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Cartesian mechanics, conditioning theory and behaviorism: some reflections on behavior and language

La mecánica cartesiana, la teoría del condicionamiento y el conductismo: algunas reflexiones sobre la conducta y el lenguaje

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Abstract

The relation between the logics of Cartesian mechanics and conditioning theory are examined. It is asserted that behaviorism adopted the logic of Cartesian mechanics through the "reflex" concept and conditioning theory. The use of logical criteria based on the representativeness of punctate events and causal relations as proximal contact has severely limited the conceptual and empirical scope of so-called radical behaviorism. The special case of verbal behavior is analyzed to demonstrate the insufficiency of basic definitions.

Key words: Cartesian mechanics, conditioning, reflex, verbal behavior

Resumen

Se examina la relación entre la lógica de la mecánica cartesiana y la de la teoria del condicionamiento. Se afirma que el conductismo adoptó la lógica de la mecánica cartesiana a través del concepto de "reflejo" y de la teoría del condicionamiento. El uso de criterios lógicos basados en la representatividad de eventos puntuales y las relaciones causales como contacto proximal, han limitado severamente la perspectiva conceptual y empírica del llamado conductismo

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radical. Se analiza el caso especial de la conducta verbal para demostrar la insuficiencia de las definiciones básicas.

Palabras clave: condicionamiento, conducta verbal, mecánica cartesiana, reflejo

> Enough to explain why I am saddened, and often depressed, by what has been happening to "behaviorism", to behavior science generally, since 1913. How far we come since then? Seems to me we may have slipped backwards. It looks to me sometimes, in my more depressed moments, like eighty years of no progress.
> *W.N. Schoenfeld* (1993)

Behaviorism is more than a term describing the beliefs and doings of a particular group of psychologists. Behaviorism has been conceived as an approach in psychology, as a philosophy of psychology, as a theory in psychology, and as a social movement in and beyond psychology. In order to restrict my discussion to psychology, I do not consider here other uses of the term in philosophy, sociology and biology.

Although all these uses of the term 'behaviorism' may be justified, I will restrict myself to only one of these meanings: behaviorism as the special philosophy of the science of psychology. I am aware that even in this restricted sense, it is difficult to advocate that behaviorism is a unique and univocal conception about the subject matter, methods and applications of psychology (Zuriff, 1985; Lee, 1988). Similar examples of this difficulty may be found in the cases of mechanics in physics, and in evolutionism in biology.

I will concentrate on the kind of behaviorism named by Skinner as "radical behaviorism" (Skinner, 1945), although I will direct my analysis to issues beyond the nature of operational definitions and the place of private events in a science of behavior (cf. Ribes, 1982). I will try to show that although behaviorism is more than a theory in psychology, it has adopted a special theoretical status in the form of conditioning theory (Schoenfeld, 1983). In doing so, behaviorism has adopted categories, assumptions and the fundamental logic of theoretical disciplines devoted to different subject-matters (mechanics and evolution the-

ory). The influence of mechanics has been specially pervasive, giving rise not only to a set of concepts -some of them progressively abandoned- but also to a prebuilt logic that has severely limited the conceptual and empirical perspective of behavior theory and methodology. I will refer to this prebuilt logic as the reflex-embedded logic of the so-called "operant" psychology.

The origins of behaviorism and the adoption of conditioning theory Boakes (1984) has extensively documented the historical influence of functionalism and evolution theory in the emergence of behaviorism. The study of animal intelligence became a central issue to explain natural selection of species' populations.[2] The other major historical influence was experimental neurology and its culmination in the work of Sechenov (1866, 1978 Spanish translation), Bekhterew (1913) and Pavlov (1927, English translation). The reflex tradition represented a systematic attempt to deal with "psychic" functions or processes in objective terms. The central nervous system became the conceptual surrogate of the soul or mind.[3] In this regard, Pavlov's (1927) words are illuminating:

> [Referring to James and Wundt's claims]... Such testimony seems to show clearly that psychology cannot yet claim the status of an exact science.
>
> If this be the case there is no need for the physiologist to have recourse to psychology. It would be more natural that experimental investigation of the physiological activities of the hemispheres should lay a solid foundation for a future true science of psychology; such a course is more likely to lead to the advancement of this branch of natural science.
>
> The physiologist must thus take his own path, where a trail has already been blazed for him. Three hundred years ago Descartes evolved the idea of the reflex..." (pp. 3-4)

The emergence of behaviorism as a new perspective about psychology's subject matter was closely tied to the discussion of the dominant method of that time: introspection (Watson, 1913).

In his 1916 paper on *The place of the conditioned reflex in psychology*, Watson proposed an alternative to introspection as a *general experimental method*: the conditioned reflex method, specially that related to motor conditioning as developed by Bekhterew. The conditioned reflex method was shown to be adequate for the study of both animal and human behavior, and was advanced in various works by Watson as the framework for analyses and *interpretation* of

2. Natural selection of species required to explore the individual adaptation process that increased the survival probability of a given population. This interest was initially shown by Thorndike (1911) in conceiving trial-and-error learning as a matter of *response selection*. This position was later adopted by Skinner (1966) and Staddon and Simmelhag (1971).
3. An exception to this general position was Loeb (1903), who argued that irritability and conductivity, that were the essential properties of the reflex, were shared in every protoplasm.

emotions, habits, thinking and personality (1924, 1926). Although Watson continued using the term habit for the analysis of behavior, he equated habits and reflexes, since habits were nothing other than collections or chains of reflexes. The central role of reflexes in the new psychology advanced by Watson was stressed by him in an address to neurologists:

> The behaviorist's psychology is based on reflexes-your *reflexes* (1926, p. 185)

The adoption of the conditioned reflex entailed not only a conceptual unit for the analysis of behavior, but also a new method and a new **logic** for observing and interpreting the subject-matter of psychology.

Skinner (1931, 1935) developed further the notion of reflex for the new psychology advanced by behaviorism. Skinner proposed the reflex as the analytic unit for the study of behavior. He examined the use of the reflex concept for the Cartesian conception of automatic action to the integrated reflexes in Sherrington. Skinner concluded that a reflex was always used as the description of a covariation of stimuli and responses. According to this view, the application of the concept of reflex to the analysis and prediction of the behavior of intact individual organisms did not require any assumption about neural paths or central mediators. The reflex consisted of ordered covariations between stimuli and responses:

> ...A reflex is defined as an observed correlation of two events, a stimulus and a response...As a scientific discipline, it must describe the event not only for itself but in its relation to other events; and, in point of satisfaction, it must *explain*. These are essentially identical activities. (p. 337)
>
> ...Reflex physiology undertakes to describe the events which intervene between a stimulus and a response. The physiological usage does not question the definition of a reflex as a correlation, for the synapse is only a conceptual expression for the "reduced" characteristics of a given correlation...The essence of the description of behavior is held to be the determination of functional laws describing the relationship between the forces acting upon, and the movement of, a given system. The reflex is, by definition, the precise instrument for this description. (p. 346)

In *The behavior of organisms* (1938), Skinner formalized the analysis of behavior in terms of two kinds of reflexes: respondent and operant, according to the classification of behavior as elicited or emitted. Respondent reflexes consisted of stimulus-response covariations while operant reflexes consisted of response-stimulus covariations. Pavlovian reflexes and trial-and-error learning were both considered as *conditioned behavior* under the descriptive frame of the

reflex. Later on, although 'covariaton', 'correlation' and 'contingency' were used to replace the reflex concept and some related terms such as reflex reserve and extinction ratio, although Skinner never gave a clear-cut definition of contingency as different from correlation or contiguity. The abandonment of the reflex concept and terminology did not preclude that behavior theory, in the form of conditioning theory, conserved the logical features of the reflex concept and its origins in Cartesian mechanics.

Cartesian mechanics and the logic of conditioning theory

Descartes' mechanics was applied to the movement of all bodies, organic and inorganic -including man (*Discourse on the Method*, *Treatise on Man*, 1980a,b Spanish translations). Two main features of Cartesian mechanics which relate to my central argument are:

1) The concept of efficient causality as proximal contact in relation to movement and force; and

2) The identification of the *point* as the descriptive element for the analysis of extension and, therefore, movement.

Efficient causality. Cartesian theory about causality as efficient cause and the principle of proximal contact were developed in *The World or Treatise on Light* and in the second part of *On the Principles of Philosophy*. Descartes conceived movement as a concept consubstancial to those of matter and body. Matter was quantity and extension. Therefore, matter always was a corporal substance. The form and essence of matter was to occupy space. Any variation in matter depended on movement.

Bodies, as quantities -or parts- in movement had the property of transferring or transmitting movement to other bodies, to the extent that movement was an essential definition of matter and not of any particular body. This view grounded the conception of mechanical causality as transmitted movement. Movement might pass from one to another body but movement could not disappear from the world. Even when a given body was resting, there was always movement as a property of extense matter, and any body in rest could be set in movement by another mobile or moving body. The movement in other body only could be transmitted by the movement of the moving body. A mobile body was required to transmit movement to other bodies.

In his first law of nature, Descartes asserted that every thing persevered in the same state insofar depended of itself. What moved once, tended to move

always. The form and state of a body would not change unless an external cause acted upon it. Nothing in the universe tended toward rest as condition, but bodies that were hard -those which parts were not separated- tended to rest. But matter was always in movement as a general state, even when some bodies might rest.

Movement, as state and change in matter and bodies, could only have an effect through contact, that is spatial and temporal contiguity, with other bodies. Translation was produced from proximity of contiguous bodies to the proximity of others, since only some bodies could be contiguous to the same mobile at the same time. Contiguity became the principle of causality as the transmission of movement by a mobile body to another body, mobile or resting.

The point as descriptive element. Cartesian mechanics, framed in a geometric model of nature, assumed the infinite divisibility of matter and chose the "point" as the ultimate representation of any body or movement. The point was the limit of the line and the component of any plurality. Thus, comparisons between bodies and their parts depended on the availability of measurement units. The point was the elementary geometric referent to establish proportional and equivalent measures in any dimension. The point was the ultimate geometric abstraction to compare all the bodies and parts of matters in terms of equivalent numerical units, irrespectively of the physical existence or inexistence of those bodies and parts. The infinite divisibility of matter was represented by a geometric construction free of all accidents of matter: the point, from which all possible geometric constructions could be built through the analytic procedure of composition and decomposition of figures and their dimensions. As Cassirer (1953 - Spanish translation) comments:

> ...We substitute, this way, the diversity of forms by the diversity of points'movements. (p. 462)

Descartes rejected the existence of atoms as indivisible material units or parts, and assumed the unlimited divisibility of matter and its parts. From this geometric perspective, the point adapted accurately to the possibility of abstracting any division of matter as extension. Independently of the *real* magnitude of such a part, it could be subsumed in a numerical dimension in which the point was the elementary representation. The point became the minimal geometric representative category of any variation in matter as movement and extension.[4]

4. Descartes, in *On the Principles of Philosophy*, assumed that the infinite divisibility of matter as extension

Cartesian mechanics provided a general logic about knowing the material world: 1) any part of bodies and matter could be reduced to the point, an abstracted atom, from which **valid** representations could be developed; 2) the world was to be described in terms of moving and resting bodies and parts, although movement was a general property of matter as extension; 3) movement to a resting body was always transmitted by the movement of a moving body and changes in conditions of any body could only be affected by the movement or lack of movement of another body; and, 4) movement (and force) were transmitted by proximal contact, and distant effects were only the succession of partial proximal contacts by contiguous bodies. This logical properties of Cartesian mechanics were incorporated by the conditioning theory through the reflex concept even when the term "reflex" was left out after the 40's.

The "absorption" of Cartesian logic by conditioning theory gave place to a variety of conceptual problems. I have previously examined those conceptual problems with special reference to Skinner's formulation (Ribes, 1995). Here, I will limit myself to discuss two general features of Cartesian logic inherent to conditioning theory: 1) the formulation of an atomistic analysis of behavior, and 2) the surrogation of descriptive functional analysis by linear causal explanation.

Atomistic analysis. The reflex logic foresaw two states of the body: movement and rest. The changes in these states were represented as discrete events by the point. The point allowed for the geometrical reconstruction of trajectory and characteristics of movement. Mechanical actions were thought as discrete punctate changes, alternating between two states. Nineteenth century biology conceived the reflex as a point-to-point correspondence between impulses as stimuli, and effects as movement. The reflex relation was described as a discontinuous, discrete relation between stimulus and response, and non-stimulus and non-response. Physiological language adapted to this conception when talking about neural impulses, all-or-none transmission, resting state of neurons, refractory period, etc. Conditioning theory persisted in this representational model, and stimulus and response were defined as punctate events in time with analogous restrictions to those of the isolated neuro-muscular preparation (Skinner, 1931).

In order to quantify the stimulus and response as replicable observational facts, these punctate events were integrated in classes (Skinner, 1935, 1938). The reflex and, later, the respondent and the operant, became class concepts,

was a consequence of the corresponding divisibility in thought.

stimuli and responses being instances of those classes, measured by their repetition as discrete, discontinuous events in time. Punctate responses and events were selected as the empirical referents of concepts describing and explaining extended segments of behavior, e.g., chaining, induction, conditioned and differential reinforcement, etc. On the other hand, concepts -and correlated procedures- such as punishment, avoidance, differential reinforcement of "not-responding" and extinction became relevant examples of two-state analysis of behavior: responses were suppressed, extinguished or reinforced not to occur, while stimuli where postponed, avoided or eliminated. Responses and stimuli took place in a continuum of non-responses and non-stimuli (Schoenfeld and Farmer, 1970). Nevertheless, the representativeness of punctate events in regard to non-events taking place in the situation was held as the basic assumption of descriptive and experimental analysis of behavior (Skinner, 1931, 1935, 1938).

Skinner based the viability of analysis on the assumption of representativeness of punctate events as order covariations:

> In the description of behavior it is usually assumed that both behavior and environment may be broken into parts, which may be referred to by name, and that these parts will retain their identity from experiment to experiment...A stimulus or a response is an *event*, that is to say, not a property; and we must return, therefore, to a definition on the principle of classes...both the stimulus and the response must be taken (tentatively, at least) as class terms, each of which embrace an indefinitely large number of particular stimuli or responses but is sufficiently well defined by the specification of one or two properties. (1935, pp. 347- 349)

The representativeness of broken parts, stimuli and responses, depended on the order of the covariation between those events or instances:

> ...the analysis of behavior is not an act of arbitrary subdividing. We cannot define the concepts of stimulus and response quite as simple as 'parts of behavior and environment' without taking account of the natural lines of fracture along which behavior and environment actually break. (Skinner, 1938, p. 33)

Thus, the defining property of a covariation was the minimal point of restriction that allowed for any correlation between instances to become representative of a general class, including defining and non-defining properties. The discrete points embraced in a particular covariation gave account of the ordered correlation between observed events *and also* of non-observed events. Both kinds of instances were assumed to be represented by the covariation of punctate stimulus-and response-events. In this context, rate and frequency of re-

sponding emerged as necessary measures to warrant the replicability of the members of an operant class, e.g. the repetition of a correlation between a variety of responses closing the microswitch and the occurrence of the reinforcer. Nevertheless, when the replicability criterion of the class did not require the repetition of the same response instance as fulfillment of the defining "property", the logical limitations of this analysis became obvious. Verbal behavior (Skinner, 1957) is the clearest example of this.

In an atomistic analysis, the covariation of punctate events can be examined *only* as classes if they are functions of third variables (causal or dispositional). Skinner (1931) defined the reflex as a covariation where R= f(S,A), that is, the response (R) was a function of the stimulus (S) and a third variable (A), usually a deprivation or motivational variable. In stating that response was a function of the stimulus and a third variable, Skinner *segregated* the covariation as the unit of analysis and, by *definition*, transformed behavior, as the continuum of unbroken responses, in an independent segment of the stimulus class covariating with it. To conceive the covariation of responses and stimuli as the unit of analysis, this should be described as R-S= f(A).

The distortion in the definition of a covariation of classes is closely tied to the concept of the reflex. The reflex is a covariation but of an antecedent and a effect, and the covariation is consistent only to the extent that the effect is produced as a consequence of an antecedent event. Because of this, the class concept developed by Skinner (1938) either for the respondent or the operant as the two forms of reflex description, entails an analysis of successive events in real time, which in the operant includes at least three moments in time in order to verify the repetition of responses given a previous reinforcer.

This atomistic analysis brought up two logic limitations:

1) The operant as a class concept could be used only with repetitive, punctate instances allowing for the "reinforcement" effect. Given an episode with the occurrence of a single response unit, with a temporal extension larger than the "point" as a discrete event, it was difficult to be described in terms of operant reinforcement, as suggested in the revisitation of the "superstition" experiment (1948) and the definition of language behavior as verbal operants (1957).

2) The formulation of a class as a covariation where each functional component could be segregated became a logical contradiction. Thus, response rate became the dependent variable of reinforcement procedures, while in verbal behavior the speaker's behavior was analyzed **assuming** a non-verbal listener. The covariation was transformed into a linear causal relation between previous

effects on the response member of the class and the reinforcement variables, including the listener as a surrogate of the pellet dispenser or the pellet itself.

Language behavior as operant behavior

In *Verbal Behavior* (1957), Skinner extended his analysis of operant behavior to the domain of language as behavior, understood as individuals speaking and listening in interaction. Skinner conceived language as verbal behavior. Verbal behavior was described as a topographical subdivision of human behavior. In this analysis, Skinner did not require any kind of special experimental or statistical support:

> ...The emphasis is upon an orderly arrangement of well- known facts, in accordance with a formulation of behavior derived from an experimental analysis of a more rigorous sort. The present extension to verbal behavior is thus an exercise in interpretation rather than a quantitative extrapolation of rigorous experimental results. (p. 11)

In choosing *verbal behavior* as the subject matter of his theoretical analysis, Skinner (1957) argued that:

> Behavior which is effective only through the mediation of other persons has so many distinguishing dynamic and topographical properties that a special treatment is justified and, indeed, demanded. Problems raised by this special mode of action are usually assigned to the field of speech or language. Unfortunately, the term 'speech' emphasizes vocal behavior and is only awkwardly applied to instances in which the mediating person is affected visually, as in writing a note. 'Language' is now satisfactorily remote from its original commitment to vocal behavior, but it has come to refer to the practices of a linguistic community rather than the behavior of any one member. The adjective 'linguistic' suffers from the same disadvantage. The term 'verbal behavior' has much to recommend it. Its etymological sanction is not too powerful, but it emphasizes the individual speaker and, whether recognized by the user or not, specifies behavior shaped and maintained by mediated consequences. It also has the advantage of being relatively unfamiliar in traditional modes of explanation. (p. 2)

Skinner assumed that verbal behavior is operant behavior, that is, behavior that acts upon the environment and that is influenced, in turn, by changes produced in the environment. Nevertheless, verbal behavior does not produce mechanical changes in the environment. Its effects are mediated by the mechanical action of another person -the listener. The listener mediates consequences (or reinforcement) of the speaker's behavior. The listener's behavior

produces mechanical effects that reinforce the verbal behavior of the speaker. Skinner (1957) stated that:

> Behavior alters the environment through mechanical action, and its properties or dimensions are often related in a simple way to the effects produced...All this follows from simple geometrical and mechanical principles...Much of the time, however, a man acts only indirectly upon the environment from which the ultimate consequences of his behavior emerge. His first effect is upon the other men...a thirsty man...may engage in behavior which produces certain pattern of sounds which in turn induce someone to bring him a glass of water. (p. 1)

Since verbal behavior is defined in terms of the mediation of the reinforcement of the speaker by the listener, the behaviors of the two individuals can not be separated. In this sense it should be understood that verbal behavior is an *episode* (Skinner, 1957, p. 2). The crucial role of the listener in defining verbal behavior is necessarily related to the special topography characterizing this subclass of operant behavior. To the extent that the topography (I prefer to talk about morphology) of verbal behavior does not produce mechanical effects on the environment, then the listener becomes the subsidiary component responsible for these effects. The interaction of the listener and the speaker consists of the mediation of reinforcement by the listener with reference to the speaker's behavior. The distinction between verbal and non-verbal behavior is based upon the mediation of the mechanical effects that must follow any operant behavior. Non-mechanical effects of behavior are functional to the extent that they mediate the initial or ultimate mechanical effects of a particular behavior of the speaker.

Nevertheless, this seems insufficient to distinguish verbal from non-verbal behavior, unless verbal behavior is equated with any behavior that is followed by social consequences. For instance, when a person is ringing a bell in order to have a door opened, it may be asked whether ringing the bell is verbal behavior. Opening the door is a mechanical effect mediated by the listener of the bell ringing, a listener that has been specially trained to open the door this way in order to "reinforce" the bell ringer. In order to distinguish verbal behavior from this kind of social behavior, Skinner (1957) added some restrictions to his initial definition:

> ...A preliminary restriction would be to limit the term verbal to instances in which the responses of the 'listener' have been conditioned...(with) the further provision that the 'listener' must be responding in ways which have been conditioned *precisely in order to reinforce the behavior of the speaker.* (pp. 224-225)

The last two words are crucial in this refinement of the definition of verbal behavior. If 'the speaker' is considered an individual behaving, the restriction does not distinguish between verbal and any kind of social behavior. If 'the speaker' means speaking (or reading, or writing) then the behavior of the listener refers to a special topography of the speaker's behavior. However then the definition loses value. Specifying the listener's behavior becomes redundant since the form of the speaker's behavior is the necessary and sufficient condition to identify verbal behavior.

The definition of verbal behavior as a subclass of operant behavior includes the listener's behavior as the stimulus component of the covariation. Verbal behavior is defined as an episode comprising the behavior of the speaker and the behavior of the listener, the latter providing mediated mechanical consequences or non-mediated "verbal" consequences. Nevertheless, given that the analysis of operant behavior is concerned in real-time "contacting" of relations between behavior as the dependent variable and reinforcement as the independent variable, two additional problems emerge. First, the behavior of the listener is considered, surprisingly, to be non-verbal (with some exceptions). Second, the speaker's behavior, considered as equivalent to lever-pressing, is analyzed as a function of reinforcement variables: the mediated environmental consequences. Skinner (1957) states that:

> ...the behavior of the listener in mediating the consequences of the speaker is not necessarily verbal in any special sense. It cannot, in fact, be distinguished from behavior in general, and an adequate account of verbal behavior need cover only as much of the behavior of the listener as is needed to explain the behavior of the speaker. The behavior of speaker and listener taken together compose what may be called a total verbal episode. There is nothing in such an episode which is more than the combined behavior of two or more individuals.
>
> Nothing "emerges" in the social unit. The speaker can be studied while assuming a listener, and the listener while assuming a speaker. The separate accounts which result exhaust the episode in which both participate.

The definition of verbal behavior proposed by Skinner as a special kind of operant behavior has inherent limitations:

a) It can not distinguish between verbal and non-verbal behaviors only in terms of consequences and its mediation;

b) It consists of an episode the analysis of which segregates its components;

c) The two terms of the definition are not symmetrical, since verbal properties of the speaker's behavior verbal depend on the listener's behavior that is

basically non-verbal; that is, the verbal property of a behavior depends on the non-verbal property of other behavior; and

d) Contrary to the concept of the operant as covariation represented by punctate events, the verbal operant consists of an episode in which the "representative unit" can not be identified independently of its topography in both sides of the covariation: the speaker and the listener.

The logical deficiencies of this definition of verbal behavior prompt at least the following questions:

a) Must all verbal behaviors have mechanically produced consequences, even when these consequences occur indirectly through the action of other individuals?

b) If this is not the case, how is verbal behavior to be distinguished from non-verbal behavior in terms of the mediation of effects by the action of another individual, when his/her behavior is an effect by itself, eg., an expression, answering a question, and so on?

c) If the speaker's behavior depends on the previous conditioning of the listener to reinforce it, is verbal behavior always identified through the listener?

d) How can it be shown that the listener's response has been specially conditioned to reinforce the speaker in a given circumstance? The listener's conditioning is part of his history and this is not an observable property of the components of the episode specified by the definition of verbal behavior.

e) If the listener's function is to reinforce the speaker's behavior based upon the criteria prescribed by a verbal community, is not this function a surrogate for the direct, mechanical effects defining operant behavior? If this is the case, the listener could be conceived merely as a manager of consequences.

f) What maintains the behavior of the listener regarding the speaker? Is the speaker in return the mediator of consequences for the speaker? How does this circular interdependence of mutual reinforcers between speaker and listener end? Appealing to negative and positive reinforcement seems far too simple to understand why people talk and write each other!

g) In order to eliminate the circularity of the definition, it is necessary to assert the following: i) verbal community maintains the behavior of the listener (however, this violates the empirical-observational level of the definition); ii) the conditioning history of the listener (that never is identified as prior, simultaneous or posterior to his conditioning as speaker) has a permanent proactive distant temporal effect on the differential behaviors of the listener regarding any speaking episode to be reinforced; and iii) the listener reinforces the

speaker due to "solidarity" or "deferred reciprocity", as it is implied, for instance, in the concept of educational reinforcement.

h) The only possible way to distinguish verbal from non-verbal behavior would be that the listener -being a nonverbal instance in the interaction- responded appropriately according to the *morphologies* (or topographies) of the speaker's behavior, providing the consequences specified by the verbal community. This view represents returning to the starting point.

Some logical flaws in the definition of verbal behavior

I will analyze in detail two aspects of the definition:

1. Verbal behavior and "mechanical" effects; and
2. The role of the listener in the verbal episode.

Verbal behavior and mechanical effects. The definition of verbal behavior formulated by Skinner entails a double classification regarding the effects of behavior. On one hand, the type of effect: mechanical or non-mechanical, and on the other hand, the way the effect is produced: directly or indirectly. According to the definition, mechanical effects directly produced by the speaker are excluded from the field of verbal behavior. Nevertheless, there are three combinations which may apply to the definition: mechanical-indirect effects, non-mechanical-direct effects and non-mechanical-indirect effects.

One alternative has to do with the mechanical effects mediated by the listener. According to this view, behavior would be verbal only if its mechanical effects are indirectly produced. The direct mechanical effects would be produced by the listener's behavior and this would justify why the listener's behavior is to be considered non-verbal most of the time. This restriction would obviously exclude as listener's behavior any behavior that, in return, could produce indirect effects through the mediation of another individual. Nevertheless, intraverbal, textual and echoic operants, for instance, are verbal operants despite the fact that they are only followed by the vocal and hearing behaviors of the listener. If verbal behavior does not require of effects mediated by the behavior of others, then the mediation of reinforcement *per se* does not define verbal behavior. But if consequences maintaining verbal behavior are mechanical and non-mechanical effects mediated by others behavior, how is verbal behavior to be distinguished from any variety of social behavior? Any behavior that is followed by consequences consisting of the behavior of others is to be regarded verbal?

A second alternative is to consider that verbal behavior is always behavior maintained by indirect effects. Since many listeners' behaviors are direct effects to the speaker (answering, hearing, doing something that does not necessarily affect the speaker, etc.), equating indirect effects to "non-mechanical" behaviors of the listener would be untenable. To avoid this, indirect effects would require at least three individuals comprising the verbal episode. Thus, this alternative is a blind-alley. But if we restrict indirect effects to mechanical consequences only, then we would find ourselves denying that when somebody says "I am eating...", since no mechanical effects are mediated by another person, this behavior is not verbal!

The role of the listener in the verbal episode.

Human behavior rarely occurs as isolated mechanical action regarding the physical environment. Human behavior usually takes place in the context of interactions with other individuals. In the case of verbal behavior, Skinner (1957) recognized that "...usually occurs only in the presence of a listener" (p. 172). This statement opens the possibility of exploring a reduction in the logical ambiguity of the definition of verbal behavior, looking for consistencies when it is approached from the listener, instead of from the speaker.

There are several circumstances in which the behavior of the speaker is evidently verbal, but in which the listener's behavior does not conform to the definition in terms of mediating effective consequences for the speaker. I will mention three instances in which the listener does not behave according to the definition of verbal behavior and, nonetheless, the behavior by the speaker seems to be undoubtedly verbal. The situations to be illustrated may raise "functional interpretations" about what may happen in relation to the speaker's behavior according to "extinction", "previous history of reinforcement", "insufficient stimulus control", and the like but these have to do with explanation and not with identification. The *definition* is not adequate *to identify* instances of the defined behavior.

First, there is a situation in which the speaker's behavior is not followed by any behavior of the listener, eg., a customer asking a waiter for a beer in a crowded bar. According to the definition, asking for a beer is not verbal behavior since the waiter does not reinforce the behavior of the speaker by serving the beer. There is a second situation in which the behavior of the speaker is followed by "imperfect" or "deficient" effects from the listener's behavior, e.g., when a

mother is training her child to use the fork and spoon when eating and despite her instructions, recommendations, orders and explanations, the child continues using his/her hands to eat. Finally, there is a third situation in which the speaker is behaving with reference to an "audience", but none of the behaviors of the audience is to be identified with "listening" as mediating consequences or reinforcement, eg., when a priest baptizes a baby, his behavior as speaker is not affected by the behaviors of the parents and child. "God" is his "listener", but it is difficult to identify the verbal episode comprising the priest's behavior and the mediated effects provided by God!

These instances show the diversity of cases in which it is difficult to *identify* the verbal features of a behavior based upon the behavior of the listener.

A second approach to the definition from the listener's behavior is to assume that any behavior from a potential speaker is verbal if, and only if, it fulfills the criteria for reinforcement set up and provided by the listener. This approach has two severe limitations. First, it is difficult to identify the listener's "reinforcing" behaviors for a given speaker in any moment, unless the listener is identified with *general prescriptions for general situations and practices*. But doing so entails accepting that individual language behavior may be identified *only* with reference to general rules and abstractions describing a verbal community. Second, identifying verbal behavior in the speaker through the reinforcement practices of the listener brings up some paradoxes.

When the weight of the definition is moved to the listener as the effective manager of a verbal community, a speaker is the one that is reinforced by the listener. This formulation of the speaker-listener relation leads to questionable conclusions, as the one described by Skinner himself in a footnote of *Verbal Behavior*:

> Our definition of verbal behavior, incidentally, includes the behavior of experimental animals where reinforcements are supplied by an experimenter or by an apparatus designed to establish contingencies which resemble those maintained by the normal listener. The animal and the experimenter comprise a small but genuine verbal community. This may offend our sense of proprieties, but there is consolation in the facts that such a relation as that represented by an abstract fact is susceptible to laboratory study. (p. 108)

Skinner, by extending his definition of verbal behavior from the perspective of the listener, fell into the paradox of stating that the pigeon or rat behaving in the experimental chamber are "speakers" showing verbal behavior, while the experimenter setting up the contingencies and its administration is the listener, the non-verbal component of the episode.

Concluding remarks

An exemplar or disciplinary matrix (Kuhn, 1974, 1982 Spanish translation) has to do with the ways scientists formulate meaningful problems and foresee solutions according to accepted theoretical categories and methods. To use Ryle's words (1949) an exemplar provides the appropriate logical geography to describe and analyze an empirical domain. Exemplars are the "conceptual eye-glasses" (Wittgenstein, 1980) through which scientists "see" certain facts and reject other events as facts because are "meaningless". Facts for a scientist are always facts from a theoretical and methodological perspective, and their conceptual allocation depend on the definitions and operations that arise from the use of an exemplar.

Definitions play a double role in exemplars and their theoretical representation (symbolic generalizations). On one hand, definitions set the empirical boundaries to be "seen" from theory, shaping raw events into meaningful facts. On the other hand, definitions contain the logical criteria for identifying and classifying facts. These two roles make of definitions the bases of every methodological operation dealing with observing, manipulating, intervening and recording.

Definitions consist of quasi-axiomatic categories classifying facts. Definitions work as empty categories that allocate events as members of factual classes. The allocation of a given event as a special fact does not depend on verification criteria, but on its adjustment to the empirical properties established by the definition. Thus, events become facts *by definition*, and their empirical properties are tied to the definitional properties. For instance, a reinforcer is an event that adjusts to the definition of increasing the frequency of a response which follows to. A reinforcer is identified in agreement to the definition and not because of some properties inherent to the event. Definitions determine not only the "facts" to be observed but also the empirical relations in which events may participate.

According to this argument, conditioning constitutes an exemplar. The facts and empirical relations that conform the domain of conditioning theory are grounded on a basic set of definitions and logical criteria. These criteria and definitions specify what to see, how to see, and the relations to be looked for. To be useful, definitions must be properly employed. To the extent that a theory is applied violating its definitions, that theory loses meaning and accuracy. The logical lines delimiting the conceptual geography of a theory is erased when concepts are used in disagreement to their definitional criteria. When theory

looses its logical consistency facts become also inconsistent. The use of inadequate definitions and the incorrect use of available definitions, both result in theoretical and empirical confusion.

I think this is the case with conditioning theory. The definitions and logical criteria on which conditioning theory is grounded are foreign to the most important dimensions of behavior.

Not recognizing the logical unfittingness of conditioning theory to deal with the unique features of behavior has fostered confusion about the true conditions of psychology from the viewpoint of behaviorists. Schoenfeld (1983) stressed this state of affairs some years ago:

> ...the contemporary state of behavior theory is an unstable one, a parturitional one, and it cannot be expected to continue that way indefinitely. Its state is not the pre-promotional sort that anticipates simple adjustment in a scientific theory. Rather, it is a transition from long-established concepts and assumptions and dogmas to others that are certain to be radically different. It will demand some difficult and painful shifts in our resistent habits of thought about behavior, in the form and content of our behavior theories.(p. 79)

Revisiting Kantor's (1924-26) conceptual contributions may pave the road in this direction.

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