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What is (not) "complex" about behavior? Radical behaviorism, self, insight and language

Diego Zilio[a*]
Hernando Neves Filho[b]

[a]*Universidade Federal do Espírito Santo, Departamento de Psicologia Social e do Desenvolvimento. Vitória, ES, Brazil*
[b]*Imagine Tecnologia Comportamental. Fortaleza, CE, Brazil*

Abstract: A criticism usually found in Psychology textbooks and manuals is that Behavior Analysis would not be able to explain complex psychological phenomena. These would be better approached by cognitivist explanations based on mechanisms internal to the organism. This study aims to discuss the relevance of this criticism in light of examples gathered from behavior-analytic literature. By analyzing researches about the formation of "self", "insight" and language, we argue that "complexity" was imported to behavior-analytic laboratories as well as it flourished in numerous fields of research of radical behaviorism tradition. Additionally, five meanings of "complexity" extracted from the consulted literature are discussed. It is concluded that there is no useful meaning to this term and, for that reason, it can be abandoned as a criterion for classifying behaviors. As a consequence, "complex behavior" should be viewed only as "behavior" and nothing else.

Keywords: radical behaviorism, cognitivism, metatheories, complex behavior.

The skepticism about the scope (or relevance) of the behavior analytic approach in the treatment of complex behavior permeates the literature (Carrara, 2005). This position was well accepted and disseminated, being found in most introductory textbooks in Psychology, which presents behaviorist approaches as relics of a past that, although still recent, would be completely outdated (Abramson, 2013; Jensen, 2006; Miller, 2003; Watrin & Darwich, 2012). Perhaps one of the first criticisms with this content, presented as a challenge, came from the philosopher Alfred Whitehead, who, in a conversation with B. F. Skinner, challenged him to account for his own behavior as he was sat at the table saying "no black scorpion is falling on this table" (Skinner, 1979). Skinner accepted the challenge and, in response, wrote the book *Verbal behavior* (1957). This book, in turn, generated more systematic criticisms as to the possibility of explaining language from a radical behaviorist perspective (although Skinner had emphasized that the object of the book was the speaker's verbal behavior), especially that by linguist Noam Chomsky (1959), for whom Skinner had unduly extrapolated the use of concepts and theories developed in experimental context (seen as simple, artificial, and focused on non-human behavior) for language, a complex phenomenon and inherently human.

Although judged as inappropriate by the behavior analytic community (Justi & Araujo, 2004; MacCorquodale, 1970; Palmer, 2006), Chomsky's criticism had remarkable influence in consolidating an alternative proposal to the study of complex behavior, a movement that became known as "cognitive revolution" (Gardner, 2003). Baars (1986), in his book on the so-called "revolution," concluded that "Chomsky's review of Skinner's book was far more influential than the book itself. His arguments have been lately extended to beyond language itself . . . to the behaviorist theory in general" (pp. 338-339). In general terms, the understanding of behavior by the study of contingencies of selection (respondent and operant) is not considered an appropriate strategy to deal with "complex" phenomena, such as language, memory, thought, consciousness, intelligence, creativity – that is, processes normally characterized as "cognitive," i.e. as part of a set of specialized mechanisms responsible for receiving and analyzing environmental inputs and for behavior (output) planning regarding the information analyzed. Characterized as "cognition," this set of mechanisms would form the link between environment and action, the center responsible for behavior control (Barret, 2016).

Obviously, the cognitivism-behaviorism debate is permeated by methodological and theoretical-philosophical questions, but we can safely say that one of the master springs that propelled or justified the "revolution" was precisely the skepticism regarding the possibility of studying the complex behavior through research supported by the radical behaviorist philosophy (Brown & Gillard, 2015; Roediger, 2004). The goal of this essay is to argue, by presenting examples of behavior analytic research, that this is an unfounded skepticism. In addition, potential problems of the cognitive proposal will be listed, aiming to show that the radical behaviorist metatheory can be the most useful alternative for the study of behaviors regarded as complex. Finally, we will reflect upon the very nature of "complexity": what does it mean to say that a phenomenon is "complex"?

* Corresponding author: dzilioufes@gmail.com

Cognitive and behaviorist metatheories

The cognitive metatheory embraces the guiding principles of cognitive research (Baars, 1986). The central characteristic of this metatheory is the encouragement to theorize about entities inferred from behavioral data (Baars, 1986). This is a deliberate reaction to the alleged behaviorist restrictions to the use of hypothetical constructs, theories and inferences in the explanation of behavior regarded as complex. For proponents of the so-called "cognitive revolution," behaviorism eliminated from psychology his proper objetct of study: cognition (Gardner, 2003). Behaviorist proposals of Watson, Skinner and Hull, among others, would be a black box for not considering what was happening in the "mind" of the subjects, prioritizing data on manifest behavior and stimulus-response relations. Hence it follows the supposed limit of behavioral approach to study behaviors classified as complex. In the classical cognitive proposal, the theory consists of a network of constructs non-observable and inferred from studies on behavior: cognitive mechanisms (Neisser, 1967). Thus, the inaccessibility of cognition is recognized. Therefore, the data produced are always indirect indicators of the proposed models. In this case, as the description does not have an observable referent, vocabularies and terms are usually imported from other domains to deal with cognitive mechanisms (Rachlin, 1994). The procedure of theory construction goes as follows: (1) observation of behavioral data from specific experimental designs; (2) proposal of cognitive models/constructs from the behavioral data analysis; (3) explanation of the occurrence of behavioral data from the characteristics of inferred models/constructs; and (4) subsequent tests of the theory.

Perhaps one of the main problems associated with this practice is the fragile connection between theory and phenomenon that we intend to explain (Zilio, 2016b). By creating explanatory models based on hypothetical constructs, scientists are not only under control of the experimental data they purport to explain – since the constructs do not refer exactly to the data (which are behavioral) –, but of alleged intermediary and unobservable causes. Whenever a cognitive instance is inferred from a behavior, an adventure is outlined, which McDowell (1991) called an "gulf of ineffability" (p. 30). This ineffable abyss is what separates an empirical, measured and observed finding, from its immaterial, inferred and supposedly emerging constituents. In short, this abyss is always found when an empirical epistemology is applied over an immaterial or not directly observed ontology.

Thus, the constructs, by being unobservable, do not act necessarily as discriminative stimulus for description of their properties and characteristics (i.e., the verbal "tacts" of the scientist), which means that such verbal responses are under control of other variables. This characteristic increases the probability of use of metaphorical vocabulary: if there is not a term to talk about the construct, other domains are imported (Harzem & Miles, 1978; Oliveira-Castro & Oliveira-Castro, 2002). It is a common practice in the cognitive approach, in which the main metaphor is the mind/cognition as a computer (Gardner, 2003). We can also quote the various metaphors associated with the construct "attention": spotlight, filter or bottleneck, which indicate mechanisms of attention – as well as the attention as limited resource, suggesting that it is a "thing" to be distributed via central executive system (Fernandez-Duque & Johnson, 2002; Zilio & Hunziker, 2015). If the verbal behavior of theorizing is not under control of the experimental data, this can also increase the chances of unwanted speculations, spurious explanations and conceptual confusion (Harzem & Miles, 1978; Zilio & Hunziker, 2015).

The free theorizing advocated by the cognitivist metatheory, based on hypothetical constructs inferred from behavioral data, might have raised a "sense" of understanding about the complex human behavior. The freedom of theorizing translates into the absence of model limits: no matter how complex the phenomenon studied can be, it will be always possible to create, from behavioral data, a hypothetical model on its operation, although there are potential problems of the strategy in the radical behaviorist and critical literature, which are briefly described herein.

On the other hand, we have the behaviorist metatheory, for which the construction of theories should always be under control of experimental data, in an inductive way and aiming only at the useful description of correlations observed between events, reduced to a minimum number of terms (Skinner, 1950), which could supposedly prevent it to deal with complex processes. Would that be the case? Would the behaviorist metatheory be suitable for the study of complex human behavior? We will evaluate this questions with a few examples.

The study on the "complex" behavior in the behavior analytic literature

Self and self-knowledge in pigeons

The first example is the research conducted by Epstein, Lanza and Skinner (1981), published in the journal *Science*, about self-knowledge or self-awareness in pigeons. It is worth mentioning the context that guided the project of the authors, because it is where we find the "complexity" of the phenomenon and its cognitive interpretation. The study focus is the phenomenon "personal identity" or "sense of self." In general terms, the research in this field involved exposing primates, usually chimpanzees (*Pan troglodytes*), to environments in which there were mirrors and any modifications in inaccessible parts of their bodies (for example, painting with odorless blue ink the area above the eyebrow). It was observed observed that, after a certain period in this environment, the chimps began to use the mirror to access/observe the parts of their bodies that were painted (Gallup Junior, 1970). This data was explained by the existence of a "sense of self" or "personal identity," a cognitive element that enabled chimps to recognize the body reflected in the mirror as theirs. It was argued that there is a qualitative psychological difference between great primates (humans, gorillas, chimpanzees and bonobos) and other species in general, since, initially, only the former ones showed such skill in front of the mirror (Gallup Junior, 1970).

In this example, we found all the elements of the cognitivist metatheory. The behavioral data related to the task of recognizing changes in their own body through mirrors creates a cognitive category (construct), the "sense of self" or "personal identity," which explains the data from which they were inferred and qualitatively separate great primates from other species (hypothesis not supported by the data).

In this context, Epstein, Lanza and Skinner (1981) established an experimental design in which pigeons (*Columba livia*) were trained to use a mirror to find stimuli (circumferential blue self-adhesive figures) located in parts not directly observable. From the use of differential reinforcement, a history of "use of mirrors" in three pigeons was created. The authors trained two distinct repertoires in a period of ten days. The first one consisted in pecking at blue dots painted in visible places on their own body (wings, chest and abdomen). After pecking at the dots, the trough was manually triggered. There was no mirror in this stage. This repertoire was modeled until pigeons verified their own body in search of dots, pecking at them whenever found. The second repertoire was trained in the presence of a mirror and, initially, the blue dots were in different places of the experimental chamber wall. After pecking at these dots, which were identical to those used in the training of the first repertoire, the animals were fed. Then the dots at which the pigeons should peck (after removal of the dots) were presented briefly. In a third stage, the dot was being reflected in the mirror (the presentations were made while the pigeon was standing in front of the mirror) and responses to turn around and peck at the location reflected were shapped (responses to peck at the reflection were not reinforced).

Once the practice ended, the mirror recognition test was held. In this test, a blue dot was placed on the chest of the animals, covered by a "necklace" made of white paper. The necklace was placed in such a way that prevented the animal to see the dot, which was visible only if it stood in front of the mirror. An initial control was carried out with the dot covered with the necklace, without the presence of the mirror, and no pigeon pecked at the hidden dot (they also did not peck at the necklace while observed in a control in which the animal was only with it, without the mirror and without the hidden dot). In the presence of the mirror, the three pigeons inspected the necklace and pecked at the hidden dot many times.

Given this result, Epstein, Lanza and Skinner (1981) argued that the use of mirrors depends on prerequisite behavioral repertoires – when some repertoires are enought such as those trained, the use of the mirror is generalized (Uchino & Watanabe, 2014). These data brought new arguments regarding the use of mirrors as tests of cognitive processes. For a more complete data, it is necessary to ensure or measure which repertories of mirror use these animals present and not simply make a mirror available.

As an example of what occurs with cognitivist research, data by Epstein, Lanza and Skinner (1981) are still of behavioral nature – the difference is in what you do with them. The radical behaviorist metatheory assumes that the behavioral history (selection by consequences) explains, at least in part, the establishment of behavior as complex, usually associated with mental/cognitive activities. Knowing the contingencies of selection, there is no need to attribute causes to mediating hypothetical constructs. Epstein, Lanza and Skinner (1981) conclude: "We have shown that at least one instance of behavior attributed to self-knowledge can be explained in terms of environmental history. We believe that other instances, including those displayed by humans, can also be addressed in the same manner" (p. 696). Following this path, several other studies began to emerge, showing the use of mirrors in different species, such as Asian elephants (Plotnik, de Waal, & Reiss, 2006), dolphins (Marten & Psakaros, 1994), whales and sea lions (Delfour & Marten, 2001), corvids (Prior, Schwarz, & Güntürkün, 2008), bartoid fish (Ari & D'agostino, 2016) and even ants (Cammaerts & Cammaerts, 2015). Several of these studies do not assume a necessary implication of constructs such as "sense of self" or "personal identification" (Cammaerts & Cammaerts, 2015).

"Insight" in pigeons

Another pertinent example that would supposedly involve "complex" cognitive processes exclusive to the great primates can be found in classic studies by Köhler (1925/1948) on "intelligence" via problem solving in chimpanzees (*Pan troglodytes*). In these studies, Köhler (1925/1948) noted that some of his subjects solved some of the problem situations suddenly, in a fluent and focused way, a topography of problem solving other than the named "trial and error," as described by Thorndike (1911/1966) in his studies with cats in puzzle boxes.

One of the puzzles by Köhler, in which an instance of sudden resolution was observed, became known as the box displacement test. In this situation, a banana was hung on a net located on the ceiling of the animal nursery, out of reach. In the same environment, there were several wood crates that could be used as a "ladder" to reach the banana. After several failed attempts to reach the banana directly (raising their arms, jumping etc.), some chimps "suddenly" dragged the crate up to where the banana was, climbed on it and, finally, reached the fruit. None of the chimps was trained to use boxes as a ladder – however, Köhler (1925/1948) admits not having thorough knowledge of the history of these animals and that, in fact, it was possible they had learned elements of this task in other situations. Köhler (1925/1948) named this sudden performance as "insight" (p. 219). This "insight," according to the author, would be a result of learning or understanding the "relationship between objects and events" (Köhler, 1925/1948, p. 219; 1959, p. 729).

Köhler was not, in fact, a cognitivist, but one of the founders of the gestalt psychology (Marx & Hillix, 1963/1973). Thus, his work and his conclusions do not fall immediately in the cognitive metatheory. Nevertheless, his formulation and terminology of "insight" were easily incorporated by researchers of cognitive bias – responsible for the "insight hypothesis," which is based on the sudden resolution of a problem and occurs after the animal mentally solves the problem (Taylor, Knaebe, & Gray, 2012). Thus, the original term "insight" was incorporated into the cognitivist metatheory, especially that of representational bias, which reinterpreted Köhler's "insight" as a genuinely cognitive (and inaccessible) process. During the "insight," the animal has the problem "inside its head" and, privately, operates cognitive instances that would lead to the solution of the task. After solving it "in its head," the animal would solve the real task with ease, that is, "suddenly" (Taylor, Knaebe, & Gray, 2012; Tomasello & Call, 1997).

Given this, Köhler's work generated two major fields of research regarding the sudden resolution of problems: one interested in identifying and cataloguing which animals would be able to solve problems suddenly (cognitive bias) and other worried about the role of learning (behavioral bias) in this sudden resolution (Neves Filho, 2015). In one of the most paradigmatic studies interested in the role of learning about "insight," Epstein, Kirshnit, Lanza and Rubin (1984) showed that the origin of sudden resolutions is in operant contingencies or, more specifically, in the training of prerequisite repertoire of a given task (Neves Filho, 2016).

Having pigeons (*Columba livia*) as subjects, Epstein et al. (1984) built an experimental analogue of the box displacement test. In an experimental chamber, a box that could be pushed and a miniature banana made of plastic, hanging from the ceiling of the chamber, were available. The authors trained two prerequisite repertoires to solve this task: (1) direct push and (2) climb and peck at the banana made of plastic. First, responses were shaped to push a box towards specific points of the experimental environment marked with a small piece of green cardboard. Then responses to climb that same box (placed in different and affixed places) and peck at the banana made of plastic were shaped, placing it at an inaccessible height without the use of the box. After this initial phase, the pigeons were introduced to the puzzle, which consisted in the box positioned at a significant distance from the banana (that is, it was not possible to peck at the banana even if the pigeon was on the box). The resolution of the problem demanded pushing the box toward the place where the banana was, climb on the box and peck at the plastic fruit. All the animals that received the training of the two repertories solved the problem with the typical topography of "insight" – a sudden, fluid and focused resolution. Animals that learned only one of the repertories did not solve the task – and an animal that learned to push the box in a non-directed way, but in an erratic and time-consuming way, also solved the task (requiring more time to solve the problem). This data was interpreted by the authors as an example of the emergence of new behavior through a process called the interconnection of previously acquired behavioral repertoires (Neves Filho, 2016).

The same interpretation could be assigned to the case of chimpanzees in Köhler's experiments (Delage, 2006; Neves Filho, Carvalho Neto, Taytelbaum, Malheiros, & Knaus, 2016a). Köhler did not know the history of his subject, which in itself already opens up the possibility that they have learned some of these repertories before the experiments. In addition, the serial presentation of several problems, such as that made by Köhler, is configured as a kind of training (Delage, 2011). The same occurred with the pigeons of Epstein et al. (1984), but in a more explicit and controlled way. As in the example of "self-knowledge," unlike the cognitive metatheory present in the "insight hypothesis," which assumes a mental manipulation of representations of task elements, Epstein et al., sustained by the radical behaviorist metatheory, sought alternative explanation by analyzing the history of the subjects' interaction with the environment – the explanation would be (at least partly) in the contingencies of selection. Knowing them, there would be no need to assign causes to internal hypothetical constructs.

Subsequent studies have recreated the "insight" from the indirect training of prerequisite repertoires in capuchin monkeys (Neves Filho, Carvalho Neto, Barros, & Costa, 2014; Neves Filho et al., 2016a), rats (Neves Filho, Stella, Dicezare, & Garcia-Mijares, 2015; Neves Filho, Dicezare, Martins Filho, & Garcia-Mijares, 2016b), New Caledonian crows (Neves Filho, 2015; Taylor, Elliffe, Hunt, & Gray, 2010), and humans (Sturz, Bodily, & Katz, 2010). Currently, most researchers interested in studying the "insight" outlined by Köhler admit that learning a few repertories to engage in a situation are indispensable and, thus, the phenomenon, undeniably, has an operant base (Epstein, 2015; Simonton, 2015; Weisberg, 1986).

Symbolic behavior

The studies of “self-knowledge” and “insight” in pigeons were two examples of direct interest of behavior analysts when addressing complex phenomena. In fact, the two studies that were part of the so-called Columban Simulation Project, which was an experimental project of students and colleagues of Skinner in Harvard with the goal of attacking cognitive phenomena that permeated the literature of his time by providing an operant vision on these studies (Epstein, 1981). However, in addition to the cases in which behavior analysts have entered the cognitivist field, complexity also emerged and settled as a genuine behavior analytic study area within radical behaviorist laboratories (Carvalho Neto, Barbosa, Neves Filho, Delage, & Borges, 2016).

A prime example with long tradition in behavior analysis concerns the study of symbolic behavior. Studies of discrimination and generalization of stimuli formed the basis of several pioneering and applied works interested in reading and writing, two types of human symbolic behavior (de Rose, 2005; Honig & Urcuioli, 1981; Maloney & Hopkins, 1973). In the midst of all this wealth of production, both applied and laboratory, the proposal of stimulus equivalence came up, formulated by Murray Sidman, who has been guiding the research on symbolic behavior carried out by behavior analysts (de Rose, Gil, & Souza, 2014).

In the proposal of Sidman (2000), largely based on empirical data, stimuli acquire control function from their pairing with reinforcement. Thus, various stimuli can be or become functionally equivalent, as it would be the case of the written word “house,” which would be equivalent to the drawing of a house and to the oral expression “house.” Three different stimuli, in different modes, control responses related to “house.” Starting from the paradigm of stimulus equivalence and its empirical research procedures, such as matching to sample, it is possible to study how these networks of equivalence are formed among stimuli and, therefore, the basis of symbolic behavior, both in humans and non-humans (Galvão & Barros, 2014).

Perhaps one of the main elements of equivalence relations is in the emergence of relations without direct teaching. This phenomenon is an important part of the complexity behind the human verbal behavior. The contingencies associated with the direct (and relatively simple) teaching of conditional relations manifest the emergence of new relations. And the growth in the number of conditional relations created only increases due to the addition of new groups of stimuli (de Rose & Bortoloti, 2007). Beyond the stimulus equivalence, other functional approaches to language developed by behavior analysts cover topics such as ostensible pairing (Stemmer, 1996), naming (Horne & Lowe, 1996), joint control (Lowenkron, 1998), and relational frames (Hayes, Barnes-Holmes, & Roche, 2001; Perez, Nico, Kovac, Fidalgo, & Leonardi, 2013).

As well as in equivalence, all functional approaches to language cover, to some extent, the phenomena of transfer of stimulus function. The transfer of stimulus function is something common in our daily lives. We can dislike a person X on account of their political opinions. If that person X is always in company of people Y and Z, a transfer of opinion from X to Y and Z is also likely. We thus avoid Y and Z without ever having had contact with them.

Contingent and arbitrary relationships among stimuli are bricks of buildings known as “language” and “thinking” (reasoning, problem solving) and are an essential element in the attribution of meaning. For Skinner (1945), the meaning of a term is in the variables associated with its use. Thus, applying the Skinnerian definition to the context of equivalence relations, a word acquires its meaning as a part of an equivalent stimulus class, which also includes objects, properties, or specific qualities, events and actions. This stimulus class is equivalent to its “meaning.” These relationships allow the comprehension and production of language.

Thus, we return to Whitehead’s challenge about the possibility of a behavior analytic explanation of language, with which we began this essay. How to explain his verbal behavior after saying the sentence “no black scorpion is falling on the table” to Skinner at a dinner in Harvard? First, we assume that the main function, or rather, the context that led to the utterance of this response was precisely the supposed limits of the behavioral approach. Why did Whitehead say what he said if there were no scorpions falling on the table? Perhaps because the challenge would be to explain the occurrence/construction of a seemingly meaningless sentence based on recombinations and variations of themes. However, the sentence has a meaning. We can understand it, even if we have never seen black scorpions falling on tables, because the words that make up the sentence are part of equivalence relations with objects, actions, beings, events. We may never have seen “black scorpions”, but we have seen in pictures. We may have seen scorpions of other colors and thus only associate the concept of “scorpion” with the concept of “black” color. We may never have seen scorpions falling, but we may have seen beetles falling on tables. We just swap the subject of the event (beetle by scorpion) and we can have an idea of what would be like to observe scorpions on tables and so on. In short, the equivalence relations among stimuli form the substrate of the meanings of sentences, regardless of whether such sentences have never been uttered before (and maybe here, as provocation, we can notice a possible behavior analytic interpretation/explanation for generative grammar, one of the pillars that supported Chomsky’s review).

Thus, Whitehead’s challenge, today, might not be, in fact, a challenge for behavior analysts anymore, to the extent that we have several well-documented behavioral processes that handle the origin of new behaviors, creativity and symbolic behaviors in general. Also, it is possible to affirm that the behavior analysis not only overcame Whitehead's challenge but went far beyond it, since currently not only we have basic behavioral concepts and processes that predict and control "complex" behavior in the laboratory but also in applied situations.

Final considerations: complexity?

Based on the examples described, the criticism that the behavior analysis would not have scope to deal with complex phenomena loses strength and validity. Indeed, behavior analysis has been a source of data about themes typically described as complex in psychological literature, such as creativity (Carvalho Neto et al., 2016), thinking and intelligence (Bandini & Delage, 2012), and culture (Martins & Leite, 2016). Nevertheless, manuals are still echoing old criticisms. About that, Ferguson, Brown and Torres (2016) identified that much of the psychology manuals tend to avoid controversy and advanced discussion points, as it would be the case of responses to criticism. Thus, the anacronic presentation of behavior analysis as an area uninteresting or unable to handle complex phenomena is an example of how manuals end up reproducing biased and outdated notions of certain areas, regardless of their advances and latest discussions.

It is worth ending this essay by listing some specific characteristics of the behavior analytic proposal in the study of complex psychological phenomena found in the examples described in the text. First, an essential step of behavioral research consists in seaching for the variables controling the use of psychological terms; this exercise is paramount. Wittgenstein (1953/2001) stated that psychology was permeated by experimental methods and conceptual confusion. The problem is that there is no experimental method that cures the problems arising from conceptual confusion. In short, there is conceptual confusion when there are multiple discordant factors/variables beyond the phenomenon that is the definition target, controlling the use of the concept (Zilio & Hunziker, 2015). The conceptual confusion is imminent when the theorizing behavior is not under control of the phenomenon to which it is addressed, which happens with the aforementioned theories about self, self-knowledge (consciousness), insight and symbolic behavior when based on hypothetical constructs. Thus, a fragile and inaccurate conceptual framework may not properly guide the behavior of the scientist who seeks to study the phenomenon in an experimental way. This does not occur, for example, in research by Epstein and collaborators on "self-awareness" and "insight" in pigeons. At first glance, these concepts seem to indicate cognitive/mental properties, qualitatively different and more complex in relation to the more "basic" properties studied by the operant/respondent paradigm. However, a brief location of variables associated with the use of such terms has led researchers to delimit certain behavioral repertoires (respond discriminatively to parts of the body using a mirror; behavior not directly trained). Thus, it was possible to establish functionally similar repertoires in pigeons, subjects that (by cognitivist theories) would be "qualitatively" different and, therefore, would not show such complex behaviors.

Another relevant point of the behavior analytic proposal of "complex" behaviors lies in the fact that there seems to be an inversely proportional relationship between knowing the history of the organism-environment relationship, that is, the contingencies of selection that led to their current behavior, and the attribution of the causes of behavior to states, processes or cognitive constructs inferred from behavior. Suppose that, in a visit to Epstein's laboratory, we arrive just as the pigeon is pushing the box toward the banana to, next, get on it and peck at it. What are the chances of saying "This pigeon is smart! It solve the problem by insight!"? There is a great chance, if we are not behavior analysts. On the other hand, if we know the history of the pigeon (shaping procedures by differential reinforcement, establishing repertories consistent with problem solving etc.), maybe the tendency to present the same mentalist interpretation is not so strong. We can say: "There was an emergence of new behavior from the interconnection of behaviors that already belonged to the repertoire of the pigeon." In short, by the analysis of the contingencies of selection we can find relevant and useful explanations that point to events likely to being directly related to behavior production, minimizing the use of metaphors, inferences and constructs. The verbal behavior of the scientist, in this case, would be mostly under control of the phenomenon that he aims to explain.

These considerations lead us to evaluate the very definition of "complexity." Apparently, in cognitivist literature, a "complex" behavior would be a phenomenon "qualitatively" different from "simple" relations for demanding its own cognitive processes/mechanisms. There is a cognitive mechanism associated with the ability to create "self-knowledge" or a "sense of self." There is another mechanism associated with "insight." There would be others still devoted to the construction of language, formation of concepts and meanings, creativity and so on. The multiplication of mechanisms via metaphorical vocabulary can increase the incidence of several problems, starting by the difficulty of establishing a conceptual framework shared by the cognitivist scientific community (Uttal, 2011; Zilio 2016a), plus the difficulty of establishing clear research agendas (Cromwell & Panksepp, 2012) to ultimately result in the replication crisis in the area (Gilmore, Diaz, Wyble, & Yarkoni, 2017; Uttal, 2013). Added to these problems we have the latent qualitative differentiation mentioned herein between the so-called "cognitive" and noncognitive processes. For behavior analysis, in turn, there is no qualitative difference between the behavior of the albino rat and human behavior. They are not of different qualities, i.e. they do not have different ontologies. They are all sensitive to the selection by consequences. It is assumed that there is, on the contrary, continuity between species (Carrara, 2005). That is why the behavior of rats and pigeons is studied (as well as other animals, including humans) in laboratory, because the principles arising from this analysis could also be applicable to human cases.

Another possible meaning of "complexity" involves only the number of variables responsible for producing such behaviors and not the defense of qualitative differences. This is what Skinner (1938/1966) seems to assume by saying "the only differences I expect to see revealed between the behavior of a rat and man (aside from enormous differences of complexity) lie in the field of verbal behavior" (p. 442). We say that a behavior X is more complex than a behavior Y if there is greater number of variables, or different variables, associated with the production of X.

An alternate meaning is given by Donahoe and Palmer (1994), for whom "complex" would be any behavior with unknown control variables. In other words, complexity would be derived from the ignorance of the causes of the behavior. In the case of initial studies of self-knowledge with mirrors, carried out by Gallup Junior (1970), the extraordinary data of his chimpanzees led him to the conclusion that there was something included in a select group of animals, owners of a cognitive capacity of self-knowledge absent in most of other species. However, as behavioral prerequisites have been identified as necessary for an animal to use a mirror, several other species, from fish to insects, showed similar behavior to chimps and humans in front of a mirror. The same happened in the case of "insight." Again, as behavioral processes were identified as producers of "insight," it began to be observed in different species, based on a training and testing method that considers these behavioral components. In both cases, the behavioral data made irrelevant the cognitive constructs that were initially raised as explanations.

Another element that seems to be commonly associated with the definition of "complexity" is the emergence of behavior not directly selected. This is present in all of the examples exposed previously: be in self-knowledge and "insight" of the pigeons or in the emergence of equivalence relations. From this perspective, the "emergence" would be an indicative of "complexity" and, for not being explained directly by the contingencies of selection (since there was no direct training), there should be an intermediate cognitive process (construct) responsible for its occurrence. The behavior analysis, however, explains the contingencies that led to the emergence of complex repertoires, as we have seen in the examples cited, by establishing repertories consistent with the behavior that is the focus of study (self-knowledge and "insight") and contingencies of conditional relations between events (which can lead to the emergence of equivalence relations). However, trying to understand "how" this occurs may not be exclusively a behavior analytic task – just as it is not the role of the area to answer "how" reinforcing stimuli accentuate/select a behavior or "how" a stimulus exercises a discriminative function. The "how" can be in another dimension, but this dimension is not cognitive, not constructed from inferences, and it should not be assigned the status of exclusive causal agent of behavior. This dimension concerns the neurophysiological mechanisms that mediate behavioral relationships (Donahoe & Palmer, 1994; Zilio, 2016a). To accept this fact is not to go against the precepts of behavior analysis. On the contrary, it is to recognize the limits of its analysis (Zilio, 2016a).

Thus, the term "complexity" seems to be associated with (1) a mentalist classificatory heritage based on qualitative differences between events, (2) the number of variables responsible for producing the phenomenon, (3) ignorance in relation to the variables of which the behavior is function, (4) the emergence of behavior without direct selection of such behavior, and (5) the neurophysiological differences that enable certain learning in humans and not on other subjects. Criterion (1) does not seem to sustain itself when it adopts the radical behaviorist metatheory in the study on "complex" behavior, as we have seen in the examples described herein. Criterion (5) does not properly describe complexity, but just the difference. X being different from Y does not necessarily imply that X is more complex than Y. A similar logic can be applied to criterion (3): we cannot give the quality of "complex" to a phenomenon due to the ignorance of its causes, since all phenomena one day were, somehow, "unknown" and therefore "complex." Such generality empties the term of useful meaning. Criterion (4) may also not be a relevant criterion for being too restrictive (only "emerging" relationships are complex), which does not seem to be the case. Take the whole dimension of social behavior and cultural practices: we are before behavioral processes that are admittedly complex, but that does not mean that in all social situations there is emergence of behavioral relationships not directly selected. Criterion (3) can also sin by "generality" as we observe the emergence of relations not directly selected in various situations, including respondent contingencies (usually and erroneously seen as "simpler" when compared with the operating ones) with rats. Second-order conditioning and blocking are two examples (de Rose, 2016). Finally, we have (2). Perhaps that is the only useful meaning of the term "complexity": there would be a continuum of complexity among phenomena from the number of variables responsible for its occurrence, being among them the behavioral dimension (contingencies of selection) and the physiological dimension (mechanisms that mediate the behavior). However, even so, this definition is problematic, considering that it can lead to the belief that the behavior of the rat studied in controlled laboratory situations would be "simple" in itself, which is not the case. Plus, this definition leaves us with the impossible task of answering what is the number of variables necessary to qualify a phenomenon as "complex." We must, therefore, be cautious about the meaning (2) of complexity, always considering two characteristics of that definition: its purely pragmatic value – it can be useful to assume that an event X is more complex than Y as a function of the number of variables related to the production of X and Y –; and its relational condition – complexity is always relative, an event X can only be pragmatically classified as more or less complex compared with other event(s). There is no intrinsic complexity – to assume this means running the risk of essentialism.

In short, maybe we should do with "complex" as a psychological category what Skinner (1957) did with the category "thinking." For the author, thinking was behaving and nothing beyond that. Maybe "complex behavior" is simply "behavior" and nothing else.

O que (não) há de "complexo" no comportamento? Behaviorismo radical, self, insight e linguagem

Resumo: Uma crítica comum encontrada em manuais e livros didáticos de psicologia é que a análise do comportamento não seria capaz de explicar fenômenos psicológicos complexos. Estes seriam melhor abordados por explicações cognitivistas baseadas em mecanismos internos ao organismo. Este ensaio tem como objetivo avaliar a pertinência dessa crítica à luz de exemplos da literatura analítico-comportamental. A partir da análise de pesquisas que tratam de formação de self, insight e linguagem, argumenta-se que a "complexidade" foi importada para os laboratórios de análise do comportamento, assim como floresceu em diversas linhas de pesquisa de tradição behaviorista radical. Em adição, são discutidos cinco significados possíveis dados à "complexidade" extraídos da literatura consultada. Conclui-se que não há significado útil do termo e que, por essa razão, talvez seja pertinente abandoná-lo como critério de classificação de comportamentos. Como consequência, "comportamento complexo" seria simplesmente "comportamento" e nada mais.

Palavras-chave: behaviorismo radical, cognitivismo, metateorias, comportamento complexo.

Qu'est qui est (et n'est pas) « complexe » dans le comportement ? Béhaviorisme radical, « self », « insight » et langage

Résumé : Une critique généralement trouvée dans les manuels et les livres de psychologie est que l'analyse de comportement ne serait pas capable d'expliquer les phénomènes psychologiques complexes. Ceux-ci seraient mieux abordées par des explications cognitives basées sur des mécanismes internes à l'organisme. Cet article vise à discuter la pertinence de cette critique à la lumière d'exemples de la littérature sur l'analyse de comportement. En analysant la recherche sur la formation du « self », « Insight » et du langage, on soutient que la "complexité" a été importé pour les laboratoires d'analyse comportementale, mais a aussi prospéré dans des nombreux domaines de recherche de la tradition béhavioriste radical. En outre, cinq significations possibles de « complexité » extraites de la littérature consultée sont discutés. On conclut qu'il n'y a pas de sens utile à ce terme et que, par conséquent, il peut être abandonné en tant que critère de classification des comportements. En conséquence, "comportement complexe" serait tout simplement "comportement" et rien de plus.

Mots-clés: béhaviorisme radical, cognitivisme, metathéorie, comportement complexe.

¿Qué (no) hay de "complejo" sobre el comportamiento? Conductismo radical, *Self*, *Insight* y lenguaje

Resumen: Una de las críticas a la Análisis de la Conducta, que se encuentran en los manuales y libros didácticos de psicología, es que esta no sería capaz de explicar los fenómenos psicológicos complejos. Estos serían mejor abordados por las explicaciones cognitivas basadas en los mecanismos internos del organismo. Este trabajo tiene como objetivo evaluar la relevancia de esta crítica a la luz de ejemplos de la literatura. A partir de investigaciones acerca del "*self*", "*insight*" y lenguaje, se argumenta que se importó la "complejidad" tanto para los laboratorios de análisis del comportamiento, como también floreció en varias líneas de investigación en la tradición conductista radical. Además, se discuten cinco posibles significados al término "complejidad". Llegamos a la conclusión de que no hay un significado útil y que, por esto, se puede abandonarlo como criterio de clasificación de comportamientos. Como resultado, "comportamiento complejo" haría simplemente "comportamiento" y nada más.

Palabras clave: conductismo radical, cognitivismo, metateorías, comportamiento complejo.

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