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A Bottom-up Approach to Concept Possession

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Abstract

We present a bottom-up approach to the problem of fixing psychological requirements to concept possession. It is argued that four constraints are required: abstraction, directedness, multimodality and off-line processing. Taken together, these psychological requirements yield a view of concepts similar (on certain aspects) to “dual” philosophical pictures: both inferential role and referential mechanisms are necessary to characterize conceptual competence.

Keywords: concepts, categorization, animal thinking.

1. A methodological premise

Two oppositions can be found in the philosophical literature on concepts.

First, there is a theoretical opposition between a characterization of concepts in terms of *abilities* (or *capacities*), and a characterization of concepts in terms of things, or *particulars*.

The second dichotomy is meta-theoretical. On the one hand, theories of concepts are taken to provide *individuation* conditions; on the other hand, theories of concepts are supposed to provide *possession* conditions. This latter opposition concerns the kind of question a theory of concepts should answer: “What kind of entity is a concept?”, rather than “What is required in order to ascribe a concept to an agent”?

At first glance, one would say that endorsing either of the meta-theoretical options does not determine the theoretical way of characterizing concepts. For instance, one could start with the problem of establishing what the possession conditions of a concept are, and eventually reach one of two conclusions: concepts are mental particulars or they are a family of abilities. Indeed, generally speaking, it would appear strange that constraints on the *form* of a theory would also determine its *content*.

However, as Fodor correctly points out (1998, Cap. 1), there is an historical-factual, though nonlogical, link between the characterization of concepts in terms of abilities and the idea that the core problem of a theory of concepts is to determine possession conditions. In fact, this meta-theoretical option is usually motivated by scepticism towards the possibility of identifying concepts with particulars, “things”. The classical reference is Wittgenstein (1953), whose

explication of the notion of meaning in terms of use/competence derives mainly from his negative attitude as to meaning reification. A combination of scepticism and anti-metaphysical concerns is, therefore, the main reason for “reducing” concepts to abilities¹. This attitude has arguably influenced cognitive science. Being interested in concepts essentially from a psychological point of view – that is, to concepts regarded as those mental endowments which allow certain epistemic performances – cognitive scientists are naturally inclined to establish a close link between possession conditions and the manifestation of certain abilities. In other words, one cannot state what a concept is independently of what agents are able to do.

According to Fodor, this is the most serious error of cognitive science, which prevents cognitive scientists from adopting the only plausible theory of concepts: informational atomism. According to informational atomism, concepts are *unstructured* mental symbols (this is the atomistic aspect), whose content is determined by a causal-nomological relation with objects in the world (this is the informational aspect)². On Fodor’s view, it is just because cognitive scientists take concepts to be abilities – rather than mental particulars – that

¹ Cf. Fodor: «... [P]eople who start with ‘What is concept possession?’ generally have some sort of Pragmatism in mind as the answer. Having a concept is a matter of what you are able to do, it’s some kind of epistemic ‘know how’ (...). The methodological doctrine that concept possession is logically prior to concept individuation frequently manifests a preference for an ontology of mental dispositions rather than an ontology of mental particulars.» (1998, pp. 3-4). A bit later Fodor suggests that scepticism is the skeleton in Dummett’s closet (cf. *ibid.*, p. 5. Indeed Dummett defended a similar position in the philosophy of language, identifying the theory of meaning with the theory of understanding).

² In a nutshell: the concept (e. g.) CAT is the mental symbol whose tokens are systematically caused by tokens of real cats in the world. Please note that to say that concepts are mental entities endowed of a content could be misleading, since concepts, whatever they are exactly, are already contents – they do not require further interpretation. Anyway, the point should be clear: The causal-nomological link with the world is what *determines* concept contentfulness. In other words, a concept is intrinsically content-bearer or “self-interpreted”, because the mental representation which carries the concept is causally linked with the world.

they go wrong in regarding them as complex (non-atomic), that is, in considering inferential patterns as constitutive of conceptual content. In other words, Fodor's claim is that cognitive science is flawed because it does not recognize that *metaphysical* questions concerning concepts are independent of and precede *epistemological* questions about concepts. For instance, one issue is what the concept CAT (or, the concept of a cat) is -- namely, the mental symbol nomologically linked to real cats; quite another issue concerns the mental structures allowing us to recognize cats, or to infer that cats are animals. It turns out, in particular, that the inferential links are not constitutive of concepts or, to put it in a slightly different way, that agents' knowledge about cats is not relevant to establish what such a concept is.

We shall persist in this alleged mistake. We do not *a priori* reject informational atomism; however, whichever theory of concepts turns out to be *right*³, the priority accorded to the epistemological question, and the related theoretical preference for a characterization in terms of abilities, come from the following reasons:

a) The metaphysical question seems to bring with itself the idea that concepts are things, particular objects (in the mind); and this does not fit well the richness and variety of performances commonly associated to the pre-theoretical, intuitive notion of concept. In other words, if concepts are mental particulars, it seems more difficult to account for the powerfulness of concepts, for instance, for their capacity to stand for a whole class of objects. Indeed, in order to be considered as a concept, a mental representation must work in a certain way, and to explain how it works is hardly exhausted by a description of the representation as such. As Ned Block (1986: 633) nicely put it, «What or how a representation represents is not only a matter of intrinsic properties of representation, but depends much more on a complex relational property: how the representation works.»

b) Suppose concepts are mental particulars, such as mental symbols. Since concepts must be already *interpreted*, these mental particulars should intrinsically be content-bearer: Content is part of the concept, it is one among its individuation conditions. But it is quite difficult to justify that a mental entity is interpreted. The few proposals on the market, such as Fodor's informational atomism, must face many criticisms (see e.g. Baker 1991; Putnam 1992). By contrast, a framework based on capacities accounts for concept contentfulness as a feature of the entire system of the relevant processes and structures.

c) To account for concepts in terms of capacities seems to fit scientific practice better, in the following sense. The approaches underlying "metaphysical" theories of concepts, including informational atomism, tend to answer the question of what concepts are (what concepts must be) on the basis of purely philosophical, *a priori* requirements or constraints, and only then to find the relevant, psychological empirical

evidence. By contrast, a naturalistic, capacities-oriented approach takes into consideration from the start the empirical evidence concerning behavior and the mental endowments postulated by cognitive scientists. Or, at any rate, this is the kind of approach we want to pursue. To establish *a priori* what a concept must be is to put the horse before the cart, so to speak.⁴

In light of the above considerations, our strategy will be the following. We shall look for some abilities with *prima facie* relevance to concept attribution, beginning with the most basic, and gradually increasing their sophistication. For each individuated ability, we shall discuss whether it is required for concept possession. Eventually, we shall argue that concept possession could be identified with a certain collection of these abilities. The relevant abilities can easily be characterized in computational terms.

This approach is naturalistic insofar as it proceeds by assimilating human mental processes to nonhuman (proto)mental processes, rather than assuming a clear-cut distinction (cf. Brandom, 2000 for the nonassimilative strategy). We call this approach "bottom-up" insofar as it starts from what is simpler, more basic (perceptual), and climbs, so to speak, on what is more sophisticated (inferential, linguistic).

This strategy does not beg the question of which theory of concepts is right. There are good reasons to think that each theory of concepts on the market gives an account of some aspects of the problem, being unable to account for others. However, we expect that our analysis will evidence the merits of some theories and the shortcomings of other theories.

2. Concepts and categorization abilities

Several mental abilities are relevant to concept attribution or, in brief, to concepts. Of course, the notion of mental ability can be picked out at different levels of analysis. Consequently, different kinds of mental abilities will be considered relevant. For instance, following a rough and popular classification schema, there are three macroabilities relevant to concepts: categorization, inference and language.

We shall assume *categorization* to be the core ability relevant to concept possession, and we shall distinguish different kinds of properties instantiated at different levels of categorization. We shall argue that, in order to ascribe concepts, some sophisticated aspects related to categorization must be present. In the last section (see §3) we shall return to the notion of inference, to see whether it fits our proposal. As far as language is concerned, it is not among the topics of this paper. To put it crudely, we assume that language is relevant in order to possess *certain* concepts, not to have conceptual abilities in general.

By 'categorization' we mean, at a first approximation, the process by which a natural or artificial system subsumes a

³ In fact, as has been stated before, the link between the meta-theoretical option and the theoretical option is not logical.

⁴ However, as we shall see, a certain extent of apriorism will also be unavoidable in our inquiry – as well as, we submit, in every inquiry aiming at outlining a theory of concepts.

stimulus under a class. As Medin & Aguilar (1999) nicely put it, categorization is «the process by which distinct entities are treated as equivalent». Thus, an agent can be said to be somehow able to categorize if there is evidence that he or she takes some particulars to be put together under some aspects⁵.

Whatever pre-theoretical, intuitive notion of concept is assumed, it has to account for categorizing abilities; in other words, being endowed to a certain extent with this ability is a *necessary* condition in order to be able to conceptualize. Ability to categorize is a minimal requirement to ascribe concepts, since these are in the first place tools for putting together particulars for a variety of goals: giving appropriate behavioral responses to stimuli of a given kind, forming inductive predictions about properties that have to be applied to new (never met before) particulars, and so on.

Indeed, all theories of concepts on the market provide accounts of categorization. These theories can be distinguished essentially by the fact that they offer a different explanation of how categorization works.

At first glance, there are two crucial aspects involved in the formation of categories. The first is *abstraction*: to “build” a class, one abstracts from some features and focuses on some other features. Trivially, being green rather than red is not important for an apple in order to be (categorized as) an apple. Please notice that we are not talking about sophisticated “abstract” concepts, such as DEMOCRACY or ELEGANCE, but only about the ability to pick out some aspects, and exclude others. Without this ability no particular could be considered on a par with another particular under some aspect.

The second aspect, which is somehow symmetrical to the previous one, is *directedness*, that is, the property of conceptual structures to carry information, or represent, entities in the world. No matter how a category is built, a pattern is generated that is regularly associated to something in the world. Something mental mediates the stimulus and the behavioral response. This corresponds to a (very minimal) notion of representation. That is to say, concepts require representational abilities.

One might describe directedness as a sort of *aboutness*, a bare, primitive referential relation that even thermostats can instantiate, but we prefer to dispense with this too much committing way of speaking. The point is just that any kind of categorization involves the instantiation of a certain mechanism that stands, or represents, a certain collection of particulars. This does yet not amount to a full notion of reference, which, at least according to some authors (e.g. Deacon, 1997), requires a system of symbols each standing for something.

⁵ We will always use ‘category’ as synonymous with ‘class of objects’. That is, our notion of category corresponds only to the *extensional* aspect of the notion of concept. Remember also that we are talking about *subjective* categories: We are not interested in the question whether the categories formed by people are appropriate by certain public normative standards (naturalistic constraint).

Clearly, this definition of directedness does not suggest that language is necessarily involved in categorization. As we will see below (§2.1), many behavioral patterns, of different degrees of sophistication, show that a given stimulus has been subsumed under a certain category. For instance, in order to ascribe perceptual categorization, it is enough that an animal behaves differently in response to different kinds of stimuli.

2.1 Evidence from animal categorization: rats

As we said, categorizing a stimulus amounts to subsuming it under a class. Many experimental data provide evidence that even animals far from us in phylogeny are able to categorize stimuli. Take, for instance, an experiment aimed at establishing to what extent categorization in rats is accurate (McIntosh, 1994). If the experimenter feeds a rat on some coffee at t1 and causes it to have a stomach ache at t3 (by a lithium chloride injection), the next day the rat will be off coffee, i.e., the last thing it has eaten. If, however, the rat eats some sugar at t2 (t2 < t3), then it will avoid sugar rather than coffee. Results are shown in Table 1.

Table 1

	t1	t2	t3	Behavior
Case 1	<i>Coffee</i>	—	<i>Stomach ache</i>	<i>Coffee avoidance</i>
Case 2	<i>Coffee</i>	<i>Sugar</i>	<i>Stomach ache</i>	<i>Sugar avoidance (not coffee)</i>

These data suggest that the rat is able to represent a category such as “stuff-to-avoid” in a rather accurate way, discriminating bad food on the grounds of non-trivial cues such as the events’ temporal order.

The two criteria regarded as necessary for categorization, i.e., abstraction and directedness, are both satisfied: rats abstract from differences among particular foods and pick out the common attribute of noxiousness; it is this feature that determines behavior, implicitly establishing an informational link with bad food.

It is worth to point out that a third feature of animal categorization has sometimes been highlighted in literature. According to Dretske (1986), in order to ascribe a genuine representational ability to a system, the system must be endowed with multimodality, that is, the ability to pick out one and the same feature of a stimulus by multiple sensory channels (Dretske 1986, p. 33).⁶

Multimodality allows to establish what the content of a representation is. In fact, when there is only one sensorial channel, we have no basis to claim that the content of a representation is the external (distal) stimulus rather than, e.g., the proximal stimulus. This systematic ambiguity in the

⁶ More precisely, Dretske claims that representations can also be ascribed to systems that are able to exploit in a single sense modality different external features of a stimulus. We shall restrict ourselves to multimodality.

content determination is removed in the multiple-sense case, because there are two distinct paths connecting the endpoints, that is, the relevant representation and its object⁷. In other words, multimodality allows us to establish whether an animal is representing or misrepresenting something.

Therefore, Dretske's argument is fundamentally that a genuine representational ability requires also the ability of misrepresenting, which, in turn, requires multimodality.

Multimodality seems to be present in many vertebrates, including rats. Therefore, we could say that bare animal categorization is characterized by abstraction, directedness and multimodality. Is this "bare categorization" enough to attribute concepts? Let us discuss another example, involving more complex animals, such as monkeys. As we shall see, monkeys' behaviour is probably easier to interpret, in the sense that the properties we have individuated so far are more apparent.

2.2 Monkeys

The example we are going to discuss is taken from Cheney and Seyfarth (1990), who observed a group of vervet monkeys living free in a park. Vervet monkeys, who live in groups of 10-30 individuals, engage in complex vocal interactions. Each individual uses a set of 25-30 signals, which appear to be messages to conspecifics. The most frequent communication contexts are dangerous situations, search for food and sexual interaction. Each of these contexts is characterized by the use of highly specific vocal signals. For instance, three different alarm calls are produced facing different predators such as snakes, birds of prey (usually, eagles) and big cats (typically, leopards). The reaction of monkeys hearing an alarm is very specific as well: leopard alarms make vervets run into trees, whereas eagle alarms cause them look up or run into bushes; in response to a snake alarm, vervets keep still and peer at their surroundings.

Notice that the escape reaction is not triggered by a unique cause. In fact, even when he is not alerted by a conspecific alarm, the monkey who sees a leopard runs away (over and above alarming his conspecifics). Therefore this is also a case of multimodal categorization, as recognition is performed through different sensory channels.

Now, although the behavioral pattern of vervet monkeys is quite sophisticated in comparison with the rats' behavior discussed in section 2.1, we submit that this kind of categorization is still too coarse-grained. In fact, the vervet monkeys' behavior in the face of an alarm is a *rigid* reaction. Whenever a leopard is perceived, a monkey cries and escapes. On the other side of the communication channel, whenever a monkey perceives a leopard alarm, it escapes.

⁷ However, as Dretske points out, multimodality as such does not yet rule out the possibility that the content of a representation is disjunctive, as it could happen when two different stimuli -- say, an elm and a beech -- have some sensorial properties in common. Dretske accounts for this problem by invoking the notion of indication function (cf. 1986, pp. 35-6).

That is to say, the stimulus <leopard alarm> only triggers escape reactions. This seems to show that the requirements on categorization so far individuated are necessary but not yet sufficient. Why do we argue that concepts require a sort of *non-rigid* categorization? Before answering this question, let us draw attention to another kind of empirical data, concerning the neural level.

The relevant experimental evidence concerns canonical and mirror neurons, two classes of visuo-motor cells found in the premotor cortex (F5) of macaques' brain. Canonical neurons fire both when the animal grasps a certain object using a certain grip and when it observes an object which can be grasped in the same way. According to Gallese, canonical neurons could subserve multimodal representation of an organism-object relation.

Mirror neurons discharge both when the monkey makes a specific action and when he observes another agent performing the same kind of action. For example, they fire when the animal grasps an object and when he sees someone grasping the same kind of object. Some mirror neurons are multimodal since they fire not only when the monkey *visually* perceives an agent performing an action, but also when he *hears* the same action being performed by someone (Kohler et al., 2002). There are also mirror neurons which can detect a (partially) occluded action. For example, "grasping" mirror neurons fire when the animal sees an action whose final, relevant part is occluded by an opaque screen (Umiltà *et al.*, 2001).

To sum up, the properties of macaques' categorization processes are abstraction, directedness and multimodality. In particular, with regard to abstraction, canonical neurons fire independently of the specific object's shape. Likewise, mirror neurons fire both when the action is seen and when the action is heard.

According to Gallese, these properties are sufficient to attribute concepts and, in particular, the concept of a *goal-oriented action*. Yet we believe something is still missing. Let us go back to the psychological level.

2.3 On-line and off-line processes

A sophisticated feature of macaques' categorization consists in the inhibition of action. In fact, since pre-motor regions are activated when an action is perceived, one could expect the same action to be actually performed. Yet, despite F5 neurons' activity, perceiving an action does not necessarily lead the monkey to act. In this sense, an action is prepared without being really performed, a working modality that could be called "off-line", meaning that there is a "detachment" from action.

This feature is quite sophisticated, since it weakens the rigidity of the categorization models discussed earlier. But the notion of off-line categorization we are interested in requires more than this. Take, e.g., canonical neurons. They can be said to work "on-line" insofar as, in the light of the available evidence, they fire only when an object is present in the perceptual field of the monkey. In other words, the category-

like representation realized by canonical neurons' firing seems to be necessarily triggered by perceptual contingencies, in a bottom-up way.

It seems, however, that conceptual capacities involve the possibility to exploit a representation even when the stimulus is not present. Arguably, it is the possession of concepts that allows us, for instance, to figure out a potential danger, so that to plan a preventive behavior. Indeed, according to Haugeland (1998), this feature is necessary even in order to speak of representations: Something is a representation only if it can *stand in for* the stimulus, so that the relevant behavior can be guided by the mechanism, in stead of the stimulus.

This suggests that full-blooded off-line modality -- the only one that can fully remove rigidity -- requires more than inhibition of action. It requires the possibility to trigger the process in a top-down way. Therefore, we define off-line processing as the conjunction of the two following conditions:

- 1) Off-line representations can be activated not only by objects in the perceptual field but also by top-down processes such as imagery or long-term memory;
- 2) Off-line representations can be activated without triggering any real action: an action is planned but its execution is inhibited.

We claim that *concept attribution requires the ability to perform off-line processes in this full-fledged sense*. In other words, conceptual competence requires off-line processing in the sense that (1) representations can be activated in a top-down manner, and (2) representations can trigger *simulated* (rather than actual) actions. A similar view is put forward by Bickerton (1995), in a different, language-oriented, context.

As we pointed out earlier, the second constraint is still satisfied by mirror neurons⁸. However, according to our proposal, in order to attribute concepts to macaques, the first constraint must be met as well. Whether or not it is fulfilled in monkeys remains an open empirical question. In any case, the relevant point is that off-line processing is the last and crucial constraint necessary to attribute concepts. Therefore, a system can be ascribed conceptual competence if and only if *all* of the following features are present:

- a) abstraction
- b) directedness
- c) multimodality
- d) off-line processing

Let us work out more deeply why we hold that off-line processing is necessary for concept possession. Admittedly, this claim is to a certain extent a matter of stipulation: the issue of establishing what counts as conceptual capacity is not purely empirical. However, there are at least two reasons supporting our hypothesis.

First, the pretheoretical notion of concept seems to require a kind of *generality* which is over and above the kind of

generality involved in bare (nonhuman) categorization – the notion of generality captured by the feature of abstraction. The idea is that one and the same representation can be exploited in several different mental operations; in particular, we can use it in reasoning. This intuition was formalized by Evans' (1982) so-called generality constraint, according to which if an agent has the ability to entertain the proposition Fa ($= a$ is an F), he also has the ability of entertaining the proposition Ga , for each concept G he can grasp.

The independence from sensori-motor constraints is a special case of generality: among the different possible uses of a representation, there are situations which are not constrained to the "here and now". Following our definition of off-line processing, on the one hand representations can be activated in a top-down way, (i.e. by imagery processes operating on long term memory data) and, on the other hand, this activation does not necessarily yield the execution of any motor plan.

Second, if concept attribution were based only on abstraction, directedness, and multimodality, a system would be confined to a rigidity which does not easily fit our pretheoretical notion of concept. This is evidenced by vervet monkeys' alarms as discussed by Cheney & Seyfarth: in presence of leopard alarm, they cannot but react, rigidly, by crying and escaping. There is, so to speak, too much determinism in the vervets' behavior to attribute them the relevant concepts.

Admittedly, rigid, species-specific patterns of behavior are not useless. On the contrary, being the product of natural selection, this rigidity is typically part of a good strategy to avoid mortal dangers. To put it in a slogan, to act is better than to stand still.

Rigid patterns of behavior are typically very cautious, in the sense that they happen to be also triggered by false positives: sometimes a danger is seen in a harmless situation. Again, this is a good strategy for survival in simple systems. However, to acquire the power to inhibit behaviour constitutes a significant cognitive improvement for a biological system. An animal belonging to a species characterized by rigid patterns of behavior gets a selective advantage when it becomes able to inhibit an action: its cognitive system is less deceived by false positives and can "decide" when it is the case to act.

That said, our proposal should not be taken as a dogmatic thesis about what a concept *is* (in terms of possession conditions). Rather, empirical data seem to show that the relevant abilities (bare categorization, that is, abstraction and directedness; multimodal categorization; off-line multimodal categorization) are distributed along a *continuum*, such that the boundary between the non-conceptual (or pre-conceptual) and the conceptual is fuzzy. We might say that proto-concepts are included in the leftmost area of the continuum, whereas full-blooded concepts belong to the rightmost area. In the middle, there is a grey area in which conceptual capacities begin to emerge. This would provide further evidence for the widespread thesis according to which the concept of concept

⁸ The off-line working modality, even if limited to the motor side, does not seem to play any role in Gallese's discussion on the conditions required to attribute concepts.

is vague, prototypical. In a way, it is just for a sort of anthropological chauvinism that we are inclined to claim that concepts are only located in the rightmost part of the continuum.

3. Inferences and inferential role theories

Let us conclude by briefly outlining a few points about inferences and inferential role.

First, in our paper we did not appeal to the notion of inference, which is often considered as the mark of conceptual, because it appears, in our opinion, rather ambiguous. Admittedly, at the core of 'inference' lies the (conscious) derivation of a conclusion from premises. To have concepts amounts to being able to use concepts in this kind of inferences (see e.g. Crane 1992, p. 144), an idea already familiar to Frege. The off-line modality can be seen as an alternative way to account for this kind of exploitations of concepts, in the sense that inferences are paradigmatic cases of off-line uses of representations.

However, the notion of inference has also been used to denote the kind of processes constitutive of perception. Since Helmholtz, it is common to regard a perceptual task as a kind of unconscious inferential process. Accordingly, we should have distinguished two kinds of inferences: off-line or high-level inferences, which are the core inferences, and on line inferences, which are rigid and necessarily triggered by sensory information. On the interest of clarity, we chose to give up the inferentialist talk.

Second, even if one insisted that our off-line account amounts, after all, to the thesis that inferences are necessary for concepts, our account should not be considered as a version of the so-called inferential role theories about concepts. According to inferential theories, to possess a concept is to be able to make some inferences. We know what the concept DOG is if (and only if) we possess some relevant beliefs on dogs, such as that a dog is a barking mammal with a highly-developed sense of smell, and so on. Although this way of speaking is compatible with our view, the focus and the method of our account are rather different. Our aim is to relate, in a bottom-up, empirical way, human capacity to non human abilities, whereas typical inferential role theories assume a language-oriented characterization from the start and proceed in an *a priori* way. They do not comment on the basic categorical processes underlying inferential roles.

Conclusions

We have taken categorization as the core ability relevant to concept possession, and we have distinguished some different kinds of properties involved in different levels of categorization. Four constraints have been individuated in order to possess concepts: abstraction, directedness, multimodality and off-line processing. The last requirement, in particular, allows us to account for the popular (and plausible) thesis according to which inferences are necessary

for concepts, without being involved in the inferentialist, top-down talk.

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