

# ANALISIS FILOSOFICO

VOLUMEN XXXVIII, NÚMERO 2  
NOVIEMBRE 2018

SADAF

# WHY THE CONTENT OF ANIMAL THOUGHT CANNOT BE PROPOSITIONAL

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## Abstract

In “Steps toward Origins of Propositional Thought”, Burge claims that animals of different species are capable of making deductive inferences. According to Burge, that is why propositional thought is extended beyond the human mind to the minds of other kinds of creatures. But, as I argue here, the inferential capacities of animals do not guarantee a propositional structure. According to my argument, propositional content has predicates that might involve a quantificational structure. And the absence of this structure in animal thought might explain some of the differences with the propositional content of human thought.

KEY WORDS: Predication; Propositional Structure; Deductive Inference; Non-Propositional Structure.

## Resumen

En “Hacia los orígenes del pensamiento proposicional”, Burge sostiene que animales de diferentes especies son capaces de hacer inferencias deductivas. Según él, esa es la razón por la cual el pensamiento proposicional se extiende más allá de la mente humana, hacia la mente de otras especies. Pero, como argumento acá, la capacidad inferencial de los animales no garantiza que el pensamiento de los animales tengan una estructura proposicional. De acuerdo con mi argumento, el contenido proposicional tiene predicados con una estructura cuantificacional, cuya ausencia en el pensamiento animal podría explicar algunas de sus diferencias con el pensamiento proposicional humano.

PALABRAS CLAVE: Predicación; Estructura proposicional; Inferencia deductiva; Estructura no proposicional.

## Introduction

In “Steps toward Origins of Propositional Thought”, Burge claims that propositional thought is extended beyond the human mind to animals of different species. His argument rests on the idea that non-human primates are capable of making deductive inferences, and on the assumption that propositional thought emerges from deductive capacities.

Burge defends a functional view of propositional content. According to this view, propositional content is distinguished from other kinds of content in virtue of the functional and psychological roles of its constitutive elements. Along this line, Burge claims that a representational state with propositional content presupposes a capacity for pure predication and for deductive inference. So far, Burge takes these capacities as general conditions for thought, but whereas pure predication is conceived as a constitutive condition, a capacity for deductive inference is supposed to provide an empirical basis for the attribution of propositional content. According to the constitutive condition, propositional contents are constituted by pure predicates. Pure predicates are representations of properties – such as BODY or BROWN – that do not have a referential function, and do not involve the attribution of the property they represent to a particular entity. In his words, pure predicates are functional independent; that is, they are “attributives” that function with independence of referential contexts and hence are not meant to be true of any entity.<sup>1</sup>

According to the empirical condition, the presence of negation, disjunction, and conditional, as they are employed in deductive inferences, is conceived as a criterion for propositional content. According to Burge, this is so because the application of logical connectives to a representation of properties produces the emergence of pure predication (Burge 2010b, p. 67). In his argument, Burge claims that the presence of logical connectives and, thus, the possession of a logical form, obstructs the attributive function of predicates. For instance, in “This<sub>1</sub> F is not G”, the presence of negation occludes the attribution of the property G to the entity referred to by the singular structure, “this<sub>1</sub> F”. Consequently, here G is not applied to make an attribution. In addition, a logical form is characterized by the generality of the inferential patterns; this means that it should be possible to apply inferential capacities to different domains or subject matters. The rule of *modus ponens*, for instance, is sensitive to the form of a proposition, but remains blind to its content. So, according to Burge, when they are accompanied by logical connectives, the representation of properties can play a predicative role that may be clearly distinguished from the attributive role that it might play within the scope of referential contexts, such as perception.

Burge contrasts propositional content with perceptual content. Like propositional content, perceptual content is composed by general

<sup>1</sup> Burge uses the term attributive to refer to a general element either from perception or cognition. In the latter case, it could be replaced by “property concept”.

as well as singular elements. But, in contrast, perceptual content is composed by representations of properties that accompany and are applied by context-bound identificational referential elements, to make attributions. Thus, perceptual content is constituted by attributives within referential contexts and, thus, might be veridical of particular entities. Thus, whereas propositional content as well as perceptual content are constituted by general and singular elements, only in perception every general element has an attributive function and, thus, can be veridical of singular elements. Hence, the idea that propositional thought emerges in early cognition, i. e. in non-human animals, needs to be broadly understood along with Burge's anti-intellectualist account of perception and reason (Burge 2010a, 2010c).

Finally, based on a series of experiments by Call (2006) that show that some primates are capable of making exclusion transitions, Burge takes animals to be capable of making deductive inferences. In support of this claim, he adds that animal inferences have the subject-matter-general character that is the "hallmark" of logic (Burge 2010b, p. 64). In view of that, he concludes that propositional content is extended to non-human animal thoughts. It is important to note that this conclusion depends not only on the observation of patterns of deductive inferences in animal thinking, but also on the acceptance of the thesis that patterns of deductive inferences involve pure predication.

I deeply sympathize with Burge's anti-intellectualist view of perception and propositions. Also, I agree with him that not only the content of perception, but also the content of animal thought is structured. But I do not think that the content of animal thought has a propositional structure. Along this line, in this paper, I will present an objection against the thesis, defended by Burge (2010), that the content of animal thought has a propositional structure. According to my argument, a capacity for deductive inference does not entail a capacity for pure predication. Hence, it cannot provide an empirical basis for propositional content, as Burge understands it. In addition, I will argue that animal reasoning lacks the generality of domain or subject matter that is characteristic of our logic capability to reason. In what follows, I will deal with these two issues separately, one at a time.

First, I want to distinguish another way in which *pure* predicates are functional independent, besides Burge's own proposal. As Burge claims, pure predicates do not play an attributive role. So, for example, in *that F is not G*, while *F* plays an attributive role, since it is part of a singular demonstrative referential thought, *G* does not function to make an attribution within the scope of a context-bound,

identificational, referential structure (Burge 2010b, p. 43). But there are other propositional functions as well. According to an extended philosophical tradition, pure predicates (i.e. predicates that are part of propositional structures) involve a highly detached and theoretical comprehension of the attributive, regardless of the entities that might fall under its extension (Evans 1982, Peacocke 1992). According to this view, which I want to advocate, grasping a predicate *G* involves the comprehension of the instance relation, the comprehension of what is to be *G* for an arbitrary entity (Gibson 2004). This comprehension is shown paradigmatically in general thoughts with a quantificational structure, and also in metaphors, where predicates are separated from their attributive function and creatively employed in unusual contexts. In the content underlying this kind of thoughts, the attributive falls outside the scope of a referential structure in a *full-blown* sense in virtue of being attached to bounded variables. In general terms, pure predicates involve a quantificational structure, which is responsible for the generality of domain, characteristic of logic (King 1996).<sup>2</sup>

I will develop this further distinction by focusing on negative contents as they are analyzed by first order logic (i.e. the Predicate calculus), whose notion of validity relies on the internal structure of propositions. This strategy differs from Burge's, which is mainly focused on inferences of propositional logic (p. 58). According to my argument, without the help of a quantificational structure, a capacity for deductive inferences does not produce a capacity for pure predication. Hence, despite the fact that non-humans' capacity for deductive inferences might contribute to the functional independence of the representational constituents of their thoughts (i.e. of their attributives), it does not entail a capacity for pure predication. Hence, if pure predication is constitutive of propositional contents, as Burge says, then deductive capacities do not entail the emergence of propositional content in animal thought either.

It might sound weird to say that a capacity for inference, as it is analyzed by propositional logic, is not correlative to propositional thought. However, Burge himself advocates a fine-grained notion of proposition according to which content is propositional depending on its components; i.e., in case it is constituted by a pure predicate. So, even if this fine-grained distinction between propositional and non-

<sup>2</sup> The claim that propositional predicates involve a quantificational structure must be taken as a modal requirement; thus it does not mean that pure predicates occur only in quantificational propositions.

propositional content is left out, the question regarding whether *propositional inference* provides the resources for *pure predication* remains.

This leads us to our second issue. Burge claims that animals' exclusion transitions are subject-matter-general, since they cross "cognitively different systems dealing with different subject matters" (Burge 2010b, p. 62). Still, I will argue against this thesis based on some empirical considerations. Different researchers have shown that animal reasoning has important restrictions of domain (Allen 2006; Cheney and Seyfarth 1985, 1990; Hurley 2003). So, for instance, even though it has been shown that non-human primates have capacities for transitive inferential transitions along with social domains, there is no evidence that these capacities can be extended beyond that context. Similarly, unless there is evidence to the contrary, from the observation of capacities for exclusion transitions in certain contexts, there is no reason to assume that those capacities can be extended to other new different contexts (for instance, from physical to social contexts).

In section 2, I will briefly present Burge's theory of propositional content. Then, in section 3, I will criticise Burge's argument for the emergence of propositional thought. More specifically, I will criticise his assumption that deductive capacities provide empirical conditions for recognizing pure predication and, subsequently, for recognizing psychological states with propositional content. If this criticism were right, it would undermine Burge's claim about the content of animal thought. According to my argument, if – as Burge says – propositional structure is understood in terms of pure predication, despite being capable of making deductive inferences, the content of animal thought is not propositionally structured. Finally, in section 3.1, I will argue that the inferential capacities of animals lack general subject-matter character. On the contrary, I will suggest that the inferential capacities of animals have restrictions of domain, that is, they do not transcend different subject matters. As I want to suggest, generality of domain in a full-blown sense emerges with the help of a quantificational structure.

## 2. Propositions and Predicative Structure

Many philosophers understand propositions as mere representations of facts. From this view, any factual representation as such – for instance, perception, cognitive maps, beliefs, and so on – has propositional content. On the contrary, Burge advocates a fine-

grained notion of proposition, based on the structure and function of representational content.

Some have thought that whether perception is propositional depends on whether what is represented is an object or a state of affairs. I believe that this view has things backwards. The issue is over the organization, structure, form of the representational state. A state of affairs can be represented either with a singular representational structure or with a propositional structure. (...) The question at issue concerns the way, the structure of the mode of presentation, of the representational content. (Burge 2010b, p. 33)

According to this view, Burge states that not only propositional content, but also perceptual and other non-propositional contents are structured, and also have referential as well as attributive elements to pick up particulars and attribute properties to them. However, he claims that propositional content is distinguished from non-propositional contents, such as the content of perception, in virtue of their underlying structure, and the functional role of the elements that compose their structure.

On Burge's account, propositional content possesses a main predicate, that is, "an attributive that functions predicatively without being applied to make an attribution by a singular or plural, demonstratively-governed referential application." (Burge 2010b, p. 43) According to Burge, main predicates are functional-independent. It means that they fall outside the scope of any identificational referential structure, they do not function in referring, and they are not applied attributively by a referential element. Thus, main predicates are not veridical of any *de re* identified entity. Burges states that main predicates can function predicatively in at least three different ways (p. 42): Firstly, in general propositions with a quantificational structure, they can function attributively without being veridical of any *de re* identified entity (see *body* in sentence 1). Secondly, they can function predicatively as part of a larger attribution without itself making an attribution, as happens in negative, conditional, and disjunctive sentences (see *body* in sentences 2, 3, and 4). Thirdly, they can function predicatively without being part of any attribution much less itself making an attribution. This is the case of negative existential sentences (see *body* in sentence 5).

1. every planet is a *body*,
2. that<sub>1</sub> smudge on the hill is not a *body*,

3. if that<sub>1</sub> smudge is a *body*, it is a large one,
4. some shape on the hill is either a *body* or a shadow,
5. it is not the case that anything non-spatial is a *body*

On the other hand, Burge holds that perceptual content contains both context-bound *singular referential* elements and *general attributive* elements. In contrast to main predicates, the general elements involved in perception accompany and are applied by the singular elements, and function to be veridical of perceived particulars. In other words, perceptual attributives function to be applied by the context-bound singular (or plural) identificational reference, and to make attributions to the purportedly perceived entity: their function is to make an attribution to an entity, as part of an identificational reference. Along this line, Burge challenges intellectualist views of singular reference, according to which individuation requires a linguistic criteria for identity, which in turn depends on the logical apparatus for quantification, sortal predicates, identity, and pronouns (see Evans 1982; Fodor 2008; Quine 1953). Then, since both perceptual and propositional content are structured and contain singular elements as well as general attributives, propositional content is distinguished from perceptual content in virtue of containing a pure predicate; that is, an attributive which plays a pure predicative function, and that is not attributed to a particular entity.<sup>3</sup>

In addition, Burge holds that, besides having a capacity for pure predication, psychological states with propositional content are *identified* by having a capacity for propositional inference (2010, p. 45). Furthermore, he claims that the presence of deductive inference provides an empirical basis for identifying the emergence of pure predication:

by reflecting on inference, we can gain insight into the problem of recognizing empirical conditions for separating pure predication from attribution that is applied by (within the scope of) context-bound identificational reference. We can thereby gain insight into empirical conditions for recognizing propositional psychological states. (Burge 2010b, p. 57)

As I have already stated, one of the aims of this paper is to deny this

<sup>3</sup>Between perceptual and propositional content, there are other non-propositional contents, which also contain both singular-referential and general-attributive elements. Burge includes in this category memory, anticipation, and map-like representations (intermodal representations).



claim. According to my argument, inferential capabilities are extended beyond propositional thinking; therefore, they provide neither the empirical conditions for pure predication nor for propositional thought. In the following section, I will argue that propositional inference does not exploit functional independence, characteristic of pure predicates, in a full-blown sense. In other words, propositional inference does not warrant a capacity for pure predication. On the contrary, the functional view of propositions endorsed here, and by Burge himself, requires inferences that can be analyzed by means of predicate calculus, whose notion of validity depends on the internal structure of sentences. Hence, according to this, the fact that animals have inferential capabilities does not imply that animals have a capacity for pure predication, nor does it entail that they have propositional thought. Furthermore, inferential capacities, as they are possessed by animals, lack the generality of domain that Burges finds to be characteristic of logic.

### **3. The Content of Animal Thought**

As mentioned above, Burge claims that a capacity for pure predication and a capacity for deductive inference are both indicators of propositional content. Whereas the first one is a constitutive criterion, the second one is empirical. In addition, he argues that animal thinking has propositional content. According to his argument, animals show a capacity for making different kinds of deductive inference across different subject matters.

In order to work properly, Burge's argument for the presence of propositional content in animal thought assumes that the capacity for making deductive inferences presupposes a capacity for pure predication. This assumption is required in order to claim that the capacity for making inferences as it is exhibited in animals is sufficient to show that the content of their mental states is propositionally structured. Otherwise, an additional argument would be required, which shows that animal reasoning presupposes a capacity for pure predication. Since Burge has not provided such argumentation and, on the contrary, he holds that pure predication in animals emerges with deductive inference (2010, p. 58), that assumption merits analysis.

My argumentative strategy will be the following: I will argue that, although the examples of animal reasoning provided by Burge presuppose an inferential capacity that can be analyzed in terms of propositional logic, they provide neither an empirical basis nor sufficient support for an account of animal thought in terms of pure predication.

Consequently, those examples do not provide evidence for the thesis that the content of animal thought has a propositional structure.

To develop his argument, Burge takes some examples of animal reasoning from experiments made by Call (2006, 2007) with non-human primates. Those examples presuppose deductive inferences, which depend on *Modus Ponens*, *Modus Tollens*, and *Modus Tollendo Ponens* (also called exclusion inference). These kinds of inferences depend entirely on the logical connectives, which range over complete representational structures as they are analysed by propositional logic, and, hence, as Burge himself recognizes, they are inferences that do not depend on a predicative structure (2010, p. 65)<sup>4</sup>. Let us focus on a case of animals' exclusion reasoning (*modus tollendo ponens*):

For example, a chimpanzee or great ape is shown that one piece of food is hidden in one of two containers. The food is shown; a closed hand reaches into one container, then, emerging closed, into the other; then the hand is shown to be empty. Next, one container is shown to be empty. The primate is invited to choose between the containers. ... some non-human animals, including apes, show the sort of behavior that suggests deductive inference. They immediately choose the non-empty place, without needing to look into it. (Burge 2010b, p. 59)

Burge takes it as a case of exclusion inference, which has the form of “p or q, not-p, so q”, and includes the logical connectives for negation, conditional, and disjunction. To defend this interpretation of the evidence for animal reasoning, Burge states that the exclusion transitions underlying the primate's responses to the experiments: i) presuppose intermodal capabilities, which precludes associative explanations instead of a representational account; ii) “instantiate directly, and structural-element-by-structural-element” the logical structure of propositional inference by exclusion, iii) and cross different subject matters – such as localization, causation, and permanence of objects – that he considers to involve heterogeneous cognitive systems governed by different psychological principles that, according to Burge, show the general subject matter character of logical structure.

<sup>4</sup>Hence, the moral is the following: either propositional structure – as Burge says – involves pure predication and, consequently, propositional *inferences* do not necessarily presuppose propositional *structure*, or propositional structure does not necessarily involve pure predication, which means that propositional thinking requires some sort of basic predication. In what follows, I will take Burge's view of proposition that is committed to the idea of pure predication.

Burge analyzes two different theories that have been proposed to explain this kind of psychological transitions in non-propositional terms. On the one hand, Bermúdez (2006) has developed a proto-logical approach based on the representation of contrary properties (like absence and presence). On the other hand, Rescorla (2009) has offered an inductive approach in terms of Bayesian inferences by means of cartographic systems. But Burge denies that exclusion transitions can be explained by a non-deductive account. On the one hand, he claims that non-deductive explanations are inadequate, since they rest on the unfounded argument that in the absence of language or meta-representational capacities, animals can have neither propositional states nor make deductive inferences. On the other hand, according to Burge, these explanations are inadequate for a natural account of the subject-matter-general character that those transitions portray: Whereas Bermúdez's proto-logic requires the introduction of new pairs of contraries for each new transition, Rescorla's maps instantiate combinatorial rules that only govern over those domains that can be represented by them (i. e. spatial domains).

I will not focus on Burge's arguments against non-deductive explanations of animal reasoning. Against non-deductive views, I agree with Burge that the attribution of deductive capacities is often the best explanation for an account of the psychological transitions among mental states of non-human animals. My criticism focuses on another issue. More specifically, I claim that the kind of inference-which Burge is focused on does not bring about – at least not necessarily, as he argues – pure predication. To do that, I will focus on the operator of negation. My argument, however, can be generalized to the cases of disjunction and conditional, which are also components of| exclusion inferences. Before I develop my criticism, I will briefly reconstruct Burge's argument in favour of the emergence of pure predication – and propositional thought – from deductive capacities.

Burge claims that the presence of negation blocks the attribution of the property to the entity referred to by the singular identificational element. That is, when a representation of a property is negated, it does not mean to be veridical of any referred entity. Hence, he argues, negation is one of the ways in which an attributive can be detached from its attributive function to become a pure predicative element.

Negation is one form that exhibits very clearly the liberation of attributives from a role in being applied by singular representation. In *it is not the case that that1 F is G* or *that1 F is non-G*, there is

no way to construe the attributive  $G$  as occurring in anything but a purely predicative, even non-attributive, role. (p. 66)

But there are important differences between the sorts of negation that operate in “it is not the case that  $\text{that}_1 F$  is  $G$ ”, on the one hand, and “ $\text{that}_1 F$  is non- $G$ ”, on the other. Whereas the operator in “ $\text{that}_1 F$  is non- $G$ ” is internal negation, in the case of “it is not the case that  $\text{that}_1 F$  is  $G$ ” an external negation operates. Internal negation, which belongs to *Predicate Calculus*, functions by negating the application of a predicate to a singular (or plural) element: here,  $Fa \wedge \neg Ga$ . External negation, which belongs to *Propositional Logic*, functions, instead, by negating the complete content of a proposition: here,  $\neg (Fa \wedge Ga)$ , which would take the form of  $\neg P$  in propositional notation due to being blind to the internal structure of propositions. However, Burge takes both cases as providing support for the emergence of pure predication. It is true that Burge acknowledges the existence of a logical difference; however, I suspect that he underestimates them.

In particular, in order to develop his argument, Burge must presuppose that the kind of negation that operates in animal exclusion transitions is internal, that is, an operator that functions within a predicative structure by negating the attribution of a property to an entity, as the negation operating in “ $\text{that}_1 F$  is non- $G$ ”. If the negation was external, it would not function by negating the attribution of the property to the referred entity. Contrariwise, it would function by negating the whole content (i.e. by negating the attribution of the property to the referred entity). This is the case of the negation operating in “it is not the case that *that<sub>1</sub> F is G*”, which in turn can be represented as  $\neg P$  according to Propositional Logic.

Burge argues that “the connection between pure predication on one hand, and negation, disjunction, and conditionalization, on the other, suggests a route for the emergence of propositional structure from its perception-based, non-propositional structural predecessors”. As I understand it, this emergence depends on the thesis that the content of perception and the content of proposition are both composed by general attributive elements and by singular referential elements, on the one hand, and on the thesis that in propositional logic the attributive function of the general element is inhibited, on the other. I deeply sympathize with the former, but I am less persuaded by the latter. I do think there is a connection, but I believe that it is more indirect than what Burge suggests.

Along this line, I want to hold that, from a *cognitive* point of

view, for external negation a creature does not *need* a capacity for pure predication. She needs to exploit, instead, an attributive capacity in the context of a singular referential structure, which is already available in perception. Since the content that results from the application of that capacity is denied, it is supposed that it is not the case that the referred entity instantiates the attributed property. Thus, strictly speaking, the content of her mental state cannot be perceptual, but another sort of non-propositional content (which does not involve pure predication). However, the capacity for blocking the attribution could depend on perceptual capacities; more specifically, it could be based on the previous perceptual attribution of the property to the referred entity. In this sense, the kind of content of this mental state would be of the same kind of content of memory and perceptual anticipation. According to Burge, although the attributive elements participating in the content of memory and perceptual anticipation are not currently involved in an attribution within a singular perceptual reference, they function in a full sense when they are activated to be applied by or connected to singular reference in perception (Burge 2010b, p. 50).

This interpretation has at least two important benefits. Firstly, it preserves the idea that deductive inferences as they are conceived by propositional logic do not rely on the internal structure of content, but only on its relations to other contents. Secondly, it does not preclude Burge's analysis of perceptual content as a structured representation. It only rejects the presence of pure predication. Having said that, why should we prefer either one or the other way of interpreting negation in the exclusion transitions as they are shown in animals' experiments?

In the first place, I think that the fact that animal exclusion transitions are deductive does not mean that the main attributive is a pure predicate. In other words, we cannot assume that logical deduction and pure predication are directly or necessarily connected, much less if we want to take deductive capacities as an empirical criterion for the emergence of pure predication and propositional structure. Second, if we take the negation involved in the transition as internal, and with it we accept that the attributive plays the role of a pure predicate, then it would be predictable that the attributive can have other functions, characteristic of pure predicates.

According to a classic conception of language and thought – that holds from Frege, Russell, and Wittgenstein to Evans, Peacocke, Quine and Fodor – predicates are identified with propositional functions, from objects to truth-values. That is, predicates contain *argument places* that can be occupied by objects or bound variables, which in turn involve

the logical resources of quantificational structure. According to Burge's theory, this would represent an intellectualist conception of thought. I do not think that this is the whole truth of predication, but I do believe that intellectualism has highlighted an important function of sentential predicates, or pure predicates, as Burge names them. The idea that belongs to logic that predicates contain argument places that can be filled by constants and variables is related to another philosophical idea about the comprehension of predicates. So, according to this view, predicates are characterized by a high degree of generality in that the comprehension of a predicate,  $P$ , involves a comprehension of the attributive regardless of the entities that might fall under its extension (Evans 1982, Peacocke 1992): that is, *what is for something to be  $P$* . So, the comprehension of a predicate involves a detached and theoretical knowledge of the property that it represents. This knowledge is detached in that it is independent of particular entities that might instantiate the property represented by  $P$ , and theoretical in that it presupposes knowledge of the general conditions for something to be  $P$ .

To understand 'red', for instance, is to understand what is meant by saying that a thing is red. You have to bring in the form of a proposition. You do not have to know, concerning any particular 'this', that 'This is red' but you have to know what is the meaning of saying that anything is red. You have to understand what one would call 'being red'. (...) When you understand 'red' it means that you understand propositions of the form that 'x is red'. (Russell 1918, p. 196)

So, according to this logical view, grasping a predicate  $G$  involves the comprehension of the *instance* relation, the comprehension of *what is to be  $G$*  for an arbitrary entity (Gibson 2004). Otherwise, the creature cannot help but think of  $Ga, Pa, Gb, Pb$ , within the context of referential structures, for particular instantiations of the attributives.<sup>5</sup> This idea is shown paradigmatically in general thoughts; that is, in thoughts with a quantificational structure – whether existential or universal – where predicates are conspicuously separated from their attributive function.

<sup>5</sup> It could be objected that if a creature can have singular thoughts of the form  $Fa$ , for any arbitrary  $F$ , so she can think  $Fa, Ga, Ha$ , and so on, why would she also need a capacity for general thoughts of the form  $\exists xFa$  or  $\forall xFa$ ? The reason is that without a quantificational structure, she will not be able to think of  $Fa$ , for any arbitrary  $F$ , but only for those  $F$ s that are bound to identificational structures, that is,  $F$ s bounded to referential context.

This is why Predicate Calculus – in contrast to Propositional Logic – clearly involves pure predication. From a cognitive point of view, among other things, this implies that the predicate can be detached from its attributive function not only in virtue of being applied outside the scope of an identificational referential context, but also to be part of other contents barely connected to perception. In other words, a creature equipped with predicates should be capable of applying attributives – whether affirmative or negative– with independence of her previous experience. In addition, a capacity for general thought provides resources for creative thinking, such as the construction and understanding of certain metaphors, such as “money is blood”, where attributives from different domains – the abstract concept, MONEY, with a physiological concept, BLOOD, are freely recombined (see Camp 2004).

However, there is nothing in Call’s studies about animal reasoning presented by Burge that can be considered as evidence for these other functions of predicates. Particularly, although those examples of animal reasoning can be legitimately interpreted as deductive, they neither show that the creature is capable of detaching the attributive from its actual content and employing it on general quantified propositions, nor of combining it creatively in other propositional contents, as it is characteristic of propositional predicates. That is, Call’s experiments do not provide evidence for pure predication. I hypothesize that the same can be said about most of the reports of animal inferences. Even higher mammals exhibit severe difficulties for freely recombining attributives; as Camp (2009) has extensively argued, they are able to think that *that<sub>1</sub> F is G* in so far as they have an encounter with a particular entity, *that<sub>1</sub>F*, being G.<sup>6</sup>

### 3.1. Inferring: A Domain-General Capacity?

Now, I would like to finish with an observation about generality that might affect Burge’s as well as my own interpretation of the kind of negation involved in animal reasoning. As we said above, based on Call’s (2006, 2007) experiments, Burge (2010, p. 62) claims that some non-human primates, and other non-human animals, display deductive capacities across different subject matters, such as the localization, causation and permanence of objects. He claims that this is “compatible

<sup>6</sup> In this line, it is often claimed that non-human animals cannot satisfy the generality constraint, at least not in a full-blown sense (Camp 2009, Beck 2012, Bermúdez 1998). However, see Carruthers (2009).

with the subject matter generality that is the hallmark of logic”, and thus provides a reason to deny non-deductive explanations of animal reasoning. I will argue hereafter, however, that the inferential capacities as animals exhibit them lack such kind of generality since they are bounded to specific domains or subject matters.

Since “generality” can be interpreted at different levels, I will start with two remarks. Firstly, in this section, the generality we are focused on is related to the inferential capacity underlying the psychological transitions, rather than to the predicative capacities (although they are intimately related).<sup>7</sup> Secondly, this kind of generality should be distinguished from the mere generalization from previous cases of a category to new cases of the same category, since even associative processes are general in this sense. The issue is about the generality of the capacity in question: in this case, reasoning, whether restricted to a single categorial domain (or subject matter) or, on the contrary, it can be extended to different domains. In other words, “generality” here refers to cross-domain generality.<sup>8</sup> So, if my observations are correct, we should reject the idea that generality is the hallmark of logic, and admit that deductive capacities can also be domain-specific. Otherwise, we should admit that animals lack deductive capacities, whether we focus on Propositional Logic or Predicate Calculus.

Before I develop my argument, I will briefly sketch Burge’s arguments against non-deductive interpretations of animal reasoning. On the one hand, Burge claims that Bermúdez’ proto-logic requires postulating new pairs of contraries and dispositions for each new exclusion transition. In other words, the capacity for proto-inferences does not rely on a general deductive principle, but on the representation of opposite situations. Hence, he argues that Bermúdez’ account misses the generality of the competence underlying exclusion transitions. On the other hand, Rescorla’s theory states that psychological transitions are modelled according to psychological principles that govern over specific maps. Therefore, the occurrence of a pattern of exclusion

<sup>7</sup> Particularly, the capacity for pure predication – which involves quantification – requires that predicates can be decoupled from any particular instantiation. This independence of predicates from instantiations brings about a capacity for formal inferences, where predicates are considered *argument places*, and a capacity for what Susan Hurley named “inferential promiscuity”, the capacity for making inferences across different domains.

<sup>8</sup> There are different ways of understanding the notion of domain specificity. In an intuitive sense, a capacity is DS when it is restricted in terms of the kind of information that it processes (Barceló Aspeitia, Eraña and Stainton 2010).



transitions across different subject matters, which involve attributives from different domains, would require the postulation of different maps. The reason is that maps are domain-specific, since they are constrained to spatial relations, such as metrical, or topological relations. Hence, the map-theory would also fail to capture the generality of the pattern of inferential transitions. As a result, Burge concludes that-Bermúdez' proto-logic as well as Rescorla's cartographic account are inadequate to represent the generality, which, according to Burge, characterizes logical transitions. However, are they inadequate to represent animal reasoning? My answer is that it should not be decided *a priori*.

Indeed, there are good empirical reasons to presume that the psychological principles underlying the inferential capacities of non-human animals are domain-specific. Along this line, and within the research field on vervet monkeys, Cheney and Seyfarth have claimed that:

Within the social group, the behaviour of monkeys suggests an understanding of causality, transitive inference, and the notion of reciprocity. Despite frequent opportunity and often-strong selective pressure, however, comparable behaviour does not readily emerge in dealings with other animal species or with inanimate objects. (Cheney and Seyfarth 1985, p. 197)

Roughly speaking, domain specificity refers to a restriction in terms of the kind of information that a system can process (Barceló Aspeitia, Eraña and Stainton 2010; Santos, Hauser and Spelke 2002). A domain-specific system is one that – in principle – *could* be generalized from a familiar domain of objects to new domains (Khalidi 2010). On the one hand, this criterion restricts domain specificity to *rules* or *principles* that are *potentially* extensible to different domains (such as inferential capacities, detectors of emotions, objects recognition, and so on) rather than database or information that might be specific to a single domain (for instance, social knowledge or knowledge about predators, folk biology, folk physics, and so on). That is, domain specificity is a feature of a cognitive capacity rather than a feature of a subject matter. Therefore, a capacity is domain-specific in case *it is* restricted to a particular subject matter, although *it could* be extended to other subject matters. On the other hand, according to this condition, to show that a cognitive capacity is domain-general would require showing that it can actually be deployed in response not only to new stimuli of a familiar kind (or within a subject matter), but to stimuli

of a new kind (Khalidi 2010).<sup>9</sup> In other words, a capacity is domain-general in case it can be extended not only to instances from a single domain or subject matter, but also to entities from different domains or subject matters.<sup>10</sup> Therefore, from this perspective, a capacity can be domain-specific despite the fact that it can be generalized to new cases within a familiar domain of objects.<sup>11</sup>

According to these criteria, inferential capacities are good candidates for domain specificity, since they are *capacities that in principle* can be generalized across new domains or subject matters. Since they do not extend to other domains, vervet monkeys' inferential capacities along social cognition – and plausibly inferential capacities of most non-human primates – are examples of domain specificity.<sup>12</sup> The case of inference is particularly interesting since, when it comes to our case, it displays a high degree of promiscuity. That is, it not only generalizes from a familiar domain to another new domain, but it reaches across *many* different domains.<sup>13</sup> More specifically, our inferential capacities are context-free: we can reason about social relationships, physical events, colors, actions,

<sup>9</sup> This condition of generality precludes rules which can deal with new items and contexts, but only insofar as those items belong to the proper domain.

<sup>10</sup> Note that the kind of generalization we are focused on in this section is different from the one implicated on attributives and pure predicates. To say that a capacity can be generalized to new stimuli from a *familiar* kind differs from saying that an attributive can be generalized to new stimuli from the *same* kind, like the capacity of subsuming different instances of cats under the concept CAT. The generality of inferential capacities ranges over sets of concepts or attributives.

<sup>11</sup> In relation to this, Khalidi (2010) adds an additional criterion that imposes an evolutionary constraint to determine if a capacity is domain-specific. In particular, it states that a capacity is general when it generalizes to stimuli for which it was not originally designed to cope with. That is, when it transcends its proper function. Therefore, it would be sufficient for a capacity to be domain-general that it can be exercised besides the domain for which it was evolutionary selected. This criterion is interesting because it allows drawing a gradation of generality, between capacities that generalize to a *new* single domain, and those that generalize to many different domains. However, it is not adequate to rule out domain-general systems. As Barceló *et al.* state, “evolution might still have selected an all purpose system like Fodor’s putative central system... Therefore, Fodor’s central system, if selected for, would have a proper function. But Fodor’s central module is the paradigmatic non-domain-specific mental mechanism. Thus, it is possible for a mechanism to have a specific proper function, yet not be domain-specific.” (2010, p. 23).

<sup>12</sup> It could be argued that thanks to being restricted to a particular domain, vervet monkeys psychological transitions are *not bona fide* inferential. However, this begs the question against domain specificity *per se*. Precisely, since inferential capacities can be generalized, they are good candidates for specificity.

<sup>13</sup> In this respect, it contrasts to some other capacities, as, for example, face recognition, which has been extended from its proper function to object recognition.

economy, laws, food, and so on, without categorial restrictions (Camp 2004). So, it is often claimed that whereas humans' reasoning capacities are inferentially promiscuous, non-human animals have inferential capacities restricted to specific domains of objects (Hurley 2003). Thus, paraphrasing Susan Hurley (2001), while human inferential capacities occupy a continuous space of reason, animals' inferential capacities instead occupy islands of rationality. From this perspective, we could reserve the term domain-specific for inferential capacities or rules that are semantically constrained to a single category (i.e. categorial restricted rules), and domain-general, for inferential capacities or rules without semantic restrictions (i.e. cross-categorial rules).

My hypothesis is that, in the special case of inferences, the extent to which capacity can be generalized largely depends on the structure of the representational content, and in turn, on the kind of predicates or attributives underlying inferential processes. Particularly, inferential promiscuity requires, on the one hand, highly formal rules of combination to combine predicates regardless of their content. On the other hand, it requires functional independent predicates to generalize, freely recombine, and make quantificational-structured inferences. These conditions pave the way to re-combinability not only within a single domain, but also across different domains. The table below offers a simplified illustration of this idea (table 1). So, for instance, a creature with social cognition can have inferential capacities to reason about cooperation, competition, and hierarchy along the social domain, as illustrated by the horizontal line. Similarly, a creature with physical cognition possesses inferential capacities to reason about causality, localization, and permanence regarding physical objects. But none of them involve inferential capacities of general domain yet. On the contrary, the inferential capacities of a creature will be domain-general only when they can be extended to reason across both social and physical domains. In the table, this would require that her inferential capacities run not only along the horizontal lines but also along vertical rows.

*Table 1*

Knowledge of properties →	Domain ↓			
	Social	Cooperation	Competition	Hierarchy
	Physical	Causality	Localization	Permanence
	Numerical	Major	Minor	Equal

The notion of functional independent predicates, when it is taken in the full-blown sense that I want to motivate here, refers to the idea that in order to recombine predicates from heterogeneous domains (and thus, endorsing inferential promiscuity), as in the thought *that<sub>n</sub> F is G*, for any predicate, *F* and *G*, a creature must be able to think of the property denoted by the predicate regardless of its particular instantiations (otherwise, the combinations would be restricted to properties as they are usually arranged in the world). That is, she must be able to have thoughts with a quantificational structure, as in 1, 5, and 6.

6. Some F is G,

which can be formalized as:

a.  $\exists x(Gx \text{ and } Fx)$

Similarly, inferential promiscuity involves highly abstract combinatorial rules, without restrictions of domains; that is, semantically neutral rules of combination (Camp 2015). This, in turn, involves predicates that can be grasped detached from their particular instantiations. Thus, functional independent predication in this full-blown sense – or pure predication – goes hand in hand with highly formal – and hence permissive – rules of combination, which produce a minimal to null contribution to the content of thought, freeing up the range of predicates that can be combined and related to each other.

Does the evidence offered by Burge provide support for the generality of domain of non-human reasoning? Recall that to defend that non-human primates' inferences are domain-general, Burge argues that, in Call's studies (2006, 2007), animal reasoning employs and integrates the comprehension of spatial localization, causation, and permanence of objects, which – according to Burge – involves different cognitive principles. However, this is not the correct way of arguing for domain generality. It seems that the comprehension of the localization, causation, and permanence of objects do not belong to different separate domains or subject matters, but they are all pieces of a general knowledge about physical objects.<sup>14</sup> That is, they involve reasoning within a single domain, as represented by the horizontal dimension on

<sup>14</sup> For an approach of animal thinking regarding different sorts of cognition, see Beck (2013) and Carey (2009).

table 1.<sup>15</sup> And despite the fact that different psychological principles are at stake, it does not account for (cross-categorical) generality insofar as the principles govern over specific domains of object or subject matters.<sup>16</sup> So, the question is whether or not the inferential capacities displayed in the field of physical cognition can be extended to reason about objects of a different domain, for example, within social cognition. And this requires generalizations across heterogeneous domains, represented by the vertical rows, on table 1. Hence, in order to argue that animals possess *general* deductive capacities, what Burge needs to show is that the inferential capacities of non-human animals can be extended across different domains of objects. However, there is no empirical basis to assume that the inferential capacities of non-human animals, as they are observed in Call's experiments, are extended across different subject matters. In addition, since inferential capacities can be domain-general as well as domain-specific, as I have argued, the existence of an inferential capacity *per se* is not sufficient to claim for its generality of domain. So, if an animal succeeds in certain tests, such as Call's (2006, 2007) experiments for exclusion transitions, it does not necessarily mean that she will be capable of succeeding in tests within different subject matters nor capable of making other kinds of inferences (transitive, for example). Although conceptually rich, non-human animals' reasoning capacities as they are deployed in Call's experiments seem to be a case of domain specificity. Thus, in contrast to the inferential promiscuity characteristic of our own cognitive system, animal reasoning *might* be restricted to particular domains (Hurley 2003).

It is important to note that this hypothesis relies, in the first place, on the lack of empirical evidence for the *general* character of animal inferential capacities. So, here, my contribution is mainly critical. However, there are some studies that claim for domain specificity of animal cognitive capacities. Along this line, it has been claimed that "teaching, planning, and transitive inference in animals differ from their human counterparts in being domain-specific." Premack (2007, 2010) provides two interesting examples: "meerkats teach their young only food-handling skills, and that by mechanisms quite different from those such as theory of mind involved in human teaching. And so far, the most convincing evidence of planning in another species is restricted to food

<sup>15</sup> Generalization, as it is represented horizontally in table 1, involves a third sense, which might be understood in terms of cognitive or informational integration.

<sup>16</sup> This sort of "animal's physics" can be regarded as an example of a central module, a special purpose but conceptually rich system (Barceló Aspeitia, Eraña and Stainton 2010).

catching. (Extracted from (Shettleworth 2012))”<sup>17</sup> Finally, these findings can be aligned with important philosophical theories that distinguish animal from human thought in terms of inferential promiscuity, free re-combinability, and so on (Beck 2012, Bermúdez 1998, Camp 2004, Evans 1982, Hurley 2001, Peacocke 1992).

Still, it could be argued that the differences between our inferential capacities and those of animals are differences of degree of generality. But, although possibly true, this is far from being an explanation. Thus, though I agree with Burge that non-human primates possess capacities for deductive inferences, an account of the differences between animal and human reasoning as well as an explanation of the restrictions of domain of animal thinking is still necessary. If we want to keep Burge’s insight that propositional thought involves pure predication, perhaps a notion of non-propositional content might go some steps forward in that direction. So, instead of accepting that the content of animal and human thought are structured in the same way, but are differentiated in virtue of the degrees of generality of their inferential capacities, and in virtue of the degrees in which their attributives (or concepts of properties) are detached from an attributive function, we can assume that animals’ inferential capacities are transitions between non-propositional contents that involve a primitive sort of predication. This suggestion includes both an empirical and a theoretical question, which is far from being replied here. However, as I have shown, Burge’s argument based on deductive inference has failed to prove the emergence of pure predication in animal reasoning, and hence, as Burge takes it, the emergence of propositional thought. The reason is that the capacities for deductive inference underlying animal reasoning neither require nor necessarily involve pure predication, that is, pure predicates with functional independence in a full-blown sense, with a general quantificational structure. In addition, it is unlikely that animals’ patterns of inference show the *generality* that is the “hallmark of logic”. Empirical studies suggest that animal cognition does not accomplish inferential promiscuity. On the contrary, it is plausible that animal cognitive capacities – whether inferential or predicative – are bounded to very specific contexts and needs, and hence occupy – as Hurley (2010) says – islands of rationality.

Thus, according to this picture, a fine-grained notion of propositional content and pure predication is supposed to explain certain psychological regularities, based on the structure of the

<sup>17</sup> See also Amici *et al.* (2012), Cheney and Seyfarth (1985), and Santos *et al.* (2002).

representational content, whereas a notion of non-propositional content and an elucidation of other forms of predication – which are far from being developed here – might *explain* the differences in the nature and degree of generality between the content of animal and human thought.

#### **4. Final Observations**

In this paper, I have argued against Burge's argument for the emergence of propositional thought in animal thought. Although I think it is a close predecessor. In this direction, I have criticised Burge's empirical condition for propositional content by elucidating a way in which predicates are functional independent in a full-blown sense. Then, I have argued that a capacity for deductive inference, as it is analysed by Propositional Logic, does not provide an empirical criterion for propositional structure, since it does not involve predication in this full-blown sense. To do that, I have retrieved a classical notion of predicate that can be found in the work of Frege, Russell, and Evans, which draws attention to some of our higher cognitive capacities. However, I do not mean to question Burge's theory as a whole, since I find his functional and anti-intellectualist view of content very attractive.

Next, I have criticised the tenet that animals' reasoning has the general subject matter character that Burge says is the hallmark of logic. However, I have argued that inferential capacities can be a good candidate for domain specificity. So, even if animals have reasoning capacities, as Call's experiments show, it does not mean that their capacities for inferences have the generality of domain that characterizes the inferential promiscuity of our capacities for reasoning. Although I have not defended a non-propositional conception for animal thought here, I believe that Burge neither provides conclusive reasons to think that it has a propositional structure, nor does he explain the nature and limitations of animal thought, and the ways in which it differs from propositional-structured human thinking.

#### **Acknowledgments**

A previous version of this paper was presented at the Workshop on Language, Cognition and Context, 2015, Montevideo, and at the IX Encuentro de Filosofía e Historia de la Ciencia del Cono Sur. I want to thank the audience for their feedback and especially Axel Barceló, Liza Skidelsky, and Laura Duhau for their helpful comments and discussion. Also, I am in debt with Daniel Kalpokas for his observations.

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*Received: December 26, 2017; accepted: August 22, 2018.*