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THE INTERWEAVING OF THE CONCEPTS OF COGNITION, BEHAVIOR, AND MIND IN ETHOLOGICAL STUDIES

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Abstract. Behavior is a particular type of organic reaction. It is a cognitively guided reaction: it is an organic reaction guided by cognitions; and cognitions are registers of the internal states of an organism, or of the states of its environment, which allow that organism to functionally adjust the patterns that govern those particular organic reactions that are its behaviors. In turn, the mental states of a living being, its mind, are the set of its cognitive states; that is, the set of states resulting from cognitions that dispose it and allow it to behave in certain ways.

Keywords: animal cognition • animal mind • behavior • ethology • mental state

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I will not discuss issues of Philosophy of Mind, nor issues of a possible Philosophy of Animal Mind; instead, I will discuss issues of Philosophy of Science. Thus, as far as the notion of mind is concerned, I will not attempt a delimitation of it that can and should serve as a basis, or as a definition, for a science of mind. In this case, of the animal mind. My approach, it may perhaps be said, is more traditional and even more modest than that. In the manner of classical studies in the Philosophy of Science, I will attempt to make explicit, or to elucidate, concepts that are already in use in a given domain of scientific research; and, for the same reason, I believe it is appropriate to say that my reflection will fall in the field of the Philosophy of Biology. I am going to talk about ethological studies, which are a domain of biological sciences. Thus, having as first reference the way in which the concepts of behavior, cognition and mind are intertwined in the field of Cognitive Ethology, I will attempt a delimitation of these concepts that, assuming this intertwining, it will intend to be valid for ethological studies in general; despite the way in which classical Ethology hid, or concealed, the cognitive presuppositions that allowed it to pose and solve its problems (Jamieson & Bekoff 1996, p.65; Allen & Bekoff 1997, p.31; De Waal 2016, p.41).

Cognitive Ethology, I understand, highlights something inherent to all ethological studies: the cognitive dimension of what we call 'behavior'. I will argue, therefore,

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that the conceptual analysis of the theoretical developments of Cognitive Ethology allows us to see that, implicitly, all studies of animal behavior involve the mutual underpinning, sometimes tacit, of the notions of behavior, cognition, and mind. This is so because the notion of behavior, if we do not want to reduce it to the notion of organic reaction in general, entails an inherently cognitive dimension whose consideration allows us a better understanding of what we are to understand by *mind*, *mental state*, *mental process*, and *mental capability*. In fact, attributing mental states to a living being is nothing more than attributing cognitions and cognitive-behavioral abilities to it: capacities to orient its behaviors, and to solve problems, in a different way from that which can occur in the case of mere physiological reactions. That is to say, a living being has a mind to the extent that it can perform behaviors that are distinguishable from these reactions; and this is true for all animal species, including *Homo sapiens*.

1. Behavior and cognition

Behavior, as Ruth Millikan (1993 p.137) correctly emphasized, is a reaction of a living being tending to control variables of its external or internal environment, or to modify the way in which these variables are affecting it. But I believe that another defining element of what we mean by behavior lies in the fact that the degree of functional adequacy of a behavioral response can always be registered by that living being. The latter is what allows the response pattern of that reaction to be corrected in its subsequent occurrences, and it is these registers that allow the adjustment of behavioral reactions, which we have to characterize as cognitions. The cognitions of an organism are the registers that this living being has of its internal states, or of the states of its environment, and which allow it to adjust, optimize, or re-try its behavioral reactions. The mind of a living being, for its part, can be characterized either as the capacity to have cognitions or cognitive states, or as the set of those states.

Thus, the mental processes of a living being can be understood as the changes that occur in those cognitive states, especially insofar as such changes are caused by cognitions: by registers of states of the environment that allow that living being to functionally adjust its behavior. Mental processes, then, are the cognitive processes that modify those mental (or cognitive) states of an organism: they are changes of those cognitive states whose most important feature is that they are produced by cognitive registers. Cognitions are permanently configuring and reconfiguring the cognitive states of an organism, and to affirm that, it is the same as saying that cognitions are configuring and reconfiguring the mental states of that organism.

Nonetheless, in order to understand this close, and inevitable, intertwining between the concepts of mind, behavior, and cognition, I will begin with a very general

point: every system is permanently affected by the states and events that occur in its surroundings. However, only in some cases do we say that the system detects or registers those states or events (Caponi 2024a, p.210). The temperature of a stone alters as the temperature of its surroundings changes, but we would hardly say that the stone detects or registers these changes. Usually, we say that a system registers or detects a change, or a state of its surroundings, when, in the face of such a situation, that system reacts or responds in a way that, from a certain point of view, can be considered as functional. That is to say, we speak of the detection of a state or change occurring in the surroundings, when such registration makes possible, or triggers, a reaction that can be considered as adequate to an intrinsic goal of the affected system; or, in any case, as adequate to a use or purpose that we are giving to that system. The first case would be that of the photocell of an automatic door that captures the movement of someone entering a store, and that would also be the case of many reactions that occur in living systems. The second case, meanwhile, could be that of the stone whose temperature may indicate that it has just been exposed to a heat source. Here we can also say that the stone has registered a state of the surroundings, just as we say that a climatic change has been recorded in certain geological strata. However, that record is only such by reference to us, observers, and not by reference to the mode of operation of the observed system itself.

It is not so, however, in the case of the photocell, or in the case of a radio, that registers a certain signal; and it is less so in the case that interests us here: that of a living being that registers states of some variables of its environment, reacting or responding to that change. This is what happens in the case of those reactions that can be characterized as physiological adaptations, such as sweating in response to an increase in the temperature of the environment, or pupil contraction in response to an increase in brightness. Clearly, there we can speak of the registration of a state, or a change in the state, of the environment, which triggers a functional response. That is to say, the system is not only affected by that circumstance, but it also responds or reacts functionally to that circumstance; and what modulates or guides that reaction is the way it captures the configuration of variables that has affected it. We say that the system captures, and not that it is just affected by that change, because that register, and the response to it, are functionally modulated: both are patterned and connected by the organization of the system in such a way that the response in question can contribute to preserving that organization independently of the contingencies of the environment that disturb it.

Nevertheless, in view of the subject discussed here, it is necessary to introduce a partition in the universe of those registers that, as I have been saying, a living being can make of the states of its external environment and also, of course, of its internal environment. I am referring to the distinction between those registers that enable and guide mere physiological reactions and those other registers, which can be labeled

as cognitions, that enable, trigger, and guide behavioral reactions. I am assuming, in effect, a distinction between, on the one hand, mere physiological reactions and, on the other hand, behaviors; and I am associating that distinction with the notion of cognition. Behaviors would be a subclass of the reactions that a system can give to the contingencies of its external and internal environments, and cognitions would be a subclass of the registers that a system can have of those configurations of variables to which it reacts. Cognition, say Simona Ginsburg & Eva Jablonka (2019 p.8), involves an interaction between a sensing mechanism and an effector mechanism. The uptake made by the sensing mechanism would be cognition itself, and the response given by the effector mechanism, by virtue of that cognition, would be the behavior.

Thus, given any living being, X, we will say that its behaviors (Cs) are those reactions of it that fulfill these conditions (Caponi 2024b, p.51):

(1) Cs change the relationship of X with its environment, either by modifying variables of that environment or by merely changing its position in it.

(2) X can register the adequacy or functional appropriateness of this new relationship with the environment, being able to adjust it with other reactions guided by this or other cognitive registers.

Note, in this regard, that the first condition is not met in the case of physiological reactions, such as sweating in response to a rise in ambient temperature, or pupil contraction in response to an increase in brightness. On the other hand, in the case of a behavior, as emphasized by Millikan (1993, p.137), the living being modifies some parameter of its environment, or it changes its position in that environment. The first case, the modification of the environment, is what happens when a spider spins its web (*cf*. Viera *et al* 2007, p.57); and the second, the change of position, or situation, in the environment, is what happens when we, faced with an intense luminous stimulus, in addition to contracting our pupils without even perceiving it, also try to adjust the position of our head, or try to make a visor with our hand, to avoid the discomfort that the sun's rays generate in us. The first, the contraction of the pupils, would be the physiological reaction: the purely physiological accommodation or adaptation. The second, the change in the position of the head or the gesture to block the light, would already fall within the domain of behavioral reactions, which is certainly what also happens with the spider that spins its web.

But I think the most important thing to consider here is the second item in that definition of behavior that I just proposed. Behavior occurs when an organism can perceive or register the appropriateness of its adaptation to the environment and can also optimize that adaptation based on those perceptions, which can then be characterized as cognitions. Thus, if we define an organic reaction as any change in state or movement of a living being to which a functional value can be attributed for

that same living being, it can be said that a behavior is an organic reaction that alters some parameter of a living being's external or internal environment, or that alters the living being's relationship with that environment, and whose functional adjustment or maladjustment is capable of being registered by that same living being, such that this registration may contribute to the adjustment of subsequent occurrences of the reaction or may place the living being in a position to attempt the reaction again.

In other words, a behavior is a reaction of a living being tending to control variables of its external or internal environment, or to modify the way in which these variables are affecting it, and whose degree of functional adequacy can be registered by said living being. The latter is what allows the response pattern of that reaction to be corrected in its subsequent occurrences. Something that does not occur in the physiological reaction whose pattern is constant: not subject to cognitive adjustments. That is why we distinguish it from behaviors. Or perhaps it would be better to say that the reaction of a living being will be considered as behavioral to the same extent, or degree, that it is adjustable or optimizable by the mediation of cognitions.

Behavior, in short, is an organic reaction that can be optimized through the mediation of learning, and this involves a very simple, but also very general, idea of cognition. Firstly, we can consider as cognitions the registers that a living being can have of the functional adjustment of the patterns that guide some of its reactions; making possible, such registers, the optimization of such patterns in future occurrences of those same reactions. Admitting this allows us to characterize learning as a cognitive modification of a type of organic reaction or a behavioral pattern. That is to say: learning is nothing more than the reinforcement, functional adjustment, extension, or elimination of a behavioral pattern by virtue of the functional adequacy or inadequacy of previous occurrences of behaviors that obeyed it. And it is based on these same considerations about the relationship between behavior and cognition that we can try to sift the notion of mind operating in Cognitive Ethology.

2. Animal mind

But, as far as that is concerned, it may be prudent to begin with a warning: if one wants to understand how Cognitive Ethologists approach the animal mind in their research, though not in their metatheoretical reflections, Gilbert Ryle is a reference that leaves us better positioned than Jerry Fodor. Instead of thinking of the mind as a system or set of representational states (Fodor 1987, p.16), in their research, and in the results that emerge from it, cognitive ethologists think of the mind as a set of states and abilities of a living being that predispose and that also enable it to act in a certain way.[1] That is, a behavior involves not only a propensity to do something, but also the ability and capacity to do it. (Ryle 2009 [1949], p.17; Carvalho 2018, p.9).

And mental states are the set of cognitive dispositions that cause, guide, and enable an animal's behaviors. The study of the mind consists of identifying and analyzing these dispositions, making explicit the patterns of connection between cognitions and the behavioral responses that these cognitions guide.

Ryle's position, I know it, is often characterized as a form of 'logical behaviorism' or 'philosophical behaviorism.' (Jacob 2004, p.418; Tanney 2009, p.xxiii; Leclerc 2025, p.67). But, if what defines logical behaviorism is the idea that mental states can be defined by "the simple mention of stimuli and behavioral outputs" (Jacob 2004, p.432), Ryle was not a behaviorist.[2] On the contrary, these mental states, which are states of a living being, are always a complex mediation between stimuli and behavioral responses, and what we need to know is the patterns of this mediation. (Ryle 2009 [1949], p.102; Tanney 2009, p.xxvi). Some of these patterns are ephemeral, and others are invariant and subject to some generalization, but, in all cases, the identification of these patterns will allow us to know the causal role, the function, that these mental states play in the determination of a behavioral response.

On the other hand, besides allowing us to speak of mental states as causal mediators between stimuli and behaviors, Ryle's point of view also allows us to speak of changes or processes that occur to those states. Changes and processes that depend on different stimuli, but also on changes in other mental states, and that can be characterized as 'cognitive processes'. The behavioral output does not only depend on a stimulus situation and a particular mental disposition; it depends on a general constellation of mental states that will influence the way in which each disposition involves manifests itself. Mental states, to put it another way, affect each other; and this affects the decoding of stimuli and the nature of the behavioral response to these stimuli, which may come from the living being's environment or from its own internal states. This, moreover, is not surprising. Although these mental states and processes are not described by virtue of their physiological materiality, but by virtue of their functions in determining behaviors and other mental states or processes, they are still states of an organism; and, therefore, it is to be expected that there are mutual influences and conditioning between them.

A hare is hungry and so is displaying foraging behavior, but suddenly she registers what she recognizes as the scent of a fox. This leads her to stop this behavior, remaining alert for a few seconds before continuing to feed. Hunger, a mental state caused by an internal stimulus, but perhaps also intensified by sensory registration of a potential food source, triggers and guides foraging behavior. But, while this is happening, an olfactory stimulus, decoded by virtue of a second mental state (which allows the hare to consider it as an index of the possible proximity of a threat), induces a third mental state: a state of alarm that affects the behavior in execution. The hare stops eating; instead, she points her ears and snout in different directions. That is to say, she behaves in the same way we have seen other hares behave when

they register indications of possible threats in their environment, and, even when our hare returns to forage, she does so with intervals that allow her to maintain the alert behavior.

On this point, Ryle's position, since it does not entail any objection to this description and analysis of the behavior and mental states of the hare, does not differ from what is usually called 'functionalism'. (Rey 2003, p.202; Jacob 2004, p.432). As Ned Block (1978 p.262) explains it, functionalism assumes that "each type of mental state is a state consisting of a disposition to act in certain ways and to have certain mental states, given certain sensory inputs and certain mental states"; and this is not in contradiction with Ryle's point of view. If "behaviorism identifies mental states with dispositions to act in certain ways in certain input situations" (Block 1978, p.262) without alluding to a configuration of mental states that affects those dispositions, then, definitely and as I have already said, Ryle was not a behaviorist. And if we say that "functionalism replaces behaviorist sensory inputs with sensory inputs and mental states" (Block 1978, p.262), we can also say that Ryle sustained something close to what later came to be called functionalism.

Meanwhile, if we add to this that functionalism replaces the "dispositions to act" with "dispositions to act and have certain mental states" (Block 1978, p.262), we fall into a formulation that, from Ryle's point of view, would make no sense at all: mental states, although they may in fact affect and condition each other, are always behavioral dispositions. But I believe that for this to be understood, and for the notion of mind involved therein to be clear, it is necessary to return to the notion of behavior. A behavior, as I have already said, is a particular type of organic reaction that aims to control variables of the external or internal environment of the living being that executes it, or to modify the way in which those variables affect it. Nevertheless, in addition to that, and as we have already seen, what also defines behavior is the fact that it is a cognitively patterned and controlled reaction. A behavior, I insist, is an organic reaction guided by cognitions; and cognitions are registers of the internal states of an organism, or of the states of its environment, which allow that organism to functionally adjust the patterns that govern such reactions. In short, attributing mental states to a living being is nothing other than attributing to it cognitions, behavioral capacities, and behavioral dispositions; that is, a living being has mental states to the same extent that it can execute behaviors: reactions that, because they are cognitively adjustable, are different from mere physiological reactions. These states, moreover, form a constellation of elements in permanent interaction. Mental states, in their continuous reconfigurations, cannot help but affect each other. That is to say, those states of a living being that are its dispositions to behave in certain ways cannot fail to affect each other. For this reason, it can also be said that all behavior is the result of a more or less labile configuration of these states.

But I think it is very important to insist on the fact that, in saying this, I am

not saying anything that adds too much to what cognitive ethologists presuppose and indeed do in their work. Beyond their eventual, and perhaps puerile, references to what might be characterized as the myth of the 'ghost in the animal machine', cognitive ethologists never stopped speaking in Rylean prose. This, as I mentioned above, can be seen both in the design of experiments and observations, as well as in the presentation and justification of results that cognitive ethologists actually present in their work (see also: Halina 2024, p.11). An example of this can be the use of the notion of cognitive map. Edward Tolman (1951, p.258) coined this concept to allude to the ability to locate and move adequately in a certain area or spatial region that a living being developed in its interactions with the objects arranged there; and cognitive ethologists have made good use of it (*cf*. Griffin 1981, p.8; Pick 1999, p.135; Rescorla 2018, p.42).

This capacity for spatial localization implied a knowledge of the relative positions and distances of certain objects that could not be explained by a simple linear series of associations between stimuli and reinforced behaviors. A rat moving in a maze that had already been run could find the food that awaited it there more quickly than it had been able to find it the first times it was placed there; and it did so even though some of the objects there had been removed or their relative locations had been modified (Tolman 1948). That is, the rat did not go from one point to another by reconstructing a series of consecutive steps already reinforced; rather, by virtue of its previous learning, it could locate itself and find the food, even if a part of the previously known indicators were absent or in a different position from the initial one. And what is interesting is that this ability not only seems to be recorded in animals phylogenetically close to Homo sapiens, as any mammal can be, but also in insects such as honeybees (Gould 2002, p.43).

Meanwhile, attributing this capacity to an animal, to register this capacity, does not imply the discovery of some neural diagram embedded in its brain; nor does it consist in the projection of an introspective knowledge from the human mind to the inner self of the rat or of the honey-bee. Attributing a cognitive map to a rat or to a honeybee is nothing more than attributing to them the ability to behave in a certain (fine-tuned) way. Which is the same thing that would happen if we allude to the capacities or abilities of an individual of our species. We can say that a person has a cognitive map of the Gothic Quarter of Barcelona when, without asking anyone, or without consulting Google Maps, that person can find the *Plaza de la Cucurulla* starting from the *Palau de la Música* located at the Borne, and not from the Ramblas, when, previously, the latter was the only route that this person had taken to get to that little square. Without denying that this supposes an inevitable neuronal inscription, but without claiming to know this record or to be spying the inner self of this person, we attribute this cognitive capacity to him/her simply because he/she can perform a cognitive-behavioral operation. That is what knowledge is; before anything else,

it is the ability to do something, it is the ability to solve a problem or even a class of problems (Ryle 2009 [1949], p.17). And, the mind, seen from this perspective, would be nothing more than the set of those states, processes, and abilities whose presupposition is imposed on us by observing what animals do or fail to do.

3. One last remark

This does not mean, I insist, that these are ectoplasmic states attributable to a ghost nestled in an inaccessible inner self. These are states of a living being which, by virtue of the heuristic advantages that this provides us with and the very difficult to overcome difficulties that their analysis in neurophysiological terms would pose, we describe, study, and explain in terms of emotional-cognitive capacities and propensities always defined and verifiable, by reference to the observable behaviors that they cause and make possible. An emotion, an expectation, or even a belief, is a disposition to act in a certain way and even an impulse to do so; and knowledge is the ability to do it. On the other hand, because they are states of a living being, we can also say that they exist and that they are material. These are states of organisms that we use to map by a vocabulary distinct from that of physiology; nevertheless, such a vocabulary allows us to trace the causal invariants (Woodward 2003, p.11) that interconnect these states with one another, while also relating them to the cognitive processes by which they are modified and to the behaviors that they in turn generate and orient.

Although we describe and explain them neither in physical terms nor with the resources of neurophysiology, although we do not know precisely what are their neural inscriptions, we can be sure that these states are causally effective, without postulating any pineal gland connecting flesh and ectoplasm; and it is also by virtue of this materiality that we can produce them, intervene in them, manipulate them, and control them experimentally. By producing changes in the environment that can be registered by the living beings with which we are interacting, be they of our species or of another, we can detect and modify those propensities, capacities, and states that we call mental. This, according to what Hacking (1983, p.262) very clearly pointed out, indicates that they are real and material: they are within the reach of our manipulations and experimental interventions. Thus, even without adopting a neurophysiological perspective, Cognitive Ethology assumes that physicalist ontology, which is the condition of possibility of all scientific knowledge, and this, as all that has been said so far, is as valid for the study of the cognition of a honey-bee as it is for the study of the cognition of *Homo sapiens*.

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Notes

[1]In this regard, see: Ristau (1991, p.102); Cheney & Seyfarth (1991, p.148), Burghardt (1991, p.79), Ristau (1992, p.127), Saidel (2002, p.55), and even Andrews (2020, p.122).

[2]Not, at least, a behaviorist in the style of Skinner (1974); although perhaps a cognitive behaviorist such as Tolman (1932).