellow ochre is—the colour that is common in all the pictures.

In example two, the subject could not proceed in the same way: although the figures all have colour (yellow ochre) in common, they also have other commonalities, such as being figures. Thus, from this example, the subject could as easily learn to apply 'yellow ochre' to yellow ochre or to figures, or even to samples (all of the samples are samples after all). Nothing in the supposed definition picks out the particular commonality that 'yellow ochre' is supposed to pick out.

Finally, in example three, there is no *a priori* colour commonality to the pictures; rather, the commonality can only be perceived if an observer *already* has the concept 'blue' (otherwise, she would see a riot of various 'colours'; not having any example of what 'not blue' is, she might also think that 'blue' just meant 'colours'). Since understanding this example is crucially dependent upon an understanding of 'blue', it follows that the example could not serve as an explanation of, or a definition of what is—or isn't—'blue'.

These points are then further expanded in §73:

73. When someone defines the names of colours for me by pointing to samples and saying "This colour is called 'blue', this 'green'..." this case can be compared in many respects to putting a table in my hands, with the words written under the colour samples. - Though this comparison may mislead in many ways. - One is now inclined to extend the comparison: to have understood the definition means to have in one's mind an idea of the thing defined, and that is a sample or a picture. So if I am shown various different leaves and told "This is called a 'leaf'", I get an idea of the shape of a leaf, a picture of it in my mind. - But what does that picture of a leaf look like

when it does not show us any particular shape, but ‘what is common to all shapes of leaf’? Which shade is the sample in my mind of the colour green - the sample of what is common to all shades of green. But might there not be such ‘general’ samples? Say a schematic leaf, or a sample of *pure* green?” - Certainly there might. But for a schema to be understood as a *schema*, and not as the shape of a particular leaf, and for a slip of pure green to be understood as all that is greenish, and not as a sample of pure green - this in turn resides in the way that samples are used. Ask yourself, what *shape* must a sample of the colour green be? Should it be rectangular? Or would it then be the sample of a green rectangle? - So should it be ‘irregular’ in shape? And what is to prevent us from regarding it - that is, from using it - only as a sample of the irregularity of shape? (Wittgenstein 1953, p34-5).

Wittgenstein poses a number of questions here that are raised by the notion of using a generalised *schema* to serve as the basis for a category. There is first the question of the form that the generalisation should take: what shape should a ‘generalised’ leaf be? Intricately linked to this is the question of how schemas are supposed to be used. Even if we can answer the first question—how we, say, generate a ‘generalised’ temperature for ice-cream—we are still left with the related question of explaining how such a generalisation is used in practice. That is, which particular aspects of the schema are general, and which are not, and how (in use) are we supposed to know which is which? We might rephrase this question to ask which parts of the schema represent ‘the generalised concept,’ and which are implementational details of the representation of this generalisation.

To relate this to a common concern in cognitive modelling, the question becomes how the possessor of a concept schema is to distinguish between those parts of the schema that are ‘conceptual information,’ and those parts of the schema that are just aspects of the media for representing that information (Cooper, Fox, Farrington & Shallice, 1996). For example: is the generalised green shape a schema for green or a schema for generalised shape? Which raises the further question: provided one could generate answers to these very challenging questions, what is supposed to be *intrinsic* to such a schema that would cause it to be used differently from an example of the category it was supposed to be a generalisation of?

In §74, Wittgenstein explicitly claims that there simply is no such intrinsic feature in a schema, and thus that a category ‘schema’ would not operate any differently from a sample of that category:

74. Here also belongs the idea that if you see this leaf as a sample of ‘leaf shape in general’ you *see* it differently from someone who regards it as, say, a sample of this particular shape. Now this may well be so - though it is not so - for it would only be to say that, as a matter of experience, if you *see* the leaf in a particular way, you use it in such-and-such a way according to such-and-such rules. Of course there is such a thing as seeing *this* way or *that*; and there are also cases where whoever sees a sample like *this* will in general use it in *this* way, and whoever sees it otherwise in another way. For example, if you see the schematic drawing of a cube as a plane figure consisting of a square and two rhombi you will, perhaps, carry out the order “Bring me something like this” differently from someone who sees the picture three-dimensionally. (Wittgenstein 1953, p35).

Johnson-Laird (1983) offers a different interpretation of §73, claiming that it shows that Wittgenstein had adopted a Kant-like (1787) approach to schemas, and argues that ‘a schema is not an image, but a model that underlies the ability to form an image’ (Johnson-Laird, 1983, p 190). Seizing on Wittgenstein’s comment that ‘for a schema to be understood as a *schema* ... in turn resides in the way that samples are used,’ Johnson-Laird claims that Wittgenstein is arguing that schemas do act as representative samples ‘in the same way as mental models acts as representative samples’ (Johnson-Laird, 1983, p 190). According to Johnson-Laird then, Wittgenstein argues in this section for a view of schemas that are ‘*not* a

set of necessary and sufficient conditions, but the typical or default characteristics of the items [they] subsume.’

As with the standard view of family resemblances, this interpretation sits ill in the context of the broader argument advanced in these passages. Wittgenstein introduces schemas here *not* because he advocates them as a basis for the mental representation of concepts, but rather to show how they cannot provide answers to questions about the mental representation of concepts: ‘*this may well be so - though it is not so.*’

As I noted earlier, Wittgenstein’s position in objecting to the idea of schemas as a basis for concepts is far more systematic than Johnson-Laird’s isolated example indicates. Wittgenstein details a list of requirements that schemas would have to fulfil if they were to act as a basis for categories:

- What form is a schema supposed to take: e.g., what shape is a generalised leaf?;
- Which aspects of a schema are generic, and which are not, and how do we explain the distinction between generic and non-generic aspects of the representation in the use of the proposed schema? What is meant by ‘generic’ in reference to a schema?
- What is supposed to be intrinsic to a schema that would cause it to be used differently to examples of whatever it was that it was supposed to be a generalisation (or model) of?

Wittgenstein makes clear in §71 - 74 that he feels that there simply are no satisfactory answers to these questions. Wittgenstein, in these passages then, is not advocating schemas as a theory of category representation; rather he is seeking to demonstrate—convincingly—that schemas alone *cannot* provide an account of how concepts are represented.<sup>8</sup>

### Samples And Similarities: Beyond The Boundary

So far the general focus of this paper has been on what Wittgenstein says categories—and by extension—categorisation, are *not*. In the course of this discussion, however, I have introduced some aspects of Wittgenstein’s account of what it is to ‘know’ a category: what having a concept of something *is*

In §69, Wittgenstein remarked ‘How should we explain to someone what a game is? I imagine that we should describe *games* to him, and we might add: “*This and similar things* are called “games.”’ And do we know any more about it ourselves?’; in §71 ‘[how might one] explain to someone what a game is? One gives examples and intends them to be taken in a particular way. –I do not, however, mean by this he is supposed to see in those examples that common thing that I – for some reason – was unable to express; but that he is now going to *employ* those examples in a particular way.’ Wittgenstein thus argues that we learn *game* from examples of games, and that our understanding of *game* is dependent upon how we re-employ (or use) these examples.

This is one of the ways in which Wittgenstein’s thesis that ‘meaning is use’ is introduced in the *Philosophical Investigations*. It should be noted, however, that ‘*meaning is*

---

<sup>8</sup> Some similar points are made by Winograd and Flores (1986) with respect to the use of simple frames to represent concepts. With respect to frames, they note ‘if we look at the literature on frame systems [for an answer to such questions] we find a mixture of hand-waving and silence. Simple rules don’t work. If, for example, defaults are used precisely when there is no explicit (previously derived) information to the contrary, then we will assume that one holds even when a simple straightforward deduction might contradict it. If analogies are treated too simply, we attempt to carry over detailed properties of one object to another for which they are not appropriate (p117)’. There is a strong parallel to be drawn between the way frames are used in artificial intelligence, and the role schemas are supposed to play in cognitive theories of categorisation.

*use*’ does not express the banal truism that meanings are determined by how we use concepts (or words). Rather, it expresses the more fundamental idea that there simply *is no more* to meaning than how the examples which comprise a category are used. This is clear even in the brief remark above: the concept of *game* is no more and no less than the way ‘game’ and examples of games are used.

75. What does it mean to know what a game is? What does it mean, to know it and not be able to say it? Is this knowledge somehow equivalent to an unformulated definition? So if it were formulated I should be able to recognise it as the expression of my knowledge? Isn’t my knowledge, my concept of a game, completely expressed in the explanations I could give? That is, in my describing examples of various kinds of game; showing how all sorts of other games can be constructed on the analogy of these; saying that I should scarcely include this or this among games; and so on. (Wittgenstein 1953, p35).

There are no boundaries, common essences or anything else, says Wittgenstein: the ‘common things’ that we—for some reason—are unable to express. Rather, categories simply comprise samples (connected by the network of commonalities alluded to in family resemblances) and ‘rules’ governing the use of these samples (use is made possible by our grasping that the samples are to be ‘taken in a particular way’).

Rundle (1996) claims (taking §75 in isolation) that Wittgenstein uses this point to establish the idea that while definitions are not something we *consult*, his arguments do not ‘exclude definitions from another role, namely that of specifying the various features of things we look to in making our classifications’ (pp 67). Rundle takes the difference in meaning between ‘bottle’ and ‘jar’ as an example:

‘although this question may never have engaged us explicitly, it takes very little reflection to conclude that we use ‘jar’ when the width of a container’s opening is close in size to the body of the container, whereas with a bottle we have a neck which tapers to a relatively narrower opening... it is clear that it is width of opening (amongst other things) that guides us in the use of these terms’ (pp 66-7).

Not only is this interpretation at odds with Wittgenstein’s arguments in the sections foregoing this passage—Wittgenstein is at pains to demonstrate that *game* cannot be given any such definition—but as studies by Sloman Malt, Shi, Gennari and Wang (1997a; 1997b) and Labov (1973) demonstrate, it is also at odds with empirical data regarding the way people actually use the terms ‘bottle’ and ‘jar.’ Labov found that drawing the kind of distinction Rundle envisages between membership and non-membership for simple physical object categories such as *cup* and *bowl* was less than straightforward: the differences between *cup* and *bowl* vary along a continuum, and different participants put the cut off point on the continuum in different places. Moreover, this point could be altered by context: if participants were asked to imagine an object which was otherwise half-way between a *cup* and a *bowl* as containing mashed potato, then participants showed a marked preference for considering the object to be a *bowl*.

Further evidence is provided by Sloman et al., who found that there was a clear distinction between naming and the kind of perceptual similarity Rundle invokes. In their study, names used to describe objects did not appear to be governed by perceptual similarity relations and names did not “exert a strong influence on the shape or conceptual similarity space, or on object locations in that space.” Learning to call [a] blue smurf a “juice box”

may make that object a member of the linguistic category “box” without making it seem more similar to rectangular things made of cardboard.” (Sloman et al, 1997b, p239).<sup>9</sup>

In any case, the key point Wittgenstein is seeking to establish here, then, is not that we should be able to specify the relevant commonalities between samples in a given category since it might be, as with *game*, that we cannot. Rather, what is important is the way commonalities are considered: knowing ‘examples of various kinds of game’ and also ‘how all sorts of other games can be constructed by analogy from these.’ Again, Wittgenstein differentiates between that which we can *specify*—the examples of games (or bottles and jars) that we have encountered previously— and the underlying process by which these previously encountered samples can inform both our understanding of new samples, and of the terms *game* or *bottle*, or *jar* more generally.

Wittgenstein is also making the point that knowing how we make these considerations—that is, being able to specify or describe the underlying cognitive – processes—is *not* relevant to our understanding of *game*; just as being able to specify our capacity for language is irrelevant to conversation. This is illustrated in much of the remainder of the *Philosophical Investigations*, where Wittgenstein’s concern for underlying processes (such as saying how samples are to be taken in such and such a way) is a key motivation for an extensive working through of the idea of ‘rule following,’ in which Wittgenstein takes care to show that following rules is a cognitive process that is instinctive rather than conscious or deliberate. (c.f. McGinn, 1983; Baker and Hacker, 1983).

### Representation and Process

As I noted above, in §76 Wittgenstein argues that ‘if someone were to draw a sharp boundary’ around a concept, he could not acknowledge that concept as being identical to the concept that he possessed whose name corresponded to it. In other words, the differences between such a bounded concept and a ‘natural concept’ would be as significant as any similarities between them. Taken together, §76, 77 and 78 develop an argument that firmly opposes the idea of definitions (and fixed category representations) altogether:

76. If someone were to draw a sharp boundary I could not acknowledge it as the one that I too always wanted to draw, or had drawn in my mind. For I did not want to draw one at all. His concept can be said to be not the same as mine, but akin to it. The kinship is that of two pictures, one of which consists of colour patches with vague contours, and the other of patches similarly shaped and distributed, but with clear contours. The kinship is just as undeniable as the difference.

77. And if we carry this comparison still further it is clear that the degree to which the sharp picture *can* resemble the blurred one depends upon the latter’s degree of vagueness. For imagine having to sketch a sharply defined picture ‘corresponding’ to a blurred one. In the latter there is a blurred red rectangle: for it you put down a sharply defined one. Of course - several such sharply defined rectangles can be drawn to correspond to the indefinite one. - But if the colours in the original merge without a hint of any outline won’t it become a hopeless task to draw a sharp picture corresponding to the blurred one? Won’t you then have to say: “Here I may as well draw a circle or a heart as a rectangle, for all the colours merge. Anything - and nothing - is right.” - And this is the position you are in if you look for definitions corresponding to our concepts in

---

<sup>9</sup> Sloman et al go on to say “... In that sense, it [the blue smurf] may not be thought of as a box even though it is called a box” (p 239). This remark is illustrative of much of the confusion that surrounds talk of concepts in cognitive science: it would appear firstly to beg the question of what a box is independently of those things that we call boxes - in Wittgensteinian terms one might say: ‘Alright, but now you owe me a definition of “box”’ - and secondly to beg the further question of how one might ‘think about’ something that one calls a “box” without thinking of it as a box!

aesthetics or ethics. In such a difficulty, always ask yourself: How did we *learn* the meaning of this word (“good” for instance)? From what sort of examples? In what language games? Then it will be easier for you to see that the word must have a family of meanings.

78. Compare *knowing* and *saying*:
- how many feet high Mont Blanc is-
  - how the word “game” is used-
  - how a clarinet sounds.

If you are surprised that one can know something and not be able to say it, you are perhaps thinking of a case like the first. Certainly not of one like the third. (Wittgenstein 1953, p36).

These sections underline the arguments developed so far: not only can we not bound category space, but any attempts to do so will be pointless: necessarily unsuccessful. One cannot use a bounded ‘definition’ or ‘representation’ to characterise an unbounded phenomenon. A sharp picture cannot characterise a blurred picture; they are simply two different pictures. Concepts are learned by the examples that typify them, and Wittgenstein argues that no common thread between these examples can define a given concept or category. Not only will any definition necessarily not capture the concept, but there is no end to the variety of definitions which one could equally validly (or rather invalidly) put forward; *‘I may as well draw a circle or a heart as a rectangle, for all the colours merge.’*

I conclude from this that Wittgenstein is not arguing for a treatment of concepts and categories, but rather, that he is trying to undermine our pre-theoretical attachment to a particular idea of what concepts and categories are. He does this in order to demonstrate that in asking what a concept or category is in this way—*with a particular determinate answer in mind*—we are asking the wrong question. Asking what a concept or category *is* is like asking how a clarinet sounds, not like enquiring after the height of mountains.

This is a vitally important, and often overlooked, aspect of Wittgenstein’s treatment of categories. If we ask the question ‘what makes a category a category?’ we should not expect to find an answer, not because the answer is somehow ‘beyond our ken’, but because we are asking, fundamentally, the wrong question. Elsewhere in the *Philosophical Investigations* (p. 308) Wittgenstein examines the way in which our problems with mental processes<sup>10</sup> and states arise. He argues that the most important step in the production of such problems is the one that goes unnoticed—the first one:

‘We talk of process and states, and leave their nature undecided. Sometime perhaps we will know more about them - we think. But that is just what commits us to a particular way of looking at the matter.’ (Wittgenstein 1953, p102).

Wittgenstein’s arguments, as examined so far, do not advocate a particular view of categories—what has become known loosely as ‘family resemblance theory’—but instead represent a thorough attempt to eliminate the temptation to see the question of how humans categorise things ~~—how it is this or that ‘thing’ are considered to be, say, ‘games’—~~ in terms of determinate, or even necessarily determinable, ‘categories.’

To Wittgenstein, the problems involved in explaining how categories are defined stem not from the phenomena under examination, but the way this phenomena has traditionally been defined; hence, perhaps, the famous *‘don’t think, but look!’* (famously criticised as being an inadequate basis for studying categorisation by Medin & Ortony, 1989). If we *‘think’*—that is, if we assume that the existence of things called ‘games’ entails the existence

---

<sup>10</sup> As I noted earlier, Wittgenstein actually considers the way *philosophical* problems concerning mental processes arise - his analysis does, however seem equally applicable to psychological problems and questions.

of categories in virtue of which the things can be considered ‘games,’ we are not exploring categorisation—we are predetermining what it can be. And since categorisation does not conform to the picture we have attempted to impose upon it, we find that our subsequent attempts at exploration are difficult and frustrating. One might draw an analogy between this process, and that of exploring a lost continent with a map one had drawn before one set out.

However, if we ‘look,’ as Wittgenstein suggests, we find that categorisation does not conform to our pre-theoretical expectations. The existence of things called games (specific) does not entail the existence of ‘categories’ (general), if all that we mean by category is some determinate thing by virtue of which *some other things* can be considered games. For if we look, we see that the use of concepts such as ‘game’ precludes the existence of simple category representations; ~~in virtue of which such things can be considered games, since~~ ‘game’ is used in such a way that there is nothing *in particular* by virtue of which ‘games’ are games. Rather, there are a number of things—samples—by virtue of which ‘games’ are games, for ‘[a] word must have a family of meanings’. And further, some process—the ‘appropriate ways’ of taking these samples—by which they contribute to the category (or categories) *game*. And that is all.

### Discussion

The broad outline of Wittgenstein’s argument can be summarised as follows:

1. That categories have no necessary or sufficient defining characteristics: rather that kinships—“family resemblances”—can be traced across categories (§65-7).
2. That these category spaces are unbounded—that is, there are no boundaries to the space across which “family resemblances” can be traced (§68, 69, 70, 71, 73).
3. That learning a category such as ‘game’ does not involve extracting an essence or schema from instances (§71-83).
4. That in learning a “category” such as game, we learn examples (instances) and appropriate ways of using these examples (§69,71, 73, 81, 82).

Taken together, these arguments do not amount to a quibble about the constitution of categories. Rather, they show that Wittgenstein was rejecting altogether the idea of categories or concepts as definitive, determinable, theoretical constructs. He sought to demonstrate in the *Philosophical Investigations* that the idea that there is a *thing* (some specific representation, even when called a category) that can determine whether a game is a game, makes as much sense as the idea that there is some *thing* that runs through the length of a thread. But further: What is a category, a game? How long is a piece of string? It isn’t that the answer to these questions is hard to find, but rather that the questions *make no sense*.

Wittgenstein’s arguments are a challenge to any strong theory of category representation—i.e. any theory couched in purely representational terms. In order to explain what a category is, such a theory would have to explain how a category essence or schema could be a determinant of categories that have no necessary or sufficient defining characteristics, but rather kinships of “family resemblances” that can be traced across them, and whose category spaces are unbounded. It would appear that Wittgenstein felt—with good reason—that these were challenges that could not be met.

### Processes versus representations?

Having set out Wittgenstein’s theoretical position regarding categories and category representation, I would like to briefly consider the implications for psychological theories of categorisation.

Wittgenstein provides a number of good reasons to believe that human categories cannot be given simple unitary accounts that are amenable to definition by a single schema. In light of this, he then undermines the idea that concepts can be defined by some ‘generalised’ category schema. His account holds that concepts cannot be given a definition *or* a general characterisation, which leaves space only for examples of things—and perhaps ‘intermediate’ generalisations—as bases for the mental representation of concepts. This offers little hope for traditional categorisation models, which attempt a descriptive characterisation of the mental representations of categories.

Why do intermediate generalizations not offer a carrot of hope? To give an example by way of illustration: an intermediate generalisation of *bird* might not capture anything about penguins, and would therefore be no more definitive of *bird* than a penguin sample. Use of an intermediate generalisation is no different from use of an example: Both are instances of the use of a concept and our understanding of that concept comprises no more than, and no less than, the totality of those samples and generalisations.<sup>11</sup>

Fortunately, progress towards an account of categorisation is not contingent on finding a solution to the problem of how categories are represented. If we instead focus on the *process* of categorisation, explaining how stored representations are combined dynamically in instances of categorisation (Wittgenstein's ‘use’), rather than trying to explain how all such instances can be given a single representational account, then Wittgenstein's questions, though challenging, are not insurmountable. From a processing point of view, the question of whether a stored representation relates to an exemplar or some intermediate generalisation is not necessarily important; it can even be irrelevant. What *is* important, from the point of view of processing, is to give a consistent account of the principles by which stored representations are meaningfully related to presented stimuli.

Wittgenstein held that meaning is use. In a similar vein, I would argue that the message of the *Philosophical Investigations* is that concepts exist in so far as they supervene on a process—concepts are, in that way, processes—and thus cannot be given any static, purely representational account. Before we give an account of these concepts (or categories), we must first attempt to give some account of the processes which underlie them.

---

<sup>11</sup> As an interesting aside, the interpretation of Wittgenstein’s position advocated in this paper holds that *any* similarity of use can constitute a ‘family resemblance,’ thus in using *game* metaphorically or analogically, we also allude to further similarities - resemblances - further stretching the extension of an associated ‘concept.’

References

- Baker, GP and Hacker, PMS (1980) *Wittgenstein: understanding and meaning: An analytical commentary on the Philosophical investigations*. Blackwell, Oxford.
- Cooper, R., Fox, J., Farrington, J. & Shallice, T. (1996) A systematic methodology for cognitive modelling. *Artificial Intelligence*, 85, 3-44.
- Goodman, N (1973) Seven strictures on similarity. (in) *Problems and Projects*, Bobbs-Merrill Co., Indianapolis, Indiana.
- Holland, JH, Holyoak, KJ, Nisbett, RE and Thagard, PR (1986). *Induction: Processes of Inference, Learning and Discovery*. MIT Press, Cambridge, Mass.
- Indurkya, B (1997) Metaphor as change of representation: an artificial intelligence perspective. *Journal of Experimental and Theoretical Artificial Intelligence* 9, 1-36.
- Johnson-Laird, PN (1983) *Mental Models*. Cambridge University Press, Cambridge.
- Katz, JJ (1972) *Semantic Theory*, Harper & Row, New York.
- Khatchadourian, H (1966) Common names and ‘family resemblances’ in G Pitcher (ed.) *Wittgenstein: the Philosophical Investigations*, McMillan, London, UK.
- Kolers, PA (1972) *Aspects of motion perception*. Pergamon Press, Oxford, UK.
- Kolers PA and Green M (1984) Color logic of apparent motion. *Perception*, 13, 249-254.
- Komatsu, L K (1992) Recent views of conceptual structure. *Psychological Bulletin*, 112(3), 500-526.
- Labov, W. (1973) The boundaries of words and their meanings. In, Bailey, C-J.N. and Shuy, R.W. (eds) *New ways of analysing variation in English*. Washington, DC: Georgetown University Press. pp 340-373.
- Lakoff, G (1987) *Women, Fire and Dangerous Things: What categories reveal about the mind*. University of Chicago Press, Chicago, Illinois.
- McGinn, C. (1985) *Wittgenstein on meaning : an interpretation and evaluation*: Blackwell, Oxford, UK.
- McGinn, M (1997) *Routledge philosophy guidebook to Wittgenstein and the Philosophical investigations*. Routledge, London, UK.
- Medin, DL (1989) Concepts and conceptual structure, *American Psychologist*, 44, 1469-1481.
- Medin, DL and Ortony, A. (1989) What is psychological essentialism? In S. Vosniadou and A. Ortony (eds) *Similarity and analogical reasoning*. Cambridge University Press. pp 183-196.

Rosch, E. and Mervis, CB (1975) Family resemblances: studies in the internal structure of categories. *Cognitive Psychology* **3**:382-439.

Rundle, B (1996) Wittgenstein and contemporary philosophy of language. Blackwell, Oxford, UK.

Sloman, S., Malt, B., Shi, M., Gennari, S. and Wang, Y. (1997a) The relationship of similarity to naming: Chinese vs. American conceptions of bottles and jars. in *Proceedings of the Nineteenth Annual Conference of the Cognitive Science Society*, Lawrence Erlbaum Associates, New Jersey, pp 697-702.

Sloman, S., Malt, B., Shi, M., Gennari, S. and Wang, Y. (1997a) Are bottles similar to one another? Sorting and naming by Chinese, Argentinians and Americans. in *Proceedings of SimCat 97*, Department of Artificial Intelligence Conference Proceedings, University of Edinburgh, Scotland, pp 233-240.