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Conceptual recombination and stimulus-independence in non-human animals

(Recombinación conceptual e independencia del estímulo en animales no-humanos)

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ABSTRACT: Camp (2009) distinguishes two varieties of conceptual recombination. One of them is full-blown or (as I prefer to call it) spontaneous recombination. The other is causal-counterfactual recombination. She suggests that while human animals recombine their concepts in a full-blown way, many non-human animals are capable of conceptual recombination but only of the causal-counterfactual kind. In this paper, I argue that there is conceptual space to draw further sub-distinctions on how various animal species may recombine their concepts. Specifically, I propose to differentiate between: a) narrow causal-counterfactual recombination, b) broad causal-counterfactual recombination, c) lean spontaneous recombination, and d) robust spontaneous recombination. Afterwards, I focus on how these distinctions relate to several previous philosophical ideas on the representational capacities of non-human animals. Finally, I provide several empirical examples suggesting that different animal species display one or another of these four ways of recombining concepts, at least in some contexts.

KEYWORDS: concepts, conceptual recombination, stimulus-independence, animal cognition.

RESUMEN: *Camp (2009) traza una distinción entre dos variedades de recombinación conceptual. Una de ellas es la recombinación plena o —como prefiero llamarla aquí— espontánea. La otra, es la recombinación causal-contrafáctica. Camp sugiere que mientras los animales humanos pueden recombinar sus conceptos de modo pleno, muchos animales no humanos son solo capaces de una recombinación conceptual de tipo causal-contrafáctico. En este trabajo defiendo que tenemos espacio conceptual para trazar algunas subdistinciones ulteriores con respecto a cómo los animales recombinan sus conceptos. Más específicamente, propongo distinguir cuatro subtipos de recombinación conceptual: a) la causal-contrafáctica estrecha, b) la causal-contrafáctica amplia, c) la espontánea débil y d) la espontánea robusta. Una vez trazadas estas distinciones, busco mostrar cómo se relacionan con algunas ideas filosóficas previas con respecto a las capacidades representacionales de los animales no humanos. Para finalizar, examino algunos ejemplos empíricos que sugieren que distintos animales despliegan una u otra de estas cuatro variantes de recombinación conceptual, al menos en algunos contextos.*

PALABRAS CLAVE: conceptos, recombinación conceptual, independencia del estímulo, cognición animal.

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1. Introduction

When philosophers discuss contents, they frequently claim that these contents represent things as having some properties or being some ways. Also, they usually hold that, typically, propositional contents involve at least two conceptual components: one playing the role of the argument in the proposition —i.e., referring to that which is described as having some properties— and another having a predicative function —i.e., the predicate specifying the properties ascribed to the entities occupying the argument place— (Soames, 2014; Hank, 2015). In paradigmatic cases, the argument role is played by the concept of a particular entity —like *John*, *Mary*, or *this dog*— while the predicative role is played by the concept of a general property —like *being hungry* or *tall*— attributed to that particular. Finally, there is a widespread consensus that thinking propositional thoughts requires some capacity to recombine their constituent concepts to form new contents.

Arguably, the capacities for conceptual recombination involved in propositional thinking could come in different degrees and kinds. Cognitive creatures may be capable of recombining all their concepts or only some of them (Camp, 2009; Carruthers, 2009). Expanding on some ideas of Elisabeth Camp, in this paper, I defend that it is also possible to distinguish different kinds of conceptual recombination in virtue of their being more or less independent from the current stimuli affecting conceptual creatures and from their past experiences.

Camp (2009) distinguishes two ways for cognitive creatures to systematically recombine their concepts: a *full-blown* or *spontaneous* way and a modest *causal- counterfactual* one. She suggests that while human animals can recombine their concepts in a full-blown way, many non-human animals are capable of systematic conceptual re-combinations, but only of the causal-counterfactual kind. In this paper, I defend that, even though Camp's distinction is insightful, there is conceptual space to draw further sub-distinctions on how different cognitive creatures may recombine their concepts.[1] In particular, I propose to distinguish four subtypes of conceptual recombination: a) narrow causal-counterfactual recombination, b) broad causal-counterfactual recombination, c) lean spontaneous recombination, and d) robust spontaneous recombination. I will examine these four sub-types of conceptual recombination showing how each contributes to the constitution of a different kind of cognitive profile. I will not be exclusively interested, however, in conceptual possibilities. I think that this enrichment of Camp's distinction will pay off by allowing us to provide enlightening accounts of some cognitive abilities and behavioral responses of several animal species. Therefore, in the last section, I will briefly explore how the proposed taxonomy can help us make sense of some behavioral patterns of various non-human species.

[1] Camp acknowledges that some sophisticated non-linguistic animals occupy a middle ground between causal-counterfactual recombination and full-blown spontaneous recombination. In her view, this is the case of animals capable of instrumental reasoning. Yet, she does not explicitly focus on the kind of combinatorial abilities they would have. Here, I attempt to fill this gap by introducing two categories to account for the conceptual abilities that surpass causal-counterfactual recombination: lean and robust spontaneous recombination.

2. *Concepts, generality, and recombination*

I will assume hereafter that some non-human animals have concepts and recombine them to form propositional contents.[2] My first aim will be to identify and examine several ways in which animals might recombine their concepts to form propositional contents with more or less independence from current stimuli and past perceptual experiences. Afterwards, I will illustrate with a few selected examples how these distinctions may help us explain some behavioral patterns of various species. Before tackling these issues, however, some previous discussion on concepts and conceptual recombination is needed. For ease of exposition, I will focus on propositional contents in which one property is ascribed to a particular entity.[3] However, I believe that the core claims regarding conceptual recombinability discussed below can be generalized, *mutatis mutandis*, to other kinds of propositional contents.

It is often claimed that thinking a propositional content like *John is tall* involves thinking about John, about the property of being tall, and attributing the latter to the former (Evans, 1982; Camp, 2009, 2015; Proust, 2013). At least when we think about particular entities, it is frequently added to this that two kinds of concepts, with their distinctive semantic functions, compose the contents of such thoughts: "concepts of particulars" or "object concepts" and "concepts of properties" or "predicative concepts" (Evans, 1982; Camp, 2009, 2015; Dickie, 2015).

Predicative concepts are general; hence it must be possible to attribute them to many different particulars. At the same time, philosophers frequently argue that possessing con-

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[2] I adopt here a deflationary understanding of propositional contents and a gradualist view of concepts. According to the gradualist view, having concepts is not an all-or-nothing affair. Instead, there are different kinds of concepts and different degrees of concept possession. Following Camp, I take concepts, in the most minimal sense, to be cognitive representations that can be recombined in some ways (cf. Camp, 2009, p. 280). In turn, I consider contents to be propositional if they represent things being a certain way and are composed of simpler recombinable conceptual units. I also think creatures that use concepts to token propositional contents must show considerable behavioral flexibility and a capacity to think about particular things under some specific aspects instead of others. Adopting these lenient notions, in this paper, I will interpret numerous behavioral patterns of different species as involving some kind of conceptual recombination or other. But there is also a growing corpus of empirical evidence suggesting that a number of animals can represent particular objects (Pepperberg, 1999; Santos *et al.,* 2003; Phillips & Santos, 2007; Gruber *et al.,* 2015) or individuals (Cheney & Seyfarth, 2007; Holekamp *et al.,* 2007; Seyfarth & Cheney, 2015) as having different properties. It has also been argued in the literature that they can recombine these representations in several ways (Carruthers, 2004; Newen & Bartels, 2007; Danón, 2022). However, those who are unconvinced by these gradualist and deflationary views can replace my use of "concepts" and "propositional contents" with the broader notions of "representational units" and "intentional contents". The key idea to examine here is whether different animals can recombine the same stable representational units with more or less independence from the current stimulus affecting them and their previous experiences. This conjecture stands even if one chooses this alternative vocabulary.

[3] Here, I focus on the most basic cases of propositional contents about physical particulars. Nevertheless, one may find propositional contents that refer to other kinds of particulars (abstract entities, instances of properties, etc.). Additionally, there might be propositional contents that do not refer to any particular entity, as happens in the case of contents like "some cabins are red" (Burge, 2010).

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cepts of particulars involves the capacity to think about individual entities as the same ones, once and again, even if some of their properties change from one encounter to another (Strawson, 1953; Millikan, 2000; Camp, 2009, 2015). If all this is correct, concepts should be redeployable in thoughts with different propositional contents.

Some philosophers take one step further and argue that genuine thinking creatures must not only be capable of attributing predicative concepts to various particular entities and thinking about particulars as having different properties. They must also satisfy a strict version of what Evans (1982) calls the Generality Constraint (GC). GC is a demanding constraint according to which genuine thinkers must be capable of combining their concepts of properties and particulars in every admissible way. However, there are those who think that if we understand GC in this way, we will have to refrain from ascribing concepts to non-human animals. After all, empirical evidence suggests that animals' capacities to recombine their conceptual representations are limited (Camp, 2009; Carruthers, 2009; Beck, 2012).

But there are other alternatives. Philosophers like Camp and Carruthers argue that conceptual abilities come in different degrees and kinds. Consequently, they also defend that some non-human animals may have basic conceptual abilities (Camp, 2009; Carruthers, 2009). Following their lead, I will assume that various animals possess concepts and can recombine some of them in some ways. Nevertheless, I will not be concerned with which concepts or how many concepts they can or cannot recombine with others. Thus, putting it bluntly, my main interest will not be the Generality Constraint. I will be interested in distinguishing four kinds of conceptual recombination, differing mainly on how concept possessors must be related to factors such as their present and past perceptual experiences to be able to recombine their concepts in various ways. Some of these combinatorial capacities will allow them to recombine different concepts on a broader spectrum of external conditions than others. In the next section, I will examine each of them closely.

3. *Four kinds of conceptual recombination*

In her paper, "Putting thoughts to work: Concepts, systematicity and stimulus-independence", Elisabeth Camp (2009) draws an initial distinction between two ways in which cognitive creatures may recombine their concepts: the "full-blown" and the "causal-counterfactual". Camp thinks that human animals recombine their concepts in an (approximately) full-blown way. On the contrary, most non-human animals can only recombine them in a causal-counterfactual manner.

According to Camp, full-blown or spontaneous recombination requires the capacity to systematically recombine one's concepts of properties and particulars in an autonomous or self-generated manner. Causal-counterfactual recombinators, on the contrary, can recombine their concepts in some ways, but only when adequate stimuli affect them. Consequently, non-human animals with "basic cognition", limited to causal-counterfactual recombinations, are characterized as mere "passive reactors". In her words:

> The only thoughts that such creatures can think are thoughts about states of affairs that are more or less directly indicated by the external stimuli presently impinging on them, or else about states of affairs that immediately satisfy a present internal stimulus, like hunger or thirst. (Camp, 2009, p. 290)

Here, I will focus exclusively on the relationship between combinatorial abilities and external stimuli, leaving aside the incidence of internal stimuli on how and when a creature recombines her concepts.[4] Even with such a restriction in place, the notion of "present stimuli" that plays a central role in Camp's characterization of causal-counterfactual recombination admits two interpretations.

One alternative is to consider that the relevant perceptual stimuli must track and indicate actual states of affairs in the creature's surrounding environment. In this narrow interpretation, the "appropriate stimuli" that operate as the "right catalyst" (Camp, 2009, p. 291), triggering the content *a is F*, are stimuli indicating that *a is F* (here and now). Creatures with this combinatorial ability will be capable of recombining concepts *a* and *F* to think the content *a is F*, but only if they are affected by perceptual stimuli indicating that this is the case in their surroundings. They will be limited to representing what is the case "right here and now" and is perceptually accessible to them.[5]

Even though Camp refers to "stimuli presently impinging", she never states that they must indicate "present states of affairs". She only claims that they must be about states of affairs "more or less directly related to them". Hence, such present stimuli might not only indicate what is happening here and now. They can also be about what happened in the past, what will happen in the future, etc. Stimuli produced by dark clouds in the sky might indicate that there will be a storm here soon, stimuli caused by a fresh wolf track may be a sign that a wolf was here a while ago, etc.

According to this more lenient interpretation, creatures capable of causal-counterfactual recombination can combine some of their concepts, like those of particular a and property F, if they meet two conditions. First, they must be affected by present stimuli S indicating, for instance, that *a was F in the past*, that *a will be F in the future* or that *a is F at a distant place*. Second, they must have learnt from previous experience that S indicate that *a is F*, or they must have an innate disposition to treat these indirect stimuli as indicating

[4] As a consequence, I will only provide an oversimplified and partial taxonomy of how different creatures recombine their concepts. However, I hope that, despite its roughness, this initial account can be complemented, in the future, in ways that incorporate how different kinds of conceptual recombinations depend (or not) on internal stimuli.

[5] Some may object that creatures capable only of representing what is happening in their immediate environments do not possess genuine concepts. It has been argued that concept possessors must satisfy the stimulus-independence requirement. Hence, they must be able to use their concepts to represent things independently of the stimuli currently impinging on them (Camp, 2009; Beck, 2018). Nevertheless, as Quilty-Dunn (2020) points out, stimulus-independence is only one of the various cognitive requirements that pragmatists about concepts impose on concept possession. Quilty-Dunn rejects the pragmatist approach and adopts a fodorian view, according to which concepts are representations that do not require particular mental abilities for their instantiation. This allows him to reject stimulus-independence as a requirement for concept possession. I favor, instead, a version of conceptual pragmatism according to which concept possession may come in various degrees and kinds. Thus, even if concept possession involves multiple cognitive abilities, diverse creatures may have these abilities in different degrees or have most of them while lacking others. Hence, I can admit that some animals may have concepts (in a weak sense) even if their representational capacities strictly depend on current stimuli affecting them.

that fact.[6] Animals that recombine their concepts in this way can also use them in a broader range of thoughts. Since they can compose contents that go beyond what is happening here and now, they can not only perceive that *a is F*. They can also remember that *a is F*, anticipate that *a is F*, believe that *a is F*, etc. The only trick here is that they cannot spontaneously think such thoughts in all kinds of circumstances. To instantiate memories, beliefs, expectations, anticipations, etc., these animals have to detect environmental cues indicating that the relevant state of affairs took place, will take place or is taking place somewhere else. In this sense, their capacities for conceptual recombination still depend on specific current stimuli.

Based on these differences, we can distinguish two kinds of causal-counterfactual recombination. Some cognitive creatures might only be able to recombine their concepts when the appropriate stimuli, narrowly understood, affect them (at least in some domains). This means that they would be able to represent some contents —such as *a is F*— only when affected by stimuli with the function of tracking and indicating that *a is F* right here and now. These creatures would be displaying *narrow causal-counterfactual* combinatorial capacities.[7]

But let us suppose, instead, that we find creatures whose combinatorial abilities can be triggered by relevant stimuli in the broad sense, at least in some domains or contexts. These creatures would be capable of thinking about things that happened in the past, will happen in the future or are happening somewhere else as long as the right stimuli, functioning as indicators of these distant states of affairs, affect them. In such a case, we can claim that these animals are capable of *broad causal-counterfactual recombination*.

So far, I have subdivided Camp's notion of causal-counterfactual recombination into two sub-types. Now, I want to propose an analogous move in the case of spontaneous conceptual recombination. Imagine that some creatures can recombine their concepts *a* and *F* even if no current stimuli indicate that this is/was/will be the case. Moreover, they can do this even if present stimuli indicate that something different is the case. This ability does not only allow them to believe that *a is F*, remember, or anticipate, it but also to imagine that *a is F*, conjecture it, etc. Yet, they are incapable of full-blown spontaneous recombination because they suffer from one relevant constriction. They can only recombine *a* and *F* to form the content *a is F* if they have previously learnt by experience that a has property F or have an innate representation of such a content.

Since they can recombine their concepts no matter what stimuli affect them, these creatures can form an extended model of reality representing how things are both in their

[6] Animals capable only of causal-counterfactual recombinations will not be able to think that *a is F* if they are not affected by appropriate stimuli. They will also be incapable of thinking that *a is F* if they lack innate or learnt dispositions to "read" that stimuli as indicating that *a is F.* On the contrary, a creature capable of spontaneous conceptual recombinations may not satisfy these requirements but still be able to form contents like *a is F* through the operation of other cognitive processes (such as processes of inference, imagination, etc.)

[7] Let us suppose this is the only sub-kind of conceptual recombination that some animals can exercise (at least in some contexts or domains). In such a case, there would be a tight link between the contents they would be able to form and the conditions in which they would be able to do this. Very briefly, they would only be able to represent current states of affairs (and they would only be able to do that if affected by triggering stimuli indicating those current states of affairs).

immediate environment and further away in space and time. This model might even include representations of possible situations as long as these hypothetical contents are about states of affairs that they have previously experienced to be the case. More importantly, these animals can put all these representations to use in different contexts, no matter what they perceive in them. There is, however, one relevant limitation to their representational capacities. They cannot token innovative contents that require recombining concepts to represent states of affairs they have neither previously experienced nor have some innate representations about. Thus, in a sense, their capacities to form new propositional contents are somewhat modest. Even if they can free their thoughts from their present experiences and think about different contents irrespective of stimuli currently impinging on them, what they can think still bears substantive links with their previous experiences (or innate representations) of how things are. I propose to name this way of recombining concepts *lean spontaneous recombination*.

Things are different in the case of animals that can spontaneously recombine their thoughts in a robust sense. These animals can recombine some of their concepts no matter what innate representations of states of affairs they may have, what they currently perceive, what stimuli affect them, and what they have previously learnt to be the case. They are capable, for example, of thinking that *a is F* even if they have never experienced that *a is F* or even if they have experienced *a being not F*. All this allows them to form creative or innovative conceptual combinations representing states of affairs that they have not previously encountered, are highly unlikely (or impossible) to find in their environments, etc. It is clear that these animals are not mere "passive reactors". Instead, they are capable of freely "detaching" (Gärdenfors, 1995) or "decentering" (Currie, 2004) themselves from how things are and from their previous experiences to form contents that involve original, unlikely or even crazy conceptual combinations.[8]

So far, I have proposed to enrich Camp's original proposal by distinguishing four different ways in which animals may recombine their concepts:

a) a narrow causal-counterfactual way;
b) a broad causal-counterfactual way;
c) a lean spontaneous way;
d) a robust spontaneous way.

One should keep in mind that these varieties of conceptual recombination are not about *how many* or *which* concepts a creature can combine (Camp 2009, p. 290).[9] The differ-

8 In brief, unlike lean spontaneous recombinators, robust spontaneous recombinators can form propositional contents which are innovative in two senses. Firstly, robust spontaneous recombinators need not have previously experienced what these contents represent. Secondly, they can form contents representing things which go beyond what their species have learnt to be the case in their phylogenetic past and what has become part of their innate representational baggage. These contents result from processes of insight, imagination, reasoning, etc., in which spontaneous recombinators deploy their capacities to combine their concepts in all sorts of ways. As a result, at least in the paradigmatic case of human animals, they may end up thinking things that were never the case, others that are physically (or even metaphysically) impossible, highly absurd, etc.

9 In the end, however, this may have some impact on the spectrum of conceptual combinations that different creatures will make and the kind of mental contents they will be able to form. Animals that can

ences between them lie mainly in the broader or narrower range of external conditions in which cognizers can put their combinatorial abilities to use and in the kind of relationship that they must have with external stimuli and previous experiences for those recombinations to take place. Narrow causal-counterfactual recombination is only possible under very specific conditions because current stimuli indicating an immediate state of affairs must be affecting the creature if she is to represent that state of affairs. Broad causal-counterfactual recombination is slightly less stringent because the range of stimuli that can trigger it is broader, including stimuli indicating states of affairs that took place in the past, will take place in the future or are taking place somewhere else. In any case, causal-counterfactual recombinators lack the capacity to autonomously conjure up thoughts when not affected by the appropriate perceptual catalyst. Lean spontaneous recombination can take place irrespective of what stimuli are affecting the animals capable of it. Thus, they can spontaneously recombine their contents to represent various states of affairs no matter what external situation they are in, provided they have experienced things being that way or have an innate representation of them. However, even if they are free from the limitations imposed by current stimuli, these creatures' combinatorial capacities are still restricted by their previous experiences (or those of their ancestors). Finally, robust spontaneous recombination can take place even if none of these conditions is met.

Here I will assume that some animals can recombine some of their concepts, and I will focus on several previous tasks. First, I will examine how the four sub-types of conceptual recombination that I have distinguished are related to various ideas in the philosophical literature on the cognitive capacities of different non-human animals, their mental states, and the divergences between human and non-human cognition. Then, I will show how, sometimes, my proposal can help enrich those previous ideas. Finally, I will provide some empirical examples suggesting that, at least in some contexts, different non-human animals display one or another of these four types of conceptual recombination. I turn to these tasks in the next section.

4. *Kinds of recombination, kinds of minds, and empirical evidence*

In the previous section, I distinguished four types of conceptual recombination. Here, I will argue that this move is compatible with several philosophical proposals on various aspects of animal minds and can help enrich them. Besides, I will present some empirical evidence suggesting we can find these four kinds of recombination in the animal kingdom.

Before moving on, however, some caveats regarding how I will deal with empirical evidence are needed. The kinds of conceptual recombination distinguished here may correspond to how the minds of different animals work *tout court*. However, I will not be able

only combine their concepts when they are affected by specific stimuli run the risk of not thinking some contents because these conditions never materialize. Animals capable of spontaneously combining their concepts in all situations will not suffer such limitations. Thus, it seems that how many contents animals can think about depends not only on how many concepts they have and how many of these concepts they can recombine. It is also affected by how limited or varied the range of situations in which they can put their combinatorial capacities to use is. The relative productivity of animals' thoughts seems to be influenced by all these factors.

to provide empirical support for such an ambitious claim. Instead, I will offer some initial evidence in favor of a more modest conjecture: that, at least in some domains or contexts, different species use one or another of these varieties of conceptual recombination. I will examine a few illustrative examples of animals whose behavior suggests that they possess a bunch of stable, concept-like representations and recombine them in one or another of the ways that I distinguish here. Yet, I will not argue that these animals recombine their concepts in the same way in every context, nor will I claim that they cannot deploy more sophisticated combinatorial abilities in other situations. Supporting these claims requires a more thorough examination of different species' cognitive capacities than I can offer at this point.

4.1. Narrow causal-counterfactual recombination

Let us focus, first, on narrow causal-counterfactual recombination. As mentioned before, this is the ability to put together concepts to form different propositional contents (such as *a is F* and *b is G*), but only if one is perceptually affected by stimuli indicating that the corresponding facts are taking place in the immediate environment. Hence, the resulting contents can only refer to what is happening here and now and will be tightly linked to one's perceptual capacities.[10]

This kind of recombination might be present in primitive cognizers that can flexibly perceive different states of affairs in their environments but cannot represent the same contents if they are not facing stimuli indicating that things are thus and so. Notably, several philosophers make the bold claim that the cognition of many —if not all— non-human animals is indeed restricted to perceptually representing and responding to what is currently happening in their immediate environments.

Dummett (1994), for instance, suggests that non-linguistic animals only have "proto-thoughts" of a perceptual and practical nature that they cannot detach from present activities and circumstances. When animals visually perceive their environments, they not only see the shape, material properties, and position of the objects around them but also visualize, simultaneously, how their actions might transform these things. Besides, we can evaluate these proto-thoughts as correct or incorrect. However, Dummett does not go into much detail regarding the nature of their contents.

In a similar vein, Nanay (2013) affirms that non-human animals' behavior is entirely guided by "pragmatic representations" that immediately direct their ongoing bodily activities. These are perceptual states representing objects as having some properties. Consequently, pragmatic representations can be correct or incorrect. In the former case, they guide the animals' actions adequately. In the latter, they don't. However, this does not

[10] I assume that these perceptual representations always represent some state of affairs happening "right here and now". Consequently, even if a creature makes a mistake and misreads the stimuli affecting her, she will not end up representing something that is the case somewhere else or at another time. Instead, she will falsely represent an immediate and current state of affairs. Of course, in such a case, she may form a content about a state of affairs (for example, *that a is F)* even when she is not affected by stimuli indicating that fact. But she will do that as a result of an erroneous use of her (normally well-functioning) capacity to take stimuli S to indicate that *as is F*. She will not be representing *that a is F* because of a general spontaneous ability to do so independently of the presence of stimuli S.

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mean they must have a syntactically articulated propositional structure. Another distinctive feature of pragmatic representations is that they exclusively represent "action properties", i.e., they only represent properties relevant to guide the agent's actions.

Gärdenfors, in turn, distinguishes "cued" from "detached" representations (1995; 2006). Cued representations stand for something that is present in the animal's current external situation or has been recently present. Detached representations, in contrast, may stand for objects, events, etc., that are neither currently present nor triggered by some recent event. Gärdenfors conjectures that while some animals (like mammals and birds) have systems of detached representations, other cognitively simpler species —like reptiles— only have cued ones.

All these proposals share the idea that there are at least some species of non-human animals whose representations cannot "float free" from their current environment but are strictly tied to it instead. If there are creatures that, at least in some contexts, recombine their concepts in a narrow causal-counterfactual way, they will show the same limitation. They will be able to form many different thoughts, but these thoughts will be only about what they perceive to be the case.

However, the thesis according to which some animals recombine their concepts in a narrow causal-counterfactual way, at least in some contexts, is not equivalent to the claim that they can only represent what is currently happening in their immediate environment. Animals capable of narrow causal-counterfactual recombination have mental states with structured contents composed of recombinable units allowing them to represent some particulars as having some properties. When philosophers claim that various (or even all) animals can only represent what happens "here and now", they do not usually take these further commitments.[11] Then, in a way, crediting some animals with causal-counterfactual recombinational abilities, even of a narrow kind, is making a somewhat bold move. It means claiming that despite being incapable of representing what lies beyond their here-and-now, they still share with cognitively more sophisticated creatures several abilities: the capacity to form propositional contents, to represent things as being in some ways, to show some productivity in their thoughts, and to recombine and redeploy the same concepts in different contexts.

Does empirical evidence justify these claims? To approach this question, we should first be clear on what kind of evidence we are looking for. On the one hand, we need to find examples of behavioral patterns that can be adequately explained by attributing to the animals acting in these ways perceptual representations of what is the case in their immediate environments. On the other, we must have evidence that they can recombine the same stable representational units (concepts) to represent different states of affairs, at least as long as they are affected by perceptual stimuli that function as direct indicators of those states of affairs.

One may find plausible examples of this kind of conceptual recombination in many animals that can perceptually track particular bodies (e.g., predators, prey, shelters, or

[11] Dummett explicitly rejects the propositional and conceptual nature of non-human animals' representational contents. Nanay seems tempted to follow the same path. Gärdenfors does not say much about whether these contents are propositional or non-propositional, structured or unstructured, composed of re-combinable units or not, etc.

conspecifics), register some of their properties, and perceptually anticipate some of their changes. An illustrative case comes from the study of nest defense responses in birds. Parenting birds have to defend their nests or young from different predators. However, defense responses are risky for the parents, and the birds would benefit if they could balance the degree of threat posed by a predator to the eggs and chicks and the danger for the adults themselves. Some studies by Sordahl suggest that two shorebirds, American Avocets and Black-necked Stilts, can do this since they discriminate between sub-types of predators depending on the danger they pose to adults, chicks, and eggs (Sordahl, 2004).

In a series of field observations and experiments, Sordahl found that avocets and stilts responded more or less aggressively to different predators, accordingly to the threat they posed to the defending parents and the eggs or chicks. In their natural environments, their responses to mammals were weak and sparse, while in the case of humans, they were of intermediate intensity. In the case of avian predators, their responses were more aerial and stronger. Nevertheless, they still reacted more or less intensively to avian predators depending on how risky they were for them. Finally, Sordahl detected that stilts and avocets who had eggs gave more aggressive responses to gulls (predators that eat eggs) than those who had chicks. Analogously, when they had young, these birds gave more aggressive responses to herons (which eat young) and less aggressive responses to gulls. In contrast, birds that had lost their nests or broods showed no reaction to predators.

Sordahl's studies show that stilts and avocets can distinguish predators from non-predators (since they do not respond aggressively either to novel artificial objects in experimental studies or to other species that are not predators but resemble them). They also suggest that these birds discriminate between predators that are more dangerous than others or between predators that are more dangerous to the eggs from predators that pose a greater risk for the young. I find this consistent with the idea that these animals have combinatorial capacities allowing them to do two things: represent different kinds of predators and attribute various properties to them. They may, for instance, represent gulls as *predators that are highly dangerous for the eggs* and also *as being mildly dangerous for the parent*. Or they may represent herons as *highly dangerous for the parent* and as *chick-eaters*. Yet, for all we know, all these complex representations about different sub-types of predators and the kinds and degrees of danger they pose are strictly triggered by the perceptual detection of each predator in their immediate environment. Therefore, these seem to be cases involving causal-counterfactual recombination. Other birds also show subtle capacities to discriminate different types of enemies in ways that are sensitive to the kind of threat they pose, the contextual situation they are in, etc. (Gelbach & Leverett, 1995; Whittam & Leonard, 2000). Further examination of these data may provide other plausible candidates for causal-counterfactual recombination.

4.2. Broad causal-counterfactual recombination

Let us focus now on broad causal-counterfactual recombination. Creatures that recombine their concepts in this way have more powerful representational capacities than those only capable of narrow causal-counterfactual recombination. It should be transparent why this is so: these animals may combine their concepts of objects and properties not only when they are perceptually affected by stimuli indicating that something nearby is the case but also when current perceptual cues indicate that something was the case, will be the case, is

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the case somewhere else, etc.[12] However, they still suffer from two limitations. First, they cannot choose when or in what situations to represent these things; they can only do so when specific stimuli affect them. Second, these stimuli indicate that some state of affairs is/was/will be the case for the following reason: there is a causal or correlational link between the latter and the former that these animals have learnt or came innately equipped to track. But there is no similar causal or correlational link between current stimuli and states of affairs that have never happened, are imaginary, fictitious, etc. So, it seems that creatures that recombine their concepts in a broad causal-counterfactual way will not be capable of representing such contents.

Creatures with broad causal-counterfactual combinatorial capacities are similar, in some key respects, to what Millikan describes as "pushmi-pullyu animals." According to Millikan, many (if not all) animal representations are "pushmi-pullyu representations" (1995, 2004). These are perceptual representations with one sole function: to guide the animals' immediate actions directly and non-inferentially. They can do so because they are two-faced representations that simultaneously fulfil a descriptive and a prescriptive function. Thus, they tell their owners how things are out there and what they should do about it. Relevantly to our discussion, Millikan's pushmi-pullyu representations often refer to events that are distant both in space and time. Yet, animals frequently token them in response to the perception of current states of affairs indicating that something has happened in the past, will happen in the future or is happening at a distant place. An example of this is the animal for whom a frosty night or a low angle of the sun serves to release winter-preparation behavioral patterns.

But there are reasons not to rush into identifying animals that recombine their concepts in a broad causal-counterfactual way with animals that token pushmi-pullyu representations about distal affairs. Animals capable of broad causal-counterfactual recombination must possess re-deployable and recombinable conceptual units. However, it is not clear that Millikan's pushmi-pullyus are composed of concepts.[13] Besides, the notion of broad causal-counterfactual recombination imposes no constraints on whether the contents that a creature forms by recombining her concepts have a dual (descriptive and prescriptive) nature or, more traditionally, have only one of these functions. In brief, animals capable of causal-counterfactual recombination might be pushmi-pullyu creatures (at least as long as we admit that their pushmi-pullyu representations are composed of recombina-

[12] There might also be differences in the representational capacities of creatures capable of broad causal-counterfactual recombination. Some of them may, for example, be capable of remembering the past but not of representing future states of affairs, or they may have some kinds of memory but not others, etc. There is much work to do to map these subtler variances. What I am emphasizing here is what they have in common: if they are affected by the appropriate stimuli, all of them can represent (some) things that go beyond what is happening in their immediate environments.

[13] At least not always. Millikan (2004, p. 160) acknowledges that pushmi-pullyus can be "more or less articulate". I take this to mean that, even if they represent some complex states of affairs, they may differ in how many (and in which) variable and redeployable components constitute them. But, if this is so, there might be some pushmi-pullyus that are extremely unarticulated and represent that some things are some way, but in a holistic manner that admits no variation or decomposition. These pushmi-pullyu representations would not be composed of the kind of isolable and re-combinable units that we take concepts to be.

ble concepts). Yet, they could also be the owners of detached propositional attitudes, such as beliefs and desires, with only a prescriptive or descriptive function.

Turning to this second possibility, many researchers working on animal cognition consider that we can attribute to some non-human animals purely descriptive or prescriptive mental states that go beyond their perceptual here-and-now. These may include different kinds of memories (Clayton & Dickinson, 1998; Schwartz & Evans, 2001; Keven, 2016), beliefs (Saidel, 2009; Andrews, 2015; Newen & Starzak, 2022), future expectations and plans (Mulcahy & Call, 2006; Osvath & Osvath, 2008; Janmaat *et al.,* 2014), etc. However, we should keep in mind that creatures that recombine their concepts in a broad causal-counterfactual way will be capable of having these mental states only when facing adequate stimuli. Thus, we should not consider that the class of animals capable of believing, remembering, anticipating, etc., is co-extensional with the class of animals that recombine their concepts in a broad causal-counterfactual way. Some animals might spontaneously form such mental states in a wider range of situations and, as a result, they should be credited with more sophisticated combinatorial capacities. Hence, creatures that can recombine their concepts in a causal-counterfactual way are just a sub-group of those that can believe, remember, anticipate, etc.

At this point, we can ask: are there empirical grounds to claim that some animals can distance themselves from their environments in *what* they represent, coming to have contents that go beyond what they can perceive but, at least in some contexts, remain passive regarding *when* they can form such representations? To answer this question, we need to look for evidence suggesting that: i) some animals have beliefs, expectations, plans, etc., with contents that exceed what is currently happening in their immediate environment, ii) they only form these contents when they are presently affected by appropriate stimulus, and iii) these contents are composed of recombinable concepts that can be redeployed in different thoughts.

I think that we can find multiple instances of behavior satisfying requirements i)-iii) in animals that interpret the communicative signals of others to gather information about distant states of affairs. One plausible example is the famous "waggle dance" of honey bees. As is well-known, scouting bees dance in front of other bees when they return to the hive after their foraging expeditions for items such as nectar, pollen, water, etc. Their dances encode information about the distance and direction of a recent foraging site from their hives. These dances are composed of several straight waggle runs followed by a clockwise or counterclockwise loop back to the start of the new run so that the duration of the run corresponds to the distance of the food source and the angle of the run with respect to the gravity corresponds to the site's direction relative to the compass direction of the sun (Dyer, 2002). Researchers have found that the information encoded in waggle dances is effectively transferred to the spectator bees, even after several hours, or even days, from the original flight of the scouter's bees (Riley *et al.,* 2005). Arguably, waggle dances indicate to the spectator bees a state of affairs —the presence of food at the foraging site— that takes place beyond their current perceptual access. Consequently, spectator bees seem capable of forming representations about things that are not happening in their immediate environment.

Moreover, some philosophers argue that honeybees must have highly articulated representations of space, objects and places (like the hive, the nectar site, the sun, etc.) to behave as they do. Arguably, they must also be capable of recombining them in several ways (Carruthers, 2004, 2009; Tetzlaff & Rey, 2009). For instance, Carruthers thinks that we can attribute them representational contents such as *nectar is 200 meters north of the hive*, *nectar is 400 meters south from the hive*, *the hive is 200 meters north of the nectar*, *the hive is 400 meters south of the nectar*, etc. If this is correct, honeybees must have minimal representational units (concepts) which they can systematically recombine to produce different contents. Moreover, as I have just argued, they must be capable of instantiating contents about states of affairs that they are not directly perceiving. Yet, the tokening of such contents appears to be exclusively triggered by specific stimuli —the waggling dance of the scouting bees— that are reliable indicators of these states of affairs. Hence, it seems fair to consider them capable of broad causal-counterfactual recombination.

Like honeybees, many other animals produce and interpret communicative signals portraying relevant information about distant states of affairs. Thus, the empirical literature on animal communicative signaling may provide further examples of causal-counterfactual conceptual recombination. It might be interesting to consider, for instance, the "food calls" that several birds and mammals produce in feeding contexts. These are calls systematically elicited by specific perceptual stimuli indicating the presence of food. Additionally, there is evidence that, at least in some species, such calls also provide information about the quantity, quality and divisibility of the available food (Clay *et al.,* 2012). Male fowls, for example, give calls when there is food nearby and increase their call rates in response to foods of higher quality. Importantly, hens are more likely to approach a cockerel emitting food calls than a silent one. And they are even more likely to go near the male when the calls indicate a preferred food than a non-preferred one. Besides, they show this tendency even when they do not have perceptual access to the food themselves (Marler *et al.,* 1986).

As I see it, the hens' responses to the calls suggest that they can represent some things they are not perceiving: i) the presence of food; ii) the quality of food. The hens also seem to combine these representations to form complex contents about different states of affairs (roughly: *there is high-quality food* or *there is some low-quality place over there*). However, they only display these representational capacities in response to specific eliciting stimuli: the food calls indicating these different facts. This might be, then, another likely case of broad causal-counterfactual recombination.

4.3. Lean spontaneous recombination

What about lean spontaneous recombination? Creatures capable of this kind of conceptual recombination can freely think about things being some ways in all sorts of situations, provided they have had previous experiences of such facts or have an innate representation of them. This gives them a greater capacity to flexibly pursue their aims and goals by producing different conceptual recombinations to guide their behavior, no matter which external stimuli affect them.

Can we attribute this kind of spontaneity to any non-human animals? Before considering some empirical candidates, let us remember what we are looking for. We need evidence of animals that redeploy their conceptual abilities, independently of any particular triggering stimuli or cue, to form thoughts about states of affairs that they do not currently perceive. However, these animals will not be able to represent facts if they have not learnt them to be the case by previous experiences. As mentioned earlier, these claims about what some species cannot do are peculiarly hard to establish empirically. But, at least, the evidence must be compatible with that conjecture. Thus, the animals to be considered should not display a capacity to recombine their concepts in novel ways that depart from how they have learnt things to be or how they came innately equipped to represent them as being.

Some plausible examples of this kind of conceptual recombination can be found in cases of instrumental reasoning by non-human animals. Camp and Shupe (2017) claim that this kind of reasoning involves forming "...the intention to achieve a goal, G, by identifying a state of affairs M, which is neither inherently desirable nor currently actual, as-to-be-done because it will centrally contribute to actualizing G." (Camp & Shupe 2017, p. 100). Creatures who reason instrumentally do not respond directly to their immediate environment. Since they form representations of intermediate states of affairs that are neither currently the case nor indicated by current stimulus, they enjoy the independence required to be spontaneous conceptual recombinators. But are instrumental reasoners recombining their concepts in a lean or a robust spontaneous way? The answer to this depends on what kind of conceptual combinations they can make. If they combine their concepts in novel ways, which depart from their innate representations and previous experiences of how things are, they have a robust capacity for spontaneous conceptual recombination. If they show a more modest ability to autonomously represent a state of affairs M, but they can only do so if they have had previous experiences (or innate representations) of M, then they are lean spontaneous recombinators.

What happens in the case of non-human animals? Even admitting the controversial claim that some animals are capable of instrumental reasoning, one must examine what representations they form and how innovative or dependent on previous experiences these representations are before drawing any conclusion on what sorts of combinatorial capacities they are using.

Camp and Shupe (2017) claim that instrumental reasoners must represent a non-actual state of affairs M and recognize how M is connected to their goal G. This requires that they represent M by using "decoupled" representations that they can hold in mind simultaneously with representations of actual states of affairs, without confusing ones with the others. According to these philosophers, there is evidence of non-human animals that can use this kind of representations (see also Suddendorf & Whiten, 2001). Furthermore, they claim that: "there is substantial, if not incontrovertible, evidence for IR [instrumental reasoning] in a range of non-human animals, especially rodents, corvids and primates" (Camp & Shupe 2017, p.105). Some examples that come to mind are cases of animals that spontaneously seek, or even make, a tool to solve a problem that they are facing.

Here is a case to consider: chimpanzees at the Goualougo Triangle have been recorded arriving at termite nests carrying pre-made puncturing or fishing tools necessary for particular tasks (Carruthers, 2009; Byrne *et al.,* 2013). Once at the nest, they use these tools in a two-step process. The first step is to puncture the ground using a puncturing stick to access subterranean termite nests. The second is to insert a fishing stick to fish the termites using the access routes previously created. These observations suggest that the chimpanzees walk toward the fishing nest with a goal in mind. Moreover, they seem to anticipate their future needs and use a mental representation of a suitable tool in advance of the task they are about to perform at the termite nest (which they are not currently perceiving) (Byrne *et al.,* 2013). In Camp and Shupe's vocabulary, it seems that they act guided by a representation of an intermediate state of affairs regarding the kind of tools that they will have to use to reach the termites at a distant location. Besides, no specific current environmental cue appears to be triggering such behavior. Based on this, one can argue that these primates form representations of the kind of tool needed to pursue their goals by spontaneously recombining previously available concepts of the tools, the nest, and the steps involved in the fishing process. Yet, chimps have been frequently observed using sticks to fish termites in the wild. Thus, their putative intermediate representations are most likely based on previous experiential knowledge. All these lead us to conclude that they recombine these concepts in a lean spontaneous way.

We may also find interesting examples of lean spontaneous recombination in several recent studies on animal memory. Researchers in this field frequently distinguish between two kinds of situations. In one of them, animals recognize a stimulus previously experienced in the past; in the other, animals actively recall information from memory, even if there is no current triggering stimulus, by spontaneously generating memories about a specific situation or context. Although recall memory is particularly difficult to study in non-linguistic animals, some studies suggest that several animals, including great apes and some birds, enjoy this capacity (Flessert & Beran, 2021).

In one of these studies, Martin-Ordas *et al.* (2010) tested the capacity of great apes to recall when and where two types of food had been hidden. In the experiment, the subjects observed an experimenter hide two pieces of food in two of three available locations. One was a preferred but perishable frozen juice, the other a less preferred but non-perishable grape. They allowed the apes to go and look for one of these items, either after five minutes or one hour. Now, the frozen juice was edible after five minutes, but it melted and became inedible after one hour. Thus, the researchers reasoned that if the apes remembered when and where the food had been hidden, they would prefer the frozen juice on the five-minute trials because they would expect it to be edible. On the contrary, they would reverse this preference on the one-hour trials based on their knowledge that the frozen juice would be inedible. The apes responded to the tests precisely in this way.

This study shows that great apes can spontaneously recall information acquired in the past, and they can do so even when there is no current environmental stimulus that functions to indicate these past events. It also suggests they can recombine representations of different types of food ("frozen yoghurt" and "grapes") with representations of diverse locations, food edibility, etc. Yet, all they remember is what they have previously experienced. No innovative recombinations of concepts are required to form such memories. Then, this seems to be another empirical example of lean spontaneous recombination. The literature on spontaneous recalling in non-human animals will probably provide others.[14]

4.4. Robust spontaneous recombination

Finally, we reach the most potent of our four kinds of conceptual recombination: the robust spontaneous one. Creatures with this capacity can recombine their concepts in different ways no matter what they have experienced and what stimuli currently affect them. As a consequence of such full-fledged independence, they can form new propositional con-

[14] This is an adaptation of a paradigm originally used with scrub jays by Clayton & Dickinson (1998). Their tests also indicate that scrub jays can remember what type of food they hid, when and where, and use these memories to solve the task even in the absence of perceptual cues (olfactory or visual) emanating from the food (Clayton 2017, p. 230). Like great apes, scrub jays also appear to show capacities for lean spontaneous recombination.

tents that go far beyond their experiences, encompassing unlikely states of affairs, absurd or comic ones, highly unusual situations, etc. These animals also enjoy a capacity for invention and creativity that those limited to other ways of recombining their concepts lack.

It transpires from many contemporary philosophical views that humans are the only animals that approximate this full-blown version of strong spontaneous recombinability. This could help explain why we are far more innovative and creative than other species. It might also be one of the reasons why we not only represent what is actual or useful but are also so keen on inventing narratives, art, jokes, ironies, etc.

Nevertheless, some selected (and admittedly controversial) examples of creativity and innovation in non-human animals suggest a limited but genuine capacity for robust spontaneous conceptual recombination. If this is the case, we need to explain why there is a difference between the scarce evidence of creative accomplishments in animals and humans' much more encompassing capacity to invent all kinds of objects, practices, representations, etc. One conjecture is that animals can recombine some of their concepts, but not others, in this way. For example, they may be able to recombine some concepts innovatively, but only within restricted domains that are particularly important for their survival.

Let us now turn to what evidence may indicate a capacity for robust spontaneous recombination in non-human animals. The requirements that such evidence has to satisfy are challenging. First, it must indicate that some animals spontaneously recombine some concepts with others to represent various states of affairs regardless of what perceptual stimuli presently affect them. Secondly, it must show that these animals can recombine their concepts in creative or innovative ways to represent states of affairs that they have never experienced. This last requirement is tricky because it might be hard to establish what previous experiences animals possess and whether they are currently tokening a creative or innovative thought. Despite these difficulties, let me present what I take to be a plausible example of behavior involving this kind of recombination: the invention of a hook-shaped tool by a New Caledonian crow.

Weir *et al.* (2002) observed a female crow spontaneously bending a straight wire into a hook and using it to lift a bucket with food placed inside a vertical pipe. This surprising tool-making episode occurred on the fifth trial of an experiment in which two crows had to choose between a hooked and a straight wire. Unexpectedly, the male crow removed the hooked wire leaving the female crow with only one tool available: the useless straight wire. The female crow initially attempted to lift the bucket with the straight wire. However, after several unsuccessful attempts, she suddenly began to manipulate the wire turning it into a hooked tool that she immediately used to retrieve the food. Later on, Weir *et al.* conducted a new series of experiments in which they placed a straight piece of wire on top of the tube and observed the bird's responses. They found that, in most trials, the female crow kept on successfully bending the wire until obtaining a hooked tool that she used to fetch the food.

There are reports of New Caledonian crows making two sorts of hooks with various techniques in the wild. Yet, Weir *et al.* remark that the crow of their experiments used a different method that would probably be ineffective with natural materials. Besides, she had no previous training with pliant material, and had never been observed performing similar actions on other materials. Finally, she had no model to imitate this novel behavior and no opportunity to learn how to hook wire by chance or by reinforcement. These points are important because they suggest that the crows' behavior was an act of innovation and not the mere repetition of some previous tool-making experiences.

Returning to our discussion in the previous section, one could claim that this is a case of creative instrumental reasoning. To solve the problem, the crow needs to represent an intermediate situation M (the wire-bending) that will allow her to obtain a hooked-shaped tool and figure out how this tool can help her achieve her goal. But, as Weir *et al.* point out, this crow lacks previous experience in wire-bending. She may have previously learnt that other natural materials can be bent, but she has not learnt anything similar about the wire. Now, to succeed at building the needed tool, she has to represent the straight wire as having a property that it does not presently have and that she has never experienced as a property of wire: the propensity to be turned into a hook. It appears then that the crow is combining a concept of a particular object and a property concept autonomously and innovatively. Thereby, this also seems to be a case of robust spontaneous conceptual recombination.

Bird and Emery (2009) report that hand-reared rooks show similar abilities to spontaneously create wire hook tools, despite not using tools in the wild. The researchers provided four rooks with a straight wire and the same bucket apparatus used with New Caledonian crows. All the rooks modified the wire to build a hooked-shaped tool, and they managed to retrieve the food. Bird and Emery emphasize that these birds created tools out of new material, even though they have had no previous experience with hooked wire, and their species do not make tools in the wild. What this shows, they argue, is that the rooks must have realized how to manufacture the tool by insight and not by a trial-and-error process. I think it also shows that these rooks have, just as Betty did, a capacity to recombine some building-block concepts in a robust spontaneous way. This capacity allows them to represent a material they have no previous experience with (wire) as having a property that it currently lacks: a hooked shape.[15]

Studies on animal creativity and innovation may provide further evidence of animals recombining their concepts in novel ways to represent states of affairs that they have not previously experienced. They may also help us assess how widespread cases of robust spontaneous recombination in the animal kingdom are. Meanwhile, all I want to suggest is that we already have some examples of non-human animals capable of recombining their concepts with a fair degree of independence from the external stimulation that affects them and from previous experiences.

[15] Laumer *et al.* (2017) studied whether another species, Goffin's cockatoos, can innovatively build a hooked-shaped tool out of pliant materials despite showing no ecological predisposition to bend materials in their natural environments. In their studies, the researchers provided the birds with materials to bend or unbend in order to build functional tools to reach food placed inside some containers. They divided the birds into two groups, one receiving scaffolding steps and the other receiving the same number of opportunities to manipulate de apparatus and the materials but no scaffolding. Three out of a total of thirteen birds succeed at building the appropriate hooked-shaped tools and using them to retrieve the food. One of them did not receive any previous scaffolding. According to the authors, the fact that only some birds could solve the task and that none of them could do that from the first trial shows that these cockatoos have to individually innovate the solution. It also suggests that the bird who lacked any scaffolding spontaneously represented states of affairs that she had not previously experienced (e.g., that pliable material can be bent to build a hook and that a hook can be used to retrieve the food). If this is correct, we can add Goffin's cockatoos to our list of animals capable of robust spontaneous recombination.

5. *Conclusion*

Throughout this paper, I have distinguished four ways in which different animals may recombine their concepts. I have also examined some cognitive capacities and limitations that can be explained by the fact that a creature recombines her concepts in one or another of them. Up to a certain point, this taxonomy coincides with previous philosophical ideas on the cognitive abilities of non-human animals and the differences between animal and human cognition. However, my proposal differs from previous ones at critical points, given its focus on how different creatures' combinatorial capacities depend (or not) on their relations with perceptual stimuli and prior experiences. In the long run, the taxonomy offered here may help explain systematic differences in the behavioral patterns that diverse species display, at least in some specific domains or contexts. More ambitiously, it may even reveal interesting ways of classifying together various species in virtue of how they can recombine their concepts to represent the world.

But do we have empirical evidence in its favor? Are there non-human animals capable of recombining their concepts in the ways I have distinguished? Answering these questions would require a much more thorough examination of empirical evidence than I have provided here. Nevertheless, I have offered examples of animals whose behavior gives us initial reasons to think that, at least in some domains, they can recombine their concepts in one or another of the ways previously discussed. Paying further conceptual and empirical attention to these combinatorial capacities may enhance our overall knowledge of the different kinds of minds surrounding us. It may also improve our understanding of what we have in common and what distinguishes us from them.

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