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Freitas Carneiro Leão, Monalisa de Fátima
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***SUCCESSIVE APPROXIMATIONS TO SELECTIONISM:
SKINNER'S FRAMEWORK FOR BEHAVIOR IN THE 1930s
AND 1940s***

**APROXIMACIONES SUCESIVAS AL SELECCIONISMO:
EL MARCO DE SKINNER PARA EL COMPORTAMIENTO
EN LAS DÉCADAS DE 1930 Y 1940**

Monalisa de Fátima Freitas Carneiro Leão
and Marcus Bentes de Carvalho Neto
Federal University of Pará

Abstract

Despite the centrality of selection by consequences in Skinnerian work, the adoption or not of a selectionist perspective in the first decades of Skinner's career is a controversial theme. Inconsistencies with respect to his affiliation or not with a selectionist epistemology in this period seem to reflect a lack of consensual definition of that proposal. Therefore, from three previously defined aspects of Skinner's selectionist explanatory principle, the aim of this review is to assess, through the

Monalisa de Fátima Freitas Carneiro Leão and Marcus Bentes de Carvalho Neto, Federal University of Pará.

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texts produced in the 1930s and 1940s, whether selection by consequences was used as an explanatory mode for behavior or whether there were traces of an epistemology that would lead to selectionism. It has been noted that, although at this early stage the idea of a selective process is already implicit, there are still remnants of a traditional notion of causality that is incompatible with an explanatory principle based on a relation of probabilistic interdependence between events, which explains the origin and evolution of behavior as being the product of three histories of variation and selection.

Keywords: selection by consequences, variation, causality, behavior analysis

Resumen

A pesar de que en la obra de Skinner la noción de selección por consecuencias es un punto central, determinar si en las primeras décadas de producción del autor adoptó o no una perspectiva seleccionista es un tema controversial. Las inconsistencias con respecto a la afiliación o no con la epistemología seleccionista en este período parecen un reflejo de la falta de una definición consensual de tal propuesta. Por lo tanto, a partir de tres aspectos determinantes de la propuesta explicativa seleccionista de Skinner, se evaluó si en sus escritos durante la década de 1930 y 1940 hubo o no el uso de selección por consecuencias como un modo explicativo del comportamiento, o si apenas hubo vestigios de una epistemología que llevaría al seleccionismo. Se ha notado que, a pesar de ya estar implícita, en ese periodo inicial, la idea de un proceso de selección, aún había restos de una noción tradicional de causalidad, que es incompatible con un principio explicativo basado en una relación de interdependencia probabilística entre eventos, que explica el origen y la evolución del comportamiento como producto de tres historias de variación y selección.

Palabras clave: selección por consecuencias, variación, causalidad, análisis de la conducta

The development of Skinner's science during the 1930s is commonly seen as a period that shows influences from the model of physics and chemistry, since it had its foundation in the reflex concept (e.g., Cruz & Cillo, 2008; Laurenti 2009; Micheletto, 1995; Moxley, 1999; Sérgio, 1990). Consequently, some authors, such

as Micheletto (1995), have argued that incipient references made by Skinner to the theory of evolution through natural selection in this initial phase do not necessarily substantiate a commitment to selectionism. Many other studies examining affinities between Darwin's theory and Skinner's theory of selection by consequences concurred regarding the origin of this explanatory principle, indicating different dates after the first decade (Andery, Micheletto, & Sérgio, 2000; Dittrich, 2004; Laurenti, 2009; Matos, 2003; Matos, Machado, Ferrara, Silva, Hunziker, Andery, & Figueiredo, 1989; Micheletto, 1995; Plotkin, 1987/1988; Richelle, 1987/1988), corroborating the assumption that the notion of selection by consequences cannot be identified as a characteristic of this early period of scientific production.

Palmer and Donahoe (1992), however, in a review critiquing essentialism and selectionism, argued that Skinner's account of behavior, since the beginning, affiliated with a selectionist epistemology and had its basis in the principles of selection. These authors referred to selectionism as a type of explanation derived from Darwin's evolution theory, founded in the processes of variation and selection. Considering this definition, Palmer and Donahoe stated that the main distinction between an essentialist and a selectionist explanation is the treatment given to variation. According to the authors, in emphasizing universality, essentialism considers variation as accidental and irrelevant, but to selectionism, variation is crucial in the selection process.

Palmer and Donahoe (1992) contended that in the study of behavior this selectionist treatment of variability had been present, at least since Skinner's (1935) article on "The generic nature of the concepts of stimulus and response". That is, because already at that time Skinner had recognized that variability is necessary in the creation of new forms of behavior, and had proposed methods to address the variable nature of behavior, consistent with a selectionist stance. Thus, Palmer and Donahoe underscored that in emphasizing the generic nature of units sufficient for the analysis of behavior, "Skinner's analysis of behavioral units establishes his science squarely within a selectionist paradigm" (p. 1347).

In a more specific study of the topic, Andery et al. (2000) evaluated the presence or absence of a selectionist perspective in Skinner's writings during the period from 1930 to 1938, based on four characteristics Andery et al. considered to represent the principle of selection by consequences: 1) a causal mode distinct from the mechanistic and teleological causal modes, since it seeks the determinants of behavior in the history of reinforcement and not in the immediate environment; 2) the description of history through the processes of variation and selection;

3) the assertion that the processes of variation and selection occur on more than one level; 4) the idea that the three levels of selection are interdependent and interact with each other. Andery et al.'s review of 32 publications led them to conclude that, for this period, there was no clear evidence of the conception of the three levels of selection, nor of a clean break from the mechanistic causal mode during this period. Finally, although they found some indications of the notion of selection by consequences, their research showed that the concept had not yet been well developed, and certainly was not established, in the 1930s. According to Andery et al., in this period not even the presence of the idea of conditioning evinces acknowledgment of the selective role of consequences on behavior.

Micheletto (2016) suggested that in the 1940s it is already possible to find a preliminary idea of three levels of selection in relation to behavior. She noted that in 1947, for example, Skinner indicated as part of the determination of human behavior: 1) the genetic constitution, the product of natural selection; 2) a personal history, the product of the contingencies of reinforcement history and 3) the environment social, related to cultural selection. Similarly, Matos et al. (1989) noted that in *Walden II*, Skinner (1948) presented the concept of development and maintenance of culture through the consequences to the survival of the group. Nevertheless, Matos et al. highlighted that it was in *Science and Human Behavior* (1953) that the discussion about culture emerged for the first time in a systematized way. Micheletto (1995) suggested that it was in the 1960s that an alternative, selectionist-dependent relation between events was inferred from the vantage of selection by consequences. Authors such as Plotkin (1987/1988) and Matos (2003) also suggested that important developments in Skinner's selectionist principle occurred in the 1960s.

It is possible to conclude from these studies that the controversy over the presence or absence of selection by consequences or of a selectionist perspective in the first decades of Skinner's career arises from at least two sources. The first is related to the changes that his scientific system underwent in the course of its development and the possible contradictions in his initial research program. Because of that, authors such as Cruz and Cillo (2008) stressed that the incoherencies found in this period reveal that Skinner began his work from a mechanistic perspective, but, simultaneously, that work showed signs that would replace or overtake this mechanistic-based system. Likewise, Moxley (1999) argued that Skinner's work showed conflicts between the selectionist and mechanistic views not only during the first decade, but over a long period thereafter. Moreover, the inconsistencies about the

origin of the selection by consequences mode also arise from the lack of delimiting its defining aspects, in that the previously described studies cited different characteristics to justify the authors' affirmations about its origin.

Other broad meanings are often attributed to the term 'selectionism', such as a kind of explanation for dealing with complexity (Donahoe, 2003, 2012; Palmer & Donahoe, 1992) and, as Cleaveland (2002) emphasized, the supposed linkage of a selectionist psychology to the process of selection and/or operant conditioning. Although the various possible definitions of selectionism are beyond the scope of this review, it is still worth noting that 'selectionism' does not refer exclusively to the Skinnerian explanatory mode, let alone to a definition limited to explaining behavior. Indeed, there are innumerable proposals that make use of metaphors and selectionist models for explaining other phenomena in Psychology (e.g. Campbell, 1974; Hull, 1988; Plotkin, 1994; Popper, 1972).

Considering the centrality of selectionism to behavior analysis (Catania, 2001), this review investigated the development of the selectionist explanatory principle in Skinner's works in the 1930s and 1940s. The review is the second installment in a conceptual-historical analysis of Skinner's construction of the notion of selection by consequences from the beginning of his career to his systematic presentation of the selectionist principle in his 1981 *Science* article entitled *Selection by Consequences*. The first installment was the delimiting, from three emblematic Skinnerian texts on the subject (Skinner, 1981, 1984, 1990), of three features that have been suggested to define the selectionist principle: (1) a new causal mode, which presumes a selective role of consequences; (2) the idea of evolution based on the complementarity of the variation and selection processes; and (3) his suggestion for explaining behavior in three domains (Leão & Carvalho Neto, 2016).

This analysis is not intended to exhaust discussions about selectionism in Skinner's work because it is based on one among many specific conceptualizations of the term. Moreover, the delineation of the three defining features of selectionism is not based on the traditional idea of interpretation as an instrument to reveal the definitive or essential meaning of a concept. Thus, the present analysis was predicated on Skinner's own identification of selectionism as the basis for the historical investigation of this concept throughout his writings, considering that the works that made affirmations on the subject lack clear prior definition. Finally, the main objective of this study was not to establish dates about the origin of selection by consequence in Skinner's writings, but to offer a more refined discussion about its historical development process.

For this review, seventeen documents from the 1930s and ten from the 1940s were analyzed, including articles and chapters from books, as well as Skinner's three autobiographies. The selection of the texts followed the reference list provided by Andery, Micheletto and Sérgio (2004), considering criteria such as previous reading of that first author on the theme and the help of studies about the construction of Skinner's science, as well as the search for some *keywords* related to the defined aspects of Skinner's notion of selectionism. From the reading of the selected texts, excerpts were identified, transcribed and categorized that contained observations that we believe shed light on Skinner's process of elaboration of selectionism.

From Reflex to the Operant: First Signs of the Selection Process Idea

Skinner's initial career was marked by the objective of establishing a science of behavior based on the natural sciences. This objective implied a rejection of metaphysics² and a commitment to the ideas that are characteristic of Newton's classical mechanical model such as determinism and the necessity relation between events (e.g., Cruz & Cillo, 2008; Laurenti 2009; Micheletto, 1995; Moxley, 1999; Sérgio, 1990). These ideas became evident with Skinner's proposal for explaining behavior using the reflex concept and marked the elaboration period of his explanatory system during the 1930s.

The concept of reflex in the description of behavior had a crucial role, because it reflects the kind of relation of dependency between events employed in Skinner's nascent system: "The reflex is important in the description of behavior because it is by definition a statement of the *necessity* of this relationship" (Skinner, 1931/1999, p. 433). Hence, there is a necessary and unequivocal relation between stimulus and response. It is interesting to notice that at this point Skinner already adopted Mach's idea that explanation is the description of functional relations, the same idea that later on will lead to an alternative concept of the dependency relation between events that is characteristic of a selectionist perspective. At this early stage, however, the replacement of the notion of cause by that of function did not seem to contradict the expressed necessity of the reflex relation.

² It is important to note that the term 'metaphysics' has different meanings, such as reference to ontological commitments or to explanations that infer to entities that are mentalist or materialist to elucidate a phenomenon (Abib, 2001). This term has been employed in this study to refer to a type of explanation that appeals to phenomena of a special nature, not behavioral, to explain a psychological phenomenon.

Experimentally demonstrating the necessity that characterizes reflex relations encountered certain restrictions that were intrinsically related to the issue of the variability consistently found in the course of successive elicitations. Without jumping ahead to the analysis of the initial treatment that Skinner's system gave to variability, it is noteworthy that, according to Skinner (1931/1999), these limitations that apparently could put the definition of reflex at risk in terms of stimulus-response necessity were interpreted as methodological limitations, because it was impossible to identify all the variables that would be related to the behavior studied.

Faced with difficulties imposed by the variability observed in reflex relations, it was precisely in the attempt to assure the regularity in terms of necessity between events that a second research area was proposed to describe the changes that occur in several aspects of the correlation on the basis of one more law. Therefore, the formulation of a second type of law, entitled secondary, had the function of guaranteeing the coherence of the Skinnerian explanatory system, since it implied supporting an explanation for behavior in terms of an inexorable relation between stimulus and response. Notions such as conditioning, emotion, and drive were present as changes in the strength of the reflex, reflecting orderliness in the variation itself and thus ensuring the adequacy, from a scientific standpoint, of describing behavior through the reflex principle.

The Concept of Operant and the Selection Process Through Reinforcement

The concern with identifying regularities in changes in reflex strength became central to Skinner's system and it was in the context of describing conditioning as one of the secondary laws that the notion of the reinforcing stimulus arose, a notion which, as Sério (1990) argued, began to be regarded as a defining property of the conditioning process. The first step in the formulation of the selective role of consequences seems to have been taken during the debate over the two types of reflex, in 1935, when Skinner observed that "the conditioned response of Type I does not prepare for the reinforcing stimulus, it *produces* it" (Skinner, 1935/1999b, p. 463). Hence, already in this statement, Skinner recognized that there is a type of behavior that operates in the environment and that produces reinforcement³. Although

³ It is important to emphasize that this is an evidence related to the Skinnerian writings, but Thorndike (1898/1998) identified the fact that behavior is stamped in when followed by certain consequences thirty-odd years in his 'The law of effect.'

the quotation still does not make explicit the action of a reinforcing stimulus on the probability of future responses, it was suggested in other excerpts that the role of conditioning, through reinforcement, is to alter the strength of reflex relations: "In Type I stimuli may be divided into two classes, positively and negatively conditioning, according to whether they produce an increase or decrease when used as reinforcement" (Skinner, 1935/1999b, p. 459)

The emergence of the term 'operant' (Skinner, 1937/1999) is emblematic of the development of a selectionist perspective, because the Skinnerian proposal became more flexible from that moment onwards. This flexibility is achieved by identifying another type of behavior, one which demands other principles or laws, different from those that were compatible to the concept of reflex. As first articulated (Skinner, 1937/1999), the reinforcing stimulus was not yet exclusively related to a consequent event, and there was no mention of a selective effect nor of the term 'consequence'. Nonetheless, it was the first time, at least as far as the analyzed texts are concerned, that Skinner referred to the procedure of originating new responses from undifferentiated responses through successive approximation to a specific programmed response. In Skinner's (1937/1999) words: "The response in its final form may be obtained by basing the reinforcement upon the following steps in succession. . ." (p. 469).

From this quote it can be argued that there is at that point in the development of Skinner's system the idea, at least implicitly, of a selective effect of the consequent event, the reinforcing stimulus, since it already has been suggested that a new response can be established via reinforcement, a fact that shows selection in the process. However, as noted by Serio et al. (2000), there are no direct references to the selective role of consequences produced by the operant response and, therefore, that function was not yet formulated. Consistent with these observations, Peterson (2004) stated that Skinner's reference in 1937 to the development of a final response through reinforcement was speculative. In other words, it is probable that such an idea in this period was still a hypothesis, as Skinner (1979) seemed to suggest in his autobiography: "I do not remember actually shaping lever-pressing in such explicit stages, but I was sure it could be done, and I had certainly changed the 'value of a single property' through successive approximation in producing very forceful responses" (p. 185).

On the publication of his first book (Skinner, 1938), by retaking the operant notion Skinner reiterated the idea that a response may occur without any specific observed antecedent event and still be described scientifically. This treatment of

operant behavior shows an initial attempt to insert in the scientific field a type of relation that would be more compatible with the explanatory selectionist principle proposed years later. However, the defense of the adequacy of employing the term “reflex” to describe both types of behavior and, at the same time, the acknowledgement of the distinct nature of operant behavior shows inconsistencies, which are noted in the following statement:

Operants, as predictable entities, are naturally isolated last of all because they are not controlled through stimuli and are subject to many operations. They are not obviously lawful. But with a rigorous control of all relevant operations the kind of necessity that naturally characterizes simple reflexes is seen to apply to behavior generally. (Skinner, 1938, pp. 25-26)

Likewise, Skinner (1938), while commenting the notion of reflex, continued to emphasize that: “Somewhat more generally, the term applies to a way of predicting behavior or to a predictable unit. In this broad sense the concept of the reflex is useful and applicable wherever predictability may be achieved” (p. 439).

These quotes suggest several further points. First, at the same time that Skinner (1938) referred to reflex as a necessary relation between events, he made the definition more flexible, assuming that the term is applicable, ultimately, to any behavioral unit that is susceptible to prediction and control. This suggests that the operant already was recognized a type of behavioral relation that cannot be described in terms of necessity, but that, in spite of it, exhibits regularity. Nonetheless, even emphasizing the specificities of the operant and admitting at times that the term ‘reflex’ in its original meaning is applicable to the respondent only, Skinner also pointed out that, with a certain level of control, the type of relation imposed by the reflex principle is a characteristic trait of any behavioral relation, respondent or operant.

Sustaining this type of dependency relation between events, which, however, contrasts to a selectionist perspective, proved to be harder and harder with the explanation of specific characteristics of operant behavior. For example, Skinner (1938) explained that the antecedent stimulus, in this case, no longer inexorably ensures the occurrence of the response, as a necessity relation between events presupposes: “In Type R the reinforcement is contingent upon the occurrence of the response, and there is no certain way of obtaining a response at a given time during the presentation of a discriminative stimulus” (p. 270). Thus, Skinner, while attempting to apply the reflex notion for explaining behavior in general, presented, with the

concept of operant, evidence of a transition to the adoption of an alternative type of dependency relation between events, more compatible with selectionist ideas.

The Notion of Response Class and Selection from Variations

The debate over the concept of reflex surrounded by the notion of classes of events, retained in the 1938 book, brings out the idea of the selective role of the reinforcement stimulus again. In admitting variations in the level of response class, Skinner (1938) noted that, in the context of operant behavior, a response class is defined by the reinforcement conditions. This fact, then, suggests that reinforcement has the role of selecting specific classes of responses, in the sense of increasing their probabilities of occurrence and decreasing the probability of responses belonging to other classes. If this interpretation is correct, it is possible to conclude that the first characteristic of the selectionist principle is almost explicit at this point in Skinner's work.

The selective role of consequences becomes even more evident when Skinner (1938) discussed the differentiation of a response. He made it clear that because reinforcement allows variability within the class, that is, between the parameters of the responses that belong to the class, it becomes possible to differentially reinforce a certain property of the response, such as its intensity or duration:

Although a relatively constant mean slope is maintained during reinforced responding, there is some variation in the force of single responses, and it is therefore possible to reinforce differentially with respect to this property. . . . When responses are differentially reinforced with respect to their intensity, the relative frequency of strong responses immediately increases. (p. 314)

Therefore, it is noted that there is a process in which reinforcement acts on within-class variations, resulting in the maintenance of the strength of responses that presented properties specified by the reinforcement. Although the term selection was not used and there was no explicit reference to the selective role of the reinforcing stimulus, the idea of selection via reinforcement of certain behavioral variations and not others also appears as already implicit in the context of this discussion. Furthermore, Skinner (1938) emphasized the role of reinforcement in strengthening behavior. On this point, Skinner (1979) reiterated that: "reinforcement emphasized strengthening" (p. 97). So this means that the presentation of certain environmental stimuli increases the rate of responses that are similar to those reinforced, while other are eliminated, a fact that can be seen as evidence of the selection process.

In the context of a debate concerning some properties or aspects of behavior to affirm possible contributions of the experimental analysis of behavior to neurology, Skinner (1938) referred to the retroactive action of the reinforcing stimulus: "Schemes for explaining Type S in terms of simultaneously active paths are inadequate for Type R, which presents a special problem in the apparently *retroactive action of the reinforcement*" (p. 431, emphasis added). Thus, it is possible to say that with a Type R reflex, reinforcement functions to affect behavior retroactively, increasing the probability of future occurrences. The use of term 'apparently,' however, may suggest that this recognition was still somewhat incipient.

A Historical Explanation and the Notions of 'Probability' and 'Shaping'

The end of the 1930s was marked by a change in emphasis from respondent to operant, with the prominence of what the organism does in the environment, and controversy over the applicability of the term "reflex" to both types of behavior. In the 1940s, Skinner fostered debates more focused on human behavior, contributing even more to the formulation of the selection process. In 1945, for example, in discussing the operational analysis of psychological terms, Skinner began to point out the reinforcing function of the verbal community: "The individual acquires language from society, but the reinforcing action of the verbal community continues to play an important role in maintaining the specific relations between responses and stimuli which are essential to the proper functioning of verbal behavior" (Skinner, 1945, p. 272).

Furthermore, the role of reinforcement history for explaining behavior also becomes increasingly evident. Skinner (1947/1999) started referring to behavioral history as a fundamental determinant, along with the individual's genetic constitution, of human behavior. This kind of reference brings out the historical aspect of an explanatory principle based on a selectionist perspective. This is because the latter perspective emphasizes the selective function of past consequences of behavior. Therefore, Skinnerian selectionism suggests that we look at the reinforcement history of the individual behavior, because, for this explanatory mode, the immediate events occurring when the response occurs are not sufficient to explain behavior.

An alternative notion of a dependency relation between events, more compatible with the selectionist principle also begins to appear, as when Skinner (1947/1999) used probability as a key word in his science: "The end term in a theory of behavior, in short, is the probability of action" (p. 324). Probability is a fundamental concept for the formulation of the selective role of consequences, given that this role is described in terms of its function in altering probabilities of future occurrences of

operant responses. Thus, from this perspective, control via reinforcement can be interpreted as always being probabilistic.

In the 1930s, the notion of probability was absent, at least in part because it was incompatible with the emphasis on the necessity of the reflex relation. Therefore, the idea that reinforcement alters reflex strength and, consequently, its rate of occurrence, supplied indications of a selection process, but made no reference to the probabilistic nature of the action of this process. In the 1940s, even though he had pointed out the concept of probability, Skinner (1947/1999) continued to defend the position that human behavior is completely determined, appealing to determinism as scientific premise. The term 'determinism' encompasses a multiplicity of definitions and different levels of analysis. Moreover, depending on the definition adopted, a specific connotation to the concept of probability is given (see Laurenti, 2008). Skinner (1947/1999) embraced determinism as a declared commitment and treated unpredictable aspects as products of the impossibility of identifying all the variables determining behavior. Consequently, the concept of probability was, at that time, used as a methodological tool to handle this constraint on the scope of operant behavior, and not as a natural aspect of behavioral relations, as would be assumed from a selectionist stance (see Leão & Carvalho Neto, 2016).

The emphasis on prediction and control marks the end of Skinner's works during the 1940s. With the publication of *Walden II*, the function of the reinforcing stimulus in altering probabilities was clearly described. It was also in this book, that Skinner (1948) used the verb 'shaping' (p. 105) for the first time, while discussing techniques and practices of behavioral engineering. The latter involved shaping the behavior of members of a group in order to benefit the well-being of all. It is curious that in his autobiography, Skinner (1979) wrote about an event from 1943, during a project carried out in the war period, with Norman Guttman, in which Skinner, together with Keller Breeland, on a day off, shaped the behavior of a pigeon to move a wooden ball with its beak as far as its cage. Regarding this accomplishment, Skinner declared: "I remember that day as one of great illumination. We had discovered how much easier it was to shape behavior by hand than by changing a mechanical device" (p. 268).

The remarkable effect of the use of the successive approximation technique mentioned in relation to the above episode shows that, as Peterson (2004) argued, this was possibly the first time that Skinner shaped behavior through observation and operated the reinforcer-release device with his own hands, without resorting to a mechanical device. Thus, this allows us to suggest, firstly, that while writing

Walden II, Skinner already was thinking of shaping as a specific process of behavioral change, and, secondly, perhaps because of this, the term “shaping” replaced the terms used in the 1930s, that is, ‘response differentiation’ and ‘successive approximations’. Furthermore, the presence of the notion of shaping reiterates the argument presented here that, although it had not been overtly mentioned, a selective process evinced by operant behavior already had been implicitly suggested.

Another important point that corroborates the implicit idea of a selective role of consequences is the argument that Skinner (1948) presented concerning the conflict between the good of society and the immediate good of the individual. Without focusing on cultural planning to benefit the group, aspects of which shall be discussed in more depth as the last topic below, it is worth noting the present idea of immediate consequences, reinforcing for the individual, but also of delayed consequences, which are important for the survival of culture. Therefore, despite the term ‘consequence’ having been used only colloquially at this point in Skinner’s work, a preliminary idea of selection as the mechanism for the evolution of behavior, later systematized in different dimensions, is implicit in this debate on ensuring that the individual is also under the control of the group’s well-being.

Variability: a Persistent Threat

In analyzing evidence for the first appearance of the selectionist mode in the first decades of Skinner’s system, his difficulty in sustaining a mechanistic position, such as describing, without metaphysical inferences (Micheletto, 1997), necessary relations between events, was noted above. During these first decades, the transformations that influenced the physical sciences at the end of the nineteenth century directly impacted Skinner’s treatment of the variable nature of behavioral phenomena. In his first article (Skinner, 1930), one can see how variability represented, at the time, a threat to the goal of scientifically explaining behavior through the reflex concept (see Leão, Laurenti, & Haydu, 2016).

Variability traditionally had been treated, from a mentalist perspective, as a by-product of mental entities, such as the creative mind and personality, as well as being offered as evidence of how uncontrollable and unpredictable psychological phenomena are (Sério, Andery, & Micheletto, 2005). Thus, eliminating the reflex concept in terms of the necessity between events as the basis of behavior invited the invocation of metaphysical constructs to explain such variability. So when Skinner proposed explaining behavior scientifically, the recognition of its variable nature

could suggest an approximation to metaphysics and pose a risk to his scientific program. This context suggests that Skinner's main concern in this first decade was to demonstrate that the variability in reflex relations would not pose a risk to the regularity of behavior so long as the variation itself was describable scientifically. He said that:

The resulting variability of behavior is typical of the sort which has led to protestations of the inadequacy of the reflex concept. But variability in the observed as against the predicted does not question the validity of a law if the variability is itself lawful. (Skinner, 1930, p. 434)

While observing that in a reflex relation a stimulus does not always inexorably elicit a response, Skinner (1930) started to evaluate what conditions might be responsible for the change in the strength of such stimuli. Consequently, variability was interpreted as a byproduct of certain facilitating conditions of elicitation that alter the strength of the reflex relation. In fact, as Palmer and Donahoe (1992) argued, the methods employed by Skinner in this early work had been focused on the relation between these conditions and the resulting change in the reflex strength, in order to explain the variability in behavior. Nevertheless, this treatment reflects an attempt to eliminate variability, by describing it in terms of another law, rather than recognizing it as a natural characteristic of behavioral relations. According to Skinner (1930):

In this instance, for example, it should be possible, once having determined a measure of the 'strength' of these reflexes, to investigate the conditions under which this strength changes and to *eliminate* [emphasis added] the variability by describing it in a further law. (p. 434)

This type of treatment for variability was what led to, as mentioned in the last section, the elaboration of a second field of investigation centered on secondary laws that describe changes in reflex strength as a function of other variables and which would explain the apparent variable aspect of the reflex relation: "In the behavior of intact organisms the apparent variability of specific stimulus-response relationships emphasizes the importance of laws of the second sort" (Skinner, 1931/1999, p. 438). From this, Skinner's system assured the demonstration of behavior determi-

nation through the reflex principle, free from inference from any event of alternative nature, and therefore, not physical, at the core of his explanatory proposal.

With the emergence of the concept of the operant, there was an acknowledgment of a certain spontaneity in any behavioral relation, in light of the absence of an eliciting stimulus at the moment of occurrence of this type of behavior. As Skinner (1938) noted, the “dynamic laws of operants enables us to consider behavior which does not invariably occur under a given set of circumstances as, nevertheless, reflex (i.e., as lawful)” (p. 25). However, Skinner’s explanation of the spontaneous aspect appeals to the fact that operant behavior involves an unlimited number of variables and several operations, such as drive, emotion, and conditioning, resulting in high variability. As already mentioned, though, Skinner suggested that, with broad control over the variables relevant to the behavior at hand, the necessity that characterizes a reflex relation also is applicable to operant behavior.

As changes regarding the notion of the reflex occurred, the definition of the reflex as a correlation between stimulus and response started to assume variations in individual sequences. According to Skinner (1938), responses “are selected at random from the whole class that is, by circumstances which are independent of the conditions determining the rate” (p. 36). That is, variation was explained as a product of uncontrolled conditions, which interfere in the experiment. However, this variation could be eliminated by appealing to secondary laws.

Response differentiation, discussed by Skinner (1938), evinced how within-class variability, in the case of the operant, in the course of successive ‘elicitations’, is crucial for the occurrence of differential reinforcement relating to a particular property. Even though up to this point the term “selection” had not been used, this is the first time that implicitly the idea of complementarity between variation and a selection process -represented by reinforcement - appears: “Even where there is little variation, differential reinforcement necessarily involves extinction, and some strong responses are made available” (Skinner, 1938, p. 314). So, in this context, an alternative treatment of variation seems to be offered, because the discussion is no longer about eliminating variation; variation now is considered raw material for the reinforcing stimulus action, a treatment that is characteristic of a selectionist perspective. In this case, not only does reinforcement allow within-class variability, such variability is required to differentially reinforce certain responses.

Parallel to these nuances of a distinct interpretation of variation in Skinner’s system, the debate about secondary laws was predominantly a product of the 1930s.

In a subsequent chapter about response differentiation, Skinner (1938) returned to the concept of drive, another notion inferred to account for variability. He wrote:

The problem of drive arises because much of the behavior of an organism shows an apparent variability. A rat does not always respond to food placed before it, and a factor called its 'hunger' is invoked by way of explanation. The rat is said to eat only when it is hungry. It is because eating is not inevitable that we are led to hypothesize an internal state to which we may assign the variability. Where there is no variability, no state is needed. (Skinner, 1938, p. 341)

This excerpt illustrates how the absence of an inexorable relation between stimulus and response implies the necessity of inferring concepts to account for the variability found in some behavioral relations. Contrasting his approach to one based on the inference of metaphysical concepts, even though (a) regularity of the operant is not as obvious as it is for the reflex and (b) the variables responsible for differences in strength might not be easily identified and controlled, Skinner (1938) suggested that the change in reflex strength is an orderly process. In other words, variability can be described as a regular aspect and explained scientifically, preserving the reflex nature of behavioral relations, without risking losing the scientific status of his explanatory system.

As already pointed out, Skinner (1947/1999) emphasized probability as the basic data of his scientific system. Reflecting on this concept, its relation to the idea of variation is clear, since the reference to probability only makes sense if there is variability in the behavioral relation. Hence, the variable aspect of behavior seems to demand descriptions in probabilistic terms, and these descriptions imply the recognition of variations in this relation. Nevertheless, it was also mentioned that in the 1940s Skinner still was committed to the premise of complete determination of behavior, making it possible to suggest that the inference to probability results from the impossibility of controlling all the variables that determine the behavior. If this analysis is correct, even though Skinner did not mention variability in the 1940s, it is reasonable to assume that if it had been mentioned, the treatment of variability would follow the same line of reasoning that prevailed in the 1930s.

The only mention of the term 'variation' in the 1940s, from the texts analyzed, was in *Walden II*, in a discussion of the possibility of environmental control so carefully planned that it generates youngsters with highly stereotyped behavior inside the community. Considering such a possibility, Skinner (1948), through his character Frazier, explained that although the children in *Walden II* live in the same

environment, their behavior is highly variable. Moreover, Skinner argued that it was a characteristic of this community to teach its members to respect and accept physical and behavioral limitations and differences. In that sense, variation seems to have been interpreted as a natural characteristic of community members, valued and expected by the group. So this explanatory perspective, more focused on the scope of human behavior, may have been a preliminary step in the elaboration of an alternative and selectionist treatment to behavioral variability.

It is necessary to emphasize, as well, that in *Walden II*, environmental control over individual behavior is a crucial feature of the community. That is why Castle's questions about variability, spontaneity and freedom in the face of a highly controlled context shows how the recognition of a naturally variable aspect of behavior could, at this point, make way for traditional notions based on the conception of autonomous men, interpreted as free agency. Therefore, as suggested by Leão et al. (2016), Skinner, at that point, had found in the deterministic premise the only alternative to a scientific explanation. From *Walden II* it is not possible to conclude that variation had been predominantly interpreted as a complementary process to that of selection for explaining behavior, because variation was still linked to mentalist interpretations and backed by metaphysic connotations.

Verbal Behavior and the Beginning of an Analysis at the Group Level

The idea of evolution based on three variation and selection histories is intrinsically dependent on the consolidation of the first two defining aspects of the selectionist mode, that is, the recognition of the selective role of consequences and an explanation based on the relation between variation and selection, previously analyzed. Despite the signs of the construction of these two initial characteristics in the 1930s and 1940s, there was no significant mention of natural selection and no direct reference to cultural selection in this period. From this, it seems evident that, at this early stage of Skinner's system, the last characteristic of selection by consequences – cultural selection – was yet to be elaborated. However, some of his observations which refer to verbal behavior and to group or cultural level of analysis were selected to be discussed in this section, in order to demonstrate that some fundamental aspects for the construction of what will be later labeled the third level of selection at this point already are present in Skinner's work.

In a discussion of the role of reinforcement as an operation that strengthens the operant, Skinner (1938) referred to verbal behavior, which he defined as that "part of behavior which is reinforced only through the mediation of another organism"

(p. 116). This type of reference is relevant because the explicit notion of verbal behavior and the recognition of the role of the other in scope of such behavior will be indispensable in thinking about behavioral relations at the group level and about the status of individuals as social beings. The analysis of verbal behavior became better outlined in the 1940s, when Skinner (1945) presented an alternative proposal to traditional language theories and highlighted, as noted before, the role of the verbal community in the acquisition and maintenance of language.

Therefore, the importance of verbal behavior and the contingencies originated from a verbal community for explaining human behavior is already explicit. It is important to note that Skinner's analysis is restricted to the individual level at this point, referring to the basic 3-term contingency, but with emphasis on the reinforcement offered by other's actions. In addition, as noted in the preface to *Verbal behavior* (1957), the genesis of the book dates from the late 1930s, with a nearly finished version of the book in the mid-1940s, material that was the basis of his William James lectures at Harvard and used in courses taught by Skinner on the topic at several universities over these two decades. Thus, it is no surprise that there were analyses of verbal behavior in this initial period of Skinner's career.

In 1947, in defense of the possibility of controlling human behavior, Skinner affirmed that genetic constitution, personal history, and social environment all have a role in determining behavior. As Micheletto (2016) pointed out, considering the link between these variables and natural selection, individual reinforcement history, and cultural contingencies, respectively, this kind of statement may suggest that behavior was already being perceived and understood by him as a product of three histories of variation and selection:

The genetic constitution of the individual and his personal history to date play a part in this determination. Beyond that, the control rests with the environment. The more important forces, moreover, are in the social environment, which is man-made. Human behavior is therefore largely under human control. (Skinner, 1947/1999, p. 319)

The analysis of social interactions and of the individual as member of a culture dominates *Walden II*, where Skinner (1948) defended the possibility of planning society through behavioral engineering. Even though the terms evolution and cultural selection were not yet explicit, there are strong signs of the notion of evolutionary processes in the development of cultures at this point of Skinner's system. Evidence of this concern is Skinner's (1948) highlighting of the importance of

self-control of the individuals in the community, with a view to priority promotion of the well-being of society to the detriment of the immediate benefit for the individual. This does not mean, however, that Skinner's system ignores the development of the individual's well-being, but rather that the system aims to assure that individuals are committed to the group's well-being. Otherwise, "the culture will eventually be replaced by competing cultures which work more efficiently" (p. 271). Therefore, by the late 1940s, Skinner considered cultural survival as a special value.

Furthermore, Skinner (1948) focused not only on how individual behavior directly influences the evolution of a culture, but also the fact that it is possible to intervene in the course of this evolutionary process through behavior technology. As he put it: "We can't be satisfied with a static culture. There's work to be done, if we're to survive... We need a powerful science of behavior" (Skinner, 1948, pp. 290-291). Beyond the community in *Walden II*, Skinner often pointed to the institution of family as "a medium for perpetuating a culture" (p. 138), in the sense of practices, customs and habits, implying that the family is the place to describe relations at the cultural level. Therefore, although the idea of behavior evolution based on three histories of variation and selection is not systematically established, there is clear evidence in this period of the notion of a selection process in the scope of culture and that transcends the individual level.

Final Considerations

The adoption or not of a selectionist perspective in the first decades of Skinner's career is a controversial topic and challenging to analyze, because he presented concepts and statements that sometimes are inconsistent, even in the same work, such as the adoption of the notion of functional relations parallel to necessity relations between events, which are associated with distinct epistemologies (Cruz & Cillo, 2008; Moxley, 1999). Previous knowledge about this fact made that the main objective of this study was not to identify an exact work in which a selectionist perspective became evident in Skinner's work, but to investigate, historically, how the defining characteristics of selectionism were being constructed throughout his writings.

It was noted that, as pointed out in the literature, at this early stage there are crucial steps in the construction process of a selectionist principle. In the context of this period of transition in Skinner's science it was observed that although a selective process was already implied, contrary to Matos's (2003) arguments on this point, the remains of a still-traditional notion of a dependency relation between

events (strict causation) make it impossible to point to the selectionism as an explicit characteristic of his science. Corroborating the conclusions of Andery et al. (2000), and others (e.g., Matos et al. (1989); Dittrich, 2004; Laurenti, 2009; Matos, 2003, 1988) that Skinner's selectionist perspective comes to fruition after the first two decades of his career, a selectionist perspective was not yet present at this early stage of his writings.

This observation has implications for the development of the second feature of Skinnerian selectionism, because the treatment of variation as a complementary process to that of selection depends necessarily on accepting an alternative notion of causality, which, among other things, acknowledges the probabilistic nature of behavioral relations. These conclusions contradict Palmer and Donahoe's (1992) arguments because even though variation has been a concern since very early in such science, it has been treated as a threat to such a scientific endeavor and not as a complementary process to that selection for explaining behavior. Moreover, a selectionist treatment for variation, even if it was present in this period, according to the definition adopted in this review, would not in itself enough to characterize Skinnerian science as a selectionist one.

Finally, despite references to different types of behavior determinations (cf. Micheletto, 2016), it is suggested that a systematized and organized notion for interpreting behavior through three selectionist histories was absent from Skinner's 1930s and 1940s conceptual framework for behavior. Although strong evidence of a third level of selection was noted in *Walden II*, and the survival of culture has already appeared as a persistent concern, there was no systematized explanation of cultural evolution as a distinct level of analysis, nor is there evidence indicating that Darwin's theory represented for Skinner, at that time, a concept with special relevance for explaining behavior.

For this reason there are some authors who point to the 1950s as the time that the first evidence of a selectionist principle emerged in his work (e.g. Dittrich, 2004; Laurenti, 2009; Matos et al. 1989; Micheletto, 1995), especially with the publication of his benchmark *Science and Human Behavior* (Skinner, 1953), where, according to Matos et al. (1989), Skinner presents a clear discussion of cultural evolution. Thus, it is necessary to extend the present analysis to the 1950s and beyond to evaluate how the defining aspects of Skinner's selectionist principle were established, as well as when selection by consequences came to represent Skinner's central proposal for explaining behavior.

References

- Abib, J. A. D. (2001). Arqueologia do behaviorismo radical e o conceito de mente [Archeology of radical behaviorism and the concept of mind]. In H. J. Guilhardi, M. B. B. P. Madi, P. P. Queiroz, & M. C. Scoz (Eds.), *Sobre Comportamento e Cognição: expondo a variabilidade* (Vol. 7, pp. 20-35). Santo André: Esetec.
- Andery, M. A. P. A., Micheletto, N., & Sérgio, T. M. A. P. (2000). A construção de seleção por consequências no trabalho de B. F. Skinner [The construction of selection by consequences in B. F. Skinner's work]. *Boletim Contexto*, 21, 11-12.
- Andery, M. A. P. A., Micheletto, N., & Sérgio, T. M. A. P. (2004). Publicações de B. F. Skinner: de 1930 a 2004 [B. F. Skinner publications: from 1930 to 2004]. *Revista Brasileira de Terapia Comportamental e Cognitiva*, 6, 93-134.
- Campbell, D. T. (1974). Evolutionary epistemology. In P. A. Schlipp (Ed.), *The philosophy of Karl Popper* (Vol. 14-1, pp. 413-163). LaSalle, IL: Open Court Publishing.
- Catania, A. C. (2001). Three types of selection and three centuries. *International Journal of Psychology and Psychological Therapy*, 1(2), 151-159.
- Cleaveland, J. M. (2002). Beyond trial-and-error in a selectionist psychology. *Behavior and Philosophy*, 30, 73-99.
- Cruz, R. N., & Cillo, E. N. P. (2008). Do mecanicismo ao selecionismo: Uma breve contextualização da transição do Behaviorismo Radical [From mechanicism to selectionism: A brief contextualization of the radical behaviorismo transition]. *Psicologia: Teoria e Pesquisa*, 24(3), 375-385.
- Dittrich, A. (2004). *Behaviorismo radical, ética e política: Aspectos teóricos do compromisso social* [Radical behaviorismo, ethics and politics: theoretical aspects of social compromise] (Unpublished doctoral dissertation). Federal University of São Carlos, São Carlos, São Paulo.
- Donahoe, J. W. (2003). Selectionism. In K. A. Lattal & P. N. Chase (Eds.), *Behavior theory and philosophy* (pp. 103-128). Dordrecht, Netherlands: Kluwer Academic Publishers.
- Donahoe, J. W. (2012). Reflections on behavior analysis and evolutionary biology: A selective review of evolution since Darwin – the first 150 years. *Journal of the Experimental Analysis of Behavior*, 97, 249-260.
- Hull, D. L. (1988). A Mechanism and its metaphysics: An Evolutionary account of the social and conceptual development of science. *Biology and Philosophy*, 3, 123-156.

- Laurenti, C. (2008). Determinismo, probabilidade e análise do comportamento [Determinism, probability and behavior analysis]. *Temas em Psicologia*, 16(2), 171-183.
- Laurenti, C. (2009). *Determinismo, indeterminismo e behaviorismo radical* [Determinism, indeterminism and radical behaviorism] (Unpublished doctoral dissertation). Federal University of São Carlos, São Carlos, São Paulo.
- Leão, M. F. F. C., & Carvalho Neto, M. B. (2016). Afinal, o que é seleção por consequências? [After all, what's selection by consequences?] *Interação em Psicologia*, 20(3), 286-294.
- Leão, M. F. F. C., Laurenti, C., & Haydu, V. B. (2016). Darwinism, Radical Behaviorism, and the role of variation in Skinnerian explaining behavior. *Behavior Analysis: Research and Practice*, 16, 1-11.
- Matos, M. A. (2003). A propósito de 'A construção de seleção por consequências no trabalho de B. F. Skinner' (Andery, Micheletto & Sério, 2000) [In regard to 'The construction of selection by consequences in B. F. Skinner's work' (Andery, Micheletto & Sério, 2000)]. *Boletim Contexto*, 26, 4-6.
- Matos, M. A., Machado, L. M. C. M., Ferrara, M. L. D., Silva, M. T. A., Hunziker, M. H. L., Andery, M. A. P. A., Sério, T. M. A. P., & Figueiredo, L. C. M. (1989). O modelo de consequenciação de B. F. Skinner [Skinner's model of selection by consequences]. *Psicologia: Teoria e Pesquisa*, 5(2), 137-158.
- Micheletto, N. (1995). *Uma questão de consequências: A elaboração da proposta metodológica de Skinner* [A matter of consequences: The elaboration of the methodological proposal of Skinner] (Unpublished doctoral dissertation). Pontifical Catholic University of São Paulo, São Paulo.
- Micheletto, N. (1997). Bases filosóficas do behaviorismo radical [Philosophical bases of radical behaviorism]. In: R. A. Banaco. (Org.), *Sobre Comportamento e Cognição* (Vol. 1, pp. 29-44). Santo André: ARBytes.
- Micheletto, N. (2016). Seleção por consequências: Desdobramentos para a noção de ciência de B. F. Skinner [Selection by consequences: Deployments for the notion of science of B. F. Skinner]. *Interação em Psicologia*, 20(3), 295-304.
- Moxley, R. A. (1999). The two Skinners, modern and postmodern. *Behavior and Philosophy*, 27, 97-125.
- Palmer, D. C., & Donahoe, J. W. (1992). Essentialism and selectionism in cognitive science and behavior analysis. *American Psychologist*, 47, 1344-1358.
- Peterson, G. B. (2004). A day of great illumination: B. F. Skinner's discovery of shaping. *Journal of the experimental analysis of behavior*, 82, 317-328.

- Plotkin, H. (1988). The evolutionary analogy in Skinner's writings. In S. Modgil e C. Modgil (Eds.), *B.F. Skinner: Consensus and controversy* (pp. 139-148). New York: Falmer. (Original text published in 1987)
- Plotkin, H. C. (1994). *Darwin Machines and the Nature of Knowledge*. Cambridge, MA: Harvard University Press.
- Popper, K. (1972). *Objective knowledge: An evolutionary approach*. Oxford: Oxford University Press.
- Richelle, M. (1988). Variation and selection: The evolutionary analogy in Skinner's theory. In S. Modgil & C. Modgil (Eds.), *B.F. Skinner: Consensus and controversy* (pp. 127-137). New York: Falmer. (Original text published in 1987)
- Sério, T. M. A. P. (1990). *Um caso na história do método científico: Do reflexo ao operante* [A case in the history of the scientific method: From the reflex to the operant (Unpublished doctoral dissertation)]. Pontifical Catholic University of São Paulo, São Paulo.
- Sério, T. M. A. P., Andery, M. A. P. A., & Micheletto, N. (2005). A noção de variabilidade na obra de B.F. Skinner [The notion of variability in Skinner's work]. *Acta Comportamentalia*, 13(2), 98-110.
- Skinner, B. F. (1930). On the conditions of elicitation of certain eating reflexes. *Proceedings of the National Academy of Sciences*, 16, 433-438.
- Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. New York, NY: Appleton-Century-Crofts.
- Skinner, B. F. (1945). The operational analysis of psychology terms. *The Psychological Review*, 52, 270-277.
- Skinner, B. F. (1948). *Walden II*. New York, NY: Macmillan.
- Skinner, B. F. (1957). *Verbal Behavior*. Acton: Copley Publishing Group.
- Skinner, B. F. (1979). *The shaping of a behaviorist: Part two of an autobiography*. New York: New York University Press.
- Skinner, B. F. (1981). Selection by consequences. *Science*, 213(4507), 501-504.
- Skinner, B. F. (1984). Some consequences of selection. *The Behavioral and Brain Sciences*, 7, 502-510.
- Skinner, B. F. (1990). Can psychology be a science of mind? *American Psychologist*, 45, 1206-1210.
- Skinner, B. F. (1999). The concept of reflex in the description of Behavior. In V. G. Laties, & A. C. Catania (Eds.), *Cumulative record: definitive edition* (pp. 419-441). B. F. Skinner Reprint Series. (Original text published in 1931)

- Skinner, B. F. (1999). Current Trends in Experimental psychology. In V. G. Laties, & A. C. Catania (Eds.), *Cumulative record*: definitive edition (pp. 316-329). B. F. Skinner Reprint Series. (Original text published in 1947)
- Skinner, B. F. (1999a). The generic nature of the concepts of stimulus and response. In V. G. Laties, & A. C. Catania (Eds.), *Cumulative record*: definitive edition (pp. 442-456). B. F. Skinner Reprint Series. (Original text published in 1935)
- Skinner, B. F. (1999b). Two Types of conditioned reflex and a pseudo type. In V. G. Laties, & A. C. Catania (Eds.), *Cumulative record*: definitive edition (pp. 457-464). B. F. Skinner Reprint Series. (Original text published in 1935)
- Skinner, B. F. (1999). Two Types of conditioned reflex: A reply to Kornorski e Miller. In V. G. Laties, & A. C. Catania (Eds.), *Cumulative record*: definitive edition (pp. 465-471). B. F. Skinner Reprint Series. (Original text published in 1937)
- Thorndike, E. L. (1998). Animal intelligence: An experimental study of the associative processes in animals. *American Psychologist*, 53, 1125-1127. (Original text published in 1898).

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