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An Introduction to Interbehaviorism: Contributions to a Natural Science of Behavior

Uma Introdução ao Interbehaviorismo: Contribuições para uma Ciência Natural do Comportamento

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Abstract

The purpose of this paper is to introduce behavior scientists, students, and those interested in the philosophy of science to interbehaviorism as a sound philosophical system to guide scientific behavior. A set of philosophical assumptions must guide scientific endeavors to ensure scientists are held accountable to coherent event descriptions. Interbehaviorism, founded by J.R. Kantor, is a coherent philosophical system that is serviceable to behavior analysis as it specifically focuses on the relation between behavior and the environment. To introduce this philosophy, we illustrate key assumptions and concepts of interbehavioral thinking, and contrast them with a well-known approach of behavior science—radical behaviorism, as put forth by B. F. Skinner. Both views on behavior-environment relations operate through a monistic approach to events. We believe that the differences between these views can facilitate an introductory understanding of interbehaviorism and highlight the contributions available from an interbehavioral perspective. Though this is not an exhaustive account of the interbehavioral position, exposure to the major points made in the present work (along with suggested further readings) is a starting point to familiarity with a complete philosophical system of a natural science of behavior.

Keywords: philosophy, interbehaviorism, radical behaviorism, causality, stimulus substitution.

Resumo

O propósito deste artigo é apresentar cientistas do comportamento, estudantes e demais pessoas interessadas na filosofia da ciência ao interbehaviorismo enquanto um sistema filosófico completo para guiar comportamentos científicos. Um conjunto de premissas filosóficas deve guiar esforços científicos para assegurar que cientistas adotem descrições coerentes de eventos. O interbehaviorismo, fundado por J. R. Kantor, é um sistema filosófico coerente cujo uso confere vantagens à análise do comportamento, pois foca-se especificamente na relação entre comportamento e ambiente. Para apresentar esta filosofia, ilustramos premissas e conceitos definidores do pensamento interbehaviorista, e os contrastamos a uma conhecida abordagem da ciência do comportamento – o behaviorismo radical, conforme apresentado por B. F. Skinner, já que ambas as visões de relações comportamento–ambiente operam em um enfoque monista dos eventos. Acreditamos que as diferenças entre estas visões podem facilitar um entendimento introdutório do interbehaviorismo e destacar as contribuições disponíveis a partir de uma perspectiva interbehaviorista. Embora este não seja um tratamento exaustivo da posição interbehaviorista, a exposição aos principais aspectos discutidos no presente trabalho (em conjunto com sugestões de leituras adicionais) é um ponto de partida para a familiarização com um sistema filosófico completo de uma ciência natural do comportamento.

Palavras-chave: filosofia, interbehaviorismo, behaviorismo radical, causalidade, substituição de estímulos.

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Scientists “hold their materials to be the real world and characterize their primary activities as observations of that world. Having observed the world, the secondary activities of scientists are to describe their observations, those descriptions, collectively considered, constituting scientific knowledge” (Hayes, 1997, p. 124). Philosophers,

rather than focusing on the observations of the world as scientists do, are focused on the verbal descriptions of scientific observations (Hayes, 1997). The relation between these roles in scientific endeavors is crucial in pursuing the aims of any science.

In behavior science[1], the goal is to refine a natural science of behavior–environment interactions. This presents a challenge, given that the cultures in which behavior science were established treat human behavior *dualistically*—meaning that actions seen as mental, such as feeling and thinking, are held to be of a nature unlike that of other actions (Kantor, 1963). By this logic, moreover, mental behaviors of a covert sort (such as thinking about the answer to a question) have been assumed to bear influence on physical behaviors of a more overt sort (such as answering the question). Defenses of dualism assume that what is accessible to only one individual cannot be sufficiently explained by interactions between the organism and the environment, or if they can, there is a mental process in-between. The division of events into material and mental has several implications, one of which would be the limitation of a science of behavior to the investigation of only the supposedly non-mental class of behavioral events on the grounds that this would be the only type of events that scientists would be able to contact (Kantor, 1953).

In the field of behavior science, one of the main philosophical paradigms is radical behaviorism, which—by definition—stands in opposition to a dualistic view of behavior (e.g., Skinner, 1974). The qualifier *radical* denotes the assumption that private events (traditionally considered mental events or states) are nothing more than behavior to be accounted for in an analysis of the interactions between organisms and their environments. Radical behaviorism views private and public behavioral events similarly, differing only in the access observers have to their occurrences. In other words, radical behaviorism operates on a monistic philosophical foundation.

Radical behaviorism represents only one variety of behavior science operating on a monistic foundation. Another variety, conceived somewhat earlier than radical behaviorism, is the position of *interbehaviorism* proposed by J. R. Kantor, a philosopher of science. Kantor described the psychological event as the interaction of an organism's action with environing stimulation, taking place in a field of other factors (see next section for a description of the field). Crucially, Kantor's analysis did away with causality as a way of explaining behavior, favoring instead a nonlinear analysis. Kantor also advocated for a scientifically independent appraisal of the psychological event, of which the definition would be free of any subordination or reduction of such an event to the subject matter of other sciences for its description. These and other distinctions warrant our view that interbehaviorism, while similar to radical behaviorism in its commitment to monism, is a distinct philosophy for a science of behavior–one that can serve as a guide to the study of behavior as a natural phenomenon.

With a few exceptions, radical behaviorism is taught around the world as the main philosophy of a naturalistic science of behavior. However, interbehaviorism has contributed directly and indirectly to how contemporary behavior analysts investigate their subject matter. Our current goal, which is to provide an introductory overview of interbehaviorism, is warranted by this circumstance. We do not intend to produce an exhaustive account of what interbehaviorism is, or what it should be, as interbehaviorists' views vary to some extent from one proponent to another just as is the case for proponents of radical behaviorism. Rather, our aim is to orient the reader to what an event-field approach to the study of behavior can offer through comparisons with a more widely understood paradigm, radical behaviorism. We refer mainly to Skinner's works in our presentation of radical behaviorism as a backdrop for the introduction of interbehaviorism, as most behavior analysts are familiar with Skinner's perspective on his philosophical system.

The Purpose of Re-Introducing Interbehaviorism

Introducing interbehaviorism within the format of an article is not a new task (e.g., Smith, 1984), nor is relating it to radical behaviorism (e.g., Morris, 1982, 1984). This paper has a didactic purpose, and, as such, does not aim to be novel in the concepts or interpretations presented. The contributions this paper aims to offer for scientists interested in interbehaviorism are: 1) a concise introduction in both English and Portuguese, 2) an overview of some essential concepts specific to interbehaviorism, and 3) references for scientists interested in learning more about this philosophy (see final section for suggested readings).

[1] In the present paper, we will refer to behavior science as including all scientific approaches developed from the assumption that behavior ought to be investigated for its own sake (rather than as the expression of hypothetical constructs, such as mental or cognitive entities). The term *behavior analysis* will be exclusively used to describe the subtype of behavior science developed by orienting to the set of assumptions and operations particular to radical behaviorism (rather than other behaviorisms) as a scientific system.

First, it is our intention that the present paper, as a didactic article, be published in both Portuguese and English so a wider audience can be reached. Second, a comparison of radical behaviorism and interbehaviorism is given, but this comparison is used only insomuch as the comparison to radical behaviorism *aids in facilitating understanding* of interbehaviorism. Other works have compared them for the purposes of arguing for or against integration of the two (e.g., dos Santos & de Carvalho Neto, 2021; Morris, 1982, 1984; Tourinho, 2004). The general view of integrating the two was well-stated by Morris (1982) when he considered that integration, "may yield important benefits for both: radical behaviorists can be provided with a broader conceptual framework within which to operate, and interbehavioral psychologists can be provided with a set of practical, empirical constructs compatible with their more philosophical aims." (p. 188). Consideration of possible integration, however, is not the goal of the present work. Rather, the present work takes the position that interbehaviorism can stand independently of integration, as it is a complete philosophical system for the scientific study of behavior.

The independence of interbehaviorism does not imply that the work done within a radical behavioral framework is not notable—the opposite is definitely true. Radical behavioral research has been extensive and has led to many discoveries of behavior–environment interactions. Rather, stating that an interbehavioral philosophy can stand on its own is, again, to facilitate understanding of interbehaviorism. The focus on similarities and differences between the two philosophies is due to the likely understanding most early scientists have of radical behaviorism. Radical behaviorism and interbehaviorism are fundamentally different philosophical frameworks. For example, the assumptions related to causal constructs and historical factors separate the two because of how they are conceptualized and, further, by how they are relied on to describe other, relevant constructs (e.g., reinforcement can only be invoked in adherence to causal constructs). Therefore, we have focused on cause and the conceptualization of historical factors from an interbehavioral perspective – as these matters are so different from radical behaviorism that those familiar with radical behaviorism have likely not contacted these distinctions.

An Overview of Radical Behaviorism and Interbehaviorism

Both Kantor and Skinner affirm the goal of science is to make known that which is not yet known (Parrott, 1983a). Interbehaviorism and radical behaviorism are also similar in that responses, in relation to a stimulating environment, are the general focus of each (Skinner, 1938; Kantor, 1953; Parrott, 1983a). A closer look at the subject matter of each is warranted. Interbehaviorism and radical behaviorism differ in how they orient to responses in relation to the stimulating environment. The subject matter to which Skinner refers in his work is a response class in which membership depends on common controlling variables. The subject matter to which Kantor refers is a stimulus-response interaction in an integrated field. By providing these definitions, both scholars ensure that a given scientific worker can be oriented to the same event as another within the same scientific domain.

Radical Behaviorism

Radical behaviorism was founded on the assumption that behavior could be understood by studying its relations with environmental factors (Skinner, 1974). The qualifier *radical* emphasizes that the analytical tools employed assume a monistic approach to behavior. Events that are observed by only one single person (e.g., the feeling of pain) are explicitly taken into consideration in a functional analysis—thus dismissing the requirement of truth by agreement (Skinner, 1974; for an overview of meanings of the term *radical* in this context, see Carrara & Strapasson, 2014). This stipulation meant that even private states, such as feeling anxious or sad, could ultimately be analyzed in terms referring purely to behavior–environment relations (Skinner, 1984). Skinner wrote extensively on how to operationalize (i.e., describe in unambiguous terms) phenomena that were typically referred to by cognitive psychologists, as well as how to develop animal models to investigate such phenomena while avoiding explanatory fictions (e.g., superstitious behavior; Skinner, 1948). Skinner (1950) criticized theoretical constructions that referred to "another dimensional system" (p. 216) beyond descriptions of relations between observable events. Targets of this criticism included mentalistic accounts, as well as accounts reducing psychological events to the functioning of the nervous system.

Interbehaviorism

The psychological (or interbehavioral) event field—the subject matter of interbehaviorism—comprises the following: stimulus function, response function, setting factors, interbehavioral history, and the medium of contact. A psychological event is a continuously evolving event that has no beginning or end. Thus, a scientist can only analyze a confronted event if the event is *segmented*—that is, the limits of the event are arbitrarily defined to allow for a

serviceable description of it. This circumscribed event is termed a *behavior segment*. When observing a behavior segment, the scientist provides descriptions based on what type of event it is, what is to be inquired about the event (Kantor, 1958), and what characteristics of the event are thus relevant for description.

In an interbehavioral analysis of the event, the focus is on stimulus–response functions, graphically represented as S⇔R. Note that the arrow linking a stimulus and response is double-headed. This signifies that in an interbehavioral account, stimuli do not elicit, evoke, or otherwise cause a response in any way (see the *Causality* section for a more detailed discussion on cause). No stimulus is independent of a response, and vice-versa. Interbehaviorists may say a stimulus and response are *inter*dependent, or that they co-occur. For example, when someone sees (seeing being an example of a response) the written words "palm reading" on a sign, they may speak these words out loud (speaking being another example of a response). Speaking is not uniquely caused by the written words, nor is it multiply caused by the written words and all other factors in the behavior segment; rather, speaking and stimulating words are interdependent, along with the other elements of the field. An interbehavioral analysis may—for analytical purposes—divide stimulus function and response function, but within an event field, the response and stimulus are described as a single unit.

The field also includes *setting factors*, which are circumstances co-occurring with the S⇔R functions. Setting factors are related to changes in the actualization of stimulus–response functions. They may be environing things and events or conditions of the responding organism. For example, alcohol intake may be a setting factor in the presence of which the interbehavior of sign reading may be faulty or slow.

Another element of the field is *interbehavioral history*. This refers to the changes in both stimulating and responding as related to previous organism–environment functional contacts. For example, when an individual sees the palm-reading sign, reading interbehavior is related to the interbehavioral history consisting of previous situations involving reading, and is heavily influenced by the cultural auspices under which the individual was raised. On a more idiosyncratic level, a particular person may read the sign and see a friend who is not there. The friend might have spoken in the past about their interest in palm reading, or gifted our targeted individual a coupon for free palm reading. In this case, some of the stimulating properties of the friend, while the friend is no longer present, may be operating through the sign (see the *Stimulus Substitution* section for a more detailed discussion on history).

Finally, a stimulus–response function can occur only in a given *medium of contact*[2]. Signs can only be seen if there is light; sounds can only be heard if there is air. Thus, the medium of contact is the event component in which stimulus–response functions become possible.

Interbehavioral Contributions

Philosophical System

An interbehavioral perspective acknowledges that the knowledge of events is incomplete as all events are unique—a stance also taken by radical behaviorism (Parrott, 1983a). The difference for radical behaviorism, as opposed to interbehaviorism, stems from the subject matter isolated by each. As Skinner adheres to the notion of classes of events, the uniqueness of each member of a class is ignored to allow for prediction and control of similar events. An interbehavioral perspective posits that the subject of interest is a continuously evolving event; meaning, the scientist creates the bounds of observation rather than the event itself having a beginning and an end. In considering the scope of how much we can elaborate upon our descriptions of events, however, radical behaviorism and interbehaviorism differ. Skinner (1974) argues for explanations derived from other sciences, such as those to be provided by the "physiologist of the future" (p. 236), for example. Briefly put, Skinner assumed that a detailed enough knowledge of physiology would one day provide explanations and tools that are more complete than a behavioral analysis could ever be, since what happens in the physiological domain is (in his view) the missing step between the environment and behavior. In doing so, Skinner (1974) asserts that behavior analysis affords an incomplete understanding of psychological events, making a reliance on other sciences for a full understanding necessary. Although it is true that the discoveries in other sciences can contribute to psychological endeavors, the former are not necessary for elaborating upon our own descriptions. As an analogy, biology scholars do not need to rely on definitions from physics to define a cell, although interdisciplinary work can be established between these fields. Skinner's assumption that we need to rely on other sciences indicates a need for guidance as to how we can better orient ourselves to our own subject matter. It

[2] The medium of contact has been explored by Ribes-Iñesta (2020), who states language " is the medium in which all human behavior takes place" (italics added; p. 97).

is clear that a comprehensive set of assumptions must be articulated and adhered to in order to ensure that the subject matter is being oriented to and expanded on.

Broadly speaking, a coherent postulational system is a set of premises. Within it, conceptual and methodological endeavors must further elaborate event descriptions (Parrott, 1983a). The philosophy of a science provides postulations (i.e., assumptions) to which scientific workers can adhere. Unlike Skinner, Kantor provided the postulates upon which his psychological system was founded in a clear and unambiguous way. The descriptions of events made by scientific workers are made in accord with the philosophical assumptions relevant to their science (Hayes et al., 1996). If a fully articulated, coherent postulational system is lacking, scientific workers will not provide coherent descriptions of events. For example, an incomplete philosophical system may give rise to mentalistic explanations when other explanations are not yet available. When Skinner (1974) stated that the "physiologist of the future" (p. 236) would bring the missing steps between environment and behavior by successfully explaining the biological factors that cause behavior, this would supposedly make a behavioral analysis secondary. If a scientist is clear on the premise that behavior is an action of the *whole* organism, there would be no need to look at other sciences to define our subject (although physiological factors participate in the psychological event, they are not the *cause* of it). When trying to explain why organisms respond more when they are in states of deprivation, the lack of a clear set rules may allow for a scientist to invoke the mentalistic concept of drive.

A fully articulated philosophy of science assures coherence among event descriptions from all of the subsystems within that science. From an interbehavioral framework (similar to that of a radical behavioral framework), there are three subsystems of behavior science—the applied, investigative (basic), and interpretive (theoretical) domains. Each of these subsystems is essential for understanding and describing events. In more detail, the interpretive subsystem encompasses interpretations, explanations, and comparisons—the focus being the descriptions of events. The investigative subsystem emphasizes the "selection of naturally occurring events or the contrivance of events for laboratory purposes" (Kantor, 1959, p. 96), and the applied subsystem pursues verification of investigative propositions (Kantor, 1959).

Hayes (2009) posits, "the validity of behavior analysis is being challenged by a lack of coordination among its three primary subsystems. Its productivity, and thereby its progress toward the achievement of its mission, is being diminished by this circumstance" (p. 327). The disconnect between the investigative and applied subsystems of behavior analysis is evident in the limited number of citations shared between papers appearing in the Journal of Experimental Analysis of Behavior (JEAB) and those in the Journal of Applied Behavior Analysis (JABA) (Mahoney et al., 2019). In short, the scientific workers in each of these subsystems are not sufficiently oriented to the work of the other to benefit from its contributions, even though the goals of prediction and control are shared by each (Kantor, 1953; Hayes, 2009). The focus on the applied and investigative subsystems has not been on repairing the disconnect between the two; rather, the two subsystems have focused on prediction and control independently. This unfortunate circumstance demonstrates the need for a philosophical foundation upon which applied, investigative, and interpretive domains can rest—something provided by interbehaviorism.

Causality: Construct Rather Than an Event or Assumption

One of Kantor's contributions to the science of behavior was his emphasis on the distinction between events and constructs. Depending on the event of interest for a determined science, as well as a given scientist, and the constraints posed by methods and objectives, constructed descriptions may refer to distinct characteristics of events. In other words, the scientist is simply operating within a given context; that context is provided, in large part, by the subject matter, the aims, and the methods specific to the scientific discipline in which the scientist works. For example, reinforcement as a process is a description constructed from multiple observations the scientist makes of interactions between environing and organismic events. No single event is a reinforcer in itself. All definitions of behavioral phenomena are constructs. In all cases, though, scientific constructs are derived from contacts with events. When descriptive constructs are not derived from contacts with events, such constructs do not contribute to the description of those events. How the description of a given event is structured varies across scientific orientations— each of them guided by propositions constituting its interpretive practices.

A student familiar with radical behaviorism may liken the event–construct distinction with Skinner's analysis of logical and scientific behavior (e.g., Skinner, 1957, chapter 18). In his view, the scientist's behavior is under the control of environmental variables, to which a construct like reinforcement is defined by the practices of the group. Behavior targeted for reinforcement depends on the correspondence between behavior and the controlling variables; the latter including nonverbal (direct contact with the object of study) and verbal stimulation (e.g., responding to another scientist's behavior with respect to the object). Crucially, as is necessarily the case in his analysis, stimuli comprise stimulus classes,

and responses comprise response classes. Therefore, the functional relation between these classes also includes scientific behavior, consistent with the general radical behavioral approach. In other words, Skinner separates the behavior of describing and evaluating from the source of stimulation, thus placing scientific work as one more type of behavior that can be investigated. This is not what we refer to when we distinguish events and constructs in interbehaviorism. An event is the subject matter, and a construct is the product of the contact between the scientist and the event. When the scientist interacts with the event, they generate a construct or modify existing constructs. In an interbehavioral analysis, both parts of Skinner's analysis are constructs: the description of a controlling variable and the description of a unit of response. Kantor's proposal, however, is about distinguishing our description of events from events themselves.

Another aspect relevant to achieving the goals of science is adherence to naturalistic descriptions of events as mentalistic descriptions have no place in a science of behavior. Both Skinner and Kantor argue for adherence to naturalistic descriptions of events; however, Skinner's arguments do not always adhere to naturalistic descriptions. One such example is Skinner's discussion of explanations, or causes, of responses. In his view, responses are caused by a stimulus or multiple stimuli. The consideration of multiple causation, with distinct stimuli compounding for the effect of engendering a response, would make a radical behavioral account more nuanced than the "push-pull" (i.e., unidimensional, a response under the control of one single stimulus; Skinner, 1974, p. 6) causation professed by early behaviorists like Watson. Causality, however, cannot be observed in public events or private events (Parrott, 1983a). In the use of causality to explain responses, Parrott (1983b) argues that mentalism and Skinner's interpretations differ only in the "location of the alleged causes of behavior." (p. 48). In the former, the cause is in the hypothesized mind; in the latter, the cause is in the stimulus. By contrast, in Kantor's system stimuli are not held to cause responses. Rather, "all things existing as parts or features of a certain pattern of happenings may be said to participate as factors in that particular causal field" (Kantor, 1950, p. 158). Stimuli and responses are conceptualized as unitary functions comprising the focus of an integrated field (Hayes & Fryling, 2023) acknowledging the relevance of other field factors to the unit being observed.

Causality in radical behaviorism is typically understood as a dependency relation between at least (but not restricted to) two events, such that one event is taken to be the origin or source of the other event (Skinner, 1974). In the case of psychological events, the cause (or causes) is then a circumstance (or set of circumstances) either internal or external to the individual, participating in an observed behavior–environment interaction. The effect is the individual's behavior. Consider the interaction between a stimulus, such as a bird, and the response of describing its characteristics (e.g., its color, its shape). A causal (radical behavioral) analysis of this interaction consists of establishing a unidirectional dependency relation between the stimulus and the describing response. Here the bird is taken to be the point of origin for the describing behavior. In other words, the bird causes the description in this analysis. In this analysis, there may also be multiple control over the response, as when someone asks for a description of what the bird looks like. In this radical behavioral analysis, the bird could be defined as a discriminative stimulus (SD). The definition of an SD (and controlling variables in general) is appealing to radical behaviorists because it translates well into the activity of manipulating the environment in experimental settings. A discriminative stimulus is an antecedent event that exerts control over the response—or the occasion under which the response occurs. In interbehaviorism, however, no external or internal determiners can be a part of the behavior segment analyzed. To repeat, the functions of both stimulus and response are a single unit within the behavior segment. Additionally, interbehaviorists reject the notion of a stimulus as something occurring before a response (a linear analysis). Since a stimulus–response function is a single unit, both components are necessarily present at any point in time (or, as interbehaviorists may put it, at any particular configuration of the behavior segment). Lastly, such a temporal sequence implied in the definition of an SD (first stimulus, then response) assumes a unidirectional dependency relation, in which the response depends on the stimulus (but see Tourinho, 2011). Skinner (1938), inspired by Kantor, acknowledged that a stimulus and a response are interdependent but, as previously discussed, a radical behavioral account still involves describing these terms in temporal and causal relations to each other. Interbehaviorists reject these definitions of time and causality, but we will see in the following section that these terms still have a part in interbehavioral philosophy.

Questions in psychology are generally set up to identify relations between causes and effects wherein causes and effects are understood as participating in a unidirectional dependency relation and effects are understood as behaviors of an organism. Questions may be asked to clarify the relation between a scientist's manipulation of environing conditions and changes in an organism's responding. We may ask to what state of affairs does the term *causality* refer—in other words, what property of events is described by the term *causality*. All events of interest to investigators consist of interactions between organismic activity and circumstances. Organismic activity is the response component, while circumstances refer to the stimulus component. Any observation of an interaction is an interaction in itself: the scientist confronts the co-occurrence of factors. Instead of viewing causality as a property of events,

Kantor's (1958) proposal was to view causality as a tool to organize confrontations of events—in other words, causes are ways to order and interpret data.

Due to the focus on the philosophy of science, Hayes and colleagues (1996) claim they have "constructed what appears to be a noncausal description of nature" (p. 109). Claiming that causality is not a premise of the philosophy of our science is a way of explaining that causes are constructs, not events. The argument presently put forward is that causality—a hypothesized asymmetrical dependency relation— is an interpretive construct that, within psychology, is often employed as an investigative construct. As an investigative construct, causality is a working hypothesis—or, tentatively, a model—that guides the scientist's manipulative interbehavior in experiments. This construct, from a philosophical point of view, is not derived from contacts with events and is not related to the pursuit of more elaborated descriptions of events. Drawing from Kantor (1950), Hayes and colleagues (1997) state, "causal knowledge, from a philosophical standpoint, is simply knowledge of the pattern of events, nothing more." (p.109; Kantor, 1970).

A general case of the role of causality as an interpretive–investigative construct may go as follows. It is hypothesized at the onset of investigation that the stimulus phase of a particular S⇔R function is the source of the response phase, from which it follows that the absence of the stimulus component explains the absence of the response. As a proposition, this interpretation guides scientific operations: the object said to possess the relevant stimulus function is successively removed and presented in a particular pattern, and the observation of the response phase is contrasted to pre-analytic propositions. Importantly, causality as a construct—both interpretative and investigative— is not invalid in science from an interbehavioral perspective. As suggested, it is a tool that allows for successful operations with respect to relevant events.

An example may clarify the role of causes for an interbehaviorist. Although the philosophy of interbehaviorism would reject the concept of reinforcement as part of its postulational system, as it is necessarily causal, the utility of that concept for the subdomains is not rejected. Hayes and colleagues (1996) clarify that they do not "suggest that the concept of reinforcement, arising out of such influence, is lacking in utility. On the contrary, it is an extremely useful concept, provided that one's goals in science are prediction and control" (p. 105). Causality, in this way, seems to be rejected as a philosophical premise, but acknowledged for its utility within the applied and investigative subdomains. In other words, the construct of causality can assist in manipulating empirical events and interpreting its results—but in this perspective, it is not an assumption on which a philosophy of the science of behavior is based.

Stimulus Substitution: Overcoming Pseudo-Problems Relating to the Past

A fundamental aspect of scientific endeavors is the observations of the scientific worker, as all other scientific endeavors advance from these observations (Hayes & Fryling, 2009). Observations allow for the further description of events; therefore, the assumptions of the philosophy underlying the science must support observations that allow for the further descriptions of all events comprising the subject matter of that science, regardless of whether the observed event appears to be occurring with a stimulus object that is no longer present. One recurring set of questions in psychology and adjacent fields concerns how to account for learning—that is, why an individual's behavior changes as they interact with the environment. Said another way, psychologists have attempted to explain why experience changes behavior. As Hayes (1992) discussed, some cognitive psychologists assume that behavior changes due to the individual accessing hypothesized memory storages, where information units (representations of real-world events) remain until they are retrieved as needed. Although Skinner (e.g., 1974) strongly opposed this view, his account of radical behaviorism assumed operant contingencies worked because contact with the environment changed something in the physiology of the organism, which would explain the influence of the individual's history on current behavior. In contrast, interbehaviorists have offered an alternative account of history which, crucially, does not appeal to events occurring outside the psychological field to mediate what occurs in the latter. The underlying process of learning history—and all changes in reacting with respect to stimuli, to some degree—was termed *stimulus substitution* (Kantor, 1924, 1977).

Adhering to the concept of stimulus substitution ensures that an observer can observe events occurring in the current interbehavioral field. Hayes and Fryling (2009) emphasize that stimulus substitution describes how "the past event is present in the stimulating action of some present stimulus object" (p. 48). Past events are not observable events in that they are not currently present in the psychological field. Stimulus substitution, then, is the way in which the past comes to be present by way of stimulus functions detaching from the original accompanying stimulus object. Parrott (1984) details how both similarity among stimulus objects and conjunctions of them in time and space (i.e., contiguity) may establish substitute stimuli. For example, upon hearing the word *pain*, the individual

may, to some extent, feel pain, even if only at a fraction of any pain they felt from contacts with original pain-inducing objects. This is due to the previous situations in which the word *pain* co-occurred with pain-inducing objects.

As Hayes (1992) discussed, the past does not have an independent status outside the current interaction—we do not look for the child, exactly as the child was, inside the adult, or in another plane of existence. Similarly, we do not look for the practices of a contemporary culture by assuming the contemporary practices are linked to the independent existence of ancient cultural practices somewhere else in the present. Rather, for both the adult and the contemporary society, their pasts exist only as parts of their current configurations. Psychological events are similar in this regard: the past exists in the present.

The premise that the stimulus–response relation is occurring in the present permits the observer to contact what is currently happening in the interbehavioral field, rather than assuming that one part of the effective relation (the stimulus object) exists in some other time or location (e.g., in the past). This remains consistent with the concept of interbehavioral history being present in the interbehavioral field, as the history of stimulus-response relations is part of the observable field.

Interbehavioral philosophy, as applied to the subject matter of psychology, provides the construct of stimulus substitution that serves the science by: 1) ensuring that the subject matter of psychology can be observed (and therefore described), 2) permitting psychologists to forgo dualistic notions of causality when describing events, and 3) providing guidance for the scientific worker who is observing psychological events in which "a person appears to act with respect to a stimulus that is absent from the situation (i.e., a past happening)." (Hayes & Fryling, 2009, p. 48).

Time, while helpful in describing events, is a construct that, without a valid philosophy of science, may hinder the observation of events. Culturally, time is viewed linearly. In general, it is discussed as the past, present, and future. The scientific worker in psychology observes only responses occurring in the present—the observer has no access to any other time. Adhering to the assumption of stimulus substitution, the scientific worker is not hindered by the inaccessibility of the 'past', as the culture at large may posit. Rather, the relations observed are occurring in the present interbehavioral field (Hayes, 1992; Hayes & Fryling, 2009). Therefore, the past cannot be the cause of any events occurring in the field, as the substitute stimulus function is, itself, in the current field.

The observer's role in observing psychological events has also benefited from the construct of stimulus substitution. Parrott (1986) states, "observers have difficulty observing inapparent response functions because they have not had sufficient prior contacts with the person on the part of whom such functions are taking place and they do not thereby know how that person is stimulated by the objects making up his or her surrounds." (p. 57-58; italics added). The observer cannot observe substitute stimulation by observing only one stimulus–response co-occurrence. Rather, there must be a history between the observer and the observed to facilitate genuine observations. However, the sufficiency of contacts with the individual observed is somewhat ambiguous. It is not clear how much observation is sufficient for observing substitute stimulation. This is not problematic, though. Rather than deterring observation for the observer, 'sufficient history' demands that more observations are needed. In other words, if an individual responds to something in the absence of that thing, substitution is occurring. The contacts between the observer and the observed are what allows for another person to describe the occurrence of substitution—the greater these contacts, the more likely substitution is to be observed. The exact number of these contacts does not determine if it can be observed; for example, it is not the case that six previous contacts will be insufficient, but 10 contacts will be sufficient. Detecting another person's actions with respect to substitute stimuli involves contacts with unique, ambiguous events including the observed person in continuously changing setting conditions. When it occurs, if it does, its occurrence is not a matter of some quantity of previous, partially similar contacts with that person.

Stimulus substitution is one process of how the scientific worker can observe responses as they occur in the interbehavioral field, rather than adhering to causal constructs, or constructs that would hinder the further observations of events relevant to the psychological subject matter. The past, as defined in traditional and representational accounts, is not a helpful distinction when considering the observation of psychological events. It has no role in the interbehavioral field nor in the descriptions of the observations of events—at least not as a component of the event, although it can be seen as a way to describe how the event field is reconfigured. Instead of referring to the past, interbehaviorists refer to how stimulus functions *evolve* throughout successive contacts by way of stimulus substitution. Furthermore, adhering to the traditional concept of the 'past' would hinder the scientific worker from observing psychological events, as these events only occur in the present. Stimulus substitution provides direction for the observer of psychological events—to contribute more observations of what is possible to be observed.

Conclusion

The purpose of the present paper was to introduce what we consider to be important features that an interbehavioral approach brings to a natural science of behavior. J. R. Kantor dedicated his career to building a philosophical system that eliminates reliance on fictional events of the mental or biological sorts. Interbehaviorism makes explicit the assumptions upon which the troublesome task of explaining interactions involving individuals and their environments is undertaken.

Interbehaviorism is a coherent philosophical system that contributes to the science of behavior by adhering to observation, demonstrated by its rejection of cause as a part of the event being observed and its focus on events occurring in the present. Interbehaviorism, as a philosophy of science, rejects appeals to physiology as a source of psychological events, and in doing so, parts with the temptation to leave difficult tasks to other disciplines. Although an orientation to some important aspects of interbehaviorism have been highlighted, it is worth noting that not all of the assumptions and contributions of this philosophy have been addressed in this paper. For those interested in pursuing a better understanding of interbehaivorism, we recommend a multitude of works.

Recommended Readings on Interbehaviorism in Portuguese

To our knowledge, the most detailed treatment of the interbehavioral position in Portuguese is Souza's (2021) thesis on mental events as treated by both Skinner's radical behaviorism and Kantor's interbehaviorism. Souza's work successfully explores both the radical behavioral and interbehavioral perspectives in an elegant manner, and Portuguese-speaking students interested in the topic of 'mental' (private, inapparent) events are directed to this thesis.

A much more concise comparison of the mentioned perspectives is provided by dos Santos and de Carvalho Neto (2021), which focuses on comparing the degree of correspondence between concepts across Skinner's and Kantor's work, specifically emphasizing how radical behavioral definitions can be described using interbehavioral terms and vice-versa. Dos Santos and de Carvalho Neto describe several aspects of Kantor's taxonomy, but do not go in detail about the implications of interbehavioral assumptions to important scientific topics, such as a coherent scientific system beyond prediction and control, causality, and learning history.

The other two Portuguese-language articles, by Tourinho (2011) and Matos (1981), are brief in their treatment of interbehaviorism. Tourinho mentions Kantor's work insofar as Kantor influenced Skinner's views, while Matos provides a brief overview on the interbehavioral field and the ways interbehaviorism may help to avoid mentalistic and organocentric reasoning in psychology. It is worth noting that, to our knowledge, Matos' overview is the first article on interbehaviorism to be published in Portuguese.

Recommended Readings on Interbehaviorism in English

Kantor wrote extensively on the interbehavioral system, which may make the endeavor of learning more about itseem overwhelming. A thorough introduction to interbehaviorism is Hayes and Fryling's (2023) book entitled *Interbehaviorism: A Comprehensive Guide to the Foundations of Kantor's Theory and Its Applications for Modern Behavior Analysis.* In addition, Midgley and Morris' (2006) *Modern perspectives on J.R. Kantor and Interbehaviorism* provides an introductory text on Kantor and interbehaviorism. A detailed account of Kantor's postulational system may be found in *Interbehavioral Psychology* (Kantor, 1959), and *Logic of Modern Science* (Kantor, 1953).

Other scholars have also refined interbehaviorism as a philosophy of behavior science. An introductory text that provides a historical account of the early work of Kantor and Skinner, and some comparisons between the two, is made by Fuller (1973). For an introductory text that also provides a quick overview of how to conceptualize commonly used terms (e.g., imagining, thinking, perceiving, etc.) and applied problems (e.g.., psychotherapy and social responsibility), we recommend Smith (1984). On the issue of learning history and how to account for this without appealing to the concept of the mind, information storages, or physiological changes, Linda Hayes has drawn from interbehavioral concepts to define *The Psychological Present* (Hayes, 1992). Additionally, Linda Hayes, Mitch Fryling and colleagues have contributed to explaining historically important psychological phenomena, such as the problem of private events in behavior analysis (Hayes & Fryling, 2009; a topic also broached by Tourinho [2006]), memory (Fryling & Hayes, 2010), the concept of function (Fryling & Hayes, 2011), observational learning (Fryling et al., 2011), and feelings (Hayes & Fryling, 2017).

Considerations

Morris (1982) posits some reasons why Kantor's work may not have become more mainstream, indicating factors such as Kantor's "unyielding"(p. 196) criticisms of psychology and the lack of specific solutions for those

criticisms; the limited experiments he conducted; and his emphasis on philosophical concerns. In relation to these criticisms, he suggests that Kantor's work may also have been less widely acknowledged because of the context his work was in, including the adherence to mentalism within psychology, the complexity of his work being difficult to understand, and because Kantor was "not a public figure" (p. 196). Kantor's extensive contributions are not his alone to expand from; he created a comprehensive, naturalistic philosophy through which to do scientific work.

This paper has focused on Kantor and Skinner because the two are considered to be the founders of their respective philosophies; however, the scientific work within each of these domains is not limited to the work of its founder. Multiple academics have been cited as having contributed to what is known about the philosophy of our science; our goal in doing so is to emphasize that interbehaviorism, just like radical behaviorism, does not begin and end only with its founder (though the founders have laid the groundwork for others), but is furthered by others who clarify, expand, or critique the use of the philosophy to behavior science. It is the job of scientists to become familiar with the philosophy to which they adhere and to expand the work within it.

As a philosophical system that can guide the field of behavior analysis, interbehaviorism may be important to understand and adhere to in scientific endeavors. How we talk and think about our subject matter has a bearing on how we approach it, which means we must be precise in how we describe it—as other scientists can only contact our observations through our description of them.

Study Questions

1. What is the role of physiology on understanding behavior when adhering to (a) a radical behavioral perspective and (b) an interbehavioral perspective?
2. What is the difference between events and constructs?
3. Compare and contrast the relation between a stimulus and a response from a radical behavioral and interbehavioral perspective.
4. Describe a behavioral experiment you are familiar with from an interbehavioral perspective, focusing on adhering to how causality is viewed from this perspective (i.e., emphasize the interdependency of the participating factors in the field, rather than focusing just on causal dependency relations).
5. How is the past accounted for from an interbehavioral perspective and how is this view serviceable to behavior analysts?

Declaration of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Contributions from Authors

The contribution of each author can be attributed as follows: C. Smith and A. Figueira de Melo both substantially contributed to the conceptualization and writing of the current paper. C. Smith conducted the overarching literature review, structured the paper, and integrated the written and conceptual contributions from both authors. A. Figueira de Melo reviewed Portuguese-language articles, translated the current paper into Portuguese and revised terminology accordingly, enhancing its accessibility. Their combined efforts resulted in the following manuscript.

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