VERSION OF RECORD:

Alessandroni, N., & Rodríguez, C. (2019). On perception as the basis for object concepts: A critical analysis. *Pragmatics & Cognition*, 26(2/3), 321-356. <https://dx.doi.org/10.1075/pc.19027.ale>

On Perception as the Basis for Object Concepts: A Critical Analysis

Nicolás Alessandroni & Cintia Rodríguez

Departamento Interfacultativo de Psicología Evolutiva y de la Educación, Facultad de
Psicología, Universidad Autónoma de Madrid, Spain

Short Title

On Perception as the Basis for Object Concepts

Corresponding author

Nicolás Alessandroni

Departamento Interfacultativo de Psicología Evolutiva y de la Educación, Facultad de
Psicología, Universidad Autónoma de Madrid.

Calle Iván Pavlov, 6, Madrid (28049), Madrid, Spain

Tel: +34914973285 / E-mail: nicolas.alessandroni@uam.es

Twitter username: @nalessandroni / ORCID: 0000-0002-6595-0969

Abstract

Within cognitive and developmental psychology, it is commonly argued that perception is the basis for object concepts. According to this view, sensory experiences would translate into concepts thanks to the recognition, correlation and integration of physical attributes. Once attributes are integrated into general patterns, subjects would become able to parse objects into categories. In this article, we critically review the three epistemological perspectives according to which it can be claimed that object concepts depend on perception: *state non-conceptualism*, *content non-conceptualism*, and *content conceptualism*. We show that the three perspectives have problems that make perception inadequate as a conceptual basis. We suggest that the inquiry about the origin and development of object concepts can benefit from a pragmatic perspective that considers objects' *cultural functions* as a conceptual foundation. We address this possibility from the theoretical framework of the *pragmatics of the object*, considering the importance of objects' *functional permanence*.

Keywords

Object, concepts, categorisation, functional permanence, pragmatics of the object

1. Introduction

We humans live in a rich and complex world. We (inter)act daily with many objects and people, and participate in diverse activities. According to Zuccotti (2015), throughout a day a person touches, on average, 140 objects. However, there is evidence that the *material saturation* of our occidental environment is increasing (Leonard 2010; Wallman 2013). At present, we consume twice as many material goods as 50 years ago: in one house, we can find an average of 300.000 objects (Arnold et al. 2012; MacVean 2014). These magnitudes are remarkable, especially when considering that our cognitive system has limited “processing resources” (e.g., Alvarez & Franconeri 2007). If we had to relate to each object, person and event as if it were a unique and unknown entity, our cognitive system would overload, and we could not act in the world (Saussure 1916/1971). We would devote all of our time to trying to decode the world through our discriminative skills. We would become *slaves to the particular* (Bruner et al. 1956/2009: 1). However, we have come up with a cognitive solution to navigate the complexity of the world: concepts.

Concepts are commonly defined as representations of categories of things in the world, representations of groups of things that have something in common (Oakes 2008).¹ They fulfil crucial functions, such as (i) reducing the cognitive demand of handling environmental information; (ii) enabling us to identify objects and events as belonging to a category; (iii) making inferences that extend category properties to objects in the world; (iv) guiding our action; and (v) allowing us to communicate with others (Jahoda & Lewis 2015; Mandler 2004a; Margolis & Laurence 2015; Shanks 2015; Wright 1913). As the etymology of the term indicates [classic Latin *conceptum*, “that which is conceived”; noun of neuter of past participle of *concupere*, “to conceive”], concepts circumscribe what we can conceive preventing the world from being chaotic and giving it a cognitively accessible structure. They are, in short, “the glue that holds our mental world together” (Murphy 2002: 1).

¹ There are other more restrictive definitions of what a *concept* is, specific to theoretical points of view and even to disciplines (e.g., a concept in psychology is not the same as in the philosophy of the mind). This not only happens with the term “concept”, but affects many other key terms, such as “representation”, “intentionality”, “intelligence”, or “mind”. We have considered here a more generic definition on which there would be consensus among psychologists (see Nelson 2011). Term polysemy demonstrates, for us, the need for more analytical efforts to determine what the terms at play in the literature really mean.

Within the field of research on concepts and their development, one of the main issues concerns the bases of *object concepts*, that is, concepts of material entities of the world (and not of abstract entities such as “justice” or “beauty”). This topic is crucial because object concepts give our cognitive system a stability without which we could not think about the world. This is something Piaget (1937) already noticed when studying the construction of object permanence as a foundation of psychic life.

For many years, a great majority of authors have stated that object concepts are based on perception (see Anglin 1977; Clark 1973; Efron 1969): perception “is *the* input to cognition” (Cahen & Tacca 2013: 1, emphasis in the original). In this perspective, the developmental origin of object concepts lies in the cognitive processing of sensory experiences with objects. In this article, we critically review the epistemological pillars on which this can be claimed.

It should be noted that, in psychology, there is a lack of agreement regarding what an “object” is (compare, for instance, definitions provided by Gibson 1979/2015; Piaget 1937; Spelke 2000; Spitz 1965). Sometimes, the term “object” is used as an umbrella term, and sometimes it is used with a precise meaning. Often this is due to theoretical or epistemological differences. But it is also due to the polysemy of the term and the superposition of its definition with that of other terms, such as *thing*, *being*, *entity* or *item* (Rettler & Bailey 2017). When we talk about objects in this article, we refer to *artefacts*, that is, objects that were intentionally made by humans (e.g., spoons, cups and pens). We do not refer, therefore, to natural objects (e.g., stones or waterfalls), people, animals, abstract spaces (e.g., a room or a tennis court) or events (e.g., a week or a birthday).

First, we analyse the cohesion of the three epistemological perspectives supporting that object concepts depend on perception: (i) *state non-conceptualism* (perceptual mental states are non-conceptual), (ii) *content non-conceptualism* (perception has non-conceptual content), and (iii) *content conceptualism* (perception has conceptual content). Secondly, we maintain that the three perspectives have problems and that, therefore, perception is inadequate as a basis for object concepts. Finally, we briefly suggest, from the theoretical framework of the *pragmatics of the object* (Rodríguez & Moro 1999; Rodríguez et al. 2018),

that the inquiry about the origin and development of concepts can be enriched by adopting a pragmatic perspective acknowledging the *functional permanence* of objects. Apart from having perceptual properties, objects are also *signs of their canonical functions*. These functions are not evident nor transparent; they are cultural agreements that children garner thanks to adult guidance and mediated action. When children appropriate knowledge about object cultural functions, they stop interacting with isolated things and start to interact with members of cognitive classes. As this grants them access to new forms of interaction, general reasoning, communication, and action planning, we argue that functional knowledge can be considered a first step in the development of object concepts.

Our inquiry focuses on disputes regarding the ontogenetic development of object concepts. That is why we do not discuss theories stating that human concepts are already specified at birth by natural mechanisms or innate conceptual modules dependent on phylogenesis (e.g., substance, object, number, container or social contract) (Carey 2009; Cosmides & Tooby 2013; Spelke 2000; for a discussion, see Lécuyer & Rovira 1999; Rodríguez & Scheuer 2015).

2. Object concepts as a by-product of perception

The idea that concepts are based on perception is not new. It can be found in Ribot's works (1899) on the evolution of general thinking and in some texts by Köhler (1947) where he asserts that abstract concepts are based in direct perceptual experiences. This idea has had a great influence on psychological and philosophical research about the origin and development of concepts. Thus, many authors agree to define concepts as distillates of similar sensory experiences that, once formed, mediate between external inputs and externally oriented behaviours (e.g., Eimas & Quinn 1994; Horst et al. 2005; Kagan 1966; Prinz 2002). Much psychological research has been done assuming that conceptual development can be studied through experiments in which children's perception of sensory

stimuli is a *sufficient condition* for category formation (e.g., Bomba & Siqueland 1983; Casasola & Ahn 2018; Fagan 1976; Quinn & Johnson 2000; Ruff 1978; Stavans & Baillargeon 2018; Younger & Fearing 2000; for a review, see Sloutsky 2018).

This perspective assumes that sensory experiences translate into conceptual structures following a multi-step process. First, subjects are affected by sensory impressions that provide information about the ontological structure of the world. Then, thanks to attentional resources (Mandler 2008a), they analyse this cluster of sensory information, recognising relationships of similarity and correlations of attributes (Burns 1986). For some, this recognition of similarity is a natural capacity dependent on our phylogenetic history (Zentall et al. 2018). Subsequently, due to the hierarchical structure of perception, relationships and correlations between sensory attributes are integrated into more general patterns (Palmer 1977; Thill & Twomey 2016). Finally, these patterns are abstracted and redescribed, allowing subjects to parse objects into categories (Mandler 2008b; Tomikawa & Dodd 1980; Younger 2003). In a nutshell, this perspective claims that “if objects look alike they tend to be conceptualised as the same sort of thing” (Mandler et al. 1991: 266).

The first assumption behind this process is that perception is a basic and natural mode of contact between an individual and the world. As Efron says, perception is the “direct, immediate awareness of discriminated existents which results from patterns of energy absorption by groups of receptors” (Efron 1969: 147). Infants’ first inferences would be generalisations based on an innate responsivity to physical resemblances (Quine 1977), only influenced by the laws of similarity (Keil 1991). The second assumption is that sensory stimuli are complex configurations (i.e., they carry information about different characteristics of objects). In other words, perception allows us to grasp the composite structure of the world through implicit processes of analysis (Welch 1947).

The third assumption is that perception is dominant in the early stages of ontogenesis (Reichard et al. 1944). In the beginning, children would contact the world exclusively through perception. Only later would they develop other ways to cope with reality not based on perception (based, for example, on the functions of objects, which are regarded as being abstract) (Gentner 1978; Shanks 2015). But even when this later understanding becomes

available, the development of knowledge-based conceptual representations would still be constrained by early perceptually-based categorical representations (Quinn et al. 1993: 464). In this fashion, Cohen and Strauss (1979) indicate that the first concepts would form around 30 weeks of age as a result of the discrimination of visual stimuli of female faces. In the same line, Wilcox and Biondi (2015) proposed that infants aged 3½ months show sensitivity to perceptual discontinuities in speed and path of motion and that at 4½ months they rely on the perception of shape differences to individuate objects. However, concepts about spatial relationships and object functions that are not linked to perception would emerge much later, when children are 10 months old (in the first case) (Horst et al. 2005) or two or more years of age (in the second case) (Mandler 2008a; Rakison & Butterworth 1998).

Finally, there is a fourth assumption usually accepted explicitly or implicitly: from birth, when children perceive, they understand that sensory impressions correspond to objects in the world. In other words, “in every case of perception we are directly aware of the perceptual object” (Gram 1983: 18) because objects are part of our fundamental and natural cognitive ontology (Gärdenfors 2019).

These assumptions are congruent with an empiricist and realist philosophical conception of perception for which perceiving is capturing mind-independent objects of the world “as they are” (Morvan 2004). This process can be *direct*, if perception is defined as unbrokered and immediate cognition of reality (Maloney 2017), or *indirect* if it is believed that perception operates with internal representations that copy the structure of the world (for a discussion, see Maddy 2017). But realistic empiricism is not the only possible conception of perception (even if it is a mainstream conception in cognitive science). While we are unable to address the other options and their metaphysical premises here, it is important to mention that there are idealistic and phenomenological conceptions for which the objects of perception are mind-dependent. Other perspectives, such as Piaget’s *critical realism* (Zamudio & Castorina 2016), assert that reality is independent of the subject, but knowledge is not: what is real cannot be known in an absolute manner because the object is always “moving away” (Piaget 1937). Thus, perceptual objects depend on our cognitive system, the pragmatics of action and its ontogenetic development (i.e., perception is developmental in

nature) (Piaget 1961). In agreement, contemporary research suggests that throughout life children develop different forms of sensitivity that constrain the concepts they can learn (Gelaes & Thibaut 2004). Last, some perspectives advocate for the cultural nature of perception. According to these positions, to perceive is to participate in culturally determined and mediated forms of activity (Zaporozhets 2002).

Each of these alternative perspectives would lead to extensive debates about perceptual objects and contents. And this, in turn, would re-frame the discussion about the role of perception in the origin of object concepts. Given that most studies take for granted a realistic and individualistic stance for which to perceive is to capture the world in an solipsistic way (Nudds 2009), our analysis will focus in showing the epistemological inconsistencies of this stance.

3. The relationship between perceptions and concepts: Three options, three problem sets

If object concepts were based on perception, one could ask what the exact nature of that relation is. Before analysing three philosophical stances discussing this topic, we will briefly present their motivations.

In *The varieties of reference*, Gareth Evans (1982) first proposed a distinction between *conceptual* and *non-conceptual mental states*. For him, a state is conceptual if its possession presupposes conceptual capacities. Evans distinguishes between mental states such as beliefs, which would require concepts (to believe that “a feather is beautiful” requires the possession of the concepts FEATHER and BEAUTIFUL), and mental states such as perceptual experiences that would not (to see something violet does not require the VIOLET concept). Based on this classification, several authors have maintained that the relationship between perceptions and concepts entails a link between non-conceptual and conceptual

mental states. As they assume that perception is non-conceptual, this perspective is usually called *non-conceptualism*.

Some years ago, Richard Heck (2000) argued that it was imperative to draw a distinction within non-conceptualism. To say that perception is non-conceptual could mean two different things: on the one hand, that perceptual states are *themselves* non-conceptual (i.e., concepts are not needed to be in a perceptual state), and on the other hand, that the *content* of perceptual states is non-conceptual (i.e., that a conceptual belief and a non-conceptual perception represent the world in different ways). The first option makes up the core of *state non-conceptualism* (state view). The second option is the foundation of *content non-conceptualism* (content view). A crucial difference between these perspectives is that state non-conceptualism is indifferent to the content that mental states possess and only claims that beliefs and perceptions are differentiated by the *attitude* towards contents (with these being conceptual or not) (Schmidt 2015). This is decisive to determine if having a *belief about Z* entails (or not) the same representations as *perceiving Z*. Strictly speaking, it is about defining how we can think about what we perceive (Pérez et al. 2010: 12). Finally, some authors discuss the plausibility of Evans' distinction and propose that both perception and beliefs are mental states with conceptual content (see McDowell 1994/1996). *Conceptualism* holds that the relationship between perception and concepts refers to the connection between mental states of a different kind whose content is located, in both cases, on a conceptual continuum.

3.1 State non-conceptualism and its problems

For state non-conceptualism, the adjective “non-conceptual” applies to perceptual mental states but not necessarily to their contents. Therefore, this position is about the link between a subject and his perceptual experience, but not about the perceptual content itself. This link would be non-conceptual because “the subject undergoing a perceptual experience

need not possess (at the time of the experience) the concepts involved in a correct characterization of its content” (Toribio 2008: 354).

One of the logical supports of this perspective is the *fineness of grain argument*. The argument goes that it is possible for a subject to have a perceptual experience that he cannot reliably report using concepts (Heck 2000). In other words, our perceptual experience is beyond our conceptual repertoire: we do not have concepts for everything we perceive (Jacobson & Putnam 2016). We could perceive a purple gradient that is attractive to us without having a concept that adequately characterises it. Thus, it is possible to see perceptions as concept-independent mental states qualitatively different from conceptual states such as beliefs.

This perspective also implies that not every sensory experience translates into concepts. Conceptual cognition and perception would be two different processes not causally connected, the second being cognitively impenetrable, not affected by our conceptual system (Firestone & Scholl 2016). Perceptual mental states would be more basic than conceptual mental states. At first, this could seem reasonable: perceptions would be the *building blocks* of concepts, and the translation of the former into the latter would occur thanks to *subpersonal mechanisms* of abstraction and generalisation of perceptual constancies (Younger 2003).² It could even be argued that concepts are linguistic labels that are placed on these emergent abstractions of perception (see Kagan 1966). However, this perspective poses some complications, which we will now examine.

3.1.1 Perceptual constancy is not a natural phenomenon

The idea that there are *perceptual constancies* that base our conceptual system has a long history. It has captivated philosophers (e.g., Aristotle trans. 2016), scientists (e.g., Helmholtz 1867) and even poets (e.g., Shakespeare 1609/2002, sonnet 104: 589). One of its

² The *personal/sub-personal distinction* (Dennett 1969) refers to different levels of explanation of human behaviour. The *personal level* explains behaviour by attributing it to the person as a whole, in intentional, rational terms, and using folk mentalistic language (e.g., a desire is a state in which a person is or is not, and not a subsystem of it -a neuron-). The *subpersonal level* explains behaviour in terms of processes in charge of subsystems of the person (e.g., thought is the syntactic computational manipulation of internal and amodal representations).

most recognised formulations is that of Thomas Young (1807). In *A course of lectures on natural philosophy and the mechanical arts*, he proposed that:

When a considerable part of the field of vision is occupied by coloured light, it appears to the eye white, or less coloured than it is in reality: so that when a room is illuminated either by the yellow light of a candle, or by the red light of a fire, a sheet of writing paper still appears to retain its whiteness (Young 1807: 456).

Perceptual constancy refers to the natural fact that our perceptual experiences seem to remain stable in spite of changes in environmental circumstances. This would happen thanks to the physical characteristics of both the perceived objects and the environment in which we are, and the particularities of our perceptive organs. Perception would provide our conceptual system with some stability that would prevent us from perceiving the world as a chaotic flow of unorganised colours, shapes and sounds (Cohen 2015).

However, there are those who doubt the natural character of perceptual constancies. Von Helmholtz (1867), for instance, contended that perception involves not only the collection of perceptual input, but also the combination of this with knowledge coming from previous experiences. In his model, perceptual constancy derives from the contact between sensory information and the modulating mental activity of the subject. In agreement, the Weber-Fechner law (Fechner, 1860) states that the actual change in a physical stimulus does not have the same magnitude as the perceived change: mental intensities increase at a slower rate than the corresponding physical intensities. This finding supports the hypothesis that perception is not a natural and automatic process, but involves the subject's psychological activity.

More radically, Hering (1878/1964) suggested that the perceptual constancy of the colour of a thing (*memory colour*) is nothing more than the colour we see the thing having in *normal perceptual circumstances*. Interestingly, the author defined “normal perceptual

circumstances” as those in which we have more assiduously seen the colour of the thing. Hering introduces the idea that perception is a function of the subject’s experience: we do not see a banana_n as being constantly yellow because of the sensory stimuli it generates, but because of the history of experiences we have had with bananas_{1-n}. As Russell said, one has to “learn the habit of seeing things as they appear” (Russell 1959: 9). This idea has been extended by those who prefer to speak of *canonical colours* (Chiou et al. 2013; Miceli et al. 2001) to refer to the shared and intersubjective nature of the statistical knowledge of the environment. Finally, others have argued that percepts are not given in the world, but created: featural analysis and perceptual organisation depend on the *categorisation history* of the individual, top-down knowledge constraints and the specific tasks in which subjects participate (see Schyns et al. 1998; Wisniewski & Medin 1994). Perception is not a natural and straightforward object-dependent process. On the contrary, it seems to involve experience, knowledge and inferences. This leads us to the second problem that state non-conceptualists face.

3.1.2 *Perceptual constancy is conceptual*

As Merleau-Ponty said, “nothing is more difficult than to know precisely what we see” (1945/2005: 67). If perception is so complex and involves the processes we mentioned before, it should be clarified how they coordinate. This is not clear yet, and different answers would give rise to several theories of perception:

The typical color may be represented by the mean of all occurring colors, by the color that occurs in most cases (mode), by the color that is ‘purest’ (i.e., maximally saturated), or simply by a whole region of colors (exemplar-based typicality). So, the mere idea of typicality refers to a real or virtual observer (i.e., a human being or a simulating algorithm) that integrates the single exemplars encountered hitherto into a typical representation (Witzel & Gegenfurtner 2013: 2).

This quote points to a severe epistemological dilemma. If canonical colours derived from generalisation and knowledge-integration processes, perception could hardly be a basis for concepts. Perception would seem to be, itself, conceptual (Goldstone & Hendrickson 2010). A number of experiments showed that representations of canonical colours of objects are very complex and have a verbal nature (Gleason et al. 2004), and that colour sensations are not primarily motivated by incoming sensory data, but by high-level visual memory and prior knowledge (e.g., Witzel et al. 2016).

Other works (Olkkonen et al. 2010; Van Gulick & Tarr 2010) strongly suggest that colour codification entails cognitive categories: generic chromatic qualities cannot be found in any particular thing - they refer to generalisations. Moreover, there is evidence that colour categories are not determined by object reflectance but by the concept of the perceived object, which includes information about its canonical colour (Olkkonen et al. 2008). Last, the psychological *knowledge-based approach* argues that even very early in development, people have conceptual knowledge that constrains which perceptual correspondences are detected and which are ignored (Sloutsky 2003: 246). The inconsistency is manifest: concepts would need regular expressions to emerge, but perceptual regularity would need concepts to exist. Concepts could not, then, have their base in perceptual processing.

3.1.3 The perception of qualities involves different developmental achievements

In a key article about object categorisation, Wallon and Ascoli (1950) criticise those holding that perceptual abstractions base concepts. They point out that, during the first stages of ontogenesis, the object is not a set of perceptual qualities that can be distinguished with precision, but an undifferentiated, syncretic and global referent. The distinction of perceptual dimensions (e.g., colour, form, size, or shape) and their subsequent integration are not natural starting points, but developmental achievements deriving from learning and experience. For this reason, young children have so many difficulties in finding perceptual similarities between objects (Wallon & Ascoli 1950: 418). If object concepts depended on automatic perceptual abstractions, these difficulties could not be explained.

Contemporary authors have shown through empirical tasks that Wallon and Ascoli were right. Some demonstrated that the recognition of the canonical colour of objects does not emerge, in ecological contexts, before 6 months of age (Kimura et al. 2010; Yang et al. 2013). Others found that, as development progresses, subjects learn to preclude specific surface changes in compliance with cultural criteria, favouring the construction of constant categories of surfaces (Fleming 2015; Yang et al. 2015). Some also argue that perceptual discriminations emerge in different developmental times depending on which sensory dimension is to be processed. For example, Wilcox and Biondi (2015) determined that babies can individuate objects on the basis of shape differences at 4½ months of age, but not considering chromatic differences until 11½ months of age. Likewise, there is evidence that children start to perceive surface glossiness around 7 or 8 months of age (Yang et al. 2011), and that they do not develop an ability to establish extent similar to that of adults before their fourth birthday (Huttenlocher et al. 2002). Relatedly, as the characteristics of babies' body, movements and actions change, so too does the structure of their visual input, constraining the perceptual experiences they can access (Bambach et al. 2016; Smith et al. 2014). Finally, it has been argued that the ability to estimate the size of a distant object depends in no small extent on complex reasoning skills that babies do not have (Granrud 2009), and that children only integrate multi-sensory information around the age of 8 to 10 years (Gori 2015). These studies show that perception is not a primitive way of contact with the world, but a developmental and heterogeneous achievement. It seems clear, then, that perception could not possibly serve as the foundation for concepts during the first stages of ontogenesis.

3.2 Content non-conceptualism and its problems

According to content non-conceptualists, the content of perception is non-conceptual. Therefore, perceptual states and belief states involve different representations of the world (a non-conceptual and a conceptual representation, respectively). A classic argument favouring this position asserts that since animals and babies do not have concepts, but do have perceptual experiences, the contents of perceptions must be non-conceptual. Perception

would be more essential than concepts and prior to them in ontogenetic terms, and concepts, in turn, would emerge from non-conceptual perceptual content. In the following, we point out the main critiques to this perspective.

3.2.1 Non-conceptual perceptions cannot justify beliefs: A semantic problem

Like state non-conceptualists, content non-conceptualists have to clarify the link between conceptual and perceptual states. But in this case, the problem has greater epistemological implications. If there were a qualitative difference between perceptual and conceptual states (and not a difference of degree), a direct or continuous perspective could not solve the transition from perceptions to concepts. There would exist a *metaphysical gap* between perceptions and concepts we would need to overcome through something else.

This is a serious matter since in philosophy there is agreement that the translation from A to B requires that A and B have the same articulation (Kelly 2001). A can translate into B if A and B are entities of the same type. This enables A to act as a reason for B: “If perception is to justify belief, then my enjoying a particular perceptual experience must give me a reason to hold a certain belief” (Heck 2000: 506).

This issue has important implications for debates on logical, semantic and pragmatic affairs. We cannot deal with all of them here, but will mention one of outstanding importance. Consider the following question: Why can we think about the same things we perceive (e.g., to think about yesterday’s breakfast)? A useful answer would be: because perceptions and thoughts have a common conceptual articulation that allows the former to act as reasons for the latter at a semantic level. As McDowell (1994/1996) wisely summarises it, the *space of reasons* must be inside the *space of concepts*.

At this point, we face a paradox. On the one hand, content non-conceptualists think that perceptions justify our concepts. On the other hand, they suppose that perceptions have non-conceptual contents. Given that “only conceptually articulated contents can justify one

another” (Kelly 2001: 403), it would seem that content non-conceptualists have no way of linking perceptions and concepts at the semantic level.³

3.2.2 *Concepts do not have contact with the real world: A problem of reference*

If perception did not have conceptual contents, when seeing a cup we would not see an instantiation or exemplar of the concept CUP. Therefore, our perceptual experience would not inherit the properties of the CUP concept. Instead, we would experience something different (such as a bundle of sensations). The concept CUP would be circumscribed exclusively to the domain of beliefs. Because of their different content, perceptions and beliefs could not have any contact and, therefore, their relationship would be very similar to that of two parallel lines that are drawn straight to each other such that they cannot meet.

This would be equal to saying that on seeing a cup we would not see a cup at all. We would see an “undifferentiated thing”. How could we have a CUP concept unconnected to cups in the world? This problem only scales up with more abstract concepts: How could we have “a concept of a square object if that concept never made contact with square objects?” (Heck 2000: 502, see also McDowell 1994/1996).

This points to a referential conflict. For lacking a connection with the things in the world (which we would access via perception), concepts could not refer to them (Mandler & McDonough 1996: 311). Content non-conceptualism deflates perception so much that it ends up denying its cognitive relevance. There are two possible solutions. One is to postulate the existence of some external mechanism (i.e., a “pineal gland”) that causally connects perceptions with concepts. The other is to assume that the reference of concepts to the world is natural. Once they emerge, concepts would carry in themselves a link with the world. It is clear that content non-conceptualism has trouble explaining why concepts are as they are (i.e., why they have the *meaning* they have and why they *refer* to the object they refer to). It is worthwhile, then, to explore whether conceptualists can solve these problems.

³ A similar obstacle arises regarding the relation between image schemas and language (for a critical review, see Alessandroni & Rodríguez 2017).

3.3 Conceptualism and its problems

The conceptualist stance asserts that having perceptual experiences involves concepts (Brewer 1999). Paraphrasing McDowell (1994/1996), for conceptualists perception is within the *space of reasons* and thus, inside the *space of concepts*.

If perception involved conceptual abilities, the problems faced by non-conceptualist accounts would no longer seem relevant. If perception were conceptual, there would be no need to deny its complex nature. There would also be no impediment to admitting that perception established bidirectional relationships with beliefs (because it would be, itself, conceptual). Finally, given that its conceptual nature and cognitive development are not incompatible, there would be no complication in sustaining that perception develops (just as there would be no complication in saying, for example, that concepts enrich over time).

As for content non-conceptualism, there would be no semantic problem to solve, because there would not be any metaphysical gap between perceptions and beliefs. Both kinds of states would be conceptually articulated, so their back-and-forth translation would involve no trouble. On the other hand, because concepts that are put into play during our perceptual experiences would have direct contact with the world, the referential link between beliefs and perceptual experiences would be guaranteed. However, it is necessary to clarify in what sense conceptualists hold that perception is conceptual.

To be clear, conceptualists do not argue that beliefs and perceptions are conceptual *to the same degree*. For them, perceptual experience articulates in *demonstrative concepts* that differ from general concepts (Brewer 1999, 2005; McDowell 1994/1996; Sedivy 1996). These concepts refer to cases where a subject identifies an object in a demonstrative way (Evans 1982), such as when someone identifies that object X is of *that* colour when they point to it, even without knowing what *that* colour is (i.e., without having the general concept corresponding to that sensory impression). We can imagine similar cases. For instance, people who are not experts in music can attend the opera and differentiate, with no trouble,

that timbre quality from *that other* timbre quality, even without having descriptive knowledge about them (e.g., the qualities of an oboe and a flute). Demonstrative identification involves abilities related to attention and the direct recognition of objects. Thanks to these, the object of our thinking is determined relationally (i.e., via perception) and not satisfactionally (i.e., via a descriptive condition) (Nogueira de Carvalho 2016).

Nevertheless, even if they are not full-fledged concepts, demonstrative concepts require that subjects can retain and re-apply the demonstrative identification of an object outside its original context (Brewer 1999; McDowell 1994/1996). To comply with the *generality constraint* of concepts (Evans 1982), a subject should be able to recognise *that* form in a time T1 and to re-identify *that* form in a later time T2. In what follows, we refer to some difficulties conceptualism raises.

3.3.1 Demonstrative concepts are a chimaera

For some, demonstrative concepts have incoherent extension and individuation conditions (see Chuard 2007). As they exploit the presence of a quality and the possibility of a subject to identify it demonstratively, they would emerge through the direct perception of a quality that would act as a semantic value. This way, demonstrative concepts seem to behave more as singular terms than as general concepts. But as they require the subject to have the skill to re-identify the quality, they also seem to be general. In sum, they look as a chimaera, since they have “the body of a singular term but the head of a general concept” (Kelly 2001: 398). They sound like hybrid theoretical artefacts introduced *ad hoc* to link perceptual experiences with general concepts, without actually solving how both terms are linked.

3.3.2 Explanatory circularity

The conceptualist stance assumes, at the same time, (i) that the content of perception is conceptual, and (ii) that demonstrative concepts are based on perceptual experiences (i.e., they emerge from them). When considered together, (i) and (ii) lead to a logical inconsistency: to have a perceptual experience it is necessary to have concepts that, in turn,

emerge from perceptual experience. In other terms, conceptualists believe concepts are a *necessary condition for* and a *by-product of* perception. Without concepts, there would be no perceptual experiences, but without perceptual experiences, there would be no concepts. This is a case of circular reasoning. As Heck noted:

The real trouble with this position is that what it takes for granted – that experience makes demonstrative concepts of objects available to us – is itself in need of explanation (...). One cannot have information with such a conceptual articulation without already having the demonstrative concept *that object* (Heck 2000: 493, emphasis in the original).

This might well be the most significant epistemological difficulty conceptualism faces. Besides, it faces ontogenetic incompatibilities, for it would be impossible to sustain that on a developmental trajectory (e.g., that of object concepts) *x precedes z*, *x causes z* and *z causes x*. To that end, the circularity affecting conceptualism limits its application to developmental research.

3.3.3 Misperception, culture and re-identification

Given that demonstrative concepts would emerge from the direct contact with the world, their truthfulness would seem guaranteed. However, sometimes perception is not truthful. We are referring to cases of *misperception* that, despite being common (Rock 1997; Shams et al. 2000), have not been adequately accounted for by the conceptualist position (see McDowell 1994/1996: 9). Misperception would imply that the concepts a subject deploys in a given perceptual circumstance do not coincide with the state of affairs in the world (D'Alfonso 2018). Nonetheless, admitting this would seriously threaten the *openness to the world* that allegedly characterises perception.

Something similar occurs when acknowledging cultural differences in perception. There is enough evidence endorsing that inference patterns learned through participation in

cultural activities cognitively penetrate perception (Luria 1974; Vetter & Newen 2014). It would seem that the world is not self-sufficient in establishing the truth-value of perceptual experiences and demonstrative concepts are not as evident as conceptualists think.

Finally, Kelly (2001) has levelled one more argument against conceptualism. Consider a subject S who, in a perceptual experience P, demonstratively identifies two different colours: *that* colour C1 and *that other* colour C2. Suppose, now, that, after a while, S experiences again the colour qualities he had demonstratively conceptualised. According to conceptualists, since S identified the qualities in his first experience, he should be able to re-identify them in this second instance. However, this second time S does not achieve it (e.g., he does not have such a good memory). He identifies two different qualities but not as C1 and C2, but as C3 and C4. A conceptualist could only explain this in two ways: either the contents of the perceptual experiences are different (which in our thought experiment is not the case), or perceptual experiences themselves give rise to multiple concepts. The second option would make our cognitive system very ineffective because of content duplication. However, it would also convolute the reference relationships motivating conceptual formation since we form concepts to refer to the world and act effectively in it.

3.3.4 Content overlapping and animal cognition

Some authors believe conceptualism is an extreme position because it holds that the representational content of experience is always conceptual. Peacocke (2001a) noted that there can be content overlapping between the perceptual experiences of humans and animals and that this has significant consequences for conceptualism. For instance, we would have no problem in admitting that a cat can represent that something is at a certain distance from it. We would not say the same, however, about states with conceptual content: it seems clear that cats do not have concepts as those of humans. But, “if the lower animals do not have states with conceptual content, but some of their perceptual states have contents in common with human perceptions, it follows that some perceptual representational content is nonconceptual” (Peacocke 2001a: 614). In this way, Peacocke seems to prove (but see Byrne 2005) that if we recognise the cognitive characteristics of “lower animals”, we must accept

that human perception has some non-conceptual content. Were this the case, the conceptualist hypothesis would be discredited.

3.3.5 Inflexible concepts

Concepts are cognitive tools that give us greater freedom of action because they allow us to plan our actions regarding regularities we find in the world (Murphy 2002).

Nevertheless, demonstrative concepts do not seem to do the job. By arising from perceptual experience directly and automatically, they would seem to favour an inflexible dependence on them. We would have no choice but to see the world in conceptual terms from the start.

Peacocke (2001b) reasoned that this is an obstacle for two reasons. First, because it is contradictory to propose that an experience contains *per se* a demonstrative concept and that this experience grounds the acquisition of that same concept. The author proposed that experience should be considered either as a means or as an end to the process of concept formation, but not both at the same time. Second, because if a single experience were enough to form a demonstrative concept, the power of concepts to manage novelty (e.g., the perception of new objects) would be overridden.

From the conceptualist position, there is no need to posit developmental processes for the construction of demonstrative concepts. Nonetheless, given that perception itself varies in the course of ontogenesis (see section 3.1.3), it seems reasonable to believe that conceptual formation involves developmental processes, even for basic demonstrative concepts.

3.3.6 Individual concepts and explanatory solipsism

To emerge, a demonstrative concept only needs a subject capable of perceiving a world and directing his or her attention towards it. Yet, if the process followed this logic, concepts would be individual cognitive structures. This brings to conceptualism further problems because although at first children and adults do not share a common conceptual system, children develop a conceptual system that coincides with that of adults of their culture. This assures communication through concepts (Shanks 2015): two subjects can only

communicate about something if they have a *common ground*. The complication is how to reconcile the basic and automatic formation of demonstrative concepts with social communication involving common conceptual referents and meanings.

From the conceptualist point of view, there seems to be only one solution: to adopt a “critical point” theoretical perspective (Cole 1996) according to which concepts *become* social at a given developmental time. The *shared nature* of concepts would be a spontaneous, *ex nihilo* property. However, in this case the complication only moves from one level to another: it would still be necessary to clarify how natural and direct concepts relate to the cultural and complex semiotic system of language (Alessandroni & Rodríguez 2017). An alternative would be to study the construction of cultural and public conventions that give rise to communicative agreements from the beginning of life. From this perspective, it would be fundamental to include other subjects and their influence to explain the processes of conceptual formation: “meaning is the *first social thing* that is *introduced* into consciousness by the sign in its *communicative function*” (Vygotsky 2018: 258, emphasis ours). Accordingly, it seems crucial to take into account culture and semiotic mediation processes that, from early childhood, shape our cognitive systems in accordance with public norms (see Rodríguez et al. 2017).

4. Perception in its labyrinth: a pragmatic and functional way out

In the previous section, we reviewed the foundations and dilemmas of three perspectives that agree that perception is the basis of concepts. The epistemological analysis reveals that these dilemmas make up a labyrinth from which it seems impossible to exit. For example, anyone embracing Peacocke’s criticism of conceptualists (see the argument about content overlapping and animal cognition) could advocate for content non-conceptualism. However, he or she would become vulnerable to the problems of this latter perspective, from which they could not escape unless they opted, again, for a conceptualist perspective.

Even so, it might not be true that the labyrinth cannot be escaped. We propose that an exit could be reached by (i) not conceiving perception as the direct contact that a contemplative subject establishes with the world to extract sensory information; and (ii) introducing a pragmatic turn in the discussion about the origin of object concepts, acknowledging functional aspects of objects.

4.1 Perception is not contemplation

To start with, it is interesting to recall the criticism that Merleau-Ponty directs at classical realistic theories of perception. For him, these theories are atomistic inasmuch as they view objects as a combination of different sensory information that must be unified. What would cause this union? For Merleau-Ponty, traditional perspectives cannot answer this question because they see perception as contemplation and they conceive of the subject as a passive spectator of external information.

Sensory information is not enough to parse the world into categories (Mervis & Rosch 1981). First, because “it doesn't seem to be anything about experiences *per se* that requires us to be able to remember them later in exactly the detail in which we originally experienced them” (Kelly 2001: 413). Second, because “there are few categories whose members distinguish from members of neighbor categories on a single dimension” (Gelaes & Thibaut 2004: 620). Therefore, to segment reality subjects need criteria to decide which perceptual information is relevant and which is not.

For Merleau-Ponty, perception is tied to human intentions rather than to objects (Merleau-Ponty 1942/1963). His critique features a pragmatic core also defended by others. For example, James (1900) asserted that what gives meaning to cognitive structures is their practical value, and Babska (1965) proposed that cognition is framed by specific activity forms with changing functions that must be taken into account (see Galpérine 1966; Leontiev & Luria 1972). Therefore, to speak of conceptual formation is to speak of action objectives

and specific tasks: “In thought and action, the development of a concept plays the role of an instrument for achieving certain ends” (Sakharov 1990: 48).

This approach coincides with embodied perspectives claiming that cognition is not about computations over representations, but about *embodied action* (Varela et al. 1991). So-called *4E cognition paradigms* (i.e., embodied, embedded, enactive, and extended) (Gallagher 2017) argue that cognitive processes result from the dynamic interaction between an acting organism and an environment. Our conceptual system is inseparable from our physical, temporal, and spatial experience (Lakoff & Johnson 1999), and is grounded in the situational constraints that shape our actions in the world (Barsalou et al. 2018). However, even though embodied approaches have shaken traditional assumptions in cognitive science, they have not sufficiently addressed the sociocultural nature of our experience in the world (Alessandroni 2018), its ontogenetic development (Marti 2017), nor the semiotic complexity of material culture (Alessandroni & Rodríguez 2017; Malafouris 2013, 2019).

Going one step further, Wright (1913) stated that what will be perceived as a thing or object varies depending on the practical demands of a situation, and that categories have a *social and instrumental origin*. Categories are not the constructions of individuals, but fundamental conceptions of an era (Wright 1913: 656). This definition adds an interesting cultural tinge to the pragmatist approach. Categories would not be the by-product of an individual cognitive system, but the result of the participation of a subject in cultural activities: the way in which we categorise the world would not follow an individual, but a social normativity made up of public conventions and rules.

At this point, it seems reasonable to hold that perception exceeds the contemplation of, as Austin would say, “moderate-sized specimens of dry goods” (Austin 1962: 8). Perception takes place within cultural activities that determine the orientation and goals of actions. Thereby, it does not seem possible to talk about perception or conceptual formation neglecting the pragmatics of action. As for the formation of object concepts, the contributions we mentioned coincide in that, apart from the sensory impressions, it is essential to take into account the functional aspects of the material world (Archer 1966; see also Gärdenfors 2007).

We believe that considering these functional aspects in early childhood can guide us to understand the foundations of object concepts.

4.2 The *pragmatics of the object*: Cognitive development from a pragmatic, functional, and cultural perspective

If perception is viewed as participation in cultural activities, it becomes necessary to make an ontological turn regarding the object of categorisation. Objects are not mere sensory aggregates, but complex referents with *inherent* and *adherent properties* (James 1900) that are the product of cultural agreements. According to von Uexküll (1928, see also Susi & Ziemke 2005), objects transcend the physical dimension and stand as full-fledged *meaning-carriers*.

The *pragmatics of the object* (Rodríguez et al. 2018; Rodríguez & Moro 1999, 2008) is a framework for the study of human development born at the Geneva School in the 1980s. It asserts that one of the culturally determined properties of objects is their *canonical function* (i.e., cups are used for drinking, spoons are used to eat) and that children cannot access this function naturally or immediately.⁴ To put it another way, the canonical functions of objects are the product of cultural consensuses that children cannot access alone. Since objects do not show themselves being used (Rodríguez & Moro 1999: 254), in order to learn the canonical function of objects children need to participate in triadic interactions involving an adult who knows the object's public usage rules. It is important to note that *early triadic interactions* occur from the very beginning of life: at early stages of development, when the child still cannot blend in the same communicative act one object and another person, he or she is placed by others in meaning-loaded material scenarios (Alessandroni et al. 2019). Within these triadic interactions, adults take the lead by bringing into play a great variety of communicative and educative semiotic mediators among which are, for instance,

⁴ The *pragmatics of the object* differentiates from the Gibsonian approach regarding objects' *affordances* (Gibson 1979/2015). For James Gibson, affordances emerge from the encounter between a solitary subject and an object. Thus, both the meaning of objects and their action possibilities are perceived in a literal and transparent way, regardless of intersubjective communicative processes (see Costall 2012).

demonstrations of uses (immediate and distant ones), ostensive, indexical and symbolic gestures, verbalisations, adjustments, preparations and redundancies. Thanks to these instances of semiotic mediation, children progressively appropriate the culturally determined canonical functions of objects: children's cognitive development is based on "meanings that other people possess and exteriorise in situations of interaction" (Rodríguez & Moro 1999: 101). In this way, children become cultural agents who align their actions and goals with social norms. As the human capacity to establish relations between elements is very flexible (Barsalou et al. 2018), this is particularly relevant. If children's cognitive development only depended on their associative skills and their encounter with the world, there would be infinite combinations of meaning, and, so, infinite cognitive and semantic configurations. It is the encounter with other subjects that acts, from the beginning of life, as a semiotic filter that *canalises* cognitive development (Cabell & Valsiner 2014; Rossmanith & Reddy 2016). Hence, the *pragmatics of the object* proposes that the longitudinal observation and analysis of triadic interactions as they occur in everyday life is of paramount importance for researching cognitive development. Thanks to this perspective, the *pragmatics of the object* moves away from an individual-based approach and poses that cognition could not possibly be equalled to perception. Since objects are referents that can be used, they always encompass situated action contexts (i.e., cultural norms, activities, goals) and transformational processes that must be considered. Thus, it would not suffice to determine what perceptual stimuli are available for children in a particular situation and how they react to them. To describe cognitive development, it is necessary to describe as well how children share material referents and build cultural meanings about/through them from the beginning of life, with others, in terms of joint actions and semiotic processes. For it is joint action which allows children, in the beginning, to align their actions according to social criteria and appropriate the prelinguistic normativity of object uses.

Two things make the *pragmatics of the object* a consistent approach to research the origin and development of concepts. First, evidence shows that children begin to understand objects as *signs of their use* in the last third of their first year of life (and before with familiar objects), thanks to adults' guidance (Moro & Rodríguez 2000; Rodríguez 2006, 2007;

Rodríguez & Moro 1998, 1999, 2008; Rodríguez et al. 2018). When this happens, objects become *functionally permanent* (Rodríguez 2012). Besides becoming permanent in the “physical” sense described by Piaget (1937), they also become more stable cognitive entities because of the function they perform in everyday life. Physical permanence and functional permanence are not identical: while the first one refers to an enactive and perceptual stability, the second one refers to a social stability, to a public objectivity criterion. By stating that functional permanence is a pre-linguistic, early achievement, the *pragmatics of the object* differs from theories claiming that the functional knowledge of objects is only relevant for more advanced stages of cognitive and conceptual development (Clark 1973; Gentner 1978; Koopman et al. 2017; Mandler 2008a; Russell et al. 1991; Shanks 2015).

Second, the process by which objects become signs of their use involves certain degrees of generalisation and abstraction inasmuch as “the use of functional information implicates interpretive mechanisms beyond those of immediate perception and indicates a mode of categorization” (Kemler Nelson et al. 2000: 1271, see also Mandler & McDonough 1996: 311). Once children have understood that objects have canonical functions, they stop interacting with isolated *things* and start to interact with *members* of classes.

Thus, when children discern, for example, that cups are used for drinking, a *cup*₁ and another *cup*₂ become members of the same category (the category of objects used for drinking in a certain way). What brings together objects is not, in this case, a sensory similarity, but a *functional similarity* (Vygotsky 1931/1966).⁵ A small wooden and concave spoon does not perceptually resemble a larger metal and less concave spoon. These two spoons would not have the same shape, size, texture or temperature. The metal spoon could even be more similar, in perceptual terms, to a metal fork than to the small wooden spoon. However, both spoons have the same canonical function and, therefore, have equal functional meanings. Somewhere else, one of us proposed that functional categories have a normative structure that guide action (Rodríguez & Moro 1999, see also Palacios et al. 2018). From this

⁵ This kind of similarity between uses of objects is significant for the development of symbols and metaphorical thinking (see Alessandrini 2017; Palacios & Rodríguez 2015; Palacios et al. 2018).

perspective, then, to use an object by its canonical function would enable new forms of interaction, reasoning, action planning and communication for the child.

Following research by Nelson (1973, 1983, 1985) highlighting the importance of functional knowledge for our cognitive semantics, in this paper we propose, as a hypothesis, that the culturally constructed functional permanence of objects could be seen as a conceptual achievement prior to language. In other words, the appropriation of the canonical uses of objects allows children to begin to interact in and through the material world in a general and conventional way, taking advantage of common and culturally defined functional features.

In his *A treatise of human nature*, Hume (1739), one of the fathers of empiricism, had expected this possibility when discussing the relationships between *the notion of identity*, *the idea of substance* and *imagination*. After arguing that there are no constant or invariable impressions (Hume 1739: 239), the philosopher sets forth an eloquent example:

There is, however, another artifice, by which we may induce the imagination to advance a step further; and that is, by producing a reference of the parts to each other, and a combination to some common end or purpose. A ship, of which a considerable part has been changed by frequent reparations, is still considered as the same; nor does the difference of the materials hinder us from ascribing an identity to it. The *common end*, in which the parts conspire, is the same under all their variations (Hume 1739: 243, emphasis in the original).

According to Hume, what makes the ship permanent (what constitutes its conceptual core) is its function (its common end or purpose). It allows us to ascribe an identity to the ship despite discontinuities and sensory variations. Similarly, in *Psychology*, James (1900: 259) argues that conceptual thinking need not rely on similarities between things, but on similarities between meanings: to have a concept is to experience different mental states that *mean* the same thing.

For us, this is exactly what happens when children appropriate the canonical uses of objects: objects with different perceptual characteristics become signs of one and the same functional meaning (i.e., object use). Once this achievement takes place, the world is no longer the same as before, for it becomes functionally accessible and culturally determined. Grasping the canonical function of an object is, therefore, an essential step towards grasping its wider conventional semiotic potential. To develop this general functional knowledge is essential for children, since the primary function of our conceptual system is to support our *situated action* in the world (Barsalou et al. 2018). Situated actions involve different subjects, objects and events that activate goals, affect and bodily states, leading to action and outcomes.

The appropriation of the canonical uses of objects has other meaningful consequences. For example, towards the end of the first year of life children perform their first symbolic behaviours (Palacios et al. 2018). We are referring to the *symbolic uses of objects*. In these uses children represent an absent use by applying the rules of canonical use of a particular object to: (i) the same object but in a situation that does not coincide with that where the canonical use takes place in everyday life (i.e., “eating” with an empty spoon), (ii) another object (i.e., “talking on the phone” with a shoe), or (iii) a *representamen* with which a canonical use is evoked without material support (i.e., holding the hand near the ear to “talk on the phone”) (Palacios & Rodríguez 2015). Again, it should be noted that the relation of similarity is not established between physical features of objects (i.e., between a telephone and a shoe), but between their uses (i.e., a telephone used as a telephone is similar to a shoe used as a telephone). We could say that in a particular moment of development canonical uses are linked to the object to which they apply. But then, these canonical uses behave as *travelling forms* that are instantiated in other objects, breaking the primary co-extension relation between signs and objects (Alessandroni 2017). Hence, it is more suitable to talk of symbols as *third-sense forms* (Rodríguez et al. 2014). Symbols are not in place of a literal and transparent reality but are based on socioculturally constructed canonical sense forms.

This explains why adults can easily understand symbolic uses performed by children: given that we share with them a common ground of meanings relating to the canonical

functions of objects, we can embrace the semiotic operation involved in symbolic uses without effort. With the entry into the symbolic terrain, children's action possibilities multiply, because they begin to apply their functional knowledge in the absence of objects. This *pragmatic profit* exceeds, by far, perception, since "to pretend one is eating with an empty spoon, or one is talking on a replica mobile telephone, one needs to know that spoons are used for eating and mobile phones for talking" (Rodríguez et al. 2018: 228). Both the early presence of symbolic uses and their understanding by adults reinforce our hypothesis. They confirm that, in early childhood, knowledge about the canonical function of objects is stable and has a general nature compatible with the characteristics of concepts.

Our hypothesis coincides with that of other authors. To illustrate, Säljö (2018) invites to accept what he calls the *materiality of concepts* (i.e., concepts are properties of objects and the material world instead of abstract mental entities), and Oakes (2008) does not hesitate to say that the core of children's object concepts is functional:

Late in the first year, infants put toy telephones to their ears, shoes to their feet, and pretend to drink out of empty cups. These actions suggest that infants have represented more than what objects look like, and that they have concepts of those objects (Oakes 2008: 255).

Likewise, others have emphasised the importance of the functional aspects of objects for conceptual development. For instance, Mandler distinguishes between perceptual and conceptual categorisation. According to her, "perceptual similarity of exemplars is not a necessary condition for forming a conceptual category" (Mandler et al. 1991: 269; see also Mandler et al. 1987). Conceptual categorisation is based on what objects do, and generalisation processes are grounded in pragmatic aspects (such as object uses) (Mandler 2000, 2004a).⁶ Although more research is needed to find out to what extent it is plausible to

⁶ In other works, Mandler presents divergent views stating that conceptual development in early childhood is governed by universal and non-cultural factors (Mandler 2004b, for a discussion see Rodríguez & Moro 2008) or by dynamic bodily experiences, spatial innate primitives, image-schemas and schematic integrations (Mandler 2008a, 2008b; Mandler & Pagán Cánovas 2014).

talk about concepts concerning canonical and symbolic uses of objects, our hypothesis has some advantages. First, it considers objects as complex cultural referents and not only sensory aggregates. Second, it coincides with proposals made by other authors that highlight the urgent need to overcome reductionism when researching conceptual development. For example, Malt et al. (2015) claimed that it is necessary to study conceptual formation before language, and Byers (2016) and Ross (2000) have argued that it is fundamental to investigate the development of everyday life concepts in contexts where objects are used, bearing in mind their functional aspects. Others, in turn, have highlighted the importance of conducting longitudinal studies in ecological contexts (Gruber et al. 2015; Murphy 2002), and stated that it is crucial to study the influence that adults and semiotic mediation processes have on conceptual development (Pauen et al. 2015). Our approach is a contribution to the landscape of perspectives criticising perceptual reductionism and advocating for cultural and functional points of view to explain conceptual development and other cognitive processes (Barsalou et al. 2005; Chaigneau & Barsalou 2008; Chen et al. 2016; Costall & Dreier 2006; Krnel & Skubic 2015; Malafouris 2013, 2014; Säljö 2018; Smith 2005).

5. Conclusions

Concepts are cognitive resources of major importance that allow us to be in the world while maintaining cognitive economy. They reduce environmental information through categorisation, allowing us to identify objects and make inferences, guide our action and communicate. Research on concepts and their development is, thus, vital to understand cognitive and psychological development.

In this article we proposed, first, to analyse the epistemological basis of psychological and philosophical perspectives that agree in seeing perception as the foundation of concepts. In these perspectives, concepts are perceptual by-products. We distinguished between state non-conceptualism, content non-conceptualism and content conceptualism. After presenting

the premises of each position, we pointed out the main problems they face, and established that holding that perceptions are the building-blocks of concepts leads to an argumentative labyrinth with no exit.

From the framework of the *pragmatics of the object*, we explained the convenience of an alternative approach: considering the canonical functions of objects as a foundation for early object concepts. Embracing this alternative implies a thorough study of the processes by which children build up cognitive categories based on functional similarities between objects, during the last third of their first year of life (and before with familiar objects). We proposed it would be fruitful for researchers to focus on analysing the fine-grained dynamics of children's appropriation of functional knowledge within triadic interactions in ecological contexts (such as the home or the Infant School). In doing so, they could consider multiple aspects: what children do, with what objects, what the activity contexts in which action is embedded are, what adults do to canalise children's action, what communicative and educative semiotic mediators are at play at every moment, how each of them relate to objects, and how this whole very complex pragmatic and cultural system changes over time (i.e., how it develops). As the resulting empirical data would encompass a high number of variables, qualitative and microgenetic analytical approaches would surely prove useful in attaining rich descriptions of conceptual development.

Even though our proposal only refers to concepts related to artefacts and does not address concepts of natural objects or other entities (i.e., people, animals, and events), it provides important bases for an ontological turn regarding empirical research on the development of object concepts in early childhood. This is so because the *pragmatics of the object*: (i) defines objects as cultural complex referents and not sensory collections, (ii) explains cognitive development taking into account communicative and semiotic processes that take place within triadic adult-baby-object interactions, and (iii) proposes to study development through observations in ecological contexts. The challenge that remains is that of fostering research on conceptual development considering objects' cognitive relevance in pragmatic and sociocultural contexts, acknowledging not only their perceptual properties, but also their functional ones.

Declaration of Interest Statement

The authors have no ethical conflicts to disclose. The authors declare that they have neither financial interests (stocks, patents, employment, honoraria, or royalties) nor non-financial relationships (political, personal, or professional) that may be interpreted as having influenced the writing of the manuscript.

References

- Alessandroni, Nicolás. 2017. Development of metaphorical thought before language: The pragmatic construction of metaphors in action. *Integrative Psychological and Behavioral Science* 51(4). 618–642. <https://doi.org/10.1007/s12124-016-9373-3>
- Alessandroni, Nicolás. 2018. Varieties of embodiment in cognitive science. *Theory & Psychology* 28(2). 227–248. <https://doi.org/10.1177/0959354317745589>
- Alessandroni, Nicolás, Ana Moreno-Núñez, Cintia Rodríguez & María Jesús Del Olmo. 2019. Musical dynamics in early triadic interactions. A case study. *Psychological Research*. <https://doi.org/10.1007/s00426-019-01168-4>
- Alessandroni, Nicolás & Cintia Rodríguez. 2017. Is CONTAINER a natural and embodied image schema? A developmental, pragmatic, and cultural proposal. *Human Development* 60(4). 144–178. <https://doi.org/10.1159/000478841>
- Alvarez, George A. & Steven L. Franconeri. 2007. How many objects can you track?: Evidence for a resource-limited attentive tracking mechanism. *Journal of Vision* 7(13). 14. <https://doi.org/10.1167/7.13.14>
- Anglin, Jeremy M. 1977. *Word, object and conceptual development*. New York: Norton.
- Archer, James. 1966. The psychological nature of concepts. In Herbert J. Klausmeier & Chester W. Harris (eds.), *Analyses of concept learning*, 37–49. New York: Academic Press.

- Aristotle. trans. 2016. *De anima* [On the soul]. Transl. by Christopher Shields, edited by Lindsay Judson. Oxford: Clarendon Press.
- Arnold, Jeanne E., Anthony P. Graesch, Enzo Ragazzini & Elinor Ochs. 2012. *Life at home in the twenty-first century*. California: Cotsen Institute of Archaeology Press.
- Austin, John L. 1962. *Sense and sensibilia*. Oxford: Oxford University Press.
- Babska, Zofia. 1965. The formation of the conception of identity of visual characteristics of objects seen successively. *Monographs of the Society for Research in Child Development* 30(2). 112–124.
- Bambach, Sven, Linda B. Smith, David J. Crandall & Chen Yu. 2016. *Objects in the center: How the infant's body constrains infant scenes*. 2016 Joint IEEE International Conference on Development and Learning and Epigenetic Robotics (ICDL-EpiRob), Cergy-Pontoise, France: IEEE. <https://doi.org/10.1109/DEVLRN.2016.7846804>
- Barsalou, Lawrence W., Léo Dutriaux & Christoph Scheepers. 2018. Moving beyond the distinction between concrete and abstract concepts. *Philosophical Transactions of the Royal Society B: Biological Sciences* 373(1752). 20170144. <https://doi.org/10.1098/rstb.2017.0144>
- Barsalou, Lawrence W., Steven Sloman & Sergio Chaigneau. 2005. The HIPE theory of function. In Laura Carlson & Emile van der Zee (eds.), *Functional features for language and space: Insights from perception, categorization, and development*, 131–147. Oxford: Oxford University Press.
- Bomba, Paul C. & Einar R. Siqueland. 1983. The nature and structure of infant form categories. *Journal of Experimental Child Psychology* 35(2). 294–328. [https://doi.org/10.1016/0022-0965\(83\)90085-1](https://doi.org/10.1016/0022-0965(83)90085-1)
- Brewer, Bill. 1999. *Perception and reason*. New York: Oxford University Press.
- Brewer, Bill. 2005. Perceptual experience has conceptual content. In Matthias Steup & Ernest Sosa (eds.), *Contemporary debates in epistemology*, 217–230. Malden: Blackwell.

- Bruner, Jerome S., Jacqueline J. Goodnow & George A. Austin. 1956/2009. *A study of thinking*. New Brunswick: Transaction.
- Burns, Barbara. 1986. Perceptual development and categorization: I. An investigation of task demands, stimulus set similarity, and age. *The Journal of Genetic Psychology* 147(3). 359–370. <https://doi.org/10.1080/00221325.1986.9914510>
- Byers, Patrick. 2016. Knowledge claims in cognitive development research: Problems and alternatives. *New Ideas in Psychology* 43. 16–27. <https://doi.org/10.1016/j.newideapsych.2016.03.004>
- Byrne, Alex. 2005. Perception and conceptual content. In Matthias Steup & Ernest Sosa (eds.), *Contemporary debates in epistemology*, 231–250. Malden: Blackwell Publishing.
- Cabell, Kenneth R. & Jaan Valsiner (eds.). 2014. *The catalyzing mind: Beyond models of causality*. New York: Springer.
- Cahen, Arnon & Michela C. Tacca. 2013. Linking perception and cognition. *Frontiers in Psychology* 4(MAR). 1–2. <https://doi.org/10.3389/fpsyg.2013.00144>
- Carey, Susan. 2009. *The origin of concepts*. Oxford: Oxford University Press.
- Casasola, Marianella & Yeojin A. Ahn. 2018. What develops in infants' spatial categorization? Korean infants' categorization of containment and tight-fit relations. *Child Development* 89(4). e382–e396. <https://doi.org/10.1111/cdev.12903>
- Chaigneau, Sergio & Lawrence W. Barsalou. 2008. The role of function in categories. *Theoria et Historia Scientiarum* 8(1). 33–49.
- Chen, Quanjing, Frank E. Garcea & Bradford Z. Mahon. 2016. The representation of object-directed action and function knowledge in the human brain. *Cerebral Cortex* 26(4). 1609–1618. <https://doi.org/10.1093/cercor/bhu328>
- Chiou, Rocco, Paul F. Sowman, Andrew C. Etchell & Anina N. Rich. 2013. A conceptual lemon: Theta burst stimulation to the left anterior temporal lobe untangles object

- representation and its canonical color. *Journal of Cognitive Neuroscience* 26(5). 1066–1074. https://doi.org/10.1162/jocn_a_00536
- Chuard, Philippe. 2007. Indiscriminable shades and demonstrative concepts. *Australasian Journal of Philosophy* 85(2). 277–306. <https://doi.org/10.1080/00048400701343143>
- Clark, Eve V. 1973. What's in a word? On the child's acquisition of semantics in his first language. In Timothy E. Moore (ed.), *Cognitive development and the acquisition of language*, 65–110. New York: Academic Press.
- Cohen, Jonathan. 2015. Perceptual constancy. In Mohan Matthen (ed.), *The Oxford handbook of philosophy of perception*, 621–639. Oxford: Oxford University Press.
- Cohen, Leslie B. & Mark S. Strauss. 1979. Concept acquisition in the human infant. *Child Development* 50(2). 419–424. <https://doi.org/10.2307/1129417>
- Cole, Michael. 1996. *Cultural psychology. A once and future discipline*. Cambridge: Harvard University Press.
- Cosmides, Leda & John Tooby. 2013. Evolutionary psychology: New perspectives on cognition and motivation. *Annual Review of Psychology* 64. 201–229. <https://doi.org/10.1146/annurev.psych.121208.131628>
- Costall, Alan. 2012. Canonical affordances in context. *Avant* 3(2). 85–93.
- Costall, Alan & Ole Dreier (eds.). 2006. *Doing things with things. The design and use of everyday objects*. Hampshire: Ashgate.
- D'Alfonso, Simon. 2018. *McDowell and misperception*. Unpublished manuscript. <http://simondalfonso.id.au/documents/philosophy/McDowell.pdf>
- Dennett, Daniel C. 1969. *Content and consciousness*. London: Routledge.
- Efron, Robert. 1969. What is perception? In Robert S. Cohen & Marx W. Wartofsky (eds.), *Proceedings of the Boston Colloquium for the Philosophy of Science 1966/1968. Volume IV*, 137–173. Dordrecht: Springer. https://doi.org/10.1007/978-94-010-3378-7_4

- Eimas, Peter D. & Paul C. Quinn. 1994. Studies on the formation of perceptually based basic-level categories in young infants. *Child Development* 65(3). 903–917.
<https://doi.org/10.1111/j.1467-8624.1994.tb00792.x>
- Evans, Gareth. 1982. *The varieties of reference*. Oxford: Oxford University Press.
- Fagan, Joseph F. 1976. Infants' recognition of invariant features of faces. *Child Development* 47(3). 627-638. <https://doi.org/10.2307/1128177>
- Fechner, Gustav T. 1860. *Elemente der Psychophysik* [Elements of psychophysics]. Leipzig: Breitkopf und Härtel.
- Firestone, Chaz & Brian J. Scholl. 2016. Cognition does not affect perception: Evaluating the evidence for “top-down” effects. *Behavioral and Brain Sciences* 39. e229.
<https://doi.org/10.1017/S0140525X15000965>
- Fleming, Roland W. 2015. Visual development: Learning not to see. *Current Biology* 25(24). R1166–R1168. <https://doi.org/10.1016/j.cub.2015.11.012>
- Gallagher, Shaun. 2017. *Enactivist interventions*. Oxford: Oxford University Press.
- Galpérine, Piotr. 1966. Essai sur la formation par étapes des actions et des concepts [Essay on the formation of actions and concepts in stages]. In *Recherches psychologiques en U.R.S.S.*, 114–132. Moscou: Editions du Progrès.
- Gärdenfors, Peter. 2007. Representing actions and functional properties in conceptual spaces. In Tom Ziemke, Jordan Zlatev & Roslyn M. Frank (eds.), *Body, language and mind. Volume 1: Embodiment*, 167–195. Berlin: Mouton de Gruyter.
- Gärdenfors, Peter. 2019. From sensations to concepts: a proposal for two learning processes. *Review of Philosophy and Psychology* 10. 441-464. <https://doi.org/10.1007/s13164-017-0379-7>
- Gelaes, Sabine & Jean-Pierre Thibaut. 2004. L'apprentissage de concepts chez l'enfant: facteurs cognitifs, structure des catégories et théories naïves [Learning concepts in children: cognitive factors, category structure and naive theories]. *L'Année Psychologique* 104(3). 597–636. <https://doi.org/10.3406/psy.2004.29681>

- Gentner, Dedre. 1978. On relational meaning: The acquisition of verb meaning. *Child Development* 49. 988–998. <https://doi.org/10.2307/1128738>
- Gibson, James J. 1979/2015. *The ecological approach to visual perception*. New York: Psychology Press / Taylor & Francis.
- Gleason, Tracy R., Kate E. Fiske & Ruth K. Chan. 2004. The verbal nature of representations of the canonical colors of objects. *Cognitive Development* 19(1). 1–14. [https://doi.org/10.1016/S0885-2014\(03\)00044-3](https://doi.org/10.1016/S0885-2014(03)00044-3)
- Goldstone, Robert L. & Andrew T. Hendrickson. 2010. Categorical perception. *Wiley Interdisciplinary Reviews: Cognitive Science* 1(1). 69-78. <https://doi.org/10.1002/wcs.26>
- Gori, Monica. 2015. Multisensory integration and calibration in children and adults with and without sensory and motor disabilities. *Multisensory Research* 28(1–2). 71–99. <https://doi.org/10.1163/22134808-00002478>
- Gram, Moltke S. 1983. *Direct realism: A study of perception*. The Hague: Martinus Nijhoff.
- Granrud, Carl E. 2009. Development of size constancy in children: a test of the metacognitive theory. *Attention, Perception & Psychophysics* 71(3). 644–654. <https://doi.org/10.3758/APP.71.3.644>
- Gruber, Craig W., Matthew G. Clark, Sven Hroar Klempe & Jaan Valsiner (eds.). 2015. *Constraints of agency: Explorations of theory in everyday life*. Switzerland: Springer.
- Heck, Richard. G. 2000. Nonconceptual content and the ‘space of reasons’. *The Philosophical Review* 109(4). 483–523. <https://doi.org/10.2307/2693622>
- Helmholtz, Hermann von. 1867. *Handbuch der physiologischen Optik* [Handbook of physiological optics]. Leipzig: Leopold Voss.
- Hering, Ewald. 1878/1964. *Outlines of a theory of the light sense*. Cambridge: Harvard University Press.

- Horst, Jessica S., Lisa M. Oakes & Kelly L. Madole. 2005. What does it look like and what can it do? Category structure influences how infants categorize. *Child Development* 76(3). 614–631. <https://doi.org/10.1111/j.1467-8624.2005.00867.x>
- Hume, David. 1739. *A treatise of human nature*. London: J.M. Dent & Sons.
- Huttenlocher, Janellen, Sean Duffy & Susan Levine. 2002. Infants and toddlers discriminate amount: Are they measuring? *Psychological Science* 13(3). 244–249. <https://doi.org/10.1111/1467-9280.00445>
- Jacobson, Hilla & Hilary Putnam. 2016. Against perceptual conceptualism. *International Journal of Philosophical Studies* 24(1). 1–25. <https://doi.org/10.1080/09672559.2015.1047164>
- Jahoda, Gustav & Ioan M. Lewis (eds.). 2015. *Acquiring culture. Cross cultural studies in child development*. Hove: Psychology Press.
- James, William. 1900. *Psychology*. New York: Henry Holt & Co.
- Kagan, Jerome. 1966. A developmental approach to conceptual growth. In Herbert J. Klausmeier & Chester W. Harris (eds.), *Analyses of concept learning*, 37–49. New York: Academic Press.
- Keil, Frank C. 1991. The emergence of theoretical beliefs as constraints on concepts. In Susan Carey & Rochel Gelman (eds.), *The epigenesis of mind*, 237–256. Hillsdale: Erlbaum.
- Kelly, Sean D. 2001. Demonstrative concepts and experience. *The Philosophical Review* 110(3). 397–420. <https://doi.org/10.2307/2693650>
- Kemler Nelson, Deborah G., Rachel Russell, Nell Duke & Kate Jones. 2000. Two-year-olds will name artifacts by their functions. *Child Development* 71(5). 1271–1288. <https://doi.org/10.1111/1467-8624.00228>
- Kimura, Atsushi, Yuji Wada, Jiale Yang, Yumiko Otsuka, Ippeita Dan, Tomohiro Masuda, So Kanazawa & Masami K. Yamaguchi. 2010. Infants' recognition of objects using

- canonical color. *Journal of Experimental Child Psychology* 105(3). 256–263.
<https://doi.org/10.1016/j.jecp.2009.11.002>
- Köhler, Wolfgang. 1947. *Gestalt psychology. An introduction to new concepts in modern psychology*. New York: Liveright.
- Koopman, Sarah E., Bradford Z. Mahon & Jessica F. Cantlon. 2017. Evolutionary constraints on human object perception. *Cognitive Science* 41(8). 2126–2148.
<https://doi.org/10.1111/cogs.12470>
- Krnjel, Dušan & Darija Skubic. 2015. Concept formation in childhood: Cross-cultural perspectives. In James D. Wright (ed.), *International Encyclopedia of the Social & Behavioral Sciences*, 531–537. Elsevier.
- Lakoff, George & Mark Johnson. 1999. *Philosophy in the flesh*. New York: Basic Books.
- Lécuyer, Roger & Katia Rovira. 1999. Organisation perceptive, délai inter essais et catégorisation chez les bébés de quatre mois [Perceptive organization, inter-trial delay and categorization in four-month-old babies]. *L'Année Psychologique* 99(2). 209-237.
<https://doi.org/10.3406/psy.1999.28530>
- Leonard, Annie. 2010. *The story of stuff*. New York: Free Press.
- Leontiev, Alekséi N. & Aleksandr R. Luria. 1972. Some notes concerning Dr. Fodor's 'Reflections on L.S. Vygotsky's Thought and Language'. *Cognition* 1(2–3). 311–316.
[https://doi.org/10.1016/0010-0277\(72\)90024-8](https://doi.org/10.1016/0010-0277(72)90024-8)
- Luria, Aleksandr R. 1974. *Cognitive development. Its cultural and social foundations*. Edited by Michael Cole. Cambridge: Harvard University Press.
- MacVean, Mary. 2014, March 21. For many people, gathering possessions is just the stuff of life. *Los Angeles Times*. <http://articles.latimes.com/2014/mar/21/health/la-he-keeping-stuff-20140322>
- Maddy, Penelope. 2017. *What do philosophers do? Skepticism and the practice of philosophy*. New York: Oxford University Press.

- Malafouris, Lambros. 2013. *How things shape the mind. A theory of material engagement*. Cambridge: The MIT Press.
- Malafouris, Lambros. 2014. Creative thinging: The feeling of and for clay. *Pragmatics & Cognition* 22(1). 140-158. <https://doi.org/10.1075/pc.22.1.08mal>
- Malafouris, Lambros. 2019. Thinking as “thinging”: Psychology with things. *Current Directions in Psychological Science*. <https://doi.org/10.1177/0963721419873349>
- Maloney, J. Christopher. 2017. *What is it like to perceive?* Berlin: De Gruyter Mouton.
- Malt, Barbara C., Silvia P. Genari, Mutsumi Imai, Eef Ameel, Noburo Saji & Asifa Majid. 2015. Where are the concepts? What words can and can't reveal. In Eric Margolis & Stephen Laurence (eds.), *The conceptual mind*, 291–326. Cambridge: The MIT Press.
- Mandler, Jean M. 2000. Perceptual and conceptual processes in infancy. *Journal of Cognition and Development*, 1(1), 3–36. https://doi.org/10.1207/S15327647JCD0101N_2
- Mandler, Jean M. 2004a. *The foundations of mind: Origins of conceptual thought*. New York: Oxford University Press.
- Mandler, Jean M. 2004b. Two kinds of knowledge acquisition. In Joan M. Lucariello, Judith A. Hudson, Robyn Fivush & Patricia J. Bauer (eds.), *The development of the mediated mind: Sociocultural context and cognitive development*, 13–32. London: LEA.
- Mandler, Jean M. 2008a. Infant concepts revisited. *Philosophical Psychology* 21(2). 269–280. <https://doi.org/10.1080/09515080801980229>
- Mandler, Jean M. 2008b. On the birth and growth of concepts. *Philosophical Psychology*. 21(2), 207–230. <https://doi.org/10.1080/09515080801980179>
- Mandler, Jean M., Patricia J. Bauer & Laraine McDonough. 1991. Separating the sheep from the goats: Differentiating global categories. *Cognitive Psychology* 23(2). 263-298. [https://doi.org/10.1016/0010-0285\(91\)90011-C](https://doi.org/10.1016/0010-0285(91)90011-C)
- Mandler, Jean M., Robyn Fivush & J. Steven Reznick. 1987. The development of contextual categories. *Cognitive Development* 2(4). 339-354. [https://doi.org/10.1016/S0885-2014\(87\)80012-6](https://doi.org/10.1016/S0885-2014(87)80012-6)

- Mandler, Jean M. & Laraine McDonough. 1996. Drinking and driving don't mix: inductive generalization in infancy. *Cognition* 59(3). 307-335. [https://doi.org/10.1016/0010-0277\(95\)00696-6](https://doi.org/10.1016/0010-0277(95)00696-6)
- Mandler, Jean M. & Cristóbal Pagán Cánovas. 2014. On defining image schemas. *Language and Cognition* 6(4). 510–532. <https://doi.org/10.1017/langcog.2014.14>
- Margolis, Eric & Stephen Laurence (eds.). 2015. *The conceptual mind*. Cambridge: The MIT Press.
- Martí, Eduardo. 2017. Body, culture and cognition: Avoiding reductionist temptations. *Estudios de Psicología* 38(1). 140–168. <https://doi.org/10.1080/02109395.2016.1268392>
- McDowell, John. 1994/1996. *Mind and world*. Cambridge: Harvard University Press.
- Merleau-Ponty, Maurice. 1942/1963. *The structure of behavior*. Transl. by Alden L. Fisher. Boston: Beacon Press.
- Merleau-Ponty, Maurice. 1945/2005. *Phenomenology of perception*. Transl. by Colin Smith. London: Routledge.
- Mervis, Carolyn B. & Eleanor Rosch. 1981. Categorization of natural objects. *Annual Review of Psychology* 32(1). 89–115. <https://doi.org/10.1146/annurev.ps.32.020181.000513>
- Miceli, Gabriele, Erin Fouch, Rita Capasso, Jennifer R. Shelton, Francesco Tomaiuolo & Alfonso Caramazza. 2001. The dissociation of color from form and function knowledge. *Nature Neuroscience* 4(6). 662–667. <https://doi.org/10.1038/88497>
- Moro, Christiane & Cintia Rodríguez. 2000. La création des représentations chez l'enfant au travers des processus de sémiosis [The creation of representations in children through semiosis processes]. *Enfance* 53. 287–294. <https://doi.org/10.3406/enfan.2000.3185>
- Morvan, Pierre le. 2004. Arguments against direct realism and how to counter them. *American Philosophical Quarterly* 41(3). 221–234.
- Murphy, Gregory L. 2002. *The big book of concepts*. Massachusetts: The MIT Press.

- Nelson, Katherine. 1973. Some evidence for the cognitive primacy of categorization and its functional basis. *Merrill-Palmer Quarterly of Behavior and Development* 19(1). 21–39.
- Nelson, Katherine. 1983. Concepts, words, and experiments: Comment on “When is a cup not a cup?” by Anderson and Prawat. *Merrill-Palmer Quarterly* 29(4). 387–394.
- Nelson, Katherine. 1985. *Making sense: The acquisition of shared meaning*. New York: Academic.
- Nelson, Katherine. 2011. “Concept” is a useful concept in developmental research. *Journal of Theoretical and Philosophical Psychology* 31(2). 96-101.
<https://doi.org/10.1037/a0023429>
- Nogueira de Carvalho, Felipe. 2016. *Demonstrative thought*. Berlin: Walter de Gruyter.
- Nudds, Matthew. 2009. Recent work in perception: Naïve realism and its opponents. *Analysis* 69(2). 334–346. <https://doi.org/10.1093/analys/anp039>
- Oakes, Lisa M. 2008. Categorization skills and concepts. In Marshall M. Haith & Janette B. Benson (eds.), *Encyclopedia of infant and early childhood development*, 249–259. Cambridge: Academic Press / Elsevier. <https://doi.org/10.1016/B978-012370877-9.00043-8>
- Olkkonen, Maria, Christoph Witzel, Thorsten Hansen & Karl R. Gegenfurtner. 2010. Categorical color constancy for real surfaces. *Journal of Vision* 10(9). 16.
<https://doi.org/10.1167/10.9.16>
- Olkkonen, Maria, Thorsten Hansen & Karl R. Gegenfurtner. 2008. Color appearance of familiar objects: Effects of object shape, texture, and illumination changes. *Journal of Vision* 8(5). 13. <https://doi.org/10.1167/8.5.13>
- Palacios, Pedro & Cintia Rodríguez. 2015. The development of symbolic uses of objects in infants in a triadic context: A pragmatic and semiotic perspective. *Infant and Child Development* 24(1). 23–43. <https://doi.org/10.1002/icd.1873>
- Palacios, Pedro, Cintia Rodríguez & Cecilia Méndez-Sánchez. 2018. Communicative mediation by adults in the construction of symbolic uses by infants. *Integrative*

- Psychological and Behavioral Science* 52(2). 209–227. <https://doi.org/10.1007/s12124-018-9422-1>
- Palmer, Stephen E. 1977. Hierarchical structure in perceptual representation. *Cognitive Psychology* 9(4). 441–474. [https://doi.org/10.1016/0010-0285\(77\)90016-0](https://doi.org/10.1016/0010-0285(77)90016-0)
- Pauen, Sabina, Träuble Birgit, Stefanie Hoehl & Sabrina Bechtel. 2015. Show me the world: Object categorization and socially guided object learning in infancy. *Child Development Perspectives* 9(2). 111–116. <https://doi.org/10.1111/cdep.12119>
- Peacocke, Christopher. 2001a. Phenomenology and nonconceptual content. *Philosophy and Phenomenological Research* 62(3). 609–615. <https://doi.org/10.1111/j.1933-1592.2001.tb00077.x>
- Peacocke, Christopher. 2001b. Does perception have a nonconceptual content? *The Journal of Philosophy* 98(5). 239–264. <https://doi.org/10.2307/2678383>
- Pérez, Diana I., Silvia Español, Liza Skidelsky & Ricardo A. Minervino. 2010. Introducción [Introduction]. In Diana. I. Pérez, Silvia Español, Liza Skidelsky & Ricardo A. Minervino (eds.), *Conceptos. Debates contemporáneos en filosofía y psicología* [Concepts. Contemporary debates in philosophy and psychology], 7–25. Buenos Aires: Catálogos.
- Piaget, Jean. 1937. *La construction du réel chez l'enfant* [The construction of reality in the child]. Neuchâtel: Delachaux et Niestlé.
- Piaget, Jean. 1961. *Les mecanismes perceptifs* [Perceptual mechanisms]. Paris: Presses Universitaires de France.
- Prinz, Jesse J. 2002. *Furnishing the mind: Concepts and their perceptual basis*. Cambridge: The MIT Press.
- Quine, Willard van O. 1977. Natural kinds. In Stephen P. Schwartz (ed.), *Naming, necessity, and natural kinds*, 155–177. Ithaca: Cornell University Press.

- Quinn, Paul C., Peter D. Eimas & Stacey L. Rosenkrantz. 1993. Evidence for representations of perceptually similar natural categories by 3-month-old and 4-month-old infants. *Perception* 22(4). 463-475. <https://doi.org/10.1068/p220463>
- Quinn, Paul C. & Mark H. Johnson. 2000. Global-before-basic object categorization in connectionist networks and 2-month-old infants. *Infancy* 1(1). 31–46. https://doi.org/10.1207/S15327078IN0101_04
- Rakison, David H. & George E. Butterworth. 1998. Infants' attention to object structure in early categorization. *Developmental Psychology* 34(6). 1310-1325. <https://doi.org/10.1037/0012-1649.34.6.1310>
- Reichard, Suzanne, Marion Schneider & David Rapaport. 1944. The development of concept formation in children. *American Journal of Orthopsychiatry* 14(1). 156–161. <https://doi.org/10.2307/3624955>
- Rettler, Bradley & Andrew M. Bailey. 2017. Object. In Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*. Stanford: Center for the Study of Language and Information, Stanford University. <https://plato.stanford.edu/archives/win2017/entries/object/>
- Ribot, Théodule-Armand. 1899. *The evolution of general ideas*. London: Open Court Publishing Company.
- Rock, Irvin. 1997. *Indirect perception*. Cambridge: The MIT Press.
- Rodríguez, Cintia. 2006. *Del ritmo al símbolo. Los signos en el nacimiento de la inteligencia* [From rhythm to symbol. Signs at the birth of intelligence]. Barcelona: Horsori.
- Rodríguez, Cintia. 2007. God's eye does not look at signs. Early development and semiotics. *Infancia y Aprendizaje* 30(3). 343–374. <https://dx.doi.org/10.1174/021037007781787471>
- Rodríguez, Cintia. 2012. The functional permanence of the object: A product of consensus. In Eduardo Martí & Cintia Rodríguez (eds.), *After Piaget*, 123–150. New Brunswick: Transaction Publishers.

- Rodríguez, Cintia, Marisol Basilio, Karina Cárdenas, Silvia Cavalcante, Ana Moreno-Núñez, Pedro Palacios & Noemi Yuste. 2018. Object pragmatics: Culture and communication, the bases for early cognitive development. In Alberto Rosa & Jaan Valsiner (eds.), *The Cambridge handbook of socio-cultural psychology*, 2nd ed., 223–244. New York: Cambridge University Press.
- Rodríguez, Cintia, Julia Benassi, Luisa Estrada & Nicolás Alessandroni. 2017. Early social interactions with people and objects. In Alan Slater & Gavin Bremner (eds.), *An introduction to developmental psychology*, 3rd ed, 213–258. Hoboken: Wiley.
- Rodríguez, Cintia & Christiane Moro. 1998. Objects are made permanent also by their conventional use. *Infancia y Aprendizaje* 84. 67–83.
<https://dx.doi.org/10.1174/021037098760378793>
- Rodríguez, Cintia & Christiane Moro. 1999. *El mágico número tres. Cuando los niños aún no hablan* [The magic number three. When children still do not speak]. Barcelona: Paidós Ibérica.
- Rodríguez, Cintia & Christiane Moro. 2008. Coming to agreement: Object use by infants and adults. In Jordan Zlatev, Timothy P. Racine, Chris Sinha & Esa Itkonen (eds.), *The shared mind*, 89–114. Amsterdam: John Benjamins.
- Rodríguez, Cintia & Nora Scheuer. 2015. The paradox between the numerically competent baby and the slow learning of two- to four-year-old children. *Estudios de Psicología*, 36(1), 18–47. <https://doi.org/10.1080/02109395.2014.1000009>
- Rodríguez, Cintia, Pedro Palacios, Karina Cárdenas & Noemi Yuste. 2014. Les symboles: des formes de second ou de troisième sens? In Christiane Moro and Nathalie Müller-Mirza (eds.), *Sémiotique, culture et développement psychologique*, 99–116. Villeneuve d'Ascq: Presses Universitaires du Septentrion.
- Ross, Brian H. 2000. The effects of category use on learned categories. *Memory & Cognition* 28(1). 51–63. <https://doi.org/10.3758/BF03211576>
- Rossmann, Nicole & Vasudevi Reddy. 2016. Structure and openness in the development of self in infancy. *Journal of Consciousness Studies* 23(1–2). 237–257.

- Ruff, Holly A. 1978. Infant recognition of the invariant form of objects. *Child Development*, 49(2). 293-306. <https://doi.org/10.2307/1128690>
- Russell, Bertrand. 1959. *The problems of philosophy*. Oxford: Oxford University Press.
- Russell, Terry, Ken Longden & Linda McGuigan. 1991. *SPACE-Materials*. Liverpool: Liverpool University Press.
- Sakharov, Leonid. S. 1990. Methods for investigating concepts. *Soviet Psychology* 28(4). 35–66.
- Säljö, Roger. 2018. Conceptual change, materiality and hybrid minds. In Tamer G. Amin & Olivia Levrini (eds.), *Converging perspectives on conceptual change*, 113–120. Oxon: Routledge.
- Saussure, Ferdinand de. 1916/1971. *Cours de linguistique générale* [Course in general linguistics]. Paris: Payot.
- Schmidt, Eva. 2015. *Modest nonconceptualism. Epistemology, phenomenology, and content*. Cham: Springer.
- Schyns, Philippe G., Robert L. Goldstone & Jean-Pierre Thibaut. 1998. The development of features in object concepts. *Behavioral and Brain Sciences* 21(1). 1-54. <https://doi.org/10.1017/S0140525X98000107>
- Sedivy, Sonia. 1996. Must conceptually informed perceptual experience involve non-conceptual content? *Canadian Journal of Philosophy* 26(3). 413–431. <https://doi.org/10.1080/00455091.1996.10717460>
- Shakespeare, William. 1609/2002. *Complete sonnets and poems*. Oxford: Oxford University Press.
- Shams, Ladan, Yukiyasu Kamitani & Shinsuke Shimojo. 2000. Illusions: What you see is what you hear. *Nature* 408(6814). 788. <https://doi.org/10.1038/35048669>
- Shanks, David R. 2015. Concept learning and representation: Models. In James D. Wright (ed.), *International Encyclopedia of the Social & Behavioral Sciences*, 538–541. Elsevier. <https://doi.org/10.1016/B978-0-08-097086-8.43020-5>

- Sloutsky, Vladimir M. 2003. The role of similarity in the development of categorization. *Trends in Cognitive Sciences* 7(6). 246-251. [https://doi.org/10.1016/S1364-6613\(03\)00109-8](https://doi.org/10.1016/S1364-6613(03)00109-8)
- Sloutsky, Vladimir M. 2018. Category learning and conceptual development. In Simona Ghetti & John T. Wixted (eds.), *Stevens' handbook of experimental psychology and cognitive neuroscience. Volume 4*, 4th ed., 37–82. New York: Wiley.
- Smith, Linda B. 2005. Action alters shape categories. *Cognitive Science* 29(4). 665–679. https://doi.org/10.1207/s15516709cog0000_13
- Smith, Linda B., Sandra Street, Susan S. Jones & Karin H. James. 2014. Using the axis of elongation to align shapes: Developmental changes between 18 and 24 months of age. *Journal of Experimental Child Psychology* 123. 15–35. <https://doi.org/10.1016/j.jecp.2014.01.009>
- Spelke, Elizabeth S. 2000. Core knowledge. *American Psychologist* 55(11). 1233–1243. <https://doi.org/10.1037/0003-066X.55.11.1233>
- Spitz, René A. 1965. *The first year of life. A psychoanalytic study of normal and deviant developments of object relations*. New York: International Universities Press.
- Stavans, Maayan & Renée Baillargeon. 2018. Four-month-old infants individuate and track simple tools following functional demonstrations. *Developmental Science* 21(1). e12500. <https://doi.org/10.1111/desc.12500>
- Susi, Tarja & Tom Ziemke. 2005. On the subject of objects: Four views on object perception and tool use. *TripleC: Communication, Capitalism & Critique* 3(2). 6–19. <https://doi.org/10.31269/triplec.v3i2.19>
- Thill, Serge & Katherine E. Twomey. 2016. What's on the inside counts: A grounded account of concept acquisition and development. *Frontiers in Psychology* 7(March). 1–11. <https://doi.org/10.3389/fpsyg.2016.00402>

- Tomikawa, Sandra A. & David H. Dodd. 1980. Early word meanings: Perceptually or functionally based? *Child Development* 51(4). 1103–1109.
<https://doi.org/10.2307/1129550>
- Toribio, Josefa. 2008. State versus content: The unfair trial of perceptual nonconceptualism. *Erkenntnis* 69(3). 351–361. <https://doi.org/10.1007/s10670-008-9120-3>
- Uexküll, Jakob J. von. 1928. *Theoretische Biologie* [Theoretical biology]. Berlin: Springer.
- Van Gulick, Ana & Michael Tarr. 2010. Is object color memory categorical? *Journal of Vision* 10(7). 407–407. <https://doi.org/10.1167/10.7.407>
- Varela, Francisco J., Evan Thompson & Eleanor Rosch. 1991. *The embodied mind: Cognitive science and human experience*. Cambridge: The MIT Press.
- Vetter, Petra & Albert Newen. 2014. Varieties of cognitive penetration in visual perception. *Consciousness and Cognition* 27. 62–75. <https://doi.org/10.1016/j.concog.2014.04.007>
- Vygotsky, Lev S. 1931/1966. Development of the higher mental functions. In *Psychological research in the USSR*, vol. 1, 11–45. Moscow: Progress Publishers.
- Vygotsky, Lev S. 2018. From sign to meaning and sense. In Ekaterina Zavershneva & René van der Veer (eds.), *Vygotsky's notebooks*, 251–270. Singapore: Springer.
- Wallman, James. 2013. *Stuffocation*. London: Crux.
- Wallon, Henri & Gaby Ascoli. 1950. Comment l'enfant sait classer les objets [How the child classifies objects]. *Enfance* 3(1). 411–433. <https://doi.org/10.3406/enfan.1950.2196>
- Welch, Livingston. 1947. A behaviorist explanation of concept formation. *The Pedagogical Seminary and Journal of Genetic Psychology* 71(2). 201–222.
<https://doi.org/10.1080/08856559.1947.10533425>
- Wilcox, Teresa & Marisa Biondi. 2015. Object processing in the infant: lessons from neuroscience. *Trends in Cognitive Sciences* 19(7). 406–413.
<https://doi.org/10.1016/j.tics.2015.04.009>

- Wisniewski, Edward J. & Douglas L. Medin. 1994. On the interaction of theory and data in concept learning. *Cognitive Science* 18(2). 221-281. [https://doi.org/10.1016/0364-0213\(94\)90002-7](https://doi.org/10.1016/0364-0213(94)90002-7)
- Witzel, Christoph & Karl R. Gegenfurtner. 2013. Memory color. In Ronnier Luo (ed.), *Encyclopedia of Color Science and Technology*, 1–7. New York: Springer.
- Witzel, Christoph, Maria Olkkonen & Karl R. Gegenfurtner. 2016. Memory colours affect colour appearance. *Behavioral and Brain Sciences* 39. e262. <https://doi.org/10.1017/S0140525X15002587>
- Wright, William K. 1913. The genesis of the categories. *The Journal of Philosophy, Psychology and Scientific Methods* 10(24). 645. <https://doi.org/10.2307/2012373>
- Yang, Jiale, So Kanazawa, Masami K. Yamaguchi & Ichiro Kuriki. 2013. Investigation of color constancy in 4.5-month-old infants under a strict control of luminance contrast for individual participants. *Journal of Experimental Child Psychology* 115(1). 126–136. <https://doi.org/10.1016/j.jecp.2012.11.013>
- Yang, Jiale, So Kanazawa, Masami K. Yamaguchi & Isamu Motoyoshi. 2015. Pre-constancy vision in infants. *Current Biology* 25(24). 3209–3212. <https://doi.org/10.1016/j.cub.2015.10.053>
- Yang, Jiale, Yumiko Otsuka, So Kanazawa, Masami K. Yamaguchi & Isamu Motoyoshi. 2011. Perception of surface glossiness by infants aged 5 to 8 months. *Perception* 40(12). 1491–1502. <https://doi.org/10.1068/p6893>
- Young, Thomas. 1807. *A course of lectures on natural philosophy and the mechanical arts*. London: Joseph Johnson.
- Younger, Barbara A. 2003. Parsing objects into categories. Infants' perception and use of correlated attributes. In David H. Rakison & Lisa M. Oakes (eds.), *Early category and concept development*, 77–102. Oxford: Oxford University Press.

- Younger, Barbara A. & Dru D. Fearing. 2000. A global-to-basic trend in early categorization: Evidence from a dual-category habituation task. *Infancy* 1(1). 47–58.
https://doi.org/10.1207/S15327078IN0101_05
- Zamudio, Alicia M. & José A. Castorina. 2016. La cuestión del a priori: de Kant a Piaget [The question of the a priori: from Kant to Piaget]. *Schème - Revista Eletrônica de Psicologia e Epistemologia Genéticas* 8(2). 4-27.
- Zaporozhets, Alexander V. 2002. The development of sensations and perceptions in early and preschool childhood. *Journal of Russian and East European Psychology* 40(3). 22–34.
<https://doi.org/10.2753/RPO1061-0405400322>
- Zentall, Thomas R., Danielle M. Andrews & Jacob P. Case. 2018. Sameness may be a natural concept that does not require learning. *Psychological Science* 29(7). 1185–1189.
<https://doi.org/10.1177/0956797618758669>
- Zuccotti, Paula. 2015. *Everything we touch: A 24-hour inventory of our lives*. London: Viking.