

## COMMITMENTS WITH REDUCTIVE AND EMERGENT RELATIONS IN BEHAVIOR ANALYSIS

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*Abstract:* The philosophical debate on reduction and emergence commonly springs from the division of domains (and subdomains) correlated with the sciences, such as biological domains (e.g., genetics and physiology) and psychological domains (e.g., learning, perception, emotions). These domains are interconnected, with some depending on or composed of elements from others. The debate revolves around whether certain domains are reducible or irreducible to those on which they depend or are composed. In this work, following an examination of common interpretations of the notions of reduction and emergence, we aim to identify and compare radical behaviorism and molar behaviorism as regards the reducibility or irreducibility between the following pairs of domains: (i) behavioral – physiological; (ii) psychological – behavioral; (iii) teleological – contingencies of natural or operant selection; and (iv) cultural – behavioral. This article contributes, among other things, to explaining several core similarities and differences between radical behaviorism (as worked out by B. F. Skinner) and molar behaviorism (as worked out by W. M. Baum and H. Rachlin); as well as some conceptual aspects pertaining to the identity of behavior analysis and its interfaces with related research areas both in natural and social sciences.

*Keywords:* reduction; emergence; radical behaviorism; molar behaviorism; teleological behaviorism; behavior analysis.

The debate about reductive and emergent relations is huge, but it usually springs from:

1. A *differentiation between domains* (and subdomains)—sometimes with an ontological focus (the scope of reputed processes, properties, or individual entities), and at other times with a conceptual-theoretical focus (the scope of concepts, models, or theories). This differentiation correlates with the divisions in the sciences. Thus, we have the domain of theories and models of Physics (e.g., the standard model of particles) or the corresponding realities they address (subatomic particles, fundamental forces, etc.); the theoretical domains of the life sciences (e.g., theory of evolution, genetics) or the realities they encompass (evolution of species, genetic heredity); the domains of psychological theories and models (e.g., reinforcement models, self-control) or of the reputed realities they are concerned with (learning, self-control, etc.); and so forth;

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2. These domains are interconnected, with *some depending on or comprising elements of others*. For example, human learning depends on physical and chemical bases of the body and the environment; collective behavior partially depends on the behavior of the individuals involved; and
3. The higher-level domains (or subdomains) are *distinguished based on reputed novelties* they exhibit in relation to the underlying (lower level) ones. For example, laws of learning are formulated distinctly from the laws of Physics, Chemistry, and even Physiology, although human learning depends to some extent on physiological and environmental grounds, which in turn are made up of physical-chemical components.

Thus, the reduction vs. emergence debate, as commonly understood (e.g., Kim, 2006; O'Connor, 2020; Sartenaer, 2018; Silberstein, 2002), revolves around issues as to what extent this division of domains reflects phenomena reducible or irreducible to those on which they purportedly depend or are composed. Ultimately, the debate extends to whether these phenomena are reducible to the elementary micro-constituents of the universe. Most often, *inter-domain* relations are at issue (e.g., the reducibility between the biological and the physicochemical, between the psychological and the physiological); but *intra-domain* relations may also be considered (e.g., the reducibility of one set of psychological categories to another set of these categories). Notice that this debate does not necessarily assume that the universe is truly stratified into domains (or 'levels'). Some authors, such as Campbell (1974), consider that this division between domains is not merely a conventional classification but captures corresponding strata of reality. Yet, the debate stems from the simple fact that such division is made and widely utilized in science and beyond. This alone prompts questions pertaining to its ontological or epistemic status (depending on the focus).

The positions in the debate are often classified as reductionist (RED), emergentist (EME), or dualist (DUA), each having several different versions. When it comes to the status of the psychological domain, for instance, RED proposals include mind-brain identity theories (Armstrong, 1968; Lewis, 1966) and replacement proposals (e.g., Churchland, 1988). DUA posits that certain things in the universe have a special, *sui generis* constitution (so that the alphabet of the universe partly includes non-physical letters, besides physical letters, so to speak). EME is an intermediary stance between RED and DUA. Like RED, EME asserts the existence of only one basic type of reality (the "ABC of the universe"), constitutive of everything that exists, nowadays often articulated in terms of the standard model of particle Physics. Yet, differently from RED, EME holds that some domains exhibit irreducible novelties, although made up of the ABC common to everything else in the universe. Some versions of EME interpret these irreducible novelties in terms of unexplainability or unpredictability from sole consideration of underlying domains (e.g., Broad, 1925). Other versions (e.g., Campbell, 1974) conceive of irreducibility as downward (i.e., top-down) causation from higher to lower-level domains.

In this work, we aim to identify and compare the theoretical commitments of Skinner's *radical behaviorism* (RB) and Baum and Rachlin's *molar behaviorism* (MB) with some reductive and emergent relations<sup>3</sup>. We have chosen these two behavior analysis (BA) traditions due to their centrality as proposals of philosophical foundations thereof. RB has been the most influential in BA, evident in numerous behavior analysis textbooks in recent decades (e.g., Catania, 2012; Leslie, 1996; Pierce & Cheney, 2004). In turn, MB (alongside contextual behaviorism; see Hayes, 2021) stands out as one of the most prestigious alternative traditions in the field. Baum's (2017a) textbook has been widely used in BA courses; Baum, Rachlin and their collaborators have a large number of papers in BA's flagship journals (e.g., JEAB). While we focus on RB and MB in this paper, the commitments of other BA traditions to reductive and emergent relations could be explored in a follow-up study (for a

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<sup>3</sup> Rachlin (1994, 2004, 2021) puts forward a special form of Molar Behaviorism he calls Teleological Behaviorism, which shares several features of Baum's. Baum (1997, 2002, 2004, 2017a) often refers to Rachlin's approach as 'Molar Behaviorism' or 'Molar View', the term he uses to designate his own theory.

comprehensive overview of current BA traditions, see Zilio & Carrara, 2021; for a concise overview, Araiba, 2020).

We proceed here in five steps. First, based on the specialized literature, (1) we survey common characterizations of the notions of reduction and emergence, along with (2) those of reductionism and emergentism. This step helps establish the criteria we will employ to classify some of RB's and MB's theoretical commitments. Then, based on the works of Skinner, Baum, and Rachlin, and also on related specialized literature, (3) we highlight their different monist, non-dualist commitments. Having established this preliminary premise, we go on to (4) identify and spell out their different commitments regarding the reducibility or irreducibility between the following pairs of domains:

- i. *The behavioral in relation to the physiological*: whether statements about behavior can be reduced to statements about underlying physiological phenomena;
- ii. *The psychological in relation to the behavioral*: whether statements formulated using psychological categories (that is, concepts such as cognition, emotion, and their ramifications, such as reflecting, remembering, being afraid, enjoying, etc.) can be reduced to statements formed by behavioral categories (e.g., reflex behavior, operant behavior, reinforcement, schedules of reinforcement, aversive control, etc.);
- iii. *The domain of teleological properties to selection contingencies*: whether attributions of function, in the (teleological) sense of ends or purposes, made to behavior patterns and biological traits, can be reduced to statements about histories of natural or operant selection (as the case may be) and environmental aspects where the behavior or trait is situated;
- iv. *The cultural in relation to the behavioral*: whether statements about cultural phenomena (such as the transmission of customs) are reducible to statements about operant behavior and operant selection contingencies pertaining to individual organisms.

In the concluding section, (5) we summarize the points of convergence and divergence between RB and MB as regards the relations (i)-(iv). In addition, we draw attention to some differences between Baum's and Rachlin's versions of MB.

The pairs (i)-(iv) were chosen for at least two reasons. First, they are related to the contours of behavior analysis amid (other) life sciences (primarily physiology but not exclusively), as well as other traditions in psychology and the social sciences. Indeed, the subject handled in this work pertains to the historical and philosophical identity of BA in relation to other research areas (Marr & Zilio, 2013), an important topic in theoretical BA (Leigland, 2010). Second, drawing from our acquaintance with the writings of Skinner, Baum, and Rachlin, we observed that (i)-(iv) are pairs of relations addressed by both RB and MB. Accordingly, this work can also contribute to explaining the similarities and the theoretical cleavage between RB and MB—which Baum (2002) characterizes (for reasons we do not agree with, as we will explain later) as a (Kuhnian) “paradigm shift.”

### **Reduction and Emergence**

To classify the perspectives of radical behaviorism (RB) and molar behaviorism (BM) on the pairs of relations (i)-(iv) as commitments with reductive or emergent relations,<sup>4</sup> we need to clear up the concepts of reduction and emergence. This section takes on this task, based on a huge body of primary and secondary literature; in the latter case, with a particular emphasis on overviews of the reduction vs. emergence debate (including Beckerman et al., 1992; Humphreys, 2016; O'Connor, 2020; Pessoa Jr., 2013; Robinson, 2009; Sartenaer, 2018; Silberstein, 2002; Van Gulick, 2001; Walter & Eronen, 2014). From the several characterizations of these concepts, some are preferable for the goals of this paper, to wit:

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<sup>4</sup> The term ‘emergent relations’ is employed in behavior analysis in the sense of stimulus equivalence phenomena. Clearly, the term is used in this paper in another sense, pertaining to the reduction vs emergence debate in philosophy of science.

- I. The most frequent in the debate, i.e., those that enjoy prevailing consensus. This does not mean consensus on the plausibility of reductive or reductive claims (for on this the dispute is great), but rather plausibility on what these terms convey;
- II. Those centered on general aspects linked to the concepts of reduction and emergence, rather than intricately tied to specific philosophical agendas. For example, characterizations like those by Kemeny and Oppenheim (1956) and Nagel (1961) heavily rely on details of the logical empiricist view of scientific theories as interpreted axiomatic systems. The basic traits associated with the concepts of reduction and emergence came before logical empiricism, and remain independent of the specifics of that particular philosophical agenda; and
- III. Characterizations closer to the language of the approaches at stake (namely, RB and MB). Otherwise, their employment for our purposes would be compromised. In particular, those in terms of “supervenience” add details (logic of possible worlds, etc.) foreign to the language of RB and MB. There are recurring descriptions of emergence and reduction independent of such technical resources.

Considering this set of parameters (I-III), three characterizations of reduction and two of emergence stand out, as follows.

### ***Reduction***

The general idea of reduction of a domain  $X$  to another,  $Y$ , such that  $X$  depends on, or is made up of elements from,  $Y$ , is often expressed as the phenomena of  $X$  being the same thing as those of  $Y$ , or else being explainable in terms of what happens in  $Y$  and by the laws of  $Y$  (e.g., Silberstein, 2002, p. 81). Three recurring renderings of such idea are the following<sup>5</sup>:

1. *Reduction of a domain (or subdomain)  $X$ , with respect to another,  $Y$ , by type-identities*: this takes place when the types of things (processes, properties, or entities) subscribed under  $X$  are identical with types of things of  $Y$ . Notice that this does not mean a simple correlation between  $X$  and  $Y$ , but rather a matter of mapping identities of kinds of items from  $X$  with kinds of items from  $Y$ . That is, the types discriminated in  $X$  are equivalent to certain types in  $Y$ . Notice also that in this form of reduction it is not denied that the phenomena of  $X$  exist. Rather, it is claimed that they exist, but that they are nothing more and nothing less than  $Y$  phenomena. Place’s (1956) and Smart’s (1959) identity theory of certain types of psychological phenomena with types of physiological phenomena, later generalized to the psychological domain as a whole by Armstrong (1968) and Lewis (1966), is illustrative in this regard. In its generalized form, the theory asserts that psychological types (e.g., desires in humans) are identical with physiological types (activation of such and such areas of the human central nervous system). This is understood to be analogous to asserting that salt is the same as NaCl, or that heat is kinetic molecular energy;
2. *Reduction of a domain (or subdomain)  $X$ , in relation to another,  $Y$ , by elimination or substitution*: this occurs when types of things of  $X$  once reputed as reality turn out not to exist, and are replaced by types of  $Y$ . From a conceptual-theoretical standpoint, this means the replacement of concepts or models of  $X$  by those of  $Y$ , under the assumption that those of  $X$  are overall void of counterparts in the world and result ineffective, or less effective, compared to those of  $Y$ , for explaining and predicting what they are originally supposed to. This form of reduction is often illustrated using the example of caloric, which was postulated in the 17th and 18th centuries to explain the exchange of heat between bodies but later deemed non-existent. The caloric theory was replaced by that of heat as changes in the kinetic velocity of molecules in accordance with the laws of conservation of energy. So-called “eliminativist” approaches to psychological categories contend that they are replaceable for categories from

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<sup>5</sup> There is no reason why we should not take into account both ontological and epistemic formulations of reduction and emergence in this paper. Our goal here requires consideration of both.

another domain, often (as is the case of Churchland, 1988) considered to be the domain of physiology;

3. *Reduction of a domain (or subdomain) X, in relation to another, Y, as translatability*: when it is possible to translate the concepts and statements of *X* to concepts and statements of *Y*, typically with some improvements and revisions of meaning. To take an example of intra-domain reduction, in a reduction of classical mechanics to the general theory of relativity, the three laws of motion established in the former undergo a translation, leading to a partial alteration of their original meaning. Concepts of the former, such as space (conceived therein as a uniform backdrop behind physical events and expressed in Euclidean geometry), are re-signified in light of the advances achieved by the reductive theory (in which, among other things, the idea of absolute space is abandoned, and space is modeled by non-Euclidean geometries).

### ***Emergence***

The concept of emergence conveys the idea that phenomena in a given domain *X*, despite depending on or being composed of items from *Y*, do not reduce to *Y*. This is sometimes expressed through the slogan “the whole is greater than the sum of its parts.” As Pessoa Jr. (2013) puts it: “[T]he concept of emergence refers to a state of affairs in which the properties of a certain domain do not completely reduce to the properties of another domain ... despite being, in some sense, produced by this other domain” (p. 22). Thus, the emergence of domain *X* in relation to another, *Y*, conveys at least two central nuances. First, *X* depends on or is made up of items of *Y*. We say that *X* *emerges from Y*. Second, *X* represents a *novelty* in relation to *Y*. That is, phenomena of *X* are represented as having one or more features not possessed by those of *Y* (despite the dependence or compositionality of *X* in relation to *Y*). For this reason, *X* is considered irreducible to *Y*.

Various interpretations of what constitutes novelty align with different understandings of emergent relations. Considering the criteria (I-III) listed above, two prominent interpretations stand out:

- a) *Emergence of a domain (or subdomain) X, in relation to another, Y, as unexplainability / unpredictability*: when it is believed to be impossible or unfeasible to explain or predict phenomena of *X* based on sole consideration of phenomena and laws of *Y*. That is, the framework of concepts, models and laws of *Y* is not sufficient to provide the intended explanations or predictions of phenomena in *X*. For example, according to Mayr (2004),

Descending to a lower level of analysis often decreases the explanatory power of the preceding analysis .... No one would be able to infer the structure and function of a kidney even if given a complete catalog of all the molecules of which it is composed. (p. 72)

According to Mayr, biological domains are emergent in relation to the physical-chemical domains because an exclusive consideration of the latter would be insufficient to explain certain aspects of the former;

- b) *Emergence of a domain X, in relation to another, Y, in terms of downward causation*: this characterization (which goes back to Morgan, 1923, but is couched in this terminology after Campbell, 1974) states that emergence takes place when an organized whole, a phenomenon of *X*, can exert (top-down) influences on its constituent parts, pertaining to *Y*. Accordingly, causal relations occur not only at the lower-level, *Y*, in an ascending (bottom-up) manner (the determination of the higher-order domain, *X*, by the lower one, *Y*) but also the reverse. To illustrate, atoms make up the organism’s cells, which make up the organs, glands, limbs, etc. of the organism. However, what the situated organism does (e.g., physical exercises) apparently affects its parts downwards—down to the level of the atoms that make up the body. Campbell (1974), speaking of the products of natural and structurally analogous selection processes, states that

The laws of the higher-level selective system determine in part the distribution of lower-level events and substances .... [A]ll processes at the lower levels of a hierarchy are restrained by and act in conformity to the laws of the higher levels. (p. 180)

Hence, Campbell proposes that selection processes imply downward causation over their products<sup>6</sup>.

A rendering of emergence in terms of *multiple realizability* is sometimes found in the literature, where  $X$  is considered to emerge from  $Y$  if types of things in  $X$  can be realized by different types in  $Y$ . From a conceptual-theoretical standpoint, the idea is that  $X$  is multiply realizable in  $Y$  when a statement or model of  $X$  conveys varied, and not univocal, patterns of  $Y$ . For example, despite the diversity of hearts in animal kingdom, we call them by the same name ('heart') owing to their common functions (viz., pumping blood to the rest of the body).

However, it has been widely disputed whether multiple realizability is a sufficient condition of emergence. For one, authors such as Lewis (1980) suggest that multiple realizability can be reconciled with reductionism, by claiming that type-identities should be considered as relative to a given species. For another, reduction of  $X$  to  $Y$  in terms of translatability (the third sort of reduction highlighted above) is harmonious with disjunctive (i.e., non-univocal) assertions of  $Y$ , which allows for multiple realizability of  $X$  in relation to  $Y$ . Consequently, in this paper we will not assume multiple realizability as a form of emergence.

### ***Reductionism, Emergentism, and Dualism***

Let us now move on to the terms 'reductionism,' 'emergentism,' and 'dualism.' This will allow us to spell out why both radical behaviorism and molar behaviorism have reductionist and emergentist commitments, but not dualist ones. Given the characterizations of the terms 'reduction' and 'emergence' above, we are more than half-way through this task.

A *reductionist position* (RED) concerning a domain  $X$  with respect to a domain  $Y$  asserts that  $X$  reduces to  $Y$  in some relevant sense of 'reduction.' In turn, an *emergentist position* (EME) on a domain  $X$  with respect to a domain  $Y$  is one whereby  $X$  is emergent with respect to  $Y$  in some relevant sense of 'emergence.' While we have already touched on some examples of RED and EME, it is important to highlight additional aspects of RED and EME.

First, RED and EME are *monist* conceptions, meaning both RED and EME take the view that everything that exists is made up of the same kind of substance (hence the prefix *mon-*, from the Greek *mono*, which means one or single). That is, despite the differences between RED and EME, they share a common ground according to which everything in the universe, no matter how different and complex, is formed by the same "alphabet" (nowadays usually conceived of along the standard model of particle Physics), so to speak.

Typically, the monist view assumed by both RED and EME is physicalism (or materialism), whereby everything that exists, ranging from stars to the cells of organisms and their interactions with the environment, is considered physical. In this perspective, everything is understood as a matter of processes involving subatomic particles, fundamental forces, etc.). This view leaves no room for supernatural entities or others of a *sui generis* nature beyond the physical realm (e.g., Beckerman et al., 1992; Kim, 1999; Sartenaer, 2018)<sup>7</sup>.

However, there are other forms of monism, although encouraged by few. One such form is idealist monism, advocated by Berkeley (1948/1710), whereby everything that exists, including all

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6 According to Kim's (1999, 2006) causal exclusion argument, downward causation is incompatible with so-called Principle of Causal Closure of the Physical domain, whereby every physical phenomenon has a sufficient physical cause. After Kim, for some authors downward causation means situations where this principle does not apply. For the purposes of this article, we can abstract from the controversies surrounding the causal exclusion argument, as the goal of this article is to identify whether RB and MB are committed with downward causation.

7 Certain uses of the term 'physicalism' (as in Leigland, 1993) link physicalism with reductionism of higher-level domains in relation to Physics. However, we will follow the common practice of the recent literature and distinguish between reductive and non-reductive (i.e., emergent) physicalisms.

things that we classify as physical, derives from perceptual experience, and would not exist outside of it. Hence his famous dictum: “to be is to be perceived.” In this sense, for idealist monism the primary reality of all things is conceived of as psychological.

Neutral monism is a third sort of monism, according to which everything in the universe shares a single nature and is neither physical nor psychological. According to this perspective, what we classify as physical and psychological are convenient constructions out of this ultimate substance that is neither physical nor psychological. In James (1912), this ultimate substance is taken as the experience itself, which would be a “simple that” (p. 23); the rest of things are useful qualifications of aspects of the experience. In an epistemic version of neutral monism, it is claimed that the basic nature of reality is unknowable. Therefore, proponents thereof hold that we should maintain a stance of neutrality regarding what it is, leaving open the possibility that it may turn out to be physical or psychological.

Consequently, although RED and EME are usually linked with physicalist monism, it is possible to combine either RED or EME with other forms of monism. For example, as Dutra (2018) points out, one could in principle support an idealist emergentism. Identifying these non-physicalist forms of RED and EME, which are also non-dualist (as we will soon clarify), is relevant for the goal of this article. This significance arises especially because, as demonstrated in the next section, while radical behaviorism is committed to physicalist monism, molar behaviorism as put forward by Baum is committed to neutral monism.

Dualism (DUA) is antagonistic to monism. Common to DUAs is the view whereby there is not just one category of things that would form the ABC of reality. Rather, there would be two basic categories (hence the prefix *dual-*, which means two), one physical and the other non-physical. The non-physical substance is classically postulated to characterize the psychological domain. RB and MB assume monist, non-dualist views, hence qualifying as compatible approaches with some emergentist commitments.

### ***Radical Behaviorism, Molar Behaviorism, and Their Monistic Commitments***

Following part of Laudan’s (1977, 1984) understanding of the structure and dynamics of theories, behavior analysis is a tradition of scientific research, which comprises various sub-traditions. Radical behaviorism is its most prominent sub-tradition, defined by a set of (i) ontological guiding-assumptions (about the sorts of things BA should assume to exist, and their basic contours); (ii) methodological guiding-assumptions (about the methods to be adopted in BA); and (iii) axiological guiding-assumptions (about the goals BA should pursue, and the criteria it should adopt for theoretical choices). In the effort to improve BA’s problem-solving power with respect to both empirical and conceptual problems, some other versions of behaviorism have been put forward with their own proposals of guiding-assumptions [(i)-(iii)], to a greater or lesser extent alternative to those established by RB. While keeping, at least approximately, with some of the guiding-assumptions associated with RB, these alternative proposals (e.g., Hayes’ contextual behaviorism, Staddon’s theoretical behaviorism; see Zilio & Carrara, 2021) support changes in some others, thereby working as variant theoretical foundations for part of the research conducted in BA.

Therefore, RB and MB share, at least to some extent, some proposals of guiding-assumptions. To mention but a few (see Lazzeri, 2017; 2021), among them are the claims that behavior is determined non-linearly by environmental (including cultural) factors, together with hereditary factors, instead of being the result of an “initiating self” (Baum, 2017a; Skinner, 1953; Rachlin, 1991). MB retains the Skinnerian view that the variables which control behavior lie in phylogenetic and/or ontogenetic histories (in the latter case, including cultural variables, especially in the human species), together with the context where the behavior is situated. MB also recruits from RB the distinction between reflex (or respondent) and operant behavior, the former characterized by the control exercised by the antecedent environment, while the latter by the control exercised by consequences (Baum, 2017a; Rachlin, 1985, 1991; Skinner, 1953, 1976/1974); as well as the thesis that operant learning shares general parameters with natural selection: variation, differential success, and retention (e.g., Baum,

2017a; Rachlin, 1991; Skinner, 1976/1974, 1981). Moreover, MB keeps up RB's pragmatist dictum of prediction and control as the ultimate BA's goal and criterion of theoretical choice (e.g., Baum, 2017a; Rachlin & Frankel, 2009; Skinner, 1961c/1955).

The caveat "at least to some extent" is because MB re-signifies some of RB's concepts; notably (as we will see soon) the concept of operant behavior. Thus, one could say that the guiding-assumptions apparently preserved by MB are not the same. MB's change in the RB's network of concepts and guiding-assumptions brings about a change in all the semantic connections among them, to the point that it would no longer be correct to speak of sub-traditions *sharing* some guiding-assumptions. Baum (2002) emphatically suggests this when he states that MB is a "paradigm shift" in BA, in Kuhn's (1970) sense, which would imply such "incommensurability" between RB and MB. However, applying the Kuhnian notion of *paradigm* is very problematic in this context. For one, MB is far from having usurped the place of RB as a set of guiding-assumptions (or, more exactly, a Kuhnian disciplinary matrix) for BA (as would be required by Kuhn's notion). Furthermore, MB is far from having achieved the very large consensus characteristic of Kuhnian paradigms (for more reasons, see Laurenti, 2021). Even RB does not seem to satisfy all the features Kuhn attributes to paradigms<sup>8</sup>. Hence, we consider Laudan's (1977) metatheory of the structure and dynamics of scientific theories more appropriate to represent the cleavage between RB and MB. Ultimately, it is safe to say that several of MB's features are inherited from the RB, even if re-signified.

Before moving on to RB's and MB's reductive and emergentist commitments, we need to consider that they indeed have monist worldviews. Both put into question dualistic conceptions. Skinner (1953) maintains that, in addition to lending to explanatory fictions, dualism would be incompatible with the project of a scientific Psychology: "Since mental or psychic events are asserted to lack the dimensions of physical science, we have an additional reason for rejecting them" (pp. 30-31). Consequently, according to Skinner, BA should be ontologically committed only with phenomena having "dimensions of physical science." For Skinner (1961b/1945), even subjective phenomena, like the feeling of a toothache, is physical. RB considers private stimuli, more generally, to be physical: "The science of behavior must consider the place of private stimuli as physical things, and in doing so it provides an alternative account of mental life" (Skinner, 1976/1974, p. 233). Skinner (1976/1974) even states that this is part of the "heart of radical behaviorism" (p. 233).

Baum (2018), too, states that: "Dualism, however one defines it, creates a mystery that is inimical to science, because no known means exists for the mental or immaterial things to affect the physical or material things—or the other way around" (p. 58). This objection, which in part echoes Elisabeth of Bohemia's (2007/1643) criticism of Descartes' (2004/1641) dualism, calls into question interactionist dualism in particular (not non-interactionist versions of dualism, like Leibniz's, 1989/1696). Baum (2017a) suggests committing ourselves, like Skinner, to monism: "[I]nstead of dualism, we may embrace monism or, as Skinner (1945) put it, 'the *one* world'" (p. 72). However, Baum (2017a) expresses sympathy for a non-physicalist monism. At one point, Baum (2017a) shows sympathy for an idealist monism like Berkeley's (1948/1710), explicitly citing this author with approval, and stating that "a material existence apart from our experience is superfluous" (p. 65; see also p. 72). Yet, elsewhere Baum (2017b) clarifies his commitment as being with a *pragmatic agnosticism*, which is an epistemic form of neutral monism (although he does not use this term) that claims an inaccessibility to the world outside perceptual experience, and that for this reason we should hold neutrality regarding the nature of the basic stuff of reality:

What matters about a bicycle is that I see it, call it by its name, may lend it to a friend, may ride it myself. Pragmatism remains agnostic about whether a *real* bicycle exists behind these effects. ... [W]e need not bother about a reality we cannot know and is useless to science; we may concentrate on what we can know and use – our experience itself. (pp. 67-68)

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<sup>8</sup> A similar remark could be made with respect to other traditions in psychology; see Batts & Crawford (1991) and O'Donohue et al. (2003).



Rachlin, in turn, did not suggest neutral monism for MB. Rather, he takes his approach as a “physical theory of the mind” (Rachlin, 2014, p. 44), thereby in this being closer to Skinner’s view than Baum’s.

Summing up, RB assumes physicalist monism, whereas MB, specifically in Baum’s formulation, takes up a neutral monist stance. (Other authors who claim neutral monism for BA include Leslie, 2021; and Lopes, 2009.) Rachlin’s rendering of MB assumes physicalism.

### ***Reduction and Emergence in Radical Behaviorism and Molar Behaviorism***

Provided with the previous distinctions, we are now ready to spell out our comparison between RB’s and MB’s guiding-assumptions when it comes to the four following pairs of relations: (i) the behavioral to the physiological; (ii) the psychological to the behavioral; (iii) functions to selection contingencies; and (iv) the cultural to the behavioral. RB’s and MB’s views of these pairs of relations will be classified with reference to the kinds of reduction and emergence sorted out in the initial section.

### ***Relations Between Behavioral and Physiological Domains***

Both RB and MB suggest that behavior, be it respondent or operant, is not reducible to its physiological basis. Behavior exhibits features that render it emergent in relation to the physiological domain: emergent both in the sense of unexplainability / unpredictability and of downward causation.

First, RB and MB claim that it is impossible to explain or predict behavior by taking into account only what happens at the physiological level. Both assume that behaviors are determined by natural selection, respondent conditioning and/or histories of operant selection (depending on the case) together with aspects of the context they are situated, notably social and cultural in the case of humans. Skinner (1990, p. 1208) states that physiological structures and processes answer only questions about *how* behavior occurs. The reason *why* it occurs lies elsewhere, to wit, in histories pertaining to phylogeny and ontogeny, which are the realms of ethology, behavior analysis and anthropology.

Baum (2011) and Rachlin (1994, 2014) relate the science of physiology to the search for the underlying *mechanisms* of behavior, and behavior analysis to the search of the *functions* of behavior (expressed by Rachlin in terms of the Aristotelian terminology of “final causes”). As Baum (2011) puts it: “[T]he distinction between function and mechanism is the difference between understanding why behavior occurs and understanding how it occurs. Understanding function entails relating an activity to environmental events (present and past)” (p. 186). And yet: “Even if we learn much about the physiology of behavior, we only learn about mechanisms and not about the origins in the environment” (p. 190).

In this sense, RB and MB are committed to emergence relations from the behavioral to (in part) the physiological in terms of unexplainability / unpredictability. Establishing a parallel with the case of a water particle as an emerging product of hydrogen and oxygen molecules is not possible in the context of RB and MB. This is because the behavioral relations discussed by RB and MB invariably involve bodily and environmental events. Precisely, only the counterpart of the bodily events is composed of physiological processes, and it does not in itself constitute what is called ‘behavior.’ In the case of water, it would be akin to considering only hydrogen molecules; without oxygen, we would not have water. Similarly, behavior as an indivisible whole is made up of activities of the organism in interaction with environmental events.

Furthermore, RB and MB point out the (top-down) influence of selective and environmental historical processes in the configuration of the physiological bases of behavior. Skinner (1953) and Baum (2018; Baum & Heath, 1992) claim that BA is to Physiology what Evolutionary Biology is to Genetics. For Skinner, mechanisms of retention of behavior in operant selection processes are physiological, having a role analogous to that of genes in natural selection (Skinner, 1976/1974, 1990). At some point, Baum (2001) understands the retention parameter of operant selection processes in terms of recurrence of behavior (i.e., similar behaviors happening over time). Nonetheless, both

Skinner and Baum emphasize that behavioral processes bring about physiological changes, so that Physiology itself needs to make use of behavioral data to understand what happens at the level of the nervous system (Baum, 2011; Baum & Heath, 1992; Skinner, 1976/1974; see also Zilio, 2016a). As Baum (2011) says: “[U]nderstanding function is propaedeutic to studying mechanism; one must know what one is trying to explain before one can explain it” (p. 186). This is also emphasized by Rachlin (1994), resorting to Aristotle’s consideration that “the question *why* necessarily precedes the question *how* in order of investigation” (p. viii). Physiology, concerned with questions about how behavior occurs—its “efficient causes”—depends on BA. Hence, both RB and MB are, like Campbell (1974), committed to downward influence of the behavioral in relation to the physiological domain<sup>9</sup>.

However, despite this convergence between RB and MB, there are some differences regarding the irreducibility of the behavioral to the physiological. Baum (2002) considers that the watershed between RB and MB lies in divergent ontological assumptions about behavior. According to Baum (2002), who quotes Skinner (1935) in this regard (we will ponder these claims by Baum shortly), Skinner takes (a) environmental stimuli, behaviors, and consequences as discrete, not temporally extended, events; and (b) as being contiguous; in the case of operants, in particular, the consequence immediately following the behavior (see also Baum, 2004, 2021b; and Rachlin, 1991, 1994). Baum and Rachlin think that (a) in RB, behavior patterns are classes of discrete events, defined by their functional relations with stimuli and/or consequences, equally taken as classes of discrete events. As classes, behavior patterns would not be concrete events (with location and duration), but only useful abstractions. Besides, (b) RB would have inherited from classical reflexology the assumption of contiguity between stimulus and response for conditioning to occur:

Conditional reflexes were created by the repeated contiguity of members of the two classes. Later, he [Skinner] treated the law of effect in similar fashion: The response (as class) was strengthened by repeated contiguity between its members and the members of the reinforcer (as stimulus class). (Baum, 2002, p. 96)

MB, in turn, takes (a) stimuli, behaviors, and consequences as units with duration; and (b) does not require temporal contiguity between them (Baum, 2002, 2004, 2021a; Rachlin, 1994, 2021). Behaviors are seen as activities that take some time to be carried out in dynamic interaction with the environment. These activities are themselves composed of other, nested activities, less extended in time (e.g., building a house is integrated by the behaviors of building walls, windows, etc.). The reinforcing or punitive consequences of behavior can be medium and long-term (e.g., health resulting from a balanced diet combined with physical exercises). Furthermore, behavior patterns are not seen by MB as abstract classes, instantiable by several responses, but rather as molar activities themselves; that is, aggregates of less extended activities, with both the whole and the parts having location and duration.

RB indeed takes behavior patterns as classes (Skinner, 1935), thereby as abstractions. Yet, we find doubts when it comes to Baum and Rachlin’s claim that RB is committed to a necessary *contiguity* between dependent and independent variables. After all, Skinner (1935, 1938) suggests that dependent and independent variables in the behavioral domain are to be legitimized by functional relations between them, so that modification in the independent variables bring about change on the dependent ones. In Skinner’s (1935) words, they can be allowed for once obtained “orderliness of changes in the correlation” (p. 62).

Moreover, we find reasons to doubt MB’s claim that RB takes behavior patterns as classes of *discrete events*. For one, Skinner defines behaviors as activities (see Ferster & Skinner, 1957), which inherently have temporal dimension. Radical behaviorists seem to understand them as extended in time activities, as when Sidman (1989) asks “What is it that we are calling ‘behavior’?” (p. 28) and answers it by listing a series of activities more or less extended in time: “driving a car, relaxing, talking, singing, writing, reading, adding numbers, sitting, cooking, eating, teaching, studying ....” (p.

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<sup>9</sup> For a detailed treatment of the notion of causation in radical behaviorism, see Chiesa (1994, chap. 5).

28). Hence, RB does not seem to presuppose that all consequences take place immediately after the responses, nor that they are discrete events (Lazzeri, 2021; Moore, 1983, 2008). In the design of experimental research Skinner (1935, 1938) privileged contingencies involving contiguity between dependent and independent variables, facilitating the empirical establishment of functional relations. This does not mean that for him every contingency requires contiguity.

### ***Relations Between Psychological and Behavioral Domains***

RB, differently from MB, allows for private—interoceptive and proprioceptive—stimuli in its ontology, as well as covert behavior, which can be respondent or operant. Private stimuli are physiological, but as stimuli they enter into functional relations, partly influencing the likelihood of behavior. And covert behaviors, precisely because they are behaviors, are not reduced to physiological processes (even if they may appear to be confined thereto). The same explanatory principles apply to covert and overt behaviors—principles of unconditioned or conditioned reflexes (e.g., systematic desensitization), principles of reinforcement (e.g., schedules of reinforcement), and alike, depending on the case, for “[T]he events at the covert end have no special properties, observe no special laws” (Skinner, 1957, p. 438). Private stimuli differ from public stimuli in that they involve a unique contact of the organism with itself, by means of its interoceptive, proprioceptive, and endogenous neural interconnections (comprising connections among areas of the central nervous system). Yet private events are always situated in a web of relations with contextual and historical control variables (e.g., Skinner, 1953, 1976/1974). Limited observability does not preclude consideration of these phenomena in BA (Palmer, 2009, 2011).

MB, on the other hand, does not assume ontological commitments with private stimuli and covert behaviors. Although Baum (2011) does not go so far as to deny their existence, he argues they are useless to explain, predict, or control behavior, and therefore should be ignored: “[P]rivate events are unnecessary to understanding behavior. They might or might not exist; they are irrelevant. A complete account of behavior can be had without them” (p. 197). In addition, Baum (2011) claims that RB’s consideration of private stimuli and covert behavior ends up in mentalism (the mistaken search for the causal root of behavior in hypothetical or physiological internal events), so much criticized by Skinner himself. Rachlin (2014) in turn suggests that behavior is a category that applies only to the whole organism, and that which Skinner calls covert behavior would not actually be behavior, but part of the physiological mechanisms of behavior. This divergence, as Baum (1997, 2011, 2017a) and Rachlin (1994) point out, reverberates in quite different conceptions of psychological categories, such as emotions and cognition.

In the case of RB, there is some ambiguity about the correct interpretation of psychological categories. As Lazzeri (2015, 2017) shows, Skinner sometimes encourages a form of reduction by elimination of them in relation to the behavioral domain. Other times Skinner suggests they can be reduced by translation into the behavioral vocabulary. Skinner offers the latter sort of analysis when he presents the meaning of psychological terms and statements in terms of behavior-environment relations. Psychological phenomena are then viewed as made up of behaviors that can be: (i) operant, respondent, or a combination of both types; (ii) unconditioned, conditioned, or a combination of both; (iii) overt, covert, or a combination thereof; (iv) verbal, non-verbal, or a combination thereof; (v) episodic, in chains, or at different times and places; and (vi) in relation to exteroceptive, proprioceptive, interoceptive stimuli, or a combination thereof (Lazzeri, 2015, 2017, 2021).

Although Skinner does not present his philosophy of mind in such systematic way, there are a number of elements throughout his work that indicate an approach consistent with translatability reduction. The reduction is by translatability, not by type identities, since he provides, as he points out, *approximate translations* of the psychological into the behavioral language (e.g., Skinner, 1953, 1976/1974). Besides, these translations are not of one-by-one mapping. In many cases of psychological categories Skinner would not say there is a *sine qua non*, univocal type of behavior for their application. By way of illustration, in the last chapter of *Verbal Behavior*, Skinner (1957) presents an analysis of the polysemous term ‘thinking’ suggesting that, in its various senses, it means

behavior, to be explained by the same laws as other behavioral processes: “[T]hought is simply behavior – verbal or nonverbal, covert or overt. It is ... the very behavior itself in all the complexity of its controlling relations” (p. 449). Analyzing cognitive categories more generally, Skinner (1989a) stated: “Cognitive processes are behavioral processes” (p. 17).

The fact that RB is not committed to type identities between the psychological and the behavioral is particularly clear in Skinner’s analysis of emotions, as in chapter 10 of *Science and Human Behavior*. For Skinner (1953), emotions are behavioral phenomena, usually made up of operant and respondent behaviors under the control of variables: “The names of the so-called emotions serve to classify behavior with respect to various circumstances which affect its probability. ... [S]o defined, an emotion, like a drive, is not to be identified with physiological or psychic conditions” (pp. 162-163). For instance,

‘In fear’ a man tends to reduce or avoid contact with specific stimuli—as by running away, hiding, or covering his eyes and ears; at the same time he is less likely to advance toward such stimuli or into unfamiliar territory. (p. 162)

Notice that Skinner points out behavioral disjunctions in this analysis. The fact that someone is afraid of something does not mean that they always exhibit a given behavior unequivocally, although some behaviors will be exhibited. It may be that, in anger, someone behaves aggressively, but it may be that anger is alternatively formed by other behaviors, such as non-animosity in helping someone.

Importantly, it is wrong to say that for the RB psychological categories concern private stimuli and covert behaviors exclusively. For example, although sometimes one can do the math at a covert level, in many cases this is performed overtly, or partially overtly along with some covert episodes. Besides, as a rule, in any case it involves relations with historical variables from phylogeny and/or ontogeny (Lazzeri, 2015).

On the other hand, sometimes Skinner suggests a form of reduction by replacement of most psychological categories in relation to behavioral categories. Several eliminativist arguments can be found in Skinner’s work (Lazzeri, 2017; Lazzeri & Oliveira-Castro, 2010). Among them is the argument according to which psychological categories are inherently mentalistic and, thus, disturbs the effective prediction and control of behavior (e.g., Skinner, 1961d/1958, 1976/1974); and the argument whereby they correspond to a misunderstanding of behavior, analogous to explanatory fictions abandoned throughout the history of the sciences (e.g., Skinner, 1971). These arguments aim to support the replacement of psychological categories with those related to the behavioral domain in general. This aligns with eliminativist proposals such as Churchland’s (1988), with the caveat that Churchland advocates for a brain-centered reduction by replacement rather than a behavioral one.

Perhaps this tension between a reduction of psychological categories by translation and a reduction by replacement is resolved when we consider that psychological categories can assume at least two roles; to wit, that of object of study, and that of explanation of behavior. RB seems to be in line with a reduction by translation when psychological categories are taken as objects of study in the domain of verbal behavior. In this context we find the radical behaviorist understanding of psychological phenomena as having a behavioral nature. On the other hand, if taken as explanatory categories of behavior, RB is aligned with replacement reduction, as there is no room for psychological categories in its explanatory system.

Baum and Heath (1992) reiterate some of Skinner’s arguments for replacement reduction, but later Baum (1997, 2011, 2017a, 2018, 2019) came to settle on the molar analyzes of psychological categories provided by Rachlin’s teleological behaviorism (1985, 1994, 2014). For example, opposing brain-centered views, Baum (2018) states: “Rachlin (2014), in his book, *Escape of the Mind*, offers a coherent alternative: mental activity is publicly observable behavior extended in time” (p. 60). A caveat in this regard, however: unlike Baum, Rachlin, as we have already pointed out, did not suggest a neutral monism, rather committing himself to physicalism.

Rachlin (2012, 2014) calls his view a “behavioral identity theory.” From an organism having a toothache to remembering a task, he takes as identical with exhibiting certain types of publicly

observable behavior patterns. MB is committed to a type-identity reduction from the psychological to the behavioral domain, limited to publicly observable contexts and behaviors, and refraining from considering private stimuli and covert behaviors.

Noteworthy, Rachlin (e.g., 1995, 2012) opposes Skinner's eliminative take on psychological categories. Rachlin (1995) goes so far as to claim that "The crucial issue" between his approach and RB is "whether mental terms belong in a scientific psychology. Teleological behaviorism claims they do; Skinnerian behaviorism claims they do not" (p. 180). Thus, MB, especially in Rachlin's formulation, does not dismiss folk psychological vocabulary as something inherently misleading. Rather, it advocates for a research agenda of finding out psychological-behavioral type identities. The goal is to name relevant behavioral patterns in ways that are cost-effective and interesting to the broad audience outside BA, thereby enhancing BA's problem-solving power (see Lazzeri, 2017, 2021).

### ***Relations Between Functions and Selection Contingencies***

Let us now move on to the RB's and MB's views on the statements ascribing functions in the teleological sense, from the Greek *telos*, which means purpose or end, and their relations to contingencies of natural and operant selection. Functions, in this sense, are attributed in life sciences (e.g., physiology and ethology) to parts of organisms, such as cells, organs, and glands, as well as behavioral patterns. The very designation of a trait or behavior often signalizes one of its reputed functions, as in the case of territorial behavior exhibited in many species, with the function of protecting a territory. Some authors, following a suggestion by Pittendrigh (1958), prefer the term 'teleonomic,' rather than 'teleological,' for functions that do not imply anything of prior planning. But the truth is that 'function' and 'purpose' talk does not imply this connotation. For example, when Darwin (1859) and Sherrington (1906) pointed out the purposive character of reflexes and other biological adaptations, they assumed these phenomena owe their existence to "blind" selection processes. In life sciences, the terms 'function' and 'purpose' are not used, presupposing that phylogeny itself is goal-directed or involves planning.

Both RB and MB support reduction of teleological language to that of selection contingencies in the phylogeny and/or ontogeny. Skinner (1974/1976) stated that "[O]perant behavior is the very field of purpose and intention. By its nature it is directed toward the future" (p. 61). The idea is that the purposive character of operant behaviors stem from the fact they owe their existence to contingencies of reinforcement: teleological statements "generally are reducible to statements about operant conditioning, and only a slight change is required to bring them within the framework of a natural science" (Skinner, 1953, p. 87). Besides, Skinner suggested an analogy between attributions of purposes to operant behaviors and those ascribing functions to biological traits by comparing his view on the former in terms of "Thorndike's Law of Effect" to "Darwin's treatment of phylogenetic purpose" (1969/1964, p. 120). Thus, attributions of functions or purposes to behavior patterns and biological traits could be accommodated, with some slight revisions, in RB's theoretical framework, amounting to a reduction of teleological language to natural and/or operant selection contingencies by translation (see Zuriff, 1985).

On the other hand, as regarding psychological categories, Skinner (1953, 1969/1964, 1976/1974, 1981, 1989b) also proposed a replacement reduction of teleological language. According to him, teleological language connotes inverted causes (e.g., future events acting on present behavior) as well as mentalistic fictions, which hinder the goals BA should pursue (viz., prediction and control of behavior). For Skinner (1953), strictly speaking, not only do selection processes have no purpose, but neither does behavior. For him, to speak of behavior having this or that purpose would only be a misleading way of alluding to reinforcement or natural selection histories. Skinner (1989b) then claims that selection processes replace attributions of functions:

Both natural selection and operant conditioning ... conflict with well-established views. Selection replaces purpose ... The hand is not designed 'for the purpose of grasping things;' hands grasp things well because variations in structure have been selected when they improved grasping, a contribution to survival. People do not grasp things in given ways 'with the purpose

of holding them firmly;’ they grasp them in ways in which they have held them firmly, a reinforcing consequence. (p. 115)

In other words, RB holds that the model of selection by consequences replaces teleological language, which is deemed as misleading. This could be summarized under the motto: functional relations, yes; teleological functions, no. Thus, RB is committed to both reduction by translation and reduction by replacement of functions in relation to selection contingencies.

When it comes to MB, we find a sympathetic view of the use of teleological language to individuate behavior patterns in scientific context (Baum, 2004, 2013, 2021a, 2021b; Rachlin, 1994, 2014). To illustrate, Baum (2013) states that “Behavior is purposive. When we say behavior is purposive, we mean that behavior is *shaped by its consequences*” (p. 286; italics added). And yet: “[B]ehavior must be understood in light of its function. [Behavioral] Processes always exist to serve functions and may be defined according to their functions” (2021b, p. 579). Baum provides an interpretation of function / purpose talk in terms of histories of selection-by-consequences, similar to Skinner’s reduction by translation on the matter (thereby, similar to the etiological theory of functions, particularly in its recent formulation by Garson, 2016; see also Lazzeri, 2019; 2021). But Baum, differently from Skinner, does not dismiss function talk as misleading. On the contrary, once understood, function talk turns out useful to name behavior patterns of interest in BA.

Rachlin (1994, 2014) in turn uses the Aristotelian language of “final causes” to refer to functions; but restricted to operants (Lazzeri, 2021). In this sense, his modeling of functions is less comprehensive than Baum’s. However, there is evidence that the Aristotelian guise of Rachlin’s formulation is based on a view of functions in selectionist terms, too: “This Aristotelian conception, the *operant* ... shifts the focus of behavioral investigation away from efficient causes ... toward final causes – contingencies of reinforcement” (p. 83-84).

To this extent, MB shows commitment to type-identity reductions of functions to relations between behavior patterns and selection processes. MB recapitulates a thesis of (early) Tolman’s (1925) purposive behaviorism: that purpose is an aspect of behavior itself in its dynamics with the environment, and in no way presupposes mentalism. Tolman, 1925, explicitly contrasts his approach with mentalism, stating that the latter “merely *infers* purpose from these aspects of behavior; whereas we, being behaviorists, *identify* purpose with such aspects” (p. 37). Tolman (1925), however, interpreted purpose as persistence of behavior towards an object, and not in terms of selection by consequences, which MB draws from RB.

### **Relationships Between Cultural and Behavioral Domains**

Finally, let us briefly compare RB and MB on the relations between cultural phenomena and categories relating to contingencies of selection at the level of individual organisms. Both RB and MB understand cultural phenomena from a selectionist point of view, that is, as phenomena that enter selection processes, involving variation, differential success, and retention (Baum, 2017a.; Skinner, 1971, 1981).

However, as in some previous cases, Skinner is ambiguous about the nature of the relations between behavioral and cultural domains. The author defines *culture* as a set of social conditions that determine behavior, which are maintained by members of a given group. In his words: “I have taken a culture to be a social environment, the contingencies of reinforcement maintained by a group which, in addition to the physical environment, are responsible for the repertoires of new members of the group” (1988, p. 47). Skinner (1953, 1988) uses the terms ‘culture’ and ‘social environment’ interchangeably. Cultural practices, in turn, would be behaviors selected and maintained by these social contingencies called “culture” (Fernandes et al., 2017). Skinner (1953, 1971, 1981, 1988) is emphatic in stating that there are no new behavioral processes in the social/cultural dimension. In addition, Skinner links the existence of a culture to the behavior of its members:

A culture has no existence apart from the behavior of the individuals who maintain its practices. It is always an individual who behaves, who acts upon the environment and is changed by the

consequences of his action, and who maintains the social contingencies which are a culture. (1971, p. 209)

Culture is constituted by social contingencies of selection and maintenance of behaviors, and these always belong to people (Skinner claims that the culture or the group itself does not behave). The set of social contingencies that form culture, however, cannot be reduced to individual contingencies that affect single organisms, as they emerge from social relations between people in a group situation. However, its controlling effect on behavior is at the level of individual behavioral interactions, as in the following example:

There is an old law in economics, called Gresham's Law, which states that bad money drives good money out of circulation. ... [W]e can express this general principle without making specific reference to the use of money by individuals. Similar generalizations are found in sociology, cultural anthropology, linguistics, and history. But a "social law" must be generated by the behavior of individuals. It is always an individual who behaves .... If an individual possessing two pieces of money, one good and one bad, tends to spend the bad and save the good – a tendency which may be explained in terms of reinforcing contingencies – and if this is true of a large number of people, the phenomenon described by Gresham's Law arises. The individual behavior explains the group phenomenon. (1953, pp. 297-298)

Sociological, economic, or anthropological theories seem to be viewed by Skinner as descriptions of social contingencies and cultural practices stemming from behavioral interactions of people in groups. In short, they are descriptions of recurrent patterns of behavior control conditions maintained by people in a group and of behaviors that are part of the repertoire of people in that group. However, the causal relations would invariably take place in the behavioral dimension. Gresham's Law does not cause behavior. It is just an abbreviated way of describing behavior patterns that involve money. To this extent, Skinner seems to suggest a reduction by translation of social and cultural categories to "terms of reinforcing contingencies" (Skinner, 1953, p. 298).

Why, then, do we claim that there is ambiguity in Skinner's proposal regarding the relations between cultural and behavioral domains? For at other times the author claims that there is a third type of selection at the cultural level (Skinner, 1981, 1988). In his words:

A culture evolves when practices originating in this way contribute to the success of the practicing group in solving its problems. It is the effect on the group, not the reinforcing consequences for individual members, which is responsible for the evolution of the culture. (1981, p. 502)

The difficulty is in understanding what Skinner means by "effect on the group." In a later text in response to comments on the 1981 article, Skinner tries to develop his argument:

[T]he first effect occurs "at the level of the individual," but there is another effect which can be stated only at the level of the group in spite of the fact that it is always an individual who behaves. If the evolution of a culture could be said to correspond to the evolution of a species, then the evolution of cultural practices corresponds to the evolution of eyes and ears and hearts and legs and wings. (p. 47)

Unfortunately, the analogy with natural selection provides little information about what is different about the "effect" on the group (Zilio, 2016b). In a further attempt to clarify his position, Skinner (1988) wrote: "But a culture is transmitted ... when individuals who have been changed by the contingencies maintained by a group become part of a maintaining group. That process requires operant conditioning, but it is a different contingency of selection" (pp. 47-48). In this passage Skinner points out that the transmission of culture occurs when the behavior of people belonging to a group is not only controlled by the social contingencies that constitute the culture, but people

themselves become responsible for maintaining such contingencies. This point is in line with Skinner's earlier statements. Why would there be a need to postulate a different kind of selection then? Skinner does not seem to give us subsidies to develop the question.

Baum (e.g., 1995, 2000, 2004, 2017a, 2017c) was more detailed than Skinner in his discussion of the possible mechanisms responsible for the selection and maintenance of cultural practices, in his evolutionist proposal of culture. The same can be said of Rachlin (2002; 2014), even though the latter focused specifically on the role of self-control in the selection of altruism as a cultural trait.

For Baum (2000), "[C]ulture consists of behavior" (p. 181), its basic units being "practices shared by members of a group and acquired as a result of membership in the group" (p. 181). While Skinner distinguishes culture (social contingencies maintained by a given group) from cultural practices (the behaviors selected and maintained by such contingencies), Baum associates culture only with the behavioral counterpart. In short, what Baum calls culture is what Skinner calls cultural practices. This is not to say that Baum disregards the contingencies responsible for the selection and maintenance of cultural practices. However, the author does not seem to go beyond the behavioral dimension in his explanations of the selection of cultural practices:

The line between cultural practices and operant behavior patterns may be fine. Indeed, Skinner (1981) argued that cultural patterns are operant patterns. Since cultural practices presumably are maintained by their consequences, they might be considered operant patterns by definition. They may be distinguished, however, for the purpose of discussing cultural evolution by two characteristics. First, cultural practices are the possession of a group. To be called a cultural practice, a behavior pattern must occur in the members of a group .... Second, cultural practices are transmitted from member to member in the group. Unlike individual operant patterns, ... cultural practices are transmitted from one individual to another and may occur in different individuals at the same time. (Baum, 2017a, p. 401)

"Culture," then, is a concept that describes a class of behavioral relations shared by people in the same group. The transmission of cultural practices between members of a group would primarily occur through two behavioral mechanisms: imitation and instruction by rules (Baum, 2000, 2004, 2017c). In light of their molar-multiscalar approach to behavior, cultural practices would ultimately be selected for long-term consequences related to reproductive success (Baum, 2000, 2017a, 2017c). For Baum, the selection of cultural practices may depend in the short-term on immediate natural reinforcers or those mediated by the other members of the group. However, the author is emphatic when signaling that such practices "must ultimately enhance reproductive success" (p. 209).

Thus, Baum puts forward a reduction of cultural practices to behavioral processes and proposes a model of selection and maintenance primarily supported by mechanisms at the behavioral level (to wit, imitation and control by rules). Baum also considers the long-term consequences related to reproduction and fitness, which also act on organisms, since it is the organisms that reproduce and are more or less adapted to the environment. It can be said, then, that in the long run the selection of cultural practices is an effect of their long-term consequences for organisms that are part of the group. In this regard, Baum reduces the entire selection process under the control of a single consequence: reproductive success.

In short, by saying that "culture is behavior," Baum seems to align MB to reductionism by type-identities when it comes to cultural-behavioral relations. His reductionism encompasses the behavioral mechanisms responsible for the selection and maintenance of cultural practices, as well as the short or long-term consequences that maintain these practices.

## **Conclusion**

Summing up, *reduction* and *emergence* are said in various ways, among which: (i) reduction by type-identities; (ii) reduction by elimination or replacement; (iii) reduction as translatability; (a) emergence in terms of unexplainability or unpredictability; and (b) emergence in terms of downward (top-down) causation. We have elucidated each of them.



We have endeavored to identify and compare the theoretical commitments of radical behaviorism and molar behaviorism with reduction and emergence when it comes to the relations between the following pairs of domains: (i) behavioral – physiological; (ii) psychological – behavioral; (iii) functions (in the teleological sense) – natural or operant selection contingencies; and (iv) culture – behavioral. Preliminarily, we have evidenced RB’s commitment to physicalist monism and Baum’s version of MB’s commitment to a neutral monist conception. The results are summarized in the following table, which also take into account slight differences between Baum’s and Rachlin’s versions of MB:

<i>RELATIONS BETWEEN DOMAINS</i>	<i>RADICAL BEHAVIORISM</i>	<i>BAUM'S MOLAR BEHAVIORISM</i>	<i>RACHLIN'S (TELEOLOGICAL) MOLAR BEHAVIORISM</i>
<i>(i) Behavioral to physiological</i>	Emergence in terms of unexplainability / unpredictability & downward causation	Emergence in terms of unexplainability / unpredictability & downward causation	Emergence in terms of unexplainability / unpredictability & downward causation
<i>(ii) Psychological to behavioral</i>	Reduction as translatability & reduction by replacement (possible ambiguity)	Reduction by type-identities	Reduction by type-identities
<i>(iii) Functions to selection contingencies</i>	Reduction as translatability & by replacement (possible ambiguity)	Reduction by type-identities	Reduction by type-identities
<i>(iv) Culture to behavioral</i>	Reduction as translatability & emergence in terms of unexplainability / unpredictability (possible ambiguity)	Reduction by type-identities	Reduction by type-identities
<i>Some particularities</i>	Commitment with physicalist monism; commitment with behavior patterns as abstract units; commitment with private stimuli and covert responses.	Commitment with neutral monism; commitment with behavior patterns as concrete aggregates of nested activities; uncommitted to private stimuli and covert responses.	Commitment with physicalist monism; commitment with behavior patterns as concrete aggregates of nested activities; uncommitted to private stimuli and covert responses; Aristotelian modeling.

**Table 1:** Radical and molar behaviorist commitments with reductive and emergent relations.

As a corollary, it follows from the results summarized in the second and third rows of the table that radical and molar behaviorisms are committed to the emergence of the psychological in relation to the physiological, given that the physiological is (together with the environment) part of the basis behaviors depend on; and the psychological is generally understood in terms of the latter both by RB and MB, albeit with several differences.

It would be misleading to characterize RB or MB as reductionist or emergentist approaches without specifying the pairs of domains at stake. Both RB and MB have emergent and reductionist commitments. It would be misleading to characterize one or the other as purely reductionist or emergentist.

This work was largely descriptive. Nevertheless, it is worth noting that both RB and MB exhibit distinct advantages and drawbacks in our perspective. Notably, MB stands out for its heightened coherence, characterized by fewer ambiguities. Furthermore, its defense of an important place for psychological categories and function attributions in behavioral science can be considered an accurate aspect, albeit subject to refinement. Conversely, RB’s stands out for its incorporation of covert behaviors and private stimuli into its ontology. Not taking these elements into account is a severe limitation of MB (Lazzeri, 2017; 2021). Also, RB’s perspective regarding psychological categories framed in terms of translatability and, thus, token psychological - behavioral identities, is more plausible than expecting type identities, which require one-by-one mapping (see Rowlands, 1991).

However, it was not the aim here to weigh in favor of one approach over the other, which would require delving into facets of them not here addressed (for some which see Laurenti, 2021).

**Data Availability Statement**

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

## References

- Araiba, S. (2020). Current diversification of behaviorism. *Perspectives on Behavioral Science*, 43, 157-175. <https://doi.org/10.1007/s40614-019-00207-0>
- Armstrong, D. M. (1968). *A materialist theory of the mind*. Routledge.
- Batts, B., & Crawford, L. L. (1991). Problematic progress: A review of Laudan's *Progress and its problems* and *Science and values*. *Journal of the Experimental Analysis of Behavior*, 55, 337-349. <https://dx.doi.org/10.1901%2Fjeab.1991.55-337>
- Baum, W. M. (1995). Rules, culture, and fitness. *Behavior Analyst*, 18, 1-21. <http://doi.org/10.1007/BF03392688>
- Baum, W. M. (1997). New paradigm for behavior analysis: A review of *Behavior and Mind* by Howard Rachlin. *Behavior Analyst*, 20, 11-15. <https://doi.org/10.1007/BF03392758>
- Baum, W. (2000). Being concrete about culture and cultural evolution. In F. Tonneau, & N. S. Thompson (Eds.), *Perspectives in ethology, 13, Evolution, Culture, and Behavior* (pp. 181-212). Kluwer Academic.
- Baum, W. M. (2001). Two stumbling blocks to a general account of selection: Replication and information. *Behavioral and Brain Sciences*, 24, 528. <https://doi.org/10.1017/S0140525X01224169>
- Baum, W. M. (2002). From molecular to molar: A paradigm shift in behavior analysis. *Journal of the Experimental Analysis of Behavior*, 78, 95-116. <https://doi.org/10.1901/jeab.2002.78-95>
- Baum, W. M. (2004). Molar and molecular views of choice. *Behavioural Processes*, 66, 349-359. <https://doi.org/10.1016/j.beproc.2004.03.013>
- Baum, W. M. (2011). Behaviorism, private events, and the molar view of behavior. *Behavior Analyst*, 34, 185-200. <https://doi.org/10.1007/BF03392249>
- Baum, W. M. (2013). What counts as behavior? The molar multiscale view. *Behavior Analyst*, 36, 283-293. <https://doi.org/10.1007/BF03392315>
- Baum, W. M. (2017a). *Understanding behaviorism: Behavior, culture, and evolution* (3<sup>rd</sup> ed.). Blackwell.
- Baum, W. M. (2017b). Ontology for behavior analysis: Not realism, classes, or objects, but individuals and processes. *Behavior and Philosophy*, 45, 63-78.
- Baum, W. (2017c). Behavior analysis, Darwinian evolutionary processes, and the diversity of human behavior. In M. Tibayrenc, & F. J. Ayala (Eds.), *On human nature* (pp. 397-415). Academic Press.
- Baum, W. M. (2018). Berkeley, realism, and dualism: Reply to Hocutt's "George Berkeley resurrected: A commentary on Baum's 'Ontology for behavior analysis'". *Behavior and Philosophy*, 46, 57-61.
- Baum, W. M. (2019). Relativity in hearing and stimulus discrimination. *Perspectives on Behavioral Science*, 42, 283-289. <https://doi.org/10.1007/s40614-018-0161-x>
- Baum, W. M. (2021a). Introduction to molar behaviorism and multiscale behavior analysis. In D. Zilio & K. Carrara (Eds.), *Contemporary behaviorisms in debate* (pp. 43-62). Springer. [https://doi.org/10.1007/978-3-030-77395-3\\_4](https://doi.org/10.1007/978-3-030-77395-3_4)
- Baum, W. M. (2021b). Behavior, process, and scale: Comments on Shimp (2020), 'Molecular (moment-to-moment) and molar (aggregate) analyses of behavior'. *Journal of the Experimental Analysis of Behavior*, 115, 578-583. <https://doi.org/10.1002/jeab.668>
- Baum, W. M., & Heath, J. L. (1992). Behavioral explanations and intentional explanations in psychology. *American Psychologist*, 47, 1312-1317. <https://doi.org/10.1037/0003-066X.47.11.1312>
- Beckermann, A., Flohr, H., & Kim, J. (Eds.). (1992). *Emergence or reduction?* De Gruyter.
- Berkeley, G. (1710/1948). Of the principles of human knowledge: Part 1. In A. A. Luce & T. E. Jessop (Eds.), *The works of George Berkeley: Vol. 2* (pp. 41-113). Thomas Nelson & Sons.
- Broad, C. (1925). *The mind and its place in nature*. Kegan Paul.
- Campbell, D. T. (1974). 'Downward causation' in hierarchically organized biological systems. In F. J. Ayala & T. Dobzhansky (Eds.), *Studies in the philosophy of biology: Reduction and related*

- problems* (pp. 179-186). Macmillan.
- Catania, A. C. (2012). *Learning* (5<sup>th</sup> ed). Prentice Hall.
- Chiesa, M. (1994). *Radical behaviorism: The philosophy and the science*. Authors Cooperative.
- Churchland, P. M. (1988). *Matter and consciousness* (2<sup>nd</sup> ed.). MIT Press.
- Darwin, C. (1859). *On the origin of species by means of natural selection*. John Murray.
- Descartes, R. (1641/2004). *Meditações sobre filosofia primeira* [Meditations on first philosophy] (F. Castilho, Transl.). Ed. Unicamp.
- Dutra, L. H. A. (2018). *Autômatos geniais: A mente como sistema emergente e perspectivista* [Genius automata: The mind as an emergent and perspectivist system]. Ed. UnB.
- Elisabeth of Bohemia, P. (1643/2007). Elisabeth to Descartes, 6 May 1643. In L. Shapiro (Ed.), *The correspondence between Princess Elisabeth of Bohemia and René Descartes* (pp. 61-62). University of Chicago Press.
- Fernandes, D. M., Carrara, K., & Zilio, D. (2017). Apontamentos para uma definição comportamentalista de cultura [Notes for a behaviorist definition of culture]. *Acta Comportamentalia*, 25, 265-280.
- Ferster, C. B., & Skinner, B. F. (1957). *Schedules of reinforcement*. Prentice-Hall.
- Garson, J. (2016). *A critical overview of biological functions*. Springer.
- Hayes, S. C. (2021). Contextual behavioral science as a distinct form of behavioral research and practice. In D. Zilio & K. Carrara (Eds.), *Contemporary behaviorisms in debate* (pp. 239-255). Springer. [https://doi.org/10.1007/978-3-030-77395-3\\_16](https://doi.org/10.1007/978-3-030-77395-3_16)
- Humphreys, P. (2016). *Emergence*. Oxford University Press.
- Kemeny, J. G., & Oppenheim, P. (1956). On reduction. *Philosophical Studies*, 7, 6-19.
- Kim, J. (1999). Making sense of emergence. *Philosophical Studies*, 95, 3-36. <https://doi.org/10.1023/A:1004563122154>
- Kim, J. (2006). Emergence: Core ideas and issues. *Synthese*, 151, 547-559. <https://doi.org/10.1007/s11229-006-9025-0>
- Kuhn, T. S. (1970). *The structure of scientific revolutions* (2<sup>nd</sup> ed.). University of Chicago Press.
- James, W. (1912). *Essays on radical empiricism*. Longmans, Green & Co.
- Lazzeri, F. (2015). On the place of behavior in the analysis of psychological categories. *The Psychological Record*, 65, 567-77. <https://doi.org/10.1007/s40732-015-0121-8>
- Lazzeri, F. (2017). The place of ordinary psychological categories in behavior analysis. *Journal of Mind and Behavior*, 38, 167-192.
- Lazzeri, F. (2019). Funções biológicas em chave etiológico-selecionista [Biological functions in an etiological-selectionist key]. *Philosophos*, 24, 245-261.
- Lazzeri, F. (2021). Purposive behavior and psychological categories: Thoughts on teleological behaviorism. In D. Zilio & K. Carrara (Eds.), *Contemporary behaviorisms in debate* (pp. 21-32). Springer. [https://doi.org/10.1007/978-3-030-77395-3\\_2](https://doi.org/10.1007/978-3-030-77395-3_2)
- Lazzeri, F., & Oliveira-Castro, J. M. (2010). Termos psicológicos disposicionais e análise do comportamento [Dispositional psychological terms and behavior analysis]. *Princípios*, 17, 155-183.
- Laudan, L. (1977). *Progress and its problems: Towards a theory of scientific growth*. University of California Press.
- Laudan, L. (1984). *Science and values*. University of California Press.
- Laurenti, C. (2021). The molar view of behavior: A paradigm shift in behavior analysis? In D. Zilio & K. Carrara (Eds.), *Contemporary behaviorisms in debate* (pp. 63-70). Springer. [https://doi.org/10.1007/978-3-030-77395-3\\_5](https://doi.org/10.1007/978-3-030-77395-3_5)
- Leibniz, G. (1696/1989). Second explanation of the new system. In *Philosophical papers and letters* (L. E. Loemker, Transl., pp. 459-461). Kluwer.
- Leigland, S. (1993). The case against physicalism in the Analysis of Behavior. *Behavior Analyst*, 16, 351-355. <https://doi.org/10.1007/BF03392644>
- Leigland, S. (2010). Functions of research in radical behaviorism for the further development of

- behavior analysis. *Behavior Analyst*, 33, 207-22. <http://dx.doi.org/10.1007/BF03392220>
- Leslie, J. C. (2021). *Principles of Behavioral Analysis*. Psychology Press.
- Leslie, J. C. (2021). The relevance of metaphysics to behavior analysis. *Perspectives on Behavioral Science*, 44, 29-40. <https://doi.org/10.1007/s40614-020-00277-5>
- Lewis, D. K. (1966). An argument for the identity theory. *Journal of Philosophy*, 61, 17-25.
- Lewis, D. K. (1980). Mad pain and Martian pain. In: N. Block (Ed.), *Readings in philosophy of psychology: Vol. 1* (pp. 216-222). Harvard University Press.
- Lopes, C. E. (2009). Contextualismo e monismo neutro [Contextualism and neutral monism]. In R. C. Wielenska (Ed.), *Sobre comportamento e cognição, Vol. 23* (pp. 239-242). ESETec.
- Marr, M. J. & Zilio, D. (2013). No island entire of itself: Reductionism and behavior analysis. *European Journal of Behavior Analysis*, 14, 241-257. <http://dx.doi.org/10.1080/15021149.2013.11434458>
- Mayr, E. (2004). *What makes biology unique? Considerations on the autonomy of a scientific discipline*. Cambridge University Press.
- Moore, J. (1983). On molarism and matching. *Psychological Record*, 33, 313-336.
- Moore, J. (2008). *Conceptual foundations of radical behaviorism*. Sloan.
- Morgan, C. L. (1923). *Emergent evolution*. Williams & Norgate.
- Morris, E. K. (1992). The aim, progress, and evolution of behavior analysis. *Behavior Analyst*, 15, 3-29. <https://doi.org/10.1007/BF03392582>
- Nagel, E. (1961). *The structure of science*. Hackett.
- O'Connor, T. (2020). Emergent properties. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. <https://plato.stanford.edu/entries/properties-emergent/>
- O'Donohue, W., Ferguson, K. E., & Naugle, A. E. (2003). The structure of the cognitive revolution: An examination from the philosophy of science. *Behavior Analyst*, 26, 85-110. <https://doi.org/10.1007/BF03392069>
- Palmer, D. C. (2009). The role of private events in the interpretation of complex behavior. *Behavior and Philosophy*, 37, 3-19.
- Palmer, D. C. (2011). Consideration of private events is required in a comprehensive science of behavior. *Behavior Analyst*, 34, 201-207. <https://doi.org/10.1007/BF03392250>
- Pessoa Jr., O. (2013). Emergência e redução: Uma introdução histórica e filosófica [Emergence and reduction: A historical and philosophical introduction]. *Ciência e Cultura*, 65(4), 22-26. <http://dx.doi.org/10.21800/S0009-67252013000400011>
- Pierce, W. D., & Cheney, C. D. (2004). *Behavior analysis and learning* (3<sup>rd</sup> ed.). Erlbaum.
- Pittendrigh, C. S. (1958). Adaptation, natural selection and behavior. In A. Roe & G. G. Simpson (Eds.), *Behavior and evolution* (pp. 390-419). Yale University Press.
- Place, U. T. (1956). Is consciousness a brain process? *British Journal of Psychology*, 47, 44-50.
- Rachlin, H. (1985). Pain and behavior. *Behavioral and Brain Sciences*, 8, 43-83. <https://doi.org/10.1017/S0140525X00019488>
- Rachlin, H. (1991). *Introduction to modern behaviorism* (3<sup>rd</sup> ed.). Freeman.
- Rachlin, H. (1994). *Behavior and mind*. Oxford University Press.
- Rachlin, H. (1995). Things that are private and things that are mental. In J. T. Todd and E. K. Morris (Eds.), *Modern perspectives on B. F. Skinner and contemporary behaviorism* (pp. 179-183). Greenwood Press.
- Rachlin, H. (2002). Altruism and selfishness. *Behavioral and Brain Sciences*, 25, 239-296. <https://doi.org/10.1017/S0140525X02000055>
- Rachlin, H. (2012). Is the mind in the brain? A review of *Out of our Heads: Why You are Not Your Brain, and other Lessons from the Biology of Consciousness*, by Alva Noë. *Journal of the Experimental Analysis of Behavior*, 98, 131-137. <https://doi.org/10.1901/jeab.2012.98-131>
- Rachlin, H. (2014). *The escape of the mind*. Oxford University Press.
- Rachlin, H. (2021). Teleological behaviorism: Origins and present status. In D. Zilio & K. Carrara (Eds.), *Contemporary behaviorisms in debate* (pp. 3-19). Springer. <https://doi.org/10.1007/978-3->



030-77395-3\_1

- Rachlin, H., & Frankel, M. (2009). Taking pragmatism seriously: A review of William Baum's *Understanding Behaviorism: Behavior, Culture, and Evolution* (2<sup>nd</sup> edition). *Journal of the Experimental Analysis of Behavior*, 92, 131-137. <https://doi.org/10.1901/jeab.2009.92-131>
- Robinson, H. (2009). Supervenience, reduction and emergence. In R. L. Poidevin et. al. (Eds.), *The Routledge companion to Metaphysics* (pp. 527-536). Routledge.
- Rowlands, M. (1991). A defense of behaviorism. *Behavior and Philosophy*, 19, 93-100.
- Sartenaer, O. (2018). *Qu'est-ce que l'émergence?* [What is emergence?] Vrin.
- Sherrington, C. S. (1906). *The integrative action of the nervous system*. Yale University Press.
- Sidman, M. (1989). *Coercion and its fallout*. Authors Cooperative.
- Sidman, M. (1994). *Equivalence relations and behavior*. Authors Cooperative.
- Silberstein, M. (2002). Reduction, emergence and explanation. In P. Machamer & M. Silberstein (Eds.), *The Blackwell guide to the philosophy of science* (pp. 80-107). Blackwell.
- Skinner, B. F. (1935). The generic nature of the concepts of stimulus and response. *Journal of General Psychology*, 12, 40-65. <https://psycnet.apa.org/doi/10.1080/00221309.1935.9920087>
- Skinner, B. F. (1938). *The behavior of organisms*. Appleton-Century-Crofts.
- Skinner, B. F. (1953). *Science and human behavior*. Macmillan.
- Skinner, B. F. (1957). *Verbal behavior*. Prentice-Hall.
- Skinner, B. F. (1961a). *Cumulative record: Enlarged edition*. Appleton-Century-Crofts.
- Skinner, B. F. (1961b/1945). The operational analysis of psychological terms. In *Cumulative record: Enlarged edition* (pp. 272-286). Appleton-Century-Crofts.
- Skinner, B. F. (1961c/1955). What is psychotic behavior? In *Cumulative record: Enlarged edition* (pp. 202-219). Appleton-Century-Crofts.
- Skinner, B. F. (1961d/1958). The flight from the laboratory. In *Cumulative record: Enlarged edition* (pp. 242-257). Appleton-Century-Crofts.
- Skinner, B. F. (1969/1964). Operant behavior. In *Contingencies of reinforcement* (pp. 105-132). Appleton-Century-Crofts.
- Skinner, B. F. (1971). *Beyond freedom and dignity*. Knopf.
- Skinner, B. F. (1976/1974). *About behaviorism*. Vintage Books.
- Skinner, B. F. (1981). Selection by consequences. *Science*, 213, 501-504. <https://doi.org/10.1126/science.7244649>
- Skinner, B. F. (1988). Comments. In: A. C. Catania, & S. Harnad (Eds.), *The selection of behavior: The operant behaviorism of B. F. Skinner: Comments and consequences*. Cambridge University Press.
- Skinner, B. F. (1989a). The origins of cognitive thought. *American Psychologist*, 44, 13-18. <https://psycnet.apa.org/doi/10.1037/0003-066X.44.1.13>
- Skinner, B. F. (1989b). A new preface to *Beyond Freedom and Dignity*. In *Recent issues in the analysis of behavior* (pp. 113-120). Merrill Publishing.
- Skinner, B. F. (1990). Can psychology be a science of mind? *American Psychologist*, 45, 1206-1210. <https://doi.org/10.1037/0003-066X.45.11.1206>
- Smart, J. J. C. (1959). Sensations and brain processes. *Philosophical Review*, 68, 141-156.
- Tolman, E. C. (1925). Behaviorism and purpose. *Journal of Philosophy*, 22, 36-41.
- Van Gulick, R. (2001). Reduction, emergence and other recent options on the mind/body problem: A philosophic overview. *Journal of Consciousness Studies*, 8, 1-34.
- Walter, S., & Eronen, M. (2014). Reduction, multiple realizability and levels of reality. In S. French & J. Saatsi (Eds.), *The Continuum companion to the philosophy of science* (pp. 138-156). Continuum.
- Zilio, D. (2016a). On the autonomy of psychology from neuroscience: A case study of Skinner's radical behaviorism and behavior analysis. *Review of General Psychology*, 20, 155-170. <https://doi.org/10.1037/gpr0000067>
- Zilio, D. (2016b). Selecionismo, metáforas e práticas culturais: Haveria um terceiro tipo de seleção no

nível cultural? [Selectionism, metaphors and cultural practices: Would there be a third kind of selection at the cultural level?] *Interação em Psicologia*, 20, 268-278.

<http://dx.doi.org/10.5380/psi.v20i3.47398>

Zilio, D. & Carrara, K. (Eds.). (2021). *Contemporary behaviorisms in debate*. Springer.

Zuriff, G. E. (1985). *Behaviorism: A conceptual reconstruction*. Columbia University Press.

### **Statements and Declarations**

We have no known conflict of interest to disclose. The manuscript was written for the most part by the first author. The second author wrote the subsection ‘Relations Between Cultural and Behavioral Domains,’ and made substantial contributions to other parts of the section ‘Reduction and Emergence in Radical Behaviorism and Molar Behaviorism.’ Both authors read and approved the final manuscript.

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