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Contents

Conceptual Framework: a Frequency Model

MARIANO L. BIANCA – PAOLO PICCARI

Abstract In this paper we focus our attention on the nature of empirical concepts. These concepts are considered as a conceptual framework represented by a five–dimensional vector in which, in addition to the merely perceptive content (the identitive and specifying perceptive attributes), non perceptive contents (semantic reference and various significances assigned to concepts by single individuals) are analyzed. This model does not consider empirical concepts as the simple result of a generalization conducted on the basis of different perceptive instances, but highlights the relevance of non perceptive contents in their formation.

Key words Concept, generalization, prototype, mental representation, conceptual framework, visual perception.

1. Overview

Over the last 40 years the study of concepts, particularly within semiotic and cognitive disciplines, has become one of the most engaging fields of research producing a wealth of relevant findings, despite the fact that none of the descriptive or explicative models of conceptual structures has been proved adequate. The question posed is the same one that Locke and Husserl had already formulated: What are the mental processes take place when we speak, for example, about cats? The underlying question then being: What is a cat? This question has been overlooked in the analytical tradition, according to which it is not just important to ask oneself what a cat is but rather to verify whether the proposition 'a cat is an animal' is true or false. Furthermore: Why do individuals break up daily experience into discrete units by assigning them names? Why,

then, 'classify' or 'categorize'? Why group objects or events into classes, or, to use a term which is widely diffused in the cognitive sciences, into 'categories'? Why, then, formulate concepts?

Frege, contrary to every form of psychologism, asserted that a concept is objective, that is, it does not depend on our mental contents, and thus a proposition such as "the number 3 is a prime number" exists independently of the fact that we wake, sleep, live or not: something that holds true always will be and is irrelevant to the existence, present or future, of beings which recognize or do not recognize that truth (Frege 1891a). Furthermore, Frege, considering concept as function and not as a property, brought about a turning point of great relevance in philosophy, extending the application of the concept of function beyond a strictly mathematical realm. Arguments and values of a function are not just numbers, but also any kind of "objects" (the term "object" has been used by Frege). Therefore, in formulas such as f(x) = y not only can numeric expression occupy the place of arguments and values, but any sign or symbol. One example is the following: "x is the inventor of penicillin"; whatever object takes place of x, the value of the function is true or false.

According to Frege, therefore, "a concept is a function whose value is always a truth–value" (Frege 1891b). He went on to clarify that a concept is "predicative," that is, it is the meaning of a grammatical predicate (Frege 1892). The concept *dog*, for example, is designated by the expression 'x is a dog'; in this case the objects which can constitute the argument are designated by expressions collocated in subject positions and in this case x can be substituted by terms like 'bull dog', fox terrier', etc.

Thus Frege moved the first step towards resolving the notion of concept into that of meaning, which constituted the logical paradigm of reference for the most part of contemporary philosophical reflection on the nature of concepts up to the middle of the last century until Wittgenstein's first observations were formulated (Wittgenstein 1953). According to Wittgenstein, daily concepts have a weaker structure than the *definitional* ones; later on, Eleanor Rosch's studies in cognitive psychology definitively demonstrated the unsustainability of the reduction of the notion of concept to that of meaning (Rosch 1975a, 1975b, 1977, 1978).

From a cognitive point of view two functions of concept have been considered. Firstly, that of favoring cognitive economy, because it is through the codification of experience that concepts allow for the diminution of the quantity of information that must be remembered. For

example, instead of remembering every exemplar of *cat* one has ever encountered, we only remember one or at most some of those representing the class of cats. We may even have a more abstract representation, independent of the memory of each experienced exemplar.

The other important function of concepts is that of favoring inference: after having classified a cat as such, many of its specific attributes can be inferred — among which, for example, that of meowing — although these are not immediately objects of perception (Girotto–Legrenzi 1999:91).

The term 'concept', in general, has a wide meaning and can refer to any object, abstract or concrete, near or far, universal or individual. It is possible to have a concept of a fork, of the number 7, of humans and of God, of genus and species (the so–called *universals*) as a specific reality, such as a historic or artistic period like the French Revolution and the Baroque.

Although it is generally indicated by a name, a concept is not the name insofar as it is possible that different names can indicate the same concept or different concepts can erroneously be indicated by the same name.

In light of the most recent philosophical and psychological literature pointing towards new and interesting research perspectives, in this article we intend to examine in particular the formation of empirical concepts: those concepts which refer to a certain number of perceptive experiences related to objects or events considered as belonging to the same class. To reach this goal, we will briefly analyze the classical theory of concepts and the theory of prototypes, examining some of the more relevant questions, for example, how does an individual formulate the concept of 'car' on the basis of an empirical generalization after having inducted the attributes common to each car s/he has encountered?

Following this outline, empirical concepts are considered as *empirical generalizations* derived from information contained in the mental representations corresponding to a certain number of object/events which have been perceived and can be placed in a class because they share some attributes.

This paper will not take into consideration other types of concepts like *theoretical* ones, which are not derived, at least not directly, from empirical generalizations such as scientific concepts like the Big Bang, black energy, relativity, or philosophical concepts dealing with substance, transcendence, or theological concepts about God or the soul. We will also

not analyze *lexical* concepts for they do not derive from empirical generalization but rather from a linguistic description as one would encounter when learning the meaning of a lexeme found in the dictionary.

In section 2 we will examine the classical theory of concepts and the theory of prototypes; in section 3 we will consider the processes of generalization and the formation of empirical concepts; in section 4 we will analyze the structure of these concepts; in section 5 we will take into consideration visual concepts and, finally, in section 6 we will formulate some conclusions.

2. Classical Theory of Concepts and Theory of Prototypes

The *classical theory* of concepts from antiquity through the 1870s was universally accepted in the philosophical studies. Although it has been supplanted by other more recent theories, due in part to some simplistic and superficial interpretations, it is not possible to seriously deal with the topic of the formation and of the function of concepts without referring to classical theory, according to which concepts are complex mental representations whose information allow us to specify the conditions necessary and sufficient for their application. Consider, for example, the concept 'bachelor': this is a complex mental representation whose identifying attributes are 'unmarried, 'adult' and 'male'. An object is part of the *extension of* 'bachelor' only in the case that it satisfies these attributes; in other words, in order for a man to be classified as a 'bachelor' he must have all of the identifying attributes (*criterion of necessity*), which are also sufficient for that classification (*criterion of sufficiency*). Hence, in the case of the concept 'bachelor', the intension is 'to be an unmarried adult male', while the extension is represented by all of the exemplars (the members of the class) who find themselves in this condition.

What happens when one classifies objects according to the classical theory? To classify an object like 'dog', we must break up the concept of 'dog' and verify whether or not its attributes can be applied to the object in question. If all the attributes of that object are present in the concept, then the object can be considered a dog; if only one of those attributes is not applicable, then the object cannot be considered a dog.

The aporias and counterexamples that stem from the classical theory are so well known that we shall forego reviewing them and refer the reader directly to the vast literature dedicated to this topic (Margolis–

Laurence 1999; Murphy 2002; Prinz 2002; Machery 2009). In any case, as an example we might refer back to the concept 'bachelor': in its rigid definition, is it applicable to the Pope — a human being, of the male gender, unmarried? He cannot be defined as a bachelor because he cannot enter into marriage for priests of Latin rites are sworn to celibacy.

In this case the application of the concept is bound by a cognitive model regarding the typical attributes of 'bachelor' and its consequent behaviors or those enacted about him: a bachelor, for example, is an individual who can be presented to a female friend and might become her partner (Lakoff 1987). Furthermore, it is also important to underline that amongst members of the same class there could be a diversity in reference to their degree of *typicality*, that is, the degree to which each object represents a determinate class; for example, a finch would be classified as a bird more rapidly that would a penguin. On the contrary, at the base of the classical theory, if an object satisfies the conditions of affiliation with a class, it does so independently of the degree of typicality because members of a class possess an equal degree of pertinence to the same class.

In spite of these difficulties, it must be stressed that the classical theory offers an adequate explanation of the concept learning process for it is true that we learn a concept only after having acquired the attributes that make it up. In addition, that theory satisfies the criterion of economy for a single representation is used in place of an entire class.

Unlike the classical theory, the theory of prototypes holds that a class of objects is not defined by a set of necessary and sufficient conditions, but by the *best exemplar*, that is, by the *prototype*. If indeed there were a set of attributes upon which one could precisely define a class, and if those attributes pertained to all the members of the class, then each member should be equally a good exemplar of the class without differences regarding its degree of typicality.

Upon closer examination, the descriptive model of conceptual thought whose formation of concepts is meant only as a process of generalization of experiences and representations of objects in the world, is incomplete and inadequate. For example, if we look at and experience different tables, we could formulate, through inductive reasoning, a *typical exemplar* of the concept 'table' consisting of the attributes 'being a piece of furniture', 'having a plane parallel to the ground', 'having one or more legs'.

Moreover, a typical exemplar, a single *prototype*, is not capable of supplying adequate information about the diversity in some attributes

amongst the members of a class of objects it refers to. For example, does an 'ideal bird' exist as representative of all birds, large and small, black and green, winged and wingless, carnivore and herbivore? It seems unlikely that a single generalization could encompass all of these different attributes.

It is important to note that from an epistemological point of view, the empirical generalizations involved in the concept formation are mostly referred to objects which have the same attributes and as such can be grouped in the same class: for example, the class of boats, the class of stars, the class of birds and so forth. Hence, empirical generalizations are expressed in propositions which refer to a class of objects of which some are perceived on different experiences.

Through empirical generalization, formulated by an inductive process, it is possible to describe the common attributes of a group of objects thereby establishing a class. More precisely, empirical generalization, for gnoseological purpose, allow to group a large number of 'cases' on the basis of common attributes which can be assigned to each one of them. Thus, the processes of empirical generalization are fundamental for acting in the world and cognitively approaching it, classifying objects or phenomena, whether experienced or yet to be experienced, whose common attributes allow them to be considered as belonging to a class of objects.

3. Generalization Process

3.1. Mental Representations

How is the process of generalization which leads to the formation of empirical concepts carried out? In order to answer this question we must introduce the notion of *mental representation* and explain briefly its nature and formation. Mental representation is one of the functional modalities of knowledge of the world by way of the use of sense organs or rather *sensorial transducers*.

The term 'representation' refers to the fact that sense data are elaborated and capable of generating one or more mental configurations whose content (information) is, though not always entirely, *isomorphic* to the structure of the world it represents. The mental representation, relative to

every type of perception (visual, auditory, etc.), is a neuromental structure that reports the information coming from an object or event in the world (see Figure 1).

It has a double function: firstly, it is *cognitive*, that is, it generates *reliable* and *adequate* knowledge of the world; secondly, it is *operative*, that is, it triggers various forms of reaction or behavior, useful to acting and operating in the world, and a series of mental configurations such as thoughts, emotions etc. (Bianca 2009: 481–482).

Let us consider the case of visual perception. Take, for example, a book on a table. What happens when we perceive it? The photoreceptors of our retina (cones and rods) perceive visual stimuli (photons) emanating from the book (stimulus source). At this point, the codification of the information coming from the stimulus source takes place and the following neurophysiologic process (*structural transposition)* give rise to the mental representation, in this case the mental image of the book. A structural transposition is a complex neurophysiologic process which allows the transcription of reception of the stimulus by way of specific neurochemical codes belonging to the structure and the functioning of the central and peripheral nervous systems and generates a structure (the representation) which stands in mind for the structure of the object emitting the stimulus. The mental representation carries in a codified manner, though not always entirely, the attributes of the structure of the source of the stimulus (Bianca 2005: 90–95).

Mental images, for example, originating from visual experience, are sufficiently reliable representations of physical objects and as such are those which are prevalently utilized to epistemically access to the world and act within it (Bianca 2009: 27). Thus, a mental representation, which

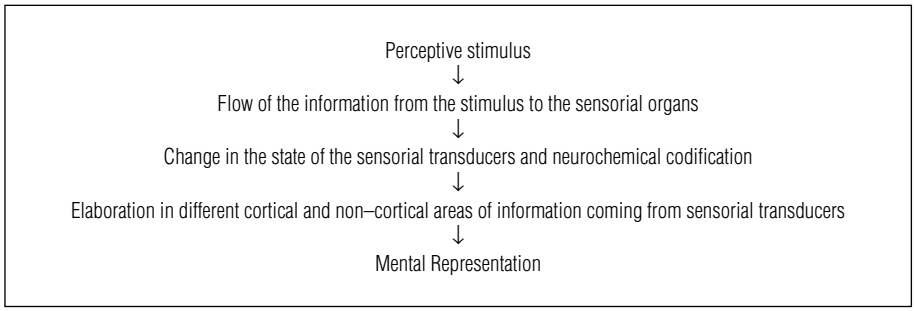

Figure 1. Mental Representation Process.

is the result of neuronal processes brought about by sensory stimuli capable of triggering the activation of many neuronal networks, *isomorphically carries* the structure of the objects of the world, generates different mental configurations and can provoke specific behaviors and actions. For example, in the brain of a gazelle the representation of 'lion', which stands for a lion in the world, is the cerebral configuration that allows her to trigger a neurophysiologic configuration which corresponds to escape, and as such, to the act of escaping.

The previous description refers to a cognitive process capable of formulating a representation. This is the final step of an elaboration in which information transmitted by a stimulus coming from an external source is processed in different areas of the brain. As such, the representation provides knowledge that is *reliable* and *adequate* about the object (which *it stands for)* throughout the elaboration of information coming to the sense receptors from the stimulus, thereby triggering actions conforming to the state of the subject and the structure of the object. The aggressive stance of the lion, for example, is not mistaken by a gazelle as a gesture of submission, but is taken for what it really is; thus, the adequate action, that of escape, is triggered in the gazelle by aggressive stance of the lion. In this case, the cerebral representation of the lion in the brain of the gazelle is both *reliable* and *adequate*; reliable because it carries the attributes of the lion and *adequate* because it allows for a certain type of behavioral response, consonant with the received information, to be put into action.

As far as the formulating process of mental representations in humans is concerned, it is necessary to observe that a human mental representation, for example a visual perception (a visual image), is not just a reliable and adequate representation of one or more objects of the world, but bearing a collection of attributes is an 'empirical generalization' based on perceptive instances of similar objects which are so assembled in to a class. In which case, it can be considered as a conceptual structure (or concept) referring to an object or a class of objects; a concept that might be useful for classifying experienced objects in successive instances.

Furthermore, if one considers that perceptive experience of the human species is prevalently visual in nature, one should conclude that most of the concepts derived from empirical generalization processes are of a visual nature and in smaller number those derived by auditory, tactile, olfactory and gustative experiences.

3.2. Two kinds of generalization process

The formation of a mental representation is the process preceding that of generalization insofar as the empirically acquired information is elaborated in a representational form. Therefore, for example, it would be possible inductively form the concept 'book' on the basis of different visual perceptions (or representations) of the book which refer to the single perceptive visual instances of the 'book' (see Figures 2 and 3).

The inductive process is a generalization which refers to the perceptive instances of type X on the basis of the trial of a limited number of perceptive instances of type X. According to the definition of Aristotle in *Topics* (I, 12, 105 to 11), induction is a process in which details lead to universals, that is, the kind of reasoning that formulates a general statement referring to all cases which possess similar characters from a group of particular statements referring to single cases.

In inductive reasoning there are three distinguishable parts: a) the *base*, b) the *passage*, c) the *conclusion*. The first part contains the statements that refer to single actually experienced instances; the second, statements that are not formulated but are referred to possible other perceptive non–experienced instances of type X; finally, the third contains one or more statements in the form of generalization through which one states or assumes that the attributes evident for a few perceptive instances of type X experienced count for all of the analogous perceptive instances of type X not experienced, and therefore one concludes that they count for all of the possible instances of type X.

In the description of the process of generalization which gives rise to the formulation of empirical concepts we mean to make reference to induction in the statistical–probability sense expressed by the following rule: when we have observed a sample of objects α and found that the frequency of the objects β between them is f, we assume that $P(\alpha, \beta) = f$, that is, the probability that α is β is f, calculated on the basis of the statistical frequency of β in α.

In the case in which a specific attribute occurs in a wide *proportion* of experienced objects of type X, one can assume that attribute is common to all of the other objects of the same type though not experienced, except when proven otherwise. When the proportion is the same in 100% of the objects experienced, that is when the attribute occurs in all of them, there is a *uniform* or *complete* generalization. This is the case when we state that "all

men are mortals" due to the fact that being mortal has always been found to be a constant in association with humankind. However, when the numeric value of that specific proportion is used as a measurement of possibility that the attribute in question will occurs in a new perceptive instance, there is a *judgment of probability*. As such, it is adequate to specify that uniform generalization or the judgment of probability are aspects of the statistical generalization based on the frequency of occurrences of an attribute in a sample of observed cases. The probability p(A) of the occurrence of an attribute identifying a class in a new perceptive instance like, for example, 'blackness' in a class of crows, is always so that $0 \leq p(A) \leq 1$; $p(A) = 0$ if and only if A is the impossible event, $(A) = 1$ if and only if an event is certain.

3.2.1. Generalization e pluribus and generalization ex uno

There are two forms of perceptive generalization, also in the statistical sense: *e pluribus* generalization and *ex uno* generalization (Bianca 2009: 261–265). *E pluribus* generalizations contain information that is attributive and referable, following the inductive process, to all of the objects of a given class (the experienced objects that we consider in the inductive process and the objects yet to be experienced). The *e pluribus* generalization can therefore be considered a concept that contains several attributes possessed by all (or nearly) of the objects of a class. It is preserved in the memory as a *perceptive type* and is useful for classifying the objects in successive perceptive experiences (Fig. 2).

However, in the case of *ex uno* generalizations certain recurrent attributes are assigned to a determinate object or event that has been experienced many times. This generalization identifies the single object and is accepted as *referable in every case* in which that single object or event has been or could be experienced or perceived. The *ex uno* generalization is a neuromental process that carries all of the attributes individuated in different perceptive instances of the same object, thus formulating a *perceptive type*, and allows that a new perceptive instance of that object be subsumed into that perceptive type (Fig 3).

Ex uno generalizations refer to a class of perceptive instances of the same object experienced in different instances, as for example: 'my university office yesterday evening,' 'my university office after the daily cleaning', 'my university office with a new computer', hence, instances which are experientially different but refer to the same object.

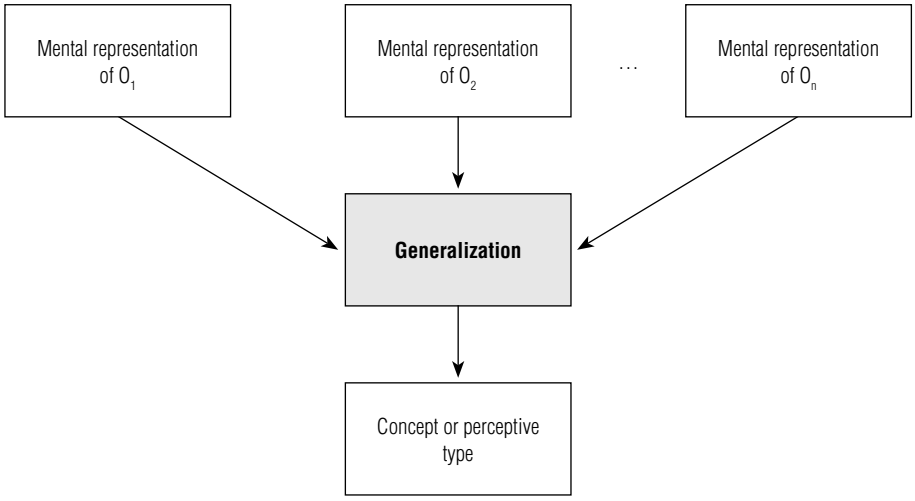

Figure 2. E pluribus generalization (O = Object).

Thus, we can define this generalization according to the following form: given a certain number of perspective instances of an object/event a number of attributes gets assigned to it which are appliable to the perceptive instances of this object, although not all of them are appliable to every instance. In other words, the *ex uno* generalization identifies the

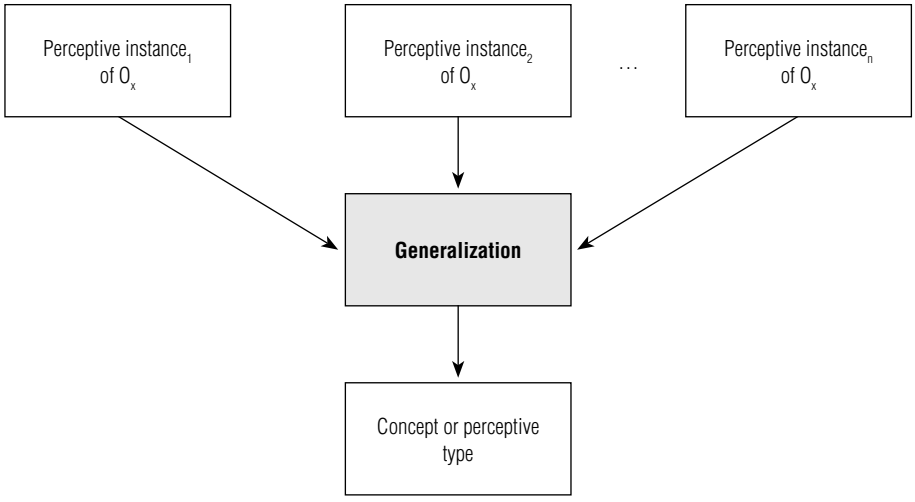

Figure 3. Ex uno Generalization (O = Object)

single object and makes reference to all of the perceptive instances of that single object/event, those which have been verified and those which are yet possible.

The generalizations, of both forms, that give rise to perceptive types or perceptive concepts are particularly important to every day knowledge because they allow for the identification, recognition and thereby the classification of the objects of the world and for their groupings into a class consisting of different objects in the case of *e pluribus generalizations* and of different perceptive instances of the same object in the case of *ex uno generalizations*.

4. Conceptual framework

The classical theory of concepts, as we have seen, states that the classes of objects are defined by necessary and sufficient criteria of belonging. All members of a class should therefore possess an equal degree of belonging to the class, that is, they should have all the attributes that typify that class and make up the necessary and sufficient conditions for membership. Actually, that may hold for some artificial and conventional concepts, but not for most empirical concepts. Indeed, classes are not logical entities defined by a set of necessary and sufficient conditions, but are determined by a set of identitive attributes most frequent (in the statistical sense) in members of the same class; from this set it is possible to obtain a typical exemplar by abstraction, one that does not possess the average value the highest number of characteristics shared by members of the class as expected in the *prototype theory* (Rosch 1977), but the identitive attributes common (most frequent) to those members.

With regards to the attributive structure of empirical concepts, it is essential to underscore that contrary to what many scholars maintain, an empirical concept does not consist solely of attributes referable to physical properties of objects, but also of other attributes assigned to objects by the individuals who experience them. For this reason we will be considering empirical concepts as *conceptual frameworks*, within which it is possible to distinguish two structures: a) an *identitive attributive nucleus* (*IAN*) referred to a class of objects or to different perceptive instances of the same object and defined according to statistical criteria, which consists of an empirical generalization, be it *e pluribus* or *ex uno*, operat-

ing on the basis of information contained in the mental representations corresponding to specific phenomenic objects; b) a specifying attributes set (SAS) referable to single objects belonging to a class, or in denotative terms, the set of specifying attributes or characteristic predicates of given members of a class. Furthermore, the *IAN*, made up of *identitive attributes* (or predicates), represents the *intention* of the concept, i.e., the set of predicates that, from a connotative point of view, define it. The *SAS*, on the other hand, is the set of attributes specifically characterizing each single object of one class, and also possess one, some or all of the attributes of the *IAN*. For example, in the case of the concept 'table', the *IAN* is made up of identitive attributes (or predicates) like 'having a rigid panel which is parallel to the ground', and 'having one or more supporting legs', whereas the *SAS* unites all of the specifying attributes (or predicates) referable to single members of the class of the tables such as 'having drawers', 'having leaves', 'being foldable', etc.

Therefore, we consider concepts as a *conceptual framework*s (*CONF*), which is represented by a five dimensional vector: *CONF* = <*IAN*, *SAS*, *SIG*, *SEM*, *NOM*>. These dimensions, examined in the sections below, correlate with one another and allow for a concept, according to precise modalities and a determinate state of mind, to perform the function of conceptual operator capable of triggering the processes of classification of the objects and subsequently to trigger different thoughts or actions.

At this point, it is necessary to formulate an analytical description of each dimension of the vector *CONF*.

4.1. The Identitive Attributive Nucleus (IAN)

The *IAN* is the result of an empirical generalization, that might be, as previously stated, either *e pluribus* or *ex uno*.

In the first case, the attributes of the *IAN* are individuated on the basis of their empirical statistical frequency as revealed in different objects, namely, they are most often found in perceptive instances of objects and, by induction, may be assigned to objects experienced at a later time.

These identitive attributes perceived are assigned both a series of *possible values*, that is, the range of possible values of an attribute, and a value of *default*, which is the value given to an attribute in a typical exemplar. For example, in the concept 'table', the attribute 'number of legs' might be '4' — the typical table has 4 legs — while the possible values are many:

1, 2, 3, 4, 5, etc. Analogously a human being, who generally has two eyes (the default value being '2'), may, due to a physical accident or to a genetic abnormality, have only one or even none (possible values 1 and 0). Therefore, the set of *default* values configures the *IAN*, that is, describes an object that can be immediately recognized as belonging to a given class.

Let us consider, for example, the class 'crows': an identitive perceptive attribute of this class is indisputably represented by 'blackness', the color whose high frequency characterizes the plumage of single crows. However, a white colored passerine with all of the identitive attributes of corvids, though lacking the identitive attribute of 'blackness', can regardless be considered a crow, even if the attribute of 'whiteness' found in that exemplar has a low statistical occurrence within the class of 'crow' and furthermore, can be considered a specifying attribute to that corvid. Thus, this bird might be placed by all rights in the class of corvids, without considering further its color (white) as an identitive attribute of the class it belongs to, but rather as a specifying attribute (a *SAS*'s attribute).

The same can be said with regards to a human being who due to an accident or genetic abnormality is without hands. In this case, the perceptive instance refers to an individual who possesses all of the other identitive attributes of the class of 'human beings' thereby rendering the absence of the identitive attribute 'hands' irrelevant from the point of view of statistical occurrence, because the coexistence of other identitive attributes legitimize their classification among the members of the class of 'human beings'.

In the second case, that of *ex uno* generalizations, an analogous process develops, but in reference to a single object which, as we have seen, has been exposed to several perceptive instances. It follows then that in the *ex uno* generalization, the frequency of the attributes refers to the perceptive instances of the same object.

It is therefore possible to define the IAN as the set of identitive attributes empirically checked on the basis of their statistical frequency with respect to a sample of objects or to the identitive attributes checked with the highest frequency related to different perceptive instances of the same object.

4.2. The Specifying Attributive Set (SAS)

The *SAS* is the set of perceptive specifying attributes (added to the identitive ones) pertaining to the single members of a class or of the single perceptive instances of the same object. In other words, in the case of

a *e pluribus* generalization it is the set of all of the predicable attributes of the objects belonging to the same class (these objects at same time share one, some or all the predicates of the *IAN*) or to different perceptive instances of single objects in the case of a *ex uno* generalization.

In the case, for example, of the class of chairs, the *IAN* would be made of identitive attributes such as 'having a seat', 'having four legs', 'having a back', to which specifying attributes can be associated such as 'being foldable', 'having arms' etc., which make up the *SAS*.

Analogously, the *SAS* can also refer to many perceptive instances of one single object: in such a case, it is made up of the attributes of the experienced object in several perceptive instances (see Section 3.2.1). Furthermore, if we take into consideration 'my watch', the corresponding *SAS* will be made up of all the specifying attributes found in each perceptive instance of 'my watch' among which 'my watch this morning', 'my watch on my desk', 'my watch with the glass broken', etc.

4.3. Significances (SIG)

SIG consist of the different and possible significances assigned to the objects of one class of objects or a class formed by different perceptive instances of the same object. For example, our concept of 'watch' is not constituted by its features alone (the image of the watch as structurally isomorphic to experienced watches), but includes many significances that we have assigned to the watch that we use, that is, for example to 'our watch, in relation to a particular moment in our existence in which we bought it' or 'our watch with the sentimental significance referred to the person gave it to us', etc. Thus, as an example, we can assign many significances to the watch that we own: the significance of 'mine' which distinguishes it from other watches, making it unique with respect to the entire class to which it belongs; 'a gift from the woman I love', which bears an emotional–existential content to it referring to the giver; 'precious' or 'beautiful', which define the specific qualities of that particular watch, both from a material or aesthetic point of view and from an emotional one (precious because it is made of gold or is from a loved one).

4.4. The Reference (SEM)

SEM is a concept's reference to a class of objects or to one object.

Thus, the concept 'cat' is also made up of its reference, that is, of all of the animals that possess the identitive attributes pertaining to the class of cats, and as such are classified as cats or even by a single cat that has been experienced repeatedly as would be true of the concept 'my cat' resulting in an *ex uno* generalization.

4.5. The name (NOM)

A 'name' as a linguistic expression is assigned to every concept thereby allowing for the nominability of the class of objects or the single object to which the concept refers. The name 'cat', for example, indicates the concept which refers to a specific class of animals.

The *NOM* brings the related concept into awareness and as such can be used for different purposes: to formulate different cognitive functions, to evoke emotions or mood states, to recall other concepts linked to the sharing of one or more attributes.

5. Visual concepts

In this section we will briefly consider the structure of what we call visual concepts, because in the human perceptive experience these are the most common and most relevant, and here we are referring in particular to the visual concepts formulated by *e pluribus* generalization. Analogously, we can analyze the visual concepts derived from *ex uno* generalizations.

The notable relevance of visual concepts has a neurophysiologic basis. The part of the CNS specialized in the elaboration of the visual stimuli (the primary and secondary visual areas in the occipital lobes) is more vast and complex than the cortical areas which elaborate information coming from the other sense organs.

Empirical concepts are the cognitive result of constant and intense perceptive activity of humans. Thus, there are empirical concepts of a tactile origin such as 'smooth' or 'soft', others that are olfactory such as 'stench' or 'fragrant', others that are auditory like 'sound' or 'noise', others still that are gustatory such as 'sweet' or 'salty'. Finally, there are concepts derived from the visual perception which represent the greater portion of empirical concepts and are made up of *figural* attributes (but also of *non–figural* attributes) predicable of an object. Indeed, a visual predicate refers to the

figural attributes of the object (dimension, color etc.), while the non–figural attributes are related to the non figural structure of an object or to its functional attributes: 'being high' in reference to a mountain is a figural predicate, while 'being scrupulous' in reference to a human being is a non–figural predicate. Often in a concept's connotative definition both types of predicates are included, for example, in the case of the concept 'dog', 'airplane', 'house', even though concepts that do not have figural predicates are not rare, like the concept of 'tasty', or 'salty'. For example, to a dog one could predicate figural attributes like 'quadruped', or 'having a tail', and non–figural attributes like 'being loyal' or 'being domestic'.

At any rate, in daily life we rely heavily both on visual concepts which refer to single objects like 'my car', and on classes of objects like 'works of visual art', which are predominately figural. These concepts distinguish themselves from non–visual concepts in that figural attributes are those that define them and make up the identitive attributive nucleus which individuates them and distinguishes between them. Hence, their *IAN* is mainly made up of figural attributes. Visual concepts consist of identitive figural attributes which can be applied to a class of objects (even if the class consists of only one object). On the one hand, they can be *ex uno* and *e pluribus* visual generalizations, and on the other they can be formulated independently of visual generalization based on visual perceptions.

In the first case a visual concept derives from a visual generalization, which can be codified in figural or non–figural language and is stored without any further direct reference to cases which may have allowed for its formulation. As such, visual concepts play a role of figural types which refer to a class in accordance with the principle of *cognitive economy*, indispensable for a correct and efficacious functioning of the mind.

In the second case, there are visual concepts which are independent of generalizations and have no reference to cases or occurrences and their formulation derives from the use of visual material stored or formulated *ex novo*, although it utilizes material which has been stored previously. This is the case, for example, with visual concepts from the mythological matrix such as the unicorn, phoenix, or sphinx, which utilize visual perceptive material derived from experience referring to animals such as the horse and the lion albeit re–elaborated by our mind or through the visual perception of illustrations or photos.

Therefore, a visual concept consists of a set of entirely or primarily figural attributes and originates from the elaboration of information

both visual and stored in the long term memory as schemes to be recalled sometimes, though not always, consciously in the moment of recognizing an object and assigning it to the class to which it belongs.

In ordinary thought visual concepts are rarely made up entirely of figural attributes because the objects are often perceived in a *perceptive space* that is broad and 'contaminated' by non–visual attributes. A "neutral" space, the "pure" background upon which objects can be seized and perceived by the subject in their empirical actuality exists only from a theoretical point of view.

The analysis of mental images (perceptive and non–perceptive) and of the processes involved aids in revealing the structure of empirical concepts and the specific dimensions (*IAN*, *SAS*, *SIG*, *SEM*, *NOM*) much more clearly, and consequently, in particular, the identitive and specifying attributes.

Indeed, as is clear from current neurophysiologic research on vision, after having been elaborated by visual apparatuses, including the areas of the visual cortex, visual stimuli are elaborated with information coming from different cortical and non–cortical areas and thus the image which gets formulated is the result of different and complex elaborations which involve cortical and non–cortical information. Hence, images cannot be reduced to the mere elaboration of information coming from visual stimuli (Bianca 2009:109–158).

As has already been shown, at the same time different visual mental representations are further elaborated in the formulation of generalizations (i.e. sharing predicates related to different representations), which are visual concepts whose *IAN*, contrary to other concepts, is made up primarily of figural attributes. The analysis of visual concepts, therefore, can corroborate our thesis on the structure of empirical concepts formulated in the previous sections.

Conclusive remarks

This article has examined the nature of empirical concepts, describing their structure through the formulation of a theoretical model based on statistical criteria which, if researched further and verified, could indicate a new perspective of study and analysis of the formation of conceptual structures based on perceptive instances.

The formation of empirical concepts is a fundamental process for knowing and describing the physical world, which is useful for "order-

ing" our experience, distinguishing one object from another, recognizing the respective differences and for acting in our world. In human beings, evidently, empirical concepts possess a complex structure because they are influenced by the cultural environment and their formation includes information which comes from different cortical, sub–cortical, and non–cortical areas. To this end, we have examined the structure of empirical concepts not only from the point of view of their perceptive content, but also taking into consideration other information of a non–perceptive nature (for example, the different significances that a subject can attribute to one or more objects belonging to a class) generally overlooked in studies and researches carried out to date both in the field of philosophy and cognitive psychology.

Empirical concepts are undoubtedly the means for formulating an awareness of the physical world. They speak of this world and allow for its description by virtue of their perceptive foundation and hence lend a reliable and adequate (as discussed) empirical understanding whose end is to live and thrive within it.

In the light of these considerations a model was formulated in which concepts are considered in their complexity as *conceptual framework* and each one represented by a five–dimensional vector in which, in addition to the merely perceptive contents (*the identitive and specifying perceptive attributes*), non–perceptive contents (semantic references and various significances assigned to concepts by single individuals) are analyzed. This model does not consider empirical concepts as the simple result of a generalization conducted on the basis of different perceptive instances, but highlights the relevance of non–perceptive contents involved in their formation process.

The model outlined in this paper tries to overcome the contrast between perceptive and non–perceptive mental processes since many empirical concepts contain non–perceptive attributes resulting from an autonomous neuromental elaboration carried out by every single individual in relation to her/his experience with the information contained in the different neuromental areas; attributes assigned on the basis of statistical frequency and on the two types of generalization; therefore, contrary to what is generally claimed, there are not only concepts that refer to a class of objects (*e pluribus* generalizations), but also concepts that refer to a class of perceptive instances related to single objects (*ex uno* generalizations).

Empirical concepts possess a complex informative structure such as that indicated in section 4, and cannot be reduced to the mere elabora-

tion of information coming from perceived stimuli. This model requires further in–depth analysis, including experimental trials, in order to clarify aspects in this article that have not been dealt with or that have only been touched upon briefly.

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