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Article

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BASIC CONCEPTS: A COGNITIVE APPROACH

SUMMARY: This article seeks to describe concepts of a special kind, these being ones that count as basic, while at the same time referring to the results of research in logic, the philosophy of language, and empirically pursued cognitive psychology. The key issue addressed is this: on what grounds are such basic concepts formed? It thus investigates issues pertaining to their formation and operation, especially in small children. (Basic-level concepts will be examples of basic concepts.) Such concepts can take the form of mental representations of objects, properties and relations. They function in classifications made by numerous and diverse cultural groups, are established at an early stage—being the first to be named and, so to speak, malleable—and their structure is not satisfactorily captured by any currently recognized theory. Moreover, they are organized around some sort of overall similarity irreducible to any particular component part. (Basic concepts pertaining to properties and relations must be based on some overall similarity, as properties and relations themselves do not consist of parts. Equally, basic concepts pertaining to objects cannot be constructed on the basis of mere parts of these objects.) Psychologists and philosophers, on the other hand, frequently claim that properties are component parts to which overall similarity can be reduced (e.g. in exemplar-based and prototype-based theories of concepts). Yet if this solution were to be accepted, one would then have to say that three- or four-month-old children are unable to establish properties before delimiting the range of the relevant category (or any fragment of this range), whilst also being unable to establish the range of that category (or any fragment of it) before delimiting its properties. The problem with this is that children can distinguish some properties; however, they are incapable of establishing within a relatively short period of time which of these properties determine membership in the sense of falling within the range of the category in question. Moreover, basic concepts cannot be organized on the basis of a relation of similarity reducible to properties, due to the fact that any such similarity will be an equivalence relation, whilst the similarity relation accessible to the child constitutes a non-equivalence relation. A further point is that no consensus has yet been agreed upon within the psychological literature as to the construction of concepts formed by three- or four-month-old children.

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1. TERMINOLOGICAL REMARKS

This section will specify how certain key terms are to be understood. As a point of departure, let us note that categories are composed of objects from the world. The word "category" is equivalent to the terms "naïve set" (Voitsekhovskii, 1995, p. 120) and "range of a name". The expression "naïve set" (hereafter, simply "set") is defined on the basis of the similarity relation, and is not a term from set theory. However, categorization is a specific form of intellectual activity consisting in, amongst other things, an acknowledgement, on the basis of either overall perceptual similarity or some particular perceptual properties, that certain objects belong to one and the same given (naïve) set.

Objects can be concrete or abstract (the former are derived from perception, whilst the latter are not). Concrete objects are divided into concrete things (e.g. a dog), concrete properties (e.g. green) and concrete relations (e.g. taller). Abstract objects are divided into abstract things (e.g. dogness), abstract properties (e.g. greenness) and abstract relations (e.g. tallness). This article will not be dealing with abstract objects.

Objects s h o w n during categorization will be defined as "samples", while those subsumed u n d e r a n a m e will be called "semantic types". Categories are themselves formed around either samples or semantic types. In language names represent categories. The present analysis will focus on the names of *concreta*, not *abstracta*.

Names are also divided into general names (involving more than one, e.g. "dog"), singular names (involving just one, e.g. "Ajdukiewicz") and empty names (with none, e.g. "square wheel"). This article will not attempt to deal with singular or empty names.

A particular delimitation of a set of objects (e.g. those designated by the word "dog") is introduced by identifying properties possessed by those objects, e.g. barking, or by determining similarities to a selected object-sample (e.g. similarity to a dog that is pointed to as representative). Meanwhile, a delimitation of a set of properties (e.g. designated as "red") or relations (e.g. designated as "being taller") is introduced by identifying a similarity to a given sample of such a property or relation. For instance, a delimitation of the range of the set of red objects is introduced by identifying their similarity to a given sample of red, while the delimitation of the range of the set of relations of being taller is introduced by identifying their similarity to a sample of being taller (such as the relation that is John's being taller than Johnny, directly shown).

Semantic relations occurring between the realm of mind or language and elements of the world will be defined by the use of the term "reference" (Carey, 2009, p. 487). A reference contains naming, designating and standing for.

A similarity is distinguishable by the following: either it is reducible to definite common parts (generally referred to as properties) or it is not so reducible. In the former case, it will be possible to talk interchangeably about possessing a similarity (further referred to as "a detailed similarity") and possessing definite common properties—even though this risks being accused of falling foul of Ockham's razor by permitting the number of posited entities to be needlessly multiplied. In the latter case, it will not be necessary to discuss the existence of common properties, as this similarity (further referred to as "the overall similarity") will not be reducible to any definite properties.

We are of the opinion that some of the most important tools enabling the binding of elements of language or thought with elements of the world are deictic (ostensive) definitions. Ostensive definitions are elementary sentences of the form "This is *N*", in which the word "*N*" can be replaced by proper nouns, definite descriptions or general names. Such definitions bind names (or concepts) with individual objects or sets of objects.

Baptismal acts of references of first names, acts of presenting references of specific descriptions and the first acts of naming selected references of general names are made by means of deictic definitions. Such elementary sentences will hereafter be referred to as "simple deictic definitions". The inductive version of ostensive definition is built from multiple "This↓ is *N*" expressions (the initial condition), combined with a rule which allows for the determination of non-demonstrative objects (the inductive condition). This will be further referred to as "deictic-inductive definition" ("ostensive-inductive definition"), and can take two forms:

$$\text{this}\downarrow \text{ is } N \wedge \ldots \wedge \forall x(W(x) \rightarrow x \text{ is } N)$$

or

$$\text{this}\downarrow \text{ is } N \wedge \ldots \wedge \forall x(x \text{ is } N \equiv W(x)).$$

These schematizations will be utilized to describe the structure of basic concepts. In any such schema, *N* represents the name being defined (the definiendum), the variable *x* corresponds to the relevant set of objects, and *W* states the conditions which objects under consideration must fulfil if they are to count as falling within the range of the name so defined.

This leaves the issue of how concepts are to be defined. Here, we shall only appeal to an understanding of concepts of the most general kind. For Rosch (1978), concepts are mental representations of objects that are in some sense self-equivalent, while according to Murphy (2004) they are just mental representations of categories.

Contemporary psychological and philosophical literature mentions three paradigms of concepts: exemplars (where categories are formed around individual properties, i.e. such properties as determine a single designatum), prototypes (where categories are formed around typical properties), and what theory-based models propose (where categories are formed around theories explaining correlations between properties; see, e.g., Machery, 2009; Walentukiewicz, 2011). None of these notions of concepts takes into account overall similarity—which is irreducible to specific common properties—as an instrument of categorization.

The following concepts (Walentukiewicz, 2011) can thus be distinguished (as meeting the criterion of being constructed around relations or properties):

1. basic (formed on the basis of an overall similarity relation, as well as indistinguishability);
2. non-basic (formed on the basis of properties).

Basic and non-basic concepts can be bound to either general or singular names. This article will deal solely with the former.

2. BASIC-LEVEL CONCEPTS

In general, it is fair to say that the psychological literature does not aim to explore basic concepts as such, or enter into discussions regarding what the very notion of a basic concept amounts to. A theory of the latter kind has only been introduced in the context of philosophical research (Walentukiewicz, 2011), whereas what we find presented in the psychological literature is the notion of a basic-level concept (cf. Rosch, 1978). Therefore, before dealing with the former, we should first introduce the latter, with the aim of determining how it stands relative to the notion of a basic concept itself.

Rosch (1978) writes about concepts in term of their possessing horizontal and vertical dimensions. The former refers to ways in which concepts differ as to type (i.e. in respect of their building), whilst the latter deals with how they vary with regard to their degree of abstraction. Horizontally, concepts divide up in terms of building, whereas vertically they are distinguished by their range.

Our own approach here will be, on the one hand, to adopt Rosch's nomenclature when discussing the vertical dimension of concepts, and as a basis for introducing the term "basic-level concept" itself (implying an intention to discuss concepts in their vertical dimension), while on the other, to introduce the structure of a new type of concept (and hence open up possibilities for discussing concepts in their horizontal dimension). Basic-level concepts, after all, are themselves a type of concept, so they, too, must possess some sort of building.

We, therefore, advance the thesis that such concepts have a special building, which has not been addressed via any of the notions of concepts so far proposed in the literature, and the aim of the present article is to substantiate precisely this thesis. Given that the literature has adopted the adjective "basic" to characterize

a certain level of concepts, and concepts of this level are also taken to furnish a distinct type of concept, it seems reasonable to retain the same descriptor for the latter. That, in brief, is why we shall define "basic concept" in terms of the idea that what it actually refers to are basic-level concepts.

3. SELECTED PROPERTIES OF BASIC CONCEPTS

So far, we have only sought to introduce the terminology adopted from existing sources. Now, with a view to identifying some initial properties of basic-level concepts, we shall set out some observations. Indeed, our exclusive focus in the ensuing investigation will be on arriving at an adequate description of four specific properties pertinent to basic concepts.

3.1. Basic Concepts Are Formed by People Belonging to Various Cultures

Both anthropologists and psychologists distinguish several levels of categorization. These levels are differentiated according to the degree of abstraction involved. Concepts of the highest level possess the highest degree of abstractness, whereas concepts on the lowest level have the lowest. On the basis of research into ethnic cultures (e.g. the Tzeltal Maya tribe from Southern Mexico, or the Aguaruna Jivaro tribe from Northern and Central Peru), the anthropologist Brent Berlin (1978) enumerated the following levels of biological categorization: the kingdom (e.g. plant, animal), the living form (e.g. tree, fish), the indirect level (e.g. evergreen, fresh water fish), the generic level (e.g. pine, bass), the specific level (e.g. white pine, black bass) and the varietal level (e.g. Western white pine, large-mouthed black bass). Berlin established these levels through observational methods, noting what objects and sets are distinguished by Indian tribes from Central and South America, what names have been assigned to these objects and sets, and what subset-inclusion relations Indian tribes identify.

Meanwhile, the psychologist Eleanor Rosch (1978) differentiated three main levels in so-called Western culture: superordinate (e.g. tree), basic (e.g. oak) and subordinate (e.g. white oak). The experiment carried out by Rosch and her research team adhered to the following general outline: the test group consisted of subjects for whom English was their native language. Nine taxonomies were selected: of trees, birds, fish, fruit, musical instruments, tools, clothing, furniture and vehicles (these made up the superordinate level). Then, with reference to anthropological investigation (when dealing with biological categories) and the cognitive intuition of the authors of the experiment (when dealing with non-biological categories), the level of basic categorizations was established and designated as the basic level (e.g. sets of oaks, maples and birches, and sets of chairs, tables and lamps, made up the basic level). The sets belonging to the subordinate level (e.g. the set of standing lamps and the set of desk lamps, the set of white oaks and the set of red oaks) were contained within the set belonging to the basic level. Subjects had to know the words which these sets referred to. The

experiment participants were then asked to supply properties which they connected with categories of individual levels. The results were as follows: few common properties were listed for sets of the superordinate level (e.g. in regard to common properties of furniture or common properties of trees), whereas a multitude of differentiating properties were identified (e.g. properties which differentiate furniture from trees). With regards to basic-level sets, a comparatively large number of common properties were listed (e.g. for sets of chairs, tables and lamps), as were a similarly large number of differentiating properties (e.g. properties differentiating chairs, tables and lamps from each other). However, there was no fundamental increase in common properties listed amongst sets of the subordinate level (e.g. for sets of standing lamps and desk lamps) in comparison to that of the basic level, and relatively fewer differentiating properties were identified for sets of this level. On this basis, it was concluded that the level of common categories (the basic level) is particularly emphasized during the categorization process. The experiment also proves that the basic level is strongly embedded within the human categorization system. Human beings utilize it even after having mastered their language.

The basic level appears in the categorization processes of all cultures, or at least the majority of them (Rosch, 1978), and corresponds to Berlin's typological levels. Usually, the basic level discussed pertains to some object. Even so, in the available literature from the field of psychology, it is sometimes suggested that the basic level appears not only during the categorization of the object, but also during the categorization of its properties and relations. For example, the following levels of concepts can be distinguished for properties and relations (cf. Walentukiewicz, 2011):

- superordinate level: *colour*,[1] *relation*;
- basic level: *green*, *red*, *taller*, *shorter*;
- subordinate level: *Caucasian red*, *the redness of the lips*, *taller by about 5 cm*, *taller by about a head*.

George Lakoff (1987, pp. 270−271, 300), meanwhile, supplies additional examples of this sort for specific concept levels:

- superordinate level: *moving*, *ingesting*;
- basic level: *running*, *walking*, *eating*, *drinking*;
- subordinate level: *ambling*, *slurping*.

[1] The symbols *…* are used to indicate concepts.

Level-specific concepts of these kinds, on his account, emerge in connection with such properties of the basic level as *tall*, *short*, *hard*, *soft*, *heavy*, *light*, *hot*, and *cold*, as well as such relational concepts as *on*.

Although some of the available literature (cf. Murphy, 2004, p. 229) argues that the basic level for properties and for relations has not yet been adequately researched, for the purposes of this article, our position—without going into unnecessary details—will be that this concept level can be distinguished for some properties and some relations. Whereas there is little dispute regarding which properties or relations belong to the basic level, there are substantial differences when identifying examples belonging to the superordinate and subordinate levels.

3.2. Basic Concepts Undergo Initial Formation During Early Childhood

It has been experimentally proven that infants aged three or four months are able to form concepts for certain objects, properties and relations.[2]

Peter D. Eimas and Paul C. Quinn (Eimas & Quinn, 1994; Quinn & Eimas, 1996, p. 195) have established that three- or four-month-old infants are able to form basic-level concepts for such animals as cats or dogs. Children of this age group are also able to form sets for horses that exclude, for instance, cats, giraffes and zebras (dogs, cats, horses, giraffes and zebras belong to sets located on the basic level in adult classifications; cf. Behl-Chadha, 1996, p. 107).

Gundeep Behl-Chadha (1996) has also determined that three- or four-month-old children are able to acquire basic-level concepts for such objects as couches, chairs or beds. They proved capable of forming a set of couches that excluded chairs and beds (Behl-Chadha, 1996, p. 120), and a set of chairs that excluded couches and beds (chairs, couches, beds belong to sets located on the basic level in adult classifications (Behl-Chadha, 1996, p. 112, 115). The children established sets of chairs comprised of kitchen chairs, swivelling desk chairs, rocking chairs, and upholstered chairs, all varying in colour and style (Victorian, rococo, colonial, contemporary, etc.; Behl-Chadha, 1996, p. 113, 115−116).

The available literature (Bornstein, Kessen, & Weiskopf, 1976) supplies evidence to suggest that colours, despite being continuous in nature, are distributed by children between qualitatively deviating categories, at least in regard to four of them, these being red, green, yellow and blue (where these belong to a set of 11 colours designated by Berlin and Kaya [1968] as “basic colours”). Experiments have proven, further, that children distinguish the colours red, blue, green and yellow from one another (Bornstein et al., 1976, p. 201).

Monochromatic light does not exist under natural circumstances. One can only contemplate whether similar results would have been reached if children had been shown colours existing in the natural world. Light waves are rays, they do

[2] These concepts need not contain all of the potentially relevant designata.

not reflect light; however, the colours possessed by objects come into being as a result of the reflecting of light from their surface.

Anna Franklin and Ian R. Davies (2004) established that three- or four-month-old children not only distinguish basic colours (red, blue, green and yellow) formed as a result of the reflecting of light, but also distinguish primary colours from secondary ones[3] (in this case, blue from purple, or red from pink; Franklin & Davies, 2004, p. 375). Therefore, there is no significant difference between the results of their investigations and the results obtained by Bornstein et al. (1976).

The results of these experiments also furnish evidence to the effect that basic-level objects are the earliest observable type of objects.

Subsequent research, undertaken mainly by psychologists and linguists, has introduced slight alterations to the above findings. These assert that although there is generally no variation between different languages (cultures) regarding the most expressive colour examples, borderline examples do cause disputes. Language can blur the lines between basic colours through the use of the same or a different name for certain given samples: this causes differentiable colours to be included in one set, or a one-colour set to be broken up into two different sets (Franklin & Davies, 2004, p. 373; Wierzbicka, 1999, p. 405−449).

The existence of basic level concepts is evidenced by the experiments conducted by Paul C. Quinn (1994). In his opinion, three-month-old children are able to form concepts for relations such as *above* or *below*, because they are able to distinguish between a situation where a dot is placed above a rod and one where it is located beneath it (Quinn, 1994, p. 58−60): "[…] young infants can […] form categorical representations of physical space that are defined by the positional relations of objects in the environment" (p. 66).

Four-month-old children are not able to master a language. That is why these experiments also ascertain that concepts for sets of objects, properties and relations, at least in some cases, are formed before children learn a language.

3.3. Basic Objects Are the Earliest to Be Named

Rosch claims that "The basic level of abstraction is that level of abstraction that is appropriate for using, thinking about, or naming an object in most situations in which the object occurs […]" (1978, p. 43).

Many researchers (Bloom, 1993; Clark, 2003; Fenson et al., 1994) corroborate the claim that names for basic objects are the first to be learnt. Children between the sixteenth and twenty-fourth month use nouns such as "ball", "milk", "bread", "apple", "dog", "cat", "mommy", "daddy", and "nana", verbs such as

[3] According to Franklin and Davis, the division introduced by Berlin and Kay treated black, white, red, green, yellow and blue as primary colours, while brown, purplish red, pink, orange and grey were classed as secondary ones (Franklin & Davies, 2004, p. 350).

"cry", "come", "sleep", and "want", and names of properties such as "red" and "green". These words are single signs (Rosch, 1978, p. 35) that are "easy to say and remember" (Stern, 1959, p. 8; Berlin, 1994, p. 92).

The basic level is used by human beings even after they have mastered a language. This does not mean that human beings form basic concepts once and for all, or that they do not undergo modifications. On the contrary, they are subject to occasional changes.

3.4. Basic Concepts Are Inconstant

The basic level is not rigidly fixed: it is malleable. Lee Brooks (1978) draws attention to this flexibility: it can become attenuated as a result of a lack of interest in distinguishing certain sets, or enhanced through specialist training. In general, city-dwellers consider *tree* to be a basic category, and not *maple* or *larch*.[4] Horse or dog experts regard subordinate categories (e.g. breeds of horses or dogs) as basic. Rosch (1977, pp. 42−43) notes that for the majority of people, airplanes are treated as being basic-level, but the same does not apply to aircraft mechanics:

> […] he considered aeroplanes as a whole more similar to each other than vehicles […], aeroplanes appear to be an example of a category in which either one or two sets of correlational structures are available depending upon the degree of knowledge of the perceiver. (Rosch 1977, p. 43)

In other words, it is possible to "heighten" the basic level so that it becomes the superordinate level without expanding one's cognitive abilities, or conversely to "lower" the basic level, thus changing it into the subordinate level through training. Nevertheless, basic-level concepts, in the majority of cases, will be used by an individual human being throughout their entire life.

So what, then, is our current state of knowledge regarding basic-level concepts? The research of anthropologists and psychologists has delivered the following characterization of them (only properties relevant to our considerations are listed here):

a) They are present in the systems of classification of multiple diverse cultures.

b) Objects from this level are the first to be recognized (and observed): e.g. the initial observation is of a dog, not a mammal or a dachshund. Moreover, they are assimilated at an early phase.

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[4] It should be noted that the term "tree" is not a term of botanical categorization, whereas the names "maple" and "larch" refer to genuses (Szweykowska & Szweykowski, 1993, p. 132; Browicz, 1993b; 1993c, p. 265, 386).

c) Objects from this level are the first to be named, most often using short words. During the initial phase of learning a language, parents and children use words relating to basic-level objects. These words are also utilized in neutral contexts, e.g. by saying "Look, a dog!" and not "Look, a mammal!" or "Look, a dachshund!" (as in the last two cases, specialist knowledge regarding mammals and dachshunds is required).

d) They are malleable: i.e. during the initial phase of learning a language, dogs are basic objects, whereas with time and after expanding one's knowledge about them, the dachshund subspecies may itself become a basic object. (People living in cities use the term "tree" on the basic level, instead of, say, the term "beech").

Even so, the above-mentioned properties do not in themselves seem informative about the building of basic-level concepts. At the same time, various authors have pointed to the need to describe sets belonging to the basic level (Lakoff, 1987; Arterberry & Bornstein, 2001), so before proceeding to our own investigations it makes sense to consider what the available literature has to say regarding the building of these concepts.

4. CRITICISM OF EXISTING HYPOTHESES

On what basis do children form categories of dogs, cats or horses? What are the predominant hypotheses regarding this in the available literature? An attempt to reach conclusions on the basis of the material available points to a substantive divergence in opinion amongst psychologists. The psychological literature suggests various grounds for differentiating basic-level categories: overall shape (e.g. Marr, 1982, pp. 215–233, 295–328; Landau, 2004, pp. 118–119), external head contours[5] (Quinn & Eimas, 1996, p. 189, 206–207), or specific properties such as a configuration of facial properties (Quinn & Eimas, 1996, p. 191, 209). Some authors specify elements which are not taken into account when differentiating categories belonging to the basic level: e.g. children do not utilize information regarding an animal's torso (Quinn & Eimas, 1996, p. 196). Several critical remarks can be formulated with regard to the above hypotheses.

Where shape is concerned, we should note that what a child actually observes are objects: e.g. dogs assuming various positions—standing, say, or lying down. The observed shape differs from position to position. Does a child remember each of these shapes? A positive answer to that question will surely elicit the observation that there can be many such positions, and that the memorizing of each and every one of them by a three- or four-month-old infant would excessively burden the child's memory. Furthermore, a child would have to remember

[5] Hereafter, the shape as well as the head contours will be recognized as specific object features.

many different additional animal shapes (e.g. those exhibited by a cat), and then be able to distinguish each shape of one animal from every shape of another animal—for instance, the various positions of a cat and a dog, respectively. At the same time, we should note that any issues surrounding the role played by shapes will be inapplicable when it comes to explaining the categorization of properties and relations.

Quinn and Eimas also put forward the claim that animals such as dogs and cats are recognized and distinguished by their external facial properties (Quinn & Eimas, 1996, p. 200). However, a dog's face is not the dog itself. In order to define the dog, the whole animal should be presented. Supplying a dog's face for observation would most likely result in the formation of the concept *dog's face*. If such an object existed independently of the dog, then a dog's face would have to, say, fly around like a wasp. Are children, therefore, really unable to distinguish a dog from its face? To conclude, we may say that it is hardly feasible to reduce the defining of dogs *per se* to a mere presenting of parts of a dog, as in the example of the dog's face.

The above-mentioned authors also state that they are unable to supply properties—including those other than the aforementioned—to which children could refer in order to distinguish cats, dogs and female lions (Quinn & Eimas, 1996, p. 191). The authors ascertain the following:

> With respect to the internal features, we do not know whether the categories are specified by the dimensions of one particular feature (e.g., the nose) or by the configuration of several features (eyes, nose, mouth). Similarly, we are unable to say whether it is the "gestalt" of the outer contour or some specific region of the external border of the head […]. (Quinn & Eimas, 1996, p. 208)

Hence, what we find is that the existing literature does not conclusively explain the issue of the formation of these categories, in that doubts arise as to the hypotheses formulated, due to the actual state of our knowledge pertaining to this topic. It remains simply unclear what type of information infants are able to use during categorization (Arterberry & Bornstein, 2001, p. 334).

Nevertheless, such speculative theorizing is not without a certain significance: firstly, it draws attention to the problem of the impossibility of delimiting the range of some category without any prior delimitation of the relevant properties, while secondly, it raises the issue of the impossibility of delimiting the properties qualifying for membership of that category without any prior delimitation of its range. Thus far, the available literature mentions two methods for distinguishing categories: on the basis of similarity and on the basis of properties (Walentukiewicz, 2011). Let us, then, now introduce the potentially controversial supposition that infants aged three- or four-months do not perceive similarities. Therefore, we suppose, the child can only use properties for categorization. Yet in order to establish some properties, the infant must presumably have prior knowledge of at least some category exemplars, etc. (given the problem highlighted above, regarding the impossibility of delimiting the range of a category without a prior

delimitation of the relevant properties, and the impossibility of delimiting properties which qualify for membership of the category without prior delimitation of its range). Even if the infant establishes a preliminary range, how is he or she supposed to know which properties determine inclusion in the category, and which exclude it from the latter? Comparing, in this regard, exemplars that belong to the category with others that do not would, in practice, take so long that the child would become discouraged from exploring the subject matter (since an infinite amount of time would be needed to compare the objects in order to successfully delimit the properties). Without the possibility of using overall similarity, three- or four-month-old children would be unable to form concepts for dogs or wardrobes.

If these concepts were formed on the basis of properties, then they would not be malleable: if the object were to possess definite properties, and these properties decided about its belonging to a category of a given level, then our perception of this fact would not be alterable. Let us assume, say, that possession of the plant-specific fruit called "acorns" is the distinctive property of oaks. Under our current supposition, this property will determine its belonging to a given genus. Nonetheless, it does not determine whether the exemplar in question belongs to any particular subspecies, such as the cork-oak (where this would require introducing further properties, e.g. the possession of a thick and elastic bark, and so on), or family (since possessing acorns is not a distinguishing property for the beech family; see Browicz, 1993a, pp. 118−119). Equally, what determines that some animal is a giraffe is its individual DNA code. This property distinguishes the species, but not subspecies of giraffe (giraffes have the same DNA, but differ in respect to pigmentation details and horn quantity) or the ruminant family. With respect to overall similarity, on the other hand, the situation differs entirely: initially, elephants can be assigned to one basic-level set, but perceptual experience will subsequently allow for this to be divided into the subsets made up of African and Indian elephants, respectively. The similarity internal to the African elephant subset, along with that internal to the Indian elephant subset and taken together with the dissimilarity between African and Indian elephants, will all be sufficiently significant in their own terms to mean that perception alone allows for the two categories to be distinguished, without any need to establish their distinctive properties.

It is generally assumed that children, at the moment of birth, do not possess any knowledge of the outside world. Essentially, they must acquire any such knowledge.[6] This is why conceptual content has to be arrived at on the basis of perception, at least during the initial formative phase of concept creation. If the child does not possess knowledge about the world, especially in regard to the distinctive properties of a category, then it must be the case that he or she utilizes

[6] This by no means implies that a child enters our world as a *tabula rasa*. He or she possesses principles which determine categorizations (principles specified by Hirsh-Pasek, Golinkoff, Hennon, & Maguire, 2004). These principles will not be discussed in this paper.

some other tool, which must be accessible via perception, available to children aged three- to four-months or more, and such as not to require significant cognitive abilities. Three- or four-month-old children are incapable of performing subtle analyses in order to establish common properties. Hence they form primary categories "without close study" (Berlin, 1978, p. 15).

The literature to date discusses both similarity and properties as possible means for identifying categories. (We should add that the theories put forward generally seek to determine which properties are important for a given field, whereas what concerns us here is not the validity of such theoretical claims, but rather what the real status is of any properties identified as such. (Walentukiewicz, 2011). Since three- or four-month-old children are unable to use properties during categorization, overall similarity is the only tool left at their disposal. By excluding properties, similarity remains as the only possible means of categorization.

5. OVERALL SIMILARITY

To begin with, let us sketch an example of a relation of overall similarity. When observing a herd of elephants and a herd of giraffes traversing, is it really necessary to refer to properties in order to determine at first glance that elephants belong to one category, and giraffes to another? What allows human beings to appropriate elephants to one category and giraffes to a different one? Given that a child does not recognize properties that could determine that something belongs to either the *elephant* or the *giraffe* category, similarity must be the sole remaining option. So what principles govern this process?

Let us first of all distinguish categorization from ordering—and with this, similarity, which is a categorizing relation, from whatever would count as an ordering relation.[7] By asserting that a given exemplar (e.g. a sparrow) constitutes a better example of a given concept (e.g. *bird*), since it shows closer similarity to a selected sample (e.g. a thrush) than to a selected alternative (e.g. a penguin), an ordering is introduced. (Hence, the similarity is a three-argument relation: *x* is more similar to *y* than to *z*.) Conversely, by asserting that the exemplar (e.g. the sparrow) belongs to the concept-range at issue (e.g. that of *bird*) by virtue of its similarity to an identified sample (e.g. thrush), a categorization is introduced. (Here the similarity is a two-argument relation: *x* is similar to *y*.)

Above and beyond this, categorizations of concepts can be subdivided into those formed by appeal to detailed similarity, and those arrived at on the basis of overall similarity.

[7] Categorization should also be distinguished from classification. Classification establishes relationships between categories and is in conformity with logical modes of division − as fulfilling the conditions of being both exhaustive and separable. Categorizations can, of course, lead to classifications.

Detailed similarity (i.e. similarity in some respects and to some extent[8] (Kotarbińska, 1959, p. 47), reduced to the possession of common properties, can be presented using the following schema of Ajdukiewicz (1975):

$$\forall_{x,y}[xP_Cy \equiv C(x) \wedge C(y)],$$

in which x represents a certain object, and P_C represents the relation of similarity reduced to possession of a common property C. The schema can be interpreted as follows: for every x and y, x will be similar to y with respect to possession of the property C if and only if x and y possess the property C. (Thus, for example, a polar bear and a refrigerator will be similar to one another with respect to the colour white, if and only if the polar bear and the refrigerator are both white.) According to this schema, the relation of detailed similarity is an equivalence relation. This, in turn, will be a reflexive relation:

$$\forall_x (xP_Cx).$$

This schema is to be interpreted as follows: for every x, x will be similar to x with respect to possession of property C (e.g. a polar bear will be similar to itself with respect to its possession of white fur).

This will also be a symmetric relation:

$$\forall_{x,y}(xP_Cy \rightarrow yP_Cx).$$

Here the schema is interpreted thus: for every x and y, if x is similar to y with respect to the possession of property C, then y will be similar to x with respect to possession of that same property (e.g. if a polar bear is similar to a refrigerator with respect to being white, then the refrigerator will be similar to the polar bear with respect to this colour).

Furthermore, this is also a transitive relation:

$$\forall_{x,y,z}(xP_Cy \wedge yP_Cz \rightarrow xP_Cz).$$

[8] On the one hand, Kotarbińska (1959) recognizes similarity as being in some respects and to a certain extent an intransitive relation (p. 65), while on the other hand she claims that such similarity is reducible to definite common properties (p. 47). If an exemplar possesses common properties, then all exemplars in the category must be similar to one another with respect to these properties and such a similarity must be a transitive relation. Yet this raises the question of whether it is conceivable that an object could possess a feature that would conclusively assign it to a given category, even when this object was in no way similar to a certain exemplar of this category that also possessed this same feature, and where the similarity consisted in a relation derived from possession of the latter. Such a scenario seems entirely implausible.

In the above instance, we interpreted the schema in this way: for every *x*, *y* and *z* , if *x* is similar to *y* with respect to possession of property *C* and *y* is similar to *z* with respect to possession of property *C*, then *x* will be similar to *z* with respect to possession of property *C* (e.g. if a polar bear is similar to a refrigerator with respect to being white, and a refrigerator is similar to a washing machine with respect to being white, then the polar bear will be similar to the washing machine with respect to being white).

Now we can ask, does overall similarity possess such logical characteristics? Giraffes, for instance, at least with regard to adults and non-defective specimens, are generally similar to one another. We are able to combine them into one set without specifying definite properties.

Overall similarity in respect of the category *giraffe* is a reflexive relation: each giraffe is generally similar to itself. It is also a symmetric relation: if one giraffe is generally similar to another, then the second will be generally similar to the first. Such similarity is not an asymmetric relation (as might be inferred from the remarks concerning similarity made by Tversky [1977]). Asymmetry is rather a feature of the ordering relation, which can be defined as follows:

$$\forall_{x,y}(xPy \rightarrow \sim(yPx)).$$

When forming its first basic-level categories, a child would have to be aware of the ordering criterion. Moreover, the ordering of the category would require the child to have pre-constructed the given category, or at least part of it. Yet category formation precedes ordering. Therefore, the similarity mentioned by Tversky (1977) cannot refer to the formation of primary categories.

It would appear that overall similarity is also an intransitive relation: even if one object is similar to another (e.g. a son is similar to his father), and this second is similar to a third (e.g. the father is similar to his father), the first need not be similar to the third (e.g. the son need not be similar to his grandfather). So is overall similarity really therefore intransitive?

Let us analyse the tools used by three- or four-month-old children during categorization. One argument could be as follows: all exemplars falling within the *giraffe* category are similar to each other. Overall similarity is a transitive relation: there are no two exemplars of *giraffe* which would not be similar overall to each other. Meanwhile, a different argument could run as follows: within the basic category *dog*, dachshunds are similar to one another, but they are not similar to a husky. Within the category *dog*, it is possible to find such exemplars as will not be similar to one another: in other words, starting out from a representative of one breed, and proceeding in terms of overall similarity, it is conceivable that a representative of another breed could be found that would be dissimilar to the first one. Hence, it can be concluded that overall similarity must be an intransitive relation. Yet the same relation cannot possess both of these mutually exclusive features. So there is a problem here that we need to at least try to elucidate.

We should note that the logical character of a relation is something altogether different from its functional operation within a category. More specifically, the relation of overall similarity is an intransitive one, yet it nevertheless functions within certain categories as a transitive relation. Natural discontinuities which exist in the biological world between certain basic-level categories are quite efficacious in this regard (this remark refers to basic categories and not species as such[9]—species themselves only occasionally constitute basic-level categories) and, for example, protect animals from different categories from mating. Anthropologists (e.g. Berlin, 1978), biologists (e.g. Mayr, 1984, pp. 531–540) as well as palaeontologists (e.g. Eldredge, 1995) discuss the subject of natural discontinuities. Within these categories, overall similarity functions as a transitive relation.

A three- or four-month-old child is observing giraffes. He or she does not know any names, but is required (or just wants) to form his or her first category. Giraffes are practically indistinguishable from one another. Each giraffe (when full-grown and without defects) is similar overall to other giraffes. If several distinct objects, in this case giraffes, exhibit overall similarity to one another, then this will suggest to the child the existence of a category to which they all belong, while, conversely, if they do not show any such overall similarity to one another, this will suffice to mean that no such category exists. The above reasoning can be formulated be means of the following schema:

$$\forall z_1 \forall z_2[(z_1 \neq z_2 \wedge z_1 P z_2) \rightarrow \exists Z(z_1 \in Z \wedge z_2 \in Z)] \text{ (Koj, 2007, p. 65)},$$

$$\forall z_1 \forall z_3[(z_1 \neq z_3 \wedge \sim(z_3 P z_1)) \rightarrow \sim\exists Z(z_1 \in Z \wedge z_3 \in Z)].$$

Here, the variables z_1, z_2 and z_3 represent members of the relevant category of objects, the symbol P expresses the relation of overall similarity, and the variable Z refers to the category in question.

Within these categories, the relation of overall similarity will be one that closes the category. So the category Z is closed by D with respect to the relation S ($D(Z, S)$), when each exemplar standing in relation S to the sample belonging to category Z also itself belongs to category Z:

$$D(Z, S) \equiv \forall z_1 \forall z_2[(z_1 \in Z \wedge z_2 S z_1) \rightarrow z_2 \in Z].$$

[9] The polar bear (*Ursus maritimus* or *Thalarctos maritimus*) is descended from the brown bear (*Ursus arctos*). It is widely accepted that they belong to two distinct species. Recently, polar bears have been seen to mate with grizzly brown bears (a sub-species of the brown bear—*Ursus arctos horribilis*). From such a relationship then issue so-called grolar bears, leading scientists to wonder whether these represent a new species. The polar bear differs from the brown bear only in terms of the colour of its fur. They are similar in weight and in body-length, as well as in their possessing a noted predisposition for swimming. This would suggest that natural discontinuities do not appear at the species level. Yet this particular case does not contradict the thesis that they exist as such: it is not possible to cross a bear with a salmon, as the bear would sooner eat the salmon. (Here we speak in jest!)

This, indeed, is how primary categories are formed. When a child begins to learn a word, he or she will already use such categories and attach names to them. A child is capable of forming a wide array of such categories, as there are many species, kinds or even races in the world, between which a sufficient number of natural discontinuities exist to allow for a fairly straightforward assignment of similar exemplars to one category, and differing exemplars to diverse categories, all on the basis of overall similarity.

When the first names begin to appear, the teacher can influence the learner to modify his or her primary categories by joining together objects that are dissimilar to one another into one category: e.g. the teacher can group dachshunds and huskies together into one category, naming them with the word "dog", simply by employing deictic definitions. Equally, the teacher can also exclude objects possessing overall similarity to one another (e.g. wolves and huskies) from co-membership of the same category, giving them different names, also by means of simple deictic definitions.

Only then can the intransitivity of the overall similarity relation reveal itself. Dachshunds are similar overall to one another, and huskies are similar overall to one another. Within the range of dachshunds or of huskies, this similarity works as a transitive relation. However, it functions as a non-transitive feature across the entire category of dogs. This can be formulated as follows:

P is an intransitive relation in category N (e.g. dogs) $\equiv \exists_{x, y, z \in N} (xPy \wedge yPz \wedge \sim(xPz))$.

When introducing its first names, the child need not rely on using properties in order to determine membership of an object in relation to a given category. Overall similarity, along with a capacity to include within one and the same category objects that are dissimilar overall on the basis of the fact that they possess common names, will prove sufficient—at least at this point in their development.

It can be assumed that overall similarity functions between wholes. The theses of Gestalt psychology furnish a theoretical background for this contention: e.g. the Wertheimer principle, which relates to groupings of objects of identical appearance or wholly similar objects within one category (Wertheimer, 1923; Palmer, 2002, pp. 101–102). Wholes are simpler than mere summations of parts (Lakoff, 1987). A single feature, or even several properties, will prove insufficient as a basis for a child's assigning objects possessing these properties to a single category. An overwhelming majority of common properties must be present. Each feature is relevant to determining such similarity—even such properties as they share with exemplars of different categories. Of course, the more common properties the objects possess, the greater will be the similarity (Tversky & Gati, 1982, p. 125). For this reason, we can partially agree with Murphy, who states that:

> […] the holistic similarity of old to new items is probably very important […], when members of a category are *all* holistically similar, there may be less reliance on memory of individual exemplars and greater reliance on a summary prototype. (Murphy, 2004, p. 85)

This same author stresses how relations of similarity hold between simplified objects, whereas, in our opinion, quite the converse is what is important: it is the similarity of whole objects that is the key factor.

The introduction of semantic types is of particular importance. These are objects which have been assigned a name, and with which other objects are compared, in order to establish whether the latter can or cannot be regarded as falling within the range of that name. They are introduced using simple deictic definitions. Where overall similarity is sufficient for category formation (as with, say, the relation of overall similarity forming the category of elephants), only one semantic type should be formulated. However, when overall similarity proves insufficient, other names allowing us to introduce multiple semantic types will be necessary. Within the category of dogs, the relation of overall similarity obtains between the semantic type and the exemplar under evaluation—e.g. between the dachshund type and other dachshunds—and in such a way that each exemplar from the breed is, in fact, suited to functioning as a semantic type. Thereafter, it is possible to assign the same name to multiple semantic types.

Basic categories are delimited in ways that are physiologico-linguistically determined. On the one hand, names are the first category designata to be assigned, while on the other, this allows for certain subcategories formed on the basis of overall similarity to be grouped together into one category, despite there being no overall similarity between them: e.g. dachshunds have an overall similarity to one another, huskies have an overall similarity to one another, but dachshunds are dissimilar to huskies; yet if we name both subcategories "dog", they end up falling into the same category. A teacher, by using an appropriate name, can unite certain subcategories formed on the basis of overall similarity into a single category, within which overall similarity does not in fact hold between all of its elements. Basic names are used in a neutral context.

The psychological and philosophical literature dealing with similarity discusses the notion of detailed similarity construed as reducible to common properties, regardless of whether these properties are theory-specific ones (Medin, 1988), typical ones (Rosch, 1978), logical ones (in the sense of being jointly necessary and sufficient for set membership) (Ajdukiewicz, 1975), or modally rigid ones (i.e. jointly necessary and sufficient for membership of some set in every possible world *W*) (Putnam, 1996; 1998, pp. 119−120; Walentukiewicz, 2011). This similarity is an equivalence relation. We, on the other hand, are proposing a different kind of similarity, irreducible to common properties and constitutive of a non-equivalence relation. Granting the correctness of such a thesis**,** contemporary theories of concepts—be they classical, prototype-based, theory-dependent or focused on modal rigidity—will be unable to explain the process of forming basic concepts. This leaves the theory of conceptual exemplars, on the

basis of which some authors (e.g. Machery, 2009) have claimed similarity to be reducible to individual properties. Yet it is the present author's view that such a theory refers only to singular concepts, and not to general ones. (Support for this thesis can be found in [Walentukiewicz, 2011].) Since we are exclusively concerned here with general concepts, and not singular ones, similarity of the kind that is reducible to individual properties will not be discussed.

The first basic categories, in the sense of those initially formed and then subsequently corrected through the introduction of appropriate names (the same names for objects belonging to the same category, and different ones for objects belonging to distinct categories), can be described with the use of the following deictic-inductive definitional schema:

$(a_1 \text{ is } N \wedge a_2 \text{ is } N \wedge \ldots \wedge a_n \text{ is } N \wedge b_1 \text{ is not } N \wedge b_2 \text{ is not } N \wedge \ldots \wedge b_m \text{ is not } N) \wedge \forall y \forall v \forall x[(y \text{ is } N \wedge xPy \wedge v \text{ is not } N \wedge \sim(xPv)) \rightarrow x \text{ is } N]$.

In the above, a_1, a_2 and a_n (individual constants) are standing for exemplars that are similar overall to one another and constitute good positive examples. Meanwhile, b_1, b_2, b_m are standing for good negative examples. Thus, we have, say, the colour of succulent grass, considered as a good example for the name "green", but we also have the cloudless sky, considered not just as a good example for the name "blue" but also as a good negative example for the name "green". At the same time, the variable *y* is an individual variable (it being possible to substitute an individual term (individual name) in place of such a variable) corresponding to a set of previously determined good samples, the variable *x* corresponds to the set of exemplars to be evaluated with regard to membership in the sense of falling or not falling within the range of the name defined, and the variable *v* corresponds to a set of good negative examples. It is necessary to remember that the basic level is delimited on the basis of at least two factors: overall similarity (the perceptual aspect) and the names employed (the linguistic aspect). It is therefore perceptual-linguistic in nature.

SUMMARY

Basic concepts are formed on the basis of overall similarity, which is a reflexive, symmetric and intransitive relation. In certain categories, however, this relation can function as transitive, due to the existence of natural discontinuities obtaining between categories of the basic level.

Some readers may be struck by the fact that we have not sought here to take into account the notion of family resemblance, as proposed by Wittgenstein (1997). Our reason for not doing so is that while the author of *Philosophical Investigations* wrote about similarity as an intransitive relation, he also took it to be reducible to an alternative—namely, bundles of features (Koj, 1969; 1988). Therefore, similarity, on Wittgenstein's account, cannot be overall similarity. Apart from this, we may note the following conclusions:

- human beings begin to apply overall similarity as a tool of categorization at the age of three or four months (and the assumption that they use it throughout their whole life seems justified);
- overall similarity is malleable;
- our first names for things are assigned to categories distinguished on the basis of overall similarity;
- overall similarity and overall dissimilarity are both perceptual: e.g. similarity is perceivable between giraffes, while dissimilarity is perceivable between giraffes and elephants;
- taking into account the claims of Gestalt psychology, overall similarity may be said to obtain between wholes; e.g. children recognize such a huge similarity between giraffes (it being unnecessary to identify common properties), and such a huge dissimilarity between giraffes and elephants (it being unnecessary to identify differentiating properties), that they are able to create categories of giraffes and elephants without any difficulty (there being no issue of which properties to select).

Since giraffes possess common perceptual properties with respect to almost all of their characteristics, and since natural discontinuities between categories of the basic level do not allow for exemplars belonging to separate categories to mate (procreate), a wide array of common properties is maintained within these categories. The categorizations formed on the basis of overall similarity will only ever be "breached" partially during the language-learning period, through the adoption of the same or a different name. When the teacher puts forward a semantic type, he or she names an exemplar—one which is not similar overall to the exemplars to which this name is assigned. Overall similarity within a subcategory delimited by semantic type remains a transitive relation, though it is an intransitive relation within the category as a whole. Overall similarity, and our first names for things, are the "tools" which allow for the formation of basic concepts.

Finally, we may also add that when children form basic-level categories, they are then able to compare exemplars in order to go on to establish properties (Gentner & Namy, 2004). Above all, on the account given here, basic concepts are no more and no less than mental representations of basic-level categories.

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