Linguistic Sources of Skinner's *Verbal Behavior*

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Formal and functional analyses of verbal behavior have been often considered to be divergent and incompatible. Yet, an examination of the history of part of the analytical approach used in *Verbal Behavior* (Skinner, 1957/1992) for the identification and conceptualization of verbal operant units discloses that it corresponds well with formal analyses of languages. Formal analyses have been carried out since the invention of writing and fall within the scope of traditional grammar and structural linguistics, particularly in analyses made by the linguist Leonard Bloomfield. The relevance of analytical instruments originated from linguistic studies (which examine and describe the practices of verbal communities) to the analysis of verbal behavior, as proposed by Skinner, relates to the conception of a verbal community as a prerequisite for the acquisition of verbal behavior. A deliberately interdisciplinary approach is advocated in this paper, with the systematic adoption of linguistic analyses and descriptions adding relevant knowledge to the design of experimental research in verbal behavior.

Key words: verbal behavior, formal and functional analyses, structural linguistics, interdisciplinary approach to verbal behavior

The thing to do with the book is largely to simply try to understand it well, as an entity in itself. As with understanding any other behavior, this means to me an effort to bring one's behavior (in this case as reader) increasingly under the control of the same sorts of variables which functioned in the control of the actual emission of the behavior under investigation. (Day, 1980, p. 165)

Linguists and behavior analysts have examined the relations that Skinner's inquiry presented in *Verbal Behavior* (1957/1992) has to the analysis of language made by linguists. Several questions have been raised: Is Skinner's analysis independent from the one made by linguistics? Is Skinner's analysis functional or formal, and how does this distinction relate to analyses offered by linguists? Does Skinner's functional analysis offer something very differ-

ent from the linguists' formal analyses? Are these competing approaches, or does Skinner's functional analysis suppose or need the formal analyses in some sense? Are they complementary models? There is no consensual or even predominant position among the several authors who have addressed these issues (see, e.g., Catania, 1973, 1998; Chomsky, 1959; Joseph, Love, & Taylor, 2001; Julià, 1982; Lee, 1984; Mabry, 1993; MacCorquodale, 1969, 1970; D. C. Palmer, 1998; Passos, 2004; Passos & Matos, 1998; Place, 1985; Ribes-Iniesta, 1982; Richelle, 1972–1973; Segal, 1977; Skinner, 1985; Tweney, 1979; Zuriff, 1976).

To compare two things, our starting point should be to specify the characteristics of both. However, the literature on verbal behavior, including *Verbal Behavior*, does not explicitly state what is considered to characterize a formal analysis of language. This lack of definition is the source of the misunderstanding of the nature of linguistic analyses as well as of many of the divergences usually found in comparisons made between function-

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al analysis of verbal behavior and formal analyses of language.

Skinner's position on the relation between his functional analysis and linguists' formal analyses is sufficiently nuanced to demand a careful treatment. On the one hand, he criticizes linguistics' approaches, for example, by listing linguistics among the disciplines that have been neither able to identify clearly the subject *verbal behavior* nor to develop appropriate methods for its study (Skinner, 1957/1992, p. 4). On the other hand, it is worthy to note his extensive use of analytical concepts and methodological instruments whose origins lie in linguistics. Throughout *Verbal Behavior* we can find linguistic units such as the *phoneme* (p. 15), the *consonant* (p. 61), the *syllable* (p. 62), the *letter* (p. 65), *affixes*, *morphemes* (p. 120), *pronominal forms* (p. 317), *adverbs*, *adjectives* (p. 318), *articles*, and the *sentence* (p. 329), among others. Even the very technique for recording the data, the quotation, made by means of alphabetic writing, is part of the tradition of linguistic studies.

Linguistic concepts appear at the very beginning of *Verbal Behavior*, in the context of the definition of the behavioral unit:

What is needed ... is a unit of behavior composed of a response of identifiable form functionally related to one or more independent variables. In traditional terms we might say that we need a unit of behavior defined in terms of both "*form and meaning*" [italics added] (p. 20)

Verbal operant units are determined by identifying functional relations between verbal behavior and the environment. The partition of speech, which is a continuum, into discrete units is an analytical step used to define the subject of study itself—because it establishes the dependent variable for which functionally related stimuli will be sought—for the analyst of verbal behavior. Linguistic units and properties of the language identified by linguistics are always

involved in the identification of verbal operants:

A long-standing problem in the analysis of verbal behavior is the size of the unit. Standard linguistic units are of various sizes. Below the level of the **word** lie **roots** and **affixes** or, more rigorously, the small "meaningful" units called **morphemes**. Above the word come **phrases**, **idioms**, **clauses**, **sentences**, and so on. Any one of these may have functional unity as a verbal operant. A bit of behavior as small as a single **speech-sound**, or even a **pitch** or **stress** pattern, may be under independent control of a manipulable variable (we shall see evidence of such "atomic" verbal operants later). On the other hand, a large segment of behavior—perhaps a **phrase** like *vast majority* or *when all is said and done* or *the truth, the whole truth, and nothing but the truth* or a whole sentence such as *Haste makes waste*—may be shown to vary under a similarly unitary functional control. [boldface added] (p. 21)

The use that Skinner made of analytical concepts, classifications, and methods, as well as techniques for recording vocal verbal behavior that were brought from linguistics indicates that linguistic knowledge is present in Chapter 2 of *Verbal Behavior* and that it pervades the whole work.

Skinner's verbal operants are contingencies of three terms—*discriminative stimulus*, *response*, and *reinforcement*. In the mand, verbal responses of a given form, emitted under deprivation or aversive stimulation, are followed by a certain specific reinforcing consequence (1957/1992, p. 35). Skinner identifies contact points, as well as differences, between his concept of mand and certain linguistic units: "The basic relationship has been recognized in syntactic and grammatical analyses (expressions such as the 'imperative mood' and 'commands and entreaties' suggest themselves), but no traditional term can safely be used here" (p. 35). Interrogative sentences, interjections, vocatives, subjunctives, and optatives are frequently also mands (p. 44).

The other verbal operants are under control of discriminative stimuli and generalized reinforcement. In an

echoic, the discriminative stimulus is auditory, the response is vocal, and the reinforcement is contingent on the formal similarity between the discriminative stimulus and the response (p. 55). Echoics can be of various sizes, such as phonemes (speech-sounds), intonation, syllables, words, phrases, and sentences (pp. 61–63).

In the textual response, the discriminative stimulus is a written text (visual or tactile stimulus) and the response is vocal (p. 65). There is no formal correspondence, but there is point-to-point correspondence between the discriminative stimulus and the verbal response (pp. 67–68, 71). The correspondence to be strengthened by reinforcement depends on the writing practices of the verbal community, studied by linguists under the heading “writing systems” (Bloomfield, 1933/1961, pp. 281–296; Daniels, 1996, pp. 3–17). Whatever the system is, a visual (or tactile) stimulus will be the occasion when the emission of a vocal response of a given form will be reinforced. The unit of a textual operant also may be of various sizes, phonemes, syllables, words, phrases or even sentences, depending on the size of the unit—letters or symbols of a phonetic alphabet, syllables, pictures, characters, formalized pictographs, or hieroglyphs—of each modality of writing system (Bloomfield, 1933/1961, pp. 283–291; Skinner, 1957/1992, pp. 65–67).

In transcription, the discriminative stimulus is verbal (auditory or visual) and the response generates a visual stimulus (Skinner, 1957/1992, pp. 69–70). Just as in a textual response, the reinforcement is contingent on the emission of a certain form of response, based on the formal or point-to-point correspondence established through the writing practices of the verbal community. Further, the size and kind of units will depend on the writing system (pp. 70–71).

The intraverbal is controlled by a verbal discriminative stimulus. The reinforcement is contingent on a response of a given form that does not present either formal or point-to-point correspondence with the discriminative stimulus (Skinner, 1957/1992, p. 71). There are intraverbal units of various sizes corresponding to a phoneme, a stress pattern, a word, phrases, or even a whole text (p. 76).

The tact is a verbal operant under the control of nonverbal discriminative stimuli (Skinner, 1957/1992, pp. 81–82). The reinforcement is contingent on the arbitrary relation between this stimulus and the form of the response. The speaker's repertoire has tacts of various sizes, such as affixes, morphemes, roots, words, phrases, sentences (pp. 119–121).

The autoclitic, the most complex of Skinner's verbal operants, is under the control of discriminative stimuli provided by the speaker's own verbal behavior and its controlling variables (1957/1992, pp. 311–315). Among others, connectives, flexions, prepositions, the grouping and the ordering of verbal responses are, frequently, autoclitics. Subjects traditionally studied as grammar and syntax involve devices that have, in addition to others, important autoclitic functions (pp. 331–332). Chapters 12, 13, and 14 of *Verbal Behavior*, dedicated to the autoclitic, are rich in references to grammar and syntax, with both appearing even in the heading of Chapter 12: “Grammar and Syntax as Autoclitic Processes.”

The term *clitic*, in use previously in linguistics (Mabry, 1993), inspired Skinner to coin the neologism *autoclitic*. According to Crystal (1980, p. 64, entry *clitic*), this term is used in grammar to indicate a linguistic form that, although similar to a word, does not sustain itself in an utterance, being dependent on another word in the verbal emission (as is the case, e.g., for the contracted forms of *be*—as *I'm*—in English). This meaning

of the term *clitic* is compatible with Skinner's statement (1957/1992, p. 313) about the existence of two systems of responses, one (the autoclitic, which is under control) based on the other (the one that controls the autoclitic). It is also compatible with his comment about certain autoclitics as the ones traditionally called prepositions, articles, conjunctions, and flexions: "They do not occur except when they accompany other verbal behavior—they are 'meaningless' by themselves" (p. 332). Finally, he states, "The term 'autoclitic' is intended to suggest behavior which is based upon or depends upon other verbal behavior" (p. 315).

This brief and very simplified exposition of Skinner's verbal operants suggests his implicit recognition that a description and classification of the language based on formal analyses, originated in a domain—grammar or, more generally, linguistics—external to behavior analysis, produced valuable discriminations of critical aspects of language that were then retaken and used by him in his analysis of verbal behavior.

At first glance, it seems that linguistic analyses were used by Skinner mostly in two ways:

1. He deduced the forms that could be part of verbal operants mainly from the linguistic presentation of the set of linguistic forms found in a given verbal community. The contingencies of reinforcement that install and maintain the various verbal operants act on the *form* of the response (1957/1992, pp. 36, 53, 81–82, 209–212), which is, therefore, an important defining element of the operant class and not of the topography of the response.¹

The reason why reinforcement by the verbal community is always contingent on the form of the response rests in the distinctive characteristic of verbal operants in relation to nonverbal operants. The topographies that integrate a nonverbal operant are established directly by their effect, often through mechanical action, in the environment. The effect of a verbal operant, in contrast, depends on the listener, because the verbal operant does not act directly on the environment. The relation between the form of the verbal response (the class of topographies that have the same effect) and the effect on the listener must be kept stable by the verbal community, which then reinforces specific forms.

2. He suggested some possible controlling variables for the forms included in verbal operants, following the direction pointed by linguistic analysis of meaning and function of units. Examples of this are the speaker's own verbal behavior, as we saw in the autoclitic, and some object or property of the world, as is the case for the tact, and so on.

To understand the participation of linguistic units in verbal operants, it is necessary to provide a more detailed examination, from a behavior-analytic perspective, of linguistic analysis and the relations it has to a functional analysis. The identification of the origins of these linguistic units helps to clarify both their nature and their pertinence for a functional analysis of verbal behavior. Linguistic knowledge incorporated in *Verbal Behavior* comes mainly from three interrelated sources: writing, traditional grammar, and Bloomfield's structural linguistics.

¹ Each emission of a linguistic form (e.g., saying "flower") will generate a unique pattern of sounds (Anttila, 1989, p. 47), corresponding thus to the behavior-analytic concept of "topography of the response." The

form itself includes all the slightly different patterns of sounds that are recognized as being the "same" by speakers and listeners (Bloomfield, 1933/1961, pp. 76–78, 158) and corresponds better to the behavior-analytic concept of "operant class of responses."

Writing and Traditional Grammar

Language has a long history of study, because all our scientific and philosophical tradition rests on the written word. The teaching of reading and writing of the standard language comprises the initial years of school—which is not by accident called *grammar school*. During grammar school we learn to represent language by means of alphabetic writing and to analyze it through analytical concepts of traditional grammar (*subject, object, predicate, verb*, etc.). The apparent simplicity of both written representation and grammatical classification by means of which literate people handle their language obscures a sophisticated analysis, whose sources already appear explicitly in philosophical speculations of Antiquity and the Middle Ages (Bloomfield, 1933/1961, pp. 3ff). Writing and grammatical analysis have been incorporated into school in such a way that we tend to naturalize them, to take them as if they are not forms of graphical representation of speech and an analysis of the language, but rather as language proper.

Units of quotation and alphabetic writing. Direct quotation, adopted by Skinner (1957/1992, pp. 14–19) as a technique for recording verbal behavior, is based on alphabetic writing and other conventions adopted for the writing of a specific language (English in the case of his quotations). Phonetic inquiry tells us that speech possesses just a few natural limits and that these do not coincide with our conventions of writing, such as letters or words:

The phonetic events that make up the time-course of speech tend to be continuous, with only relatively few steady states or sharply defined breaks that could serve as the boundaries of natural, serial units of speech organization. Obvious natural breaks do occur, however, in two circumstances in the linear production of speech by a single speaker. One is at the beginning and end of a *speaking-turn* by one participant in a conver-

sation. The other is at the beginning and end of an individual *utterance*, bounded by silence, within the individual speaking turn. Exhaustively dividing the rest of the stream of speech into a sequence of units smaller than the utterance involves appealing to a number of convenient assumptions. A key traditional assumption is that the continuum of speech can be appropriately handled, for analytic purposes, as if descriptive categories were discrete, not continuous. (Laver, 2001, p. 157)

Every system of writing consists of breaking the continuum of speech in discrete units (Bloomfield, 1933/1961, pp. 283–291; Skinner, 1957/1992, pp. 15–19), whose size—the word, the syllable, the phoneme, or any combination of these units—varies in accordance with the writing system.

An alphabet with consonants and vowels was an invention of Greek antiquity, which operates with the supposition that speech consists of a limited number of units of sound that are repeated—the phonemes (Bloomfield, 1933/1961, pp. 289–292; Robins, 1997, p. 17). To each one of these units alphabetic writing assigns a visual signal, and the auditory stimuli that constitute speech can then be represented by the sequence of visual signals that correspond to them. As for non-alphabetic writing systems, the invention of the alphabet demanded accurate analysis of the phonological and morphological structure of the language (Hovdhaugen, 1982, p. 19).

All of the writing systems represent some, but not all, of the properties of the language structure (Daniels, 1996, p. 9). The use of quotation adopted by Skinner incorporates other conventions of English language writing, beyond the alphabetic analysis—conventions such as the space between the words, punctuation marks, and so on. Each one of these signals demonstrates analytical procedures that have allowed the identification and representation of certain characteristics of English language.

Traditional grammar. By “traditional grammar,” a somewhat inaccurate expression in its connotation

of unity, linguists often mean the works on language that arose before the period of scientific linguistics (Crystal, 1997, p. 88). As does alphabetic writing, traditional grammar also has a long history. Because language has occupied such a central role in humanity's history, it became one of the earliest subjects of systematic reflection and minute inquiry. Ancient Greek scholars analyzed their language at great length motivated by two main objectives. One of them was related to the establishment and interpretation of Homeric poems, whose study was a fundamental part of a Greek citizen's education. These poems were composed a few centuries before the classical period of Greek civilization, in a form of Greek different in some ways from that spoken during the classical age. The understanding and explanation of Homeric texts certainly demanded the creation of a grammatical system (Hovdhaugen, 1982, p. 47).

The second great motivation was nascent philosophy. Philosophical questions led to the analysis of *lógos* (sentence, utterance, discourse, explanation, etc.) and already in Plato we find the distinction between *ónoma* "name (of a thing)" and *rhema* "a thing said about names (= predicate)," the foundation of two binary divisions that we still make today: *subject-predicate* and *noun-verb* (Hovdhaugen, 1982, p. 22).

Aristotle presented a first grammatical sketch of Greek language; divided *letters* into *vowels*, *semivowels*, and *consonants*; defined and described, among other concepts still in use nowadays, *syllable*, *conjunction*, *article*, *noun*, *verb*, *cases* (inflected forms of both *nouns* and *verbs*), and *discourse* or *speech*. The first grammar from Greek antiquity that we know of was the *Téchne grammatiké*, attributed to the Alexandrian Dionysius Trax, who probably wrote it in the 2nd century BC. His grammar presents eight parts of discourse, specifying the word classes that we

still use to classify the utterances of our language: *name*, *verb*, *participle*, *article*, *pronoun*, *preposition*, *adverb*, and *conjunction* (Taylor, 1995, pp. 84–86).

Apollonius Dyscolos (2nd century AD), another Alexandrian grammarian, added to morphology the study of syntax (Robins, 1997, p. 46). Beyond the notion of parts of speech, the Greeks also developed the grammatical concepts of *gender*, *inflection*, *voice*, *case*, *number*, *tense*, and *mood* (Malmkjær, 2002, p. 248).

The Romans took advantage, on behalf of Latin, of the knowledge elaborated by the Greeks for the analysis of their language (Malmkjær, 2002, pp. 247–248). The predominantly taxonomic character of Roman grammar produced excellent descriptions of Latin morphology and established the model, still current, for morphological description, by which one chooses a basic form for each paradigm and lists the inflectional morphemes (Hovdhaugen, 1982, p. 94).

Since Latin was of the utmost importance in the medieval period in Europe, as the language of diplomacy, scholarship and religion ..., Latin grammar became a fundamental ingredient of the school system, and latter grammars of the different vernacular languages were modeled on Latin grammars. (Malmkjær, 2002, p. 248)

The Middle Ages preserved the study of Greek and Latin grammar, and their model, with the categories that they used, was extended to the study of vernacular languages. Although vernacular grammars are found as early as the 7th century AD, it is just from the Renaissance on that, as a consequence of an increasing interest in vernacular languages, the elaboration of their grammars became common (Malmkjær, 2002, p. 248). These grammars were and continue to be widely used in our schools, and they provide the terms and analytical concepts we have used to analyze our language.

This terminology encompasses grammatical units (*words, phrases, clauses, sentences*, etc.), as well as categories (*gender, number, person, tense, mood*, etc.) (Malmkjær, 2002, p. 249).

Bloomfield's Structural Linguistics

Skinner not only worked with analytical instruments that originated in alphabetic writing and traditional grammar, but he also used a few others that come from structural linguistics, as is the case for the linguistic units *phoneme* and *morpheme*. Among other linguists who shared the responsibility of establishing them as the basic units of description in structural linguistics (Matthews, 2001, pp. 31ff, 82–86), the American linguist Leonard Bloomfield (1887–1949) stands out.

Although it has not been duly recognized previously, it is possible to identify the influence of Bloomfield on central aspects of Skinner's analysis (Passos & Matos, 1998), notably in (a) the similarities between Skinner's "verbal episode" (1957/1992, pp. 37–40) and Bloomfield's "act of speech" (1933/1961, pp. 22–27); (b) the physicalistic conception of meaning, understood as a property of the circumstances in which verbal behavior occurs and not of the behavior itself (Bloomfield, pp. 26–27, 139–144; Skinner, pp. 13–14); (c) the conception that the speaker's linguistic knowledge is not innate in any way, but is entirely taught by the verbal community (Bloomfield, pp. 43, 47, 281; Skinner, pp. 1–3, 28–33, 224–226); and (d) the use of the linguistic units *phoneme* and *morpheme* as appropriate tools for the analysis of the language (Bloomfield, pp. 76–80, 158–162; Skinner, pp. 16–17, 21). In this paper we will not explore all of these items; rather we will try to discern the way in which Skinner got to know Bloomfield's linguistics, as well as point to references to Bloomfield in Skinner's works. In addition, we will identify

Bloomfield as the source of Skinner's knowledge about the linguistic unit *phoneme*.

Bloomfield's structuralism established theoretical and methodological lines that deeply influenced both European and American linguistics (Fought, 1995, p. 305; Robins, 1997, pp. 237–238). According to Robins,

In the years 1940 to the present time the greater part of linguistic theory and practice may be regarded as either the continuation of what had been, or was considered to have been, his [Bloomfield's] teaching, or as reactions in different directions against it. (p. 244)

The adoption of a physicalistic position and the defense of a purely empirical method in science in general and in linguistics in particular place Bloomfield close to the behaviorism of Weiss.² These positions led him to focus his linguistic description on the overt forms of language, conceiving of them as the critical manifestation of its structure without presuming mental activities that underlie these forms (Fought, pp. 299–301). This conception of language established the fields of activity we find in Bloomfield's linguistics:

Effectively it involved the concentration on phonetics, phonological analysis, and formal grammar with an emphasis on morphology, all fields in which analysis could be based on publicly observable phenomena, speech as uttered, heard, and recorded, and words and texts as spoken or written. Its strengths were and remain solid, and in their own terms they are unchallengeable. The data are public and publicly checkable, and the methods are explicitly set out and followed. (Robins, p. 242)

For Bloomfield (1926/1970), a language consists of "the totality of utterances that can be made in a speech-community" (p. 130). Each utterance is entirely constituted of forms and these have a clear material existence, that is, they are stimuli

² By the way, Bloomfield presents, in *Language or Ideas?* (1936), one of the most competent and beautiful defenses of behaviorism.

(Anderson, 1985/1999, p. 58; Cowan, 1990/1999, p. 293). Bloomfield's structuralism has the aim of identifying the elements that constitute linguistic forms as well as the combinations in which they occur:

This gives a hint of Bloomfield's later pre-occupation with what would now be called the surface structure of language, and his lack of interest in what would now be called the deep structure of language. Basically, for Bloomfield, if it wasn't there in the utterance in some form or palpable shape, a shape that could be observed and recorded, it wasn't there at all. (Cowan, pp. 292–293)

The basic method used by Bloomfield consists of contrastive analysis, by which linguistic forms must be compared in search of similarities and differences between them, allowing the identification of their fundamental elements. In turn, this identification leads to the establishment of grammatical categories from the grouping of the elements based on their similarity (Fought, 1999, pp. 4–6). The basic elements of Bloomfield's description are the *morpheme*, the smallest unit that has meaning, and the *phoneme*, the smallest unit that has no meaning (Bloomfield, 1933/1961, pp. 158–161). Utterances are entirely constituted of morphemes, which are in turn constituted of phonemes, and their grammatical arrangements (Bloomfield, pp. 158–169).

Many of the more central conceptions defended by Bloomfield are nowadays part of the established knowledge of linguistics, such as conceiving of languages as systems, the autonomy of linguistics in relation to the other disciplines, the distinction between synchronic and diachronic linguistics as well as between language and speech, among others (Matthews, 2001, pp. 142ff). This is also the case (Matthews, 1992/1999, p. 139) for the model of linguistic description based on the morpheme, which surpassed, among linguists, the former model “word

and paradigm,” still part of the teaching of languages in schools (Robins, 1997, p. 180). Many linguists have kept an interest in Bloomfield's teachings and have also applied their efforts to demonstrate their importance, before, during, and after the period when linguistics was predominantly oriented by Chomsky (Fought, 1999, vol. 1, pp. 1–2; Murray, 1991/1999, pp. 342–343). It has even been said that Bloomfield's *Language* (1933/1961), “the book that taught linguistics to America” (Howatt, 2002, p. xxxv), “has emerged from decades of exco-riation by Chomsky and his students to general acclaim as the single greatest work of twentieth-century American linguistics” (Joseph et al., 2001, p. 242).

Skinner's connection with Bloomfield's linguistics. The field of linguistics expanded, mainly in United States universities, during the 1920s and the decades immediately following (Robins, 1997, pp. 235–236). In the period from 1922 to 1926, Skinner (1976) got his major in English literature (Hamilton College, New York) and, in 1928, initiated his doctoral studies in psychology at Harvard University (Skinner, 1979). In 1924, the Linguistic Society of America was founded (Bloomfield, 1925) and, among its charter members,³ we find William P. Shepherd, who taught French theater to Skinner at Hamilton College (Skinner, 1976, p. 215) as well as to the behaviorists Albert P. Weiss and J. R. Kantor. The presence of behaviorists in the very foundation of this society is an indication of the importance of linguistic studies among behaviorists and also of the influence of behaviorism on linguistics in that period (Schlauch, 1946).

There are several references to Bloomfield in Skinner's writings. In a letter dated from 1934 to F. S.

³The list of the charter members can be found in *Language*, 1925, 1, pp. 26–36.

Keller, we find the following evaluation:

Bloomfield, the best linguist in the field today, has come around from Wundt in his first edition (1915) to behaviorism in his last (1932) period. But his account of what is happening when words are used is laughable. [Bloomfield has acquired behavioristic leanings at Ohio State University, where A. P. Weiss, an early social behaviorist, was carrying on the tradition of George Herbert Mead and the functional school of psychology centered at Chicago. His text, *Language*, contained a simple analysis of verbal behavior in which Jill asks Jack to get her an apple, but it was oversimplified, and not much was made of it in the rest of the book.] (Skinner, 1979, p. 150, brackets in original)⁴

Possibly, it is the use of the S-R paradigm (Bloomfield, 1933/1961, pp. 23–26) to explain what might occur “when words are used” that Skinner considered “laughable.” However, later on Skinner pays homage to Bloomfield for this analysis of verbal behavior, referred to in the previous quotation, by naming his experimental subjects, two pigeons, Jack and Jill: “We named them [the pigeons] Jack and Jill in tribute to Leonard Bloomfield, who in *Language* ... represented communication behaviorally by describing an episode in which Jill asked Jack to get her an apple” (Epstein, Lanza, & Skinner, 1980, p. 545). And, in his autobiography, Skinner briefly quotes Bloomfield twice:

Bloomfield had been aware of the relevance of logical positivism. In 1930 he had written that linguistics had not yet reached the stage at which science can “win through to the understanding and control of human conduct,” but in 1936 he noted that “the logicians of the Vienna Circle have independently reached the conclusion of *physicalism*: any scientifically meaningful statement reports a movement in space and time. This confirms the conclusion of A. P. Weiss and other American workers: The universe of science is a physical universe.

This conclusion implies that statements about ideas are to be translated into statements about speech-forms.” (Skinner, 1979, pp. 281–282)

Skinner’s quotation “win through to the understanding and control of human conduct” appears in *Linguistics as a Science*: “I believe that in the near future ... linguistics will be one of the main sectors of scientific advance, and that in this sector science will then win through to the understanding and control of human conduct” (Bloomfield, 1930/1970, p. 227). The 1936 text is a summary that appears in *Language or Ideas?* The quotation of these texts from 1930 and 1936, published in *Studies in Philology* and *Language*, respectively, indicates Skinner’s knowledge of part of Bloomfield’s work published in specialized linguistic scientific journals.

Finally, in *Contingencies of Reinforcement* (1969, p. 11), Skinner mentions the great rejection of psychological explanations of language by linguists in the beginning of the 20th century and attributes to Bloomfield the main effort in the direction of finding alternative behavioral explanations to the psychological ones. Skinner suggested that Bloomfield’s behavioral explanations would not have been successful because S-R psychology was insufficiently equipped to handle the task.

Bloomfield as Skinner’s source on the phoneme. In *Language* (Bloomfield, 1933/1961, pp. 78–79) we find the term *phoneme*, a statement of this concept, and the specification of phonology as the branch of linguistics that studies the phonemes—the sounds of speech considered in relation to meaning. To identify phonemes, the units of distinctive sound, Bloomfield (p. 78) effects small variations in the pronunciation of a word and, after that, he verifies if each one of these variations results in new words, that is, in linguistic forms whose meanings differ from that of the initial word. When a variation

⁴ Skinner is mentioning, with a mistake in the dates, two books by Bloomfield, *Introduction to the Study of Language* (1914) and *Language* (1933/1961), this last one presented by Bloomfield himself (1933/1961, p. vii) as a revised edition of the 1914 one.

results in a form whose meaning differs from the meaning of the initial form, it is because the phonemes of the two forms are different. Using linguistic forms sufficient in number and type, the procedure is capable of identifying each phoneme of the initial word, until one reaches the point at which additional manipulations provide only phonemes already found.

The example presented by Bloomfield (1933/1961, pp. 78–79) involves the identification of the phonemes of the word *pin*. He compares it with other words in search of the similarities and differences between them. The steps are the following: (a) The comparison of *pin* with *fin*, *sin*, and *tin* results in the conclusion that, as well as it occurs with the other three words, *pin* contains the sound *in*, but it initiates with a sound different from the one at the beginning of the other words. (b) The comparison of *pin* with *man*, *sun*, and *hen* reveals that *pin* finishes with the same sound of these words, but the similarity between *pin* and the three previous words—*fin*, *sin*, and *tin*—is greater than the similarity with these. (c) The beginning of *pin* is equal to the one of *pig*, *pill*, and *pit*, but its ending is different from that of these other words. (d) The beginning of *pin* is the same as that for *pat*, *push*, and *peg*, but these words resemble *pin* less than *pig*, *pill*, and *pit*. (e) The beginning and the end of *pin* are equal to the ones of *pen*, *pan*, and *pun*, but the middle part of *pin* is different from the middle part of these words. (f) The beginning and the end of *pin* are different from the beginning and the end of *dig*, *fish*, and *mill*, but the middle part of *pin* is equal to the one of these words. With these substitutions of one or two of the three parts, we found forms that are similar to *pin*. If we substitute the three parts, the words that will be found will not resemble *pin*. It is not possible to identify smaller parts than these three, which, when substituted, produce

other words; therefore, Bloomfield concludes that *pin* is constituted of three parts, each one of them indivisible. These are its constituent phonemes, which also appear in other combinations to form new words, where they keep their distinctive values, and which are represented through alphabetic writing in this word by the letters *p*, *i*, and *n*.

Bloomfield (1933/1961, pp. 76–77) also states that the purely physical value of the sounds of the utterance is not sufficient to characterize it from a linguistic perspective. Thus, for example, the sound *man* pronounced two times, each time with a specific pitch scheme, will be one and the same word in English but perhaps two different words in Chinese, in which differences of pitch scheme are related to different meanings. Translating into our language as behavior analysts, this means that, for the linguist, the response topography (which produces the speech sound) is relevant only when it produces a sound that has some specific functional value particularly utilized by that language, through the reinforcing practices effective in each verbal community.

According to Skinner (1957/1992, p. 16), the method by which the linguist studies the phonemes could be exemplified as follows: (a) Given two different verbal communities and two verbal responses (*pin* and *bin*) we verify that, in one community, these responses occur under the same circumstances or have the same effect on the listener whereas, in the other one, they occur in different circumstances or have different effects on the listener. (b) Given two different verbal communities and two verbal responses (*pit* and *bit*) we verify that, in one, these answers occur under the same circumstances or have the same effect whereas, in the other, they occur in different circumstances or have different effects. (c) In the verbal community in which *pin* and *bin* have the same effect, *pit* and *bit*

will also have it, whereas in the verbal community for which *pin* and *bin* have different effects, *pit* and *bit* will also have them.

The method by which the linguist, in accordance with Skinner, identifies the phonological units (phonemes) is not guided, therefore, by the absolute acoustic value of the sounds of speech (it is not about establishing the topography of responses) but by the relation that these sounds have for the verbal community. This relation is indicated by the different or equal circumstances in which they are produced by speakers as well as by the different or equal effects that they produce on listeners. Thus, two sounds will be linguistically the same if their effects on the listener are equal—in spite of their physical differences—and they will be linguistically different if their effects are different.

It is in this same context of arguing for the phoneme that Skinner (1957/1992, pp. 16–17) emphasizes the importance of the concept of class of responses for the prediction of behavior and the fact that the definition of a class of responses is based on the presentation, by a set of responses, of certain properties by which each one of the responses in the class produces the same effect in the environment. Also, in vocal verbal behavior, Skinner comments, we are not interested in all of the auditory details but only in those through which that vocal response reaches its effect. This is the reason by which, in Skinner's words, "the 'phoneme' was an early recognition of the principle of the defining property of a response," (p. 17), because the identification of the phoneme by the linguist depends on the effect that this unit of sound produces in the verbal community.

Skinner clearly states, therefore, his understanding of the functional, rather than topographical, character of the phonological linguistic analysis. Although the linguists' structural analysis and the behavior analysts'

functional analysis are different, the criteria that guide each one of these two analyses are not opposite or contradictory.

The procedure, as shown by Bloomfield, for variation of and comparison between linguistic forms, the contrastive method, by which linguists identify the phonemes of a language as well as the linguistic forms used for exemplifying the procedure, were remarkably similar to the presentation by Skinner (1957/1992, pp. 15–16) of both the phoneme and the linguists' method for identifying the phonemes of a language (Joseph et al., 2001, p. 110; Passos & Matos, 1998). Skinner's treatment combines Bloomfield's demonstration (1933/1961, pp. 78–79) of how the linguist identifies the phonological units of a language through the comparison between similar forms, with Bloomfield's comments (pp. 77–85) that the phonemes vary in different languages, in such a way that sounds that are distinct phonemes in one language may represent only one single phoneme in another one.

A Linguistics That Fits Behavior Analysis

The recognition that linguistic concepts, methods, and techniques—from alphabetic writing, traditional grammar, and structural linguistics—were involved in the analysis presented in *Verbal Behavior* directs our reflection to the relations between our discipline and linguistics.

In the second half of the 20th century, as opposed to what had occurred in the first half, behaviorism and linguistics followed distinct courses in a noisy and unfriendly separation. Chomsky's famous review (1959) is still cited nowadays with greater or lesser sympathy by both linguists (see, e.g., Campbell, 2001, p. 101; Howatt, 2002, p. xxxvii; Joseph et al., 2001, pp. 116, 119–121; Robins, 1997, p. 260) and behavior

analysts (Catania, 1998; Knapp, 1997; Mabry, 1994; D. C. Palmer, 2000). This review surely played an important role in keeping these two fields separated.

Not less important, however, was the role exerted by the attitude explicitly adopted by Skinner in *Verbal Behavior* in relation to traditional grammar and linguistics. His evaluation that these disciplines, together with others that had been studying language, had not presented an "effective frontal attack, a formulation appropriate to all special fields" (Skinner, 1957/1992, p. 4), was understood and accepted as stating that the analysis presented in *Verbal Behavior* was appropriate to all special fields. Many behavior analysts adopted the position that Skinnerian formulations would be a substitute for the ones produced by linguistics and grammar (Hall, 1992; Julià, 1982; Lee, 1981, 1984; Mabry, 1993; Michael & Malott, 2003; Tweney, 1979). In their turn, the linguists understood that Skinner tried to demolish and disqualify linguistic analysis. For Joseph et al. (2001), Skinner differentiated his approach from that of the linguists by stating that, whereas these last were interested in form, in the practices of verbal communities, and in the circumstances in which past behavior had occurred, he was interested in function, in the behavior of the individual speaker, and in prediction of future behavior. But the biggest problem, the one that really opposed Skinner to the linguists, was the linguists' belief (including the ones who followed Bloomfield's approach)

"that speech has an independent existence apart from the behavior of the speaker." If it does not have that independent existence, then what exactly is the status of linguistics? Linguists would seem to be studying merely the "traces" of the activity, as Skinner puts it, rather than the essential activity itself. The implication is that linguistics is a sort of counterfeit, compared with the real act of studying language that is the work of the behaviourist psychologist. (pp. 110–111)

We believe that the identification of ties between linguistics and the analysis presented in *Verbal Behavior* should contribute to a more interdisciplinary attitude from both behavior analysts and linguists. It is necessary to recognize that Skinnerian analysis is not adequate to all fields, just as linguistic analysis is also not adequate to all fields. The fact that Skinner's analysis contains a great deal of linguists' formal analyses has been already pointed out as a problem (see, e.g., Chomsky, 1959; Ribes-Iñesta, 1982), but this inclusion is actually a strength. Just as a verbal community is a precondition for the existence of the speaker, the description of a verbal community's practices is a precondition, necessary although not sufficient, for the analysis of verbal operants.

We need, of course, to distinguish clearly between searching for the practices that are effective in verbal communities—the linguists' field par excellence—and searching for the behavioral processes through which speakers' and listeners' repertoires are installed and maintained—the behavior analysts' field par excellence. In the same way that the linguist does not possess the proper methodology to study the behavioral processes responsible for installing speakers' and listeners' repertoires (Bloomfield, 1927/1970, pp. 141–142, 1933/1961, p. 75), the behavior analyst does not master the proper methodology to analyze and describe the practices of verbal communities.

The identification of connections between Skinnerian and linguistic analyses does not have just historical and epistemological value; it can also have an influence on the experimental work of our field. For example, experimental analyses of verbal behavior carried on in the Skinnerian tradition have linguistic units as one of their starting points, as they occur in experiments on the teaching of writing and reading.

Thus, for example, Saunders, Johnston, and Brady (2000) concluded that accuracy in discriminating isolated letters does not guarantee accuracy in discriminating words that differ only in the first letter, even though the subjects are capable of discriminating this first letter separately. The authors resort to linguistic concepts and units, such as *word*, *letters*, *alphabetic principle*, *letter-sound relation*, *phoneme*, *consonant*, and *vowel*, that can be considered to be the core itself of the subject of their research. Other examples of this practice are the experiments that involve the linguistic concepts of, among others, *plosive*, *fricative*, and *voiced* and *unvoiced consonant phonemes* (Brasolotto, de Rose, Stoddard, & de Souza, 1993); *words*, *forms*, and *letters* (Lee & Sanderson, 1987); and *syllables*, *words*, and *letters* (Matos & d'Oliveira, 1992; Melchiori, de Souza, & de Rose, 2000).

The intentional and systematic adoption of some linguistic analyses related to those that have already been used could enhance our experimental methods. In order to establish textual behavior, we need to put the vocal response under the control of the written text, which consists of visual (or tactile) stimuli. However, our writing practices do not establish strictly regular relations between these discriminative stimuli and vocal verbal responses. The degree of irregularity of these relations varies from language to language, English writing being one of the most irregular (Bloomfield, 1933/1961, pp. 290–291, 500–503, 1961, pp. 24–25). Thus, for example, depending on the word, if the stimulus is the letter *c*, reinforcement will be consequent to the emission by the speaker of different vocal responses, as in [k] *cat*, [s] *cites*, or [tʃ] *cello* (Cohn, 2001, p. 182). Moreover, as the same letter can represent different phonemes, the same phoneme can also be represented by several different letters or even by combinations of them, as occurs

with the sound [k], which can be represented by *cat*, *kite*, *khan*, *quite* (*qu* = [kw]), *echo*, *pack*, or *box* (*x* = [ks]) (Cohn, p. 182). The English language has 39 phonemes that must be represented by the 26 Roman alphabet symbols (Cohn, p. 182), which, by itself, makes impossible the strict application of the principle of alphabetic writing by which each phoneme corresponds to only one letter.

A phonetic transcription of words used in experiments and an analysis of the relations between their spoken and written forms could improve our experiments on reading and writing. The absence of a phonetic transcription can, in this kind of study, induce researchers to commit errors, one of which could be considering as one single unit of speech what, in fact, are two different units. We may investigate, for example, the reading of Portuguese words that were not directly taught but occurred as a result of the recombination of syllables whose reading had been previously taught. If we taught *bolo* (*cake*) and *lama* (*mud*), we should not expect the emergence of *bola* (*ball*). In the Portuguese language, although written in the same way, as *bo*, the first syllables of *bolo* and *bola* differ in their vowels, whose phonological representation are, respectively, [o] and [ɔ]. They are two different phonemes because their acoustic difference establishes a distinction between words in the Portuguese language as in the noun *almoço* [o] (*lunch*), and the verb *almoço* [ɔ] (*I lunch*).

The search for new and more effective methods and techniques to teach reading and writing involves precise knowledge of the content of what will be taught—in this case, the careful specification of relations between discriminative stimuli and textual responses provided by the conventions of writing for that particular language. It is necessary, therefore, first to know the phonological system of the language whose reading is

being taught; moreover, we will need phonetic transcriptions such as the ones made using the International Phonetic Alphabet (Crystal, 1997, p. 160) in addition to a good knowledge of both lexical and grammatical structures for that language. After that, we need to identify the regular, semiirregular, and irregular relations between sounds and letters (Bloomfield, 1933/1961, pp. 500–501, 1961, pp. 29–30). We behavior analysts usually do not have the necessary training for these tasks that are so familiar to linguists. As Bloomfield (1961) put it, “The most excellent teaching technique is bound to give poor results so long as the teacher does not know what to teach” (p. 19). However, starting from the linguist’s specification of the contents to be taught, behavior analysts are capable of using the procedures and techniques of our science for training the relations between the environment and the behavior—that is, for the process of teaching.

If the use of linguistic analyses in experimental research goes unrecognized, the need for critical examination of the quality and adequacy of these analyses will not be understood. In general, we have been working with linguistic units and concepts that we learned in school, taken from traditional grammar, whose analysis, even though highly sophisticated, suffers from vices that have been found and corrected by structural linguistics. Thus, for example, linguists have shown that traditional grammar is centered on categories that are appropriate for the analysis of Greek and Latin but sometimes are not so appropriate for other languages (Bloomfield, 1933/1961, pp. 6–8, 17; Hockett, 1999; McCawley, 1999; F. Palmer, 1984, pp. 55–60; Paul, 1886/1888, p. 11; Wolff, 1987). They have also pointed to an undesirable mixture of semantic and formal criteria in the definition of word classes (Bloomfield, 1933/1961, pp. 266–268; Crystal, 1997, p. 91; F.

Palmer, 1984, pp. 34–40, 55–60, 134; Paul, 1886/1888, pp. 403–404). Another criticism is related to the strong prescriptive character of traditional grammar as well as to its dependence on written texts, mainly literary. Traditional grammar that we learned in school did not teach us how to systematically analyze the phonological system of the language and the relations that writing establishes with it. As we have been restricted to what we learned from traditional grammar, the consequence is that our experimental works on the teaching of reading and writing have not been based on a rigorously defined concept of phoneme that considers, with coherence, the phonological system of the language as a whole and its relation to writing.

If it were a concept universally accepted in the field of linguistics that language is innate, behavior analysts naturally would resist interdisciplinary work with linguists because their view is that verbal behavior is learned. Among linguists, however, the idea that language is innate is held by only a few, particularly Chomsky and those whose work has been influenced by him. In fact, this perspective has been the object of much controversy in their own field (Esper, 1973, pp. 167–168; Joseph et al., 2001, p. 119; Matthews, 2001, pp. 105–113, 150; F. Palmer, 1984, pp. 193–194; Seuren, 1998, pp. 280–285; Shi-Xu, 2000).

The debate between theory orientation and data orientation has crossed the history of linguistics and is related to the discussion about the innate or learned nature of language. The advocates of data orientation consider that the linguist’s task is the meticulous register and analysis of languages as they appear in the speech and writing of native speakers. On the other hand, the supporters of theory orientation think that the task of linguistics is to justify the existence of grammars, to explain native speakers’ linguistic knowledge, and even to clarify the brain’s or the

mind's functioning (Campbell, 2001, p. 101; Robins, 1997, pp. 39, 89–90, 103–104, 209).

To behavior analysis, meticulous analyses of languages and systems of writing are important, whatever their provenance. Probably, these analyses are found in data-oriented works. However, good descriptions and analyses are always welcome, even if they appear in theory-oriented works. After all, as F. Palmer affirms (1984),

Most of these issues [innateness of language, universal characteristics of languages] are matters of speculation and unlikely to be resolved in the near future. Moreover, they are not wholly relevant to linguistic theory and practice. It is perfectly possible to be a follower of TG [transformational generative grammar] and still reject mentalism, innateness or universals, or, alternatively, to be a structuralist and accept them. (p. 194)

As behavior analysts, we need a linguistics whose methods are compatible with our perspective of science and our conception of verbal behavior. Briefly, we need a linguistics that analyzes language as a set of stimuli, produced by the speaker, with effects on the listener's behavior. We need a linguistics that identifies linguistic units and their arrangements, which together constitute the set of stimuli, and for them to be identified using an objective method that allows the reproduction of the inquiry by other researchers.

Even though linguists now base their knowledge of languages on current linguistics and identify important differences between current linguistics and traditional grammar, these scholars recognize the continuity between structural linguistics and traditional grammar, pointing to the cumulative character of the knowledge that both perspectives have produced since the invention of writing (see, e.g., Hovdhaugen, 1982, pp. 10–11, 14; Howatt, 2002, p. xxv; Joseph et al., 2001, p. vii; Robins, 1997, pp. 7, 12, 31, 222; Taylor, 1995, pp. 83, 89). Because behavior analysts use the analysis and description of language, the cate-

gories and classifications of writing and traditional grammar, there is no reason not to use the description of language, the categories and classifications of structural linguistics.

The term *structural linguistics* is frequently applied to Bloomfield's and his followers' linguistics, which some theorists consider having been surpassed as it was "merely" taxonomic (Chomsky, 1979/1998, p. 116; Joseph, 1999; Lepschy, 1970, p. 36; Robins, 1988, p. 481, 1997, pp. 265–266). However, structural ideas such as the ones proposed to account for the system of languages, the autonomy of linguistics as the branch of science that studies these systems, the distinction between speech and language, synchronic and diachronic perspectives, the phoneme and morpheme as the minimal units of linguistic articulation—and these ideas have been defended not only by Bloomfield and his followers but by several other linguists as well—are nowadays part of the established knowledge of the discipline (Matthews, 2001, pp. 96, 142ff). In this sense, it can be said that "Whatever the different interpretations placed on the exact meaning of 'structuralism,' few linguists would now disclaim structural thinking in their work" (Robins, 1997, p. 225).

The meaning ascribed to the term *structural linguistics* can be extensive, designating the descriptive studies of the languages that consider them as systems. From the ample subject named *language*, a subject shared with several other disciplines such as psychology, philosophy, and anthropology, linguistics delimits the subfield that has as its specific task the analysis and description of language systems (the historical languages) and of writing systems (Aronoff & Rees-Miller, 2001, p. xv; Matthews, 2001, p. 11). Whatever its orientation, linguistic inquiry involves the empirical study of observed data (Robins, 1997, p. 6), and it is the results of this empirical study that interests the

behavior analyst, instead of linguists' opinions on the innate or learned character of verbal behavior. What is crucial here is acknowledging the limits of the two disciplines: Although we use linguistic concepts and analyses whose subject are a verbal community's practices in relation to the acquisition and emission of verbal behavior, the behavior analyst takes into consideration the knowledge produced by our own discipline.

Skinner believed *Verbal Behavior* to be his most important work (Sundberg, 1998). Alongside the analysis of respondent behavior, operant analysis is an analytical instrument of behavior so powerful that, in fact, it allows not only the prediction of behavior but also its production. The application of this instrument to what constitutes the most distinctive human activity, language, is a task of paramount importance if we want a psychology of human behavior.

On the other hand, Bloomfield believed that social and human sciences had not reached the accomplishments of physics and biology because they had still not been capable of systematic investigation of the role of what is specifically human, that is, language. Only the understanding of language will open the possibility of a significant human science: "The peculiar factor in man which forbids our explaining his actions upon the ordinary plane of biology, is a highly specialized and unstable biological complex, and ... this factor is none other than language" (Bloomfield, 1930/1970, p. 229). The scientific comprehension of this ample object, language, is a task that requires the integrated efforts of a set of disciplines; among these, we believe, linguistics and behavior analysis will have a prominent place. Thus, we should not disdain the linguists' invitation:

Language is too important, and in too many ways, to be left in the possession of a single

disciplinary field. It is our hope that intellectual re-fertilization—both from the past and from outside the boundaries of disciplinary linguistics—can help to open up language theory to new influences, new concerns, new approaches and new applications. ... Linguistic thought, in other words, we take to be an essentially interdisciplinary endeavour. (Joseph et al., 2001, p. x)

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POSTSCRIPT

I have the painful duty of notifying the readers about the death of the first author of this paper during the editorial revision process. Maria Amelia Matos was an especially brilliant behavior analyst, and dedicated her best efforts to enhancing the field in Brazil. I had the privilege of being her student, and she honored me with her friendship. I am sure that my deep sorrow about missing her is shared by uncountable researchers and students of behavior analysis,

who will keep trying, as I will, to work taking her as a precious model.

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Maria de Lourdes Passos