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Sources for Skinner's Pragmatic Selectionism in 1945

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Skinner's pragmatic selectionism shows up strongly in his 1945 publication, "The Operational Analysis of Psychological Terms," in which he introduced a probabilistic three-term contingency for verbal behavior. This probabilism was accompanied by an expanded contextualism and an increased emphasis on consequences with a clear alignment to pragmatism. In total, these changes represent Skinner's most striking shift from mechanistic and necessitarian values to pragmatic selectionism, and these changes may be indebted more to the conceptual contributions of others than Skinner acknowledged. Before 1945, Skinner made at least some positive associations with the views of Watson, Russell, and Carnap. From 1945 and afterwards, he strongly disassociated his views on verbal behavior from theirs. Before 1945, Skinner did not associate his views with those of Darwin or Peirce. After 1945, he strongly associated his views with those of Darwin and Peirce (in one published interview). No sources for his pragmatic selectionism, however, were referred to in 1945.

Key words: B. F. Skinner, Charles S. Peirce, three-term contingency, pragmatism, selectionism, verbal behavior

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In a cluster of changes leading to a pragmatic selectionism, Skinner (1945/1972, pp. 370–384) presented a dramatic reconceptualization of his views on verbal behavior in "The Operational Analysis of Psychological Terms." As a whole, these changes can be seen as a shift away from the positivism and S-R formulations that dominated Skinner's earlier views. Skinner, however, did not provide sources in 1945 for the new direction he was heading. Accordingly, the following presents what Skinner was turning away from, a mechanistic positivism, what he was turning toward, a pragmatic selectionism, and likely sources of support for this turn, primarily C. S. Peirce. The focus here is on the core sources for demonstrating these changes. A background of broader contexts with an emphasis on modern/postmodern distinctions is addressed elsewhere (Moxley, in press).

POSITIVIST VIEWS ON LANGUAGE

For basic certainties, Carnap offered the given elements of experience. These elements were to be connected in a logical system (Galison, 1990). In his retrospective comments on *The Logical Structure of the World*, Carnap explained,

> We assumed that there was a certain rock bottom of knowledge, the knowledge of the immediately given, which was indubitable. Every other kind of knowledge was supposed to be firmly supported by this basis and therefore likewise decidable with certainty. This was the picture which I had given in the *Logischer Aufbau*; it was supported by the influence of Mach's doctrine of the sensations as the elements of all knowledge, by Russell's logical atomism, and finally by Wittgenstein's thesis that all propositions are truth-functions of the elementary propositions. (Schilpp, 1963, p. 57).

What the immediately given consisted of, however, was not certain. In his preface to the second edition of *The Logical Structure of the World*, Carnap (1929/1967) indicated he had changed his mind and would now "consider for use as basic elements, not elementary experiences . . . but something similar to Mach's elements, e.g., concrete sense data, as, for example, 'a red of a certain type at a certain visual field place at a given time' " (p. vii). Carnap (1934) also made a case for "physicalism" and a universal language:

> Our approach has often been termed "Positivist." . . . Nevertheless, for the sake of clarity we would prefer the name of "Physicalism." For our theory is that the physical language is the universal language and can therefore serve as the basic language of Science. (pp. 94–95)

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Some version of an ideal or universal language has been of recurring interest since the 16th century (Knowlson, 1975; Moxley, 1998a; Slaughter, 1982).

These views of the logical positivists were prefigured by the logical atomism of Bertrand Russell, who was also interested in an ideal language. Russell (1918) said,

> In a logically perfect language, there will be one word and no more for every simple object, and everything that is not simple will be expressed by a combination of words, by a combination derived, of course, from the words for the simple things that enter in, one word for each simple component. A language of that sort will be completely analytic, and will show at a glance the logical structure of the facts asserted or denied. (p. 520)

Russell continued his advocacy for an ideal language in his introduction to Wittgenstein's *Tractatus Logico-Philosophicus*, a book highly regarded by the Vienna Circle for its contribution to what an ideal language would be like. For example, Wittgenstein (1922/1981) said, "The name means the object. The object is its meaning. ('A' is the same sign as 'A.')" (p. 47). Russell (1922/1981) said,

> A logically perfect language has rules of syntax which prevent nonsense, and has single symbols which always have a definite meaning. Mr. Wittgenstein is concerned with the conditions for a logically perfect language—not that any language is logically perfect, or that we believe ourselves capable, here and now, of constructing a logically perfect language, but that the whole function of language is to have meaning, and it only fulfills this function in proportion as it approaches to the ideal language which we postulate. (p. 8)

The problem in constructing such a language is quickly encountered, "The first requisite of an ideal language would be that there should be one name for every simple, and never the same name for two different simples" (p. 9). What are the simples?

On the lookout for allies, Russell (1914/1981, p. 23) had effectively rejected the prospect of any help from evolution or pragmatism. For Russell, "Evolutionism, in spite of its appeals to particular scientific facts, fails to be a truly scientific philosophy because of its slavery to time, its ethical preoccupations, and its predominant interest in our mundane concerns and destiny" (p. 30). Instead, Russell (1919) found support for his views on meaning in the S-R behaviorism of Watson:

> If we take some such word as "Socrates" or "dog," the meaning of the word consists in some relation to an object or set of objects. . . . The causes and effects of the occurrence of a word will be connected, in some way to be further defined, with the object which is its meaning. To take an unusually crude instance: You see John, and you say, "Hullo, John"—this gives the *cause* of the word; you call "John," and John appears at the door—this gives the *effect* of the word. . . . This view of language has been advocated, more or less tentatively, by Watson in his book on *Behaviour*. (pp. 7–8)

With a necessary cause-and-effect connection between word and object, meaning was a property of a word, just as a response was a property of a stimulus: "I also hold that meaning in general should be treated without introducing 'thoughts,' and should be regarded as *a property of words* [italics added] considered as physical phenomena" (Russell, 1926, p. 119).

Continuing to be influenced by Watson, Russell put the causal relations of meaning in terms of conditioned reflexes. For the listener, Russell (1927/1970) said,

> The law of conditioned reflexes is subject to ascertainable limitations, but within its limits it supplies what is wanted to explain the understanding of words. The child becomes excited when he sees the bottle; this is already a conditioned reflex, due to experience that this sight precedes a meal. One further stage in conditioning makes the child grow excited when he hears the word "bottle." He is then said to "understand" the word. (p. 52)

For the speaker, Russell said,

> The reaction of a person who knows how to speak, when he notices a cat, is naturally to utter the word "cat"; he may not actually do so, but he will have a reaction leading towards this act, even if for some reason the overt act does not take place. It is true that he may utter the word "cat" because he is "thinking" about a cat, not actually seeing one. This, however, as we shall see in a moment, is merely one further stage in the process of conditioning. (p. 54)

Russell appears to have based his in-

terpretations on Watson's early statements about words and objects. Here is a striking later example by Watson (1924/1970):

> The words function in the matter of calling out responses exactly as did the objects for which the words serve as substitutes. Wasn't it Dean Swift who had one of his characters who couldn't or wouldn't speak carry around in a bag all the objects of common use so that instead of having to say words to influence the behavior of others, he pulled out the actual object from his bag and showed it? The world would be in this situation today if we did not have this equivalence for reaction between objects and words. (p. 233)

Swift (1726/1967, p. 231; also cf. Francus, 1994, p. 26), of course, was ridiculing this conception of language, but Watson did not seem to notice.

SKINNER'S VIEWS OF VERBAL BEHAVIOR BEFORE 1945

Skinner, pre-1945, viewed Carnap and Russell favorably. In an early letter to Keller, Skinner (1979/1984) wrote, "Latest behaviorist: Carnap" (p. 149). Skinner (1989, p. 110) said he had been a charter subscriber to *Erkenntnis,* the journal of the Vienna Circle; and he saw a close relation between behaviorism and logical positivism: "As far as I was concerned, there were only minor differences between behaviorism, operationism, and logical positivism" (1979/1984, p. 161). Skinner also said of his method, "It is positivistic" (1938/1966, p. 44), and he said he "had been converted to the behavioristic position by Bertrand Russell" (1979/1984, p. 10), whom he described as "sympathetic with logical positivism" (1989, p. 110). After reading Russell's review of *The Meaning of Meaning*, Skinner (1979/1984, p. 10) bought Watson's *Behaviorism* (1924/1970) and later Russell's *Philosophy* (1927/1970). Russell's (1926) review of *The Meaning of Meaning* was largely an exposition of Russell's own theory of meaning. Evidently receptive to that theory, Skinner (1979/1984) wrote not long after reading Russell's review: "If all thought can be attributed to processes of perception and reflex, 'meaning' in all its wider sense may prove to be an expanded aspect of 'essence' " (p. 353).

Skinner went on to distinguish words by their defining properties while acknowledging that different people may have different defining properties for the same word. Speaking of the generic nature of stimulus and response, Skinner (1972) said,

> Suppose that it be casually observed that a child hides when confronted with a dog. Then it may be said, in an uncritical extension of the terminology of the reflex, that the dog is a stimulus and hiding a response. It is obvious at once that the word *hiding* does not refer to a unique set of movements nor *dog* to a unique set of stimulating forces. In order to make these terms validly descriptive of behavior it is necessary to define the classes to which they refer. . . . It is not at all certain that the properties we should thus find to be significant are those now supposedly referred to by the words *dog* and *hiding*. . . . The experimenter . . . may have some private set of properties resulting from his own training which will serve. Thus the word *hiding* may always be used *by him* in connection with events having certain definite properties, and his own results will be consistent by virtue of this definition *per accidens*. But . . . if no more accurate supplementary specification is given, the difficulty will become apparent whenever his experiments are repeated by someone with another set of private defining properties. (pp. 474–475)

Skinner's argument favors a fixed set of common class properties for words used by experimenters. On this account, meaning would be a property of a word, not the a property of unique instances of a word but the property of a word as a class of instances. Later, backing away from his S-R formulations here, Skinner (1989) said, "The paper was too strongly tied to the concept of the reflex" (p. 124).

Some of the effects of Skinner's allegiance to such a "property" theory of meaning shows in his account of Gertrude Stein's writing. Skinner did not say that her writing had uninteresting meanings, but that it was without meaning: "In any event the present argument is simply that the evidence here offered in support of a theory of automatic writing makes it *more prob-*

able that meanings are not present, and that we need not bother to look for them" (Skinner, 1972, p. 367). If meaning is a property of a word, it may make sense to say meaning is absent for words without this property. However, if the meaning of a word lies in the determiners of a word—in the three-term contingency that Skinner (1972, pp. 370–384) later maintained—then every word, in every one of its occurrences, must have determiners for that occurrence and hence some meaning, even if it is a confusing meaning. Even automatic writing would have meaning; but, as with echoic speech, the meaning may be of little interest.

In addition, the formulations that Skinner used for his discussions of verbal behavior before 1945 were stimulus and response formulations. Skinner (1936) said "In normal speech the responses 'refer to' external stimuli—to whatever is being 'talked about' " (p. 103); and these stimulus and response relations were presented as having a connection that could vary in strength: "A verbal response may be so weak as to be evoked by its appropriate stimulus only after a considerable period of time, as when we have difficulty in recalling a name" (p. 72). In these stimulus and response formulations, Skinner presented no role for consequences.

Skinner saw promise in structural forms and repetitions of word-like forms separated from their usual functional contexts. Skinner's experiments in the 1930s with his verbal summator produced results that Keller saw as resembling recent literature, which experimented extensively with word forms. Skinner (1979/1984) wrote Keller that the verbal summator was a result of theoretical deductions from the language book and that it "*simply repeats a series of vowel sounds over and over until the subject reads something into them*" (p. 176). Keller replied, "[Auden] has experimented with some rhyming . . . of this sort: gay-guy; house-horse. Stuff that . . . is a good example of the sort of spread you get with the summator. Auden is 'ganz modern,' communist, and Gertrude Steinish" (p. 176).

Skinner's focus on words as structural elements with stimulus–response meanings continued. Skinner (1938/1966) implied that certain words had essential meanings when he said that certain words, regardless of context, implicated or did not implicate conceptual schemes (pp. 7–8). In explicit rejection of Skinner's position, Midgley (1978; also cf. Hanson, 1955) made the point that the meaning of all words depends on their contexts and that the use of words is naturally theory laden. Commonly used words cannot be distinguished on the basis of whether or not they imply conceptual schemes. They all imply schemes of some sense in some contexts and different senses in different contexts. In another study, "A Quantitative Estimate of Certain Types of Sound-Patterning in Poetry," Skinner (1941) presented a structural, topographical analysis of "the objective structure of a literary work" (p. 79). Texts from Swinburne and Shakespeare were used to determine the distances between repetitions of vowels, consonants, and whole words. The purpose was to show the extent to which "*a process in the behavior of the writer*," which produces rhyme, assonance, or alliteration rests "upon a statistical proof that the existing patterns are not to be expected from chance" (p. 64).

Skinner's Pre-1945 Book on Language

Skinner was also writing a book on language. In a letter of 1934 to Richards, Skinner (1979/1984) described how well the writing was going at that time:

> I have written the best part of a book on language. . . . I begin with a few simple laws of behavior, which I treat as postulates and from which I deduce enough cases to take care of the usual linguistic data. It has all worked out surprisingly well. I get into semantics . . . and later on to the relation of thought to language, where Carnap comes in. (p. 159)

Skinner says he wrote the best part of

that book in 1934, that the writing went well, that he adopted a logical postulatory approach (favored by many mechanists from Newton to Hull), and that Carnap came in on the relation of thought to language. In addition, Skinner (1979/1984) indicated he was applying the S-R framework from his experimental work, "What I'm doing is applying the concepts I've worked out experimentally to this nonexperimental (but empirical) field" (p. 150). In another letter to Keller in the 1930s, Skinner said of the manuscript for his book, "I'm beginning to wonder why I ever stuck so doggedly to a faith in stimulus and response. It is certainly beginning to pay well now" (p. 171), which again sounds as if Skinner was pursuing an S-R analysis of verbal behavior, an analysis that vindicated his commitment to a stimulus and response approach.

Skinner's Pre-1945 Units for Operant Behavior

In his pre-1945 writing, Skinner used four alternative numbers of terms for presenting the operant. (a) In a letter to Keller in 1936, Skinner (1979/1984) flippantly referred to the operant as "a castrated reflex with no stimulus" (p. 182) (one term). (b) He referred to "the operant (s–R)" (1972, p. 494) and the operant $s.R^0$ (1938/1966, p. 261) (two terms). (c) Skinner (1972) presented Type I behavior, later to be called operant behavior, primarily as a pairing of S-R units in a linear chain of "S_0—R_0→S_1—R_1" (p. 479); but on the next page he equivocally presented Type I as a three-term formula: "S_0→R_0→S_1" (p. 480). Another three-term formula appeared in 1938/1966 with explicit necessities:

> The mechanical necessities of reinforcement require in addition to the correlation of response and reinforcement this further correlation with prior stimulation. Three terms must therefore be considered: a prior discriminative stimulus (S^D), the response (R^0), and the reinforcing stimulus (S^r). Their relation may be stated as follows: only in the presence of S^D is R^0 followed by S^r. (p. 178)

(d) However, throughout Skinner's portrayal of the operant in the 1930s, four terms in a pairing of two reflexes led the way by far in frequency and diagrammatic prominence, for example, "$s.R^0$→$S^r.R^r$" (1938/1966, p. 65). Two paired reflexes were clearly Skinner's preferred formulation for the operant.

Before 1945, Skinner held that necessity was intrinsic to all behavior, including operant behavior. Even when not observed as an invariant succession, necessity was assumed to be there (e.g., Skinner, 1932, p. 32). Skinner (1972) early affirmed the importance of necessity for the relation between stimulus and response: "The reflex is important in the description of behavior because it is by definition a statement of the *necessity* of this relation" (p. 449); and he (1938/1966) affirmed that this assumed necessity could be discovered: "[Operants] are not obviously lawful. But with a rigorous control of all relevant operations the kind of necessity that naturally characterizes simple reflexes is seen to apply to behavior generally" (p. 26; see also Scharff, 1982, 1999). Skinner also showed a structural or topographical emphasis in regarding behavior as movement: "By behavior, then, I mean simply the movement of an organism or of its parts" (1938/1966, p. 6), a definition that viewed behavior as a pattern or structure in time and which Skinner later termed "misleading" (1979/1984, p. 202). In brief, before 1945, Skinner advocated a four-term operant of paired reflexes with implied necessity at some level and showed no commitment to a probabilistic contingency of three terms.

Although 1945 is presented as a critical turning point in Skinner's views, it should not be thought of as an absolute cutoff. Skinner (1953) claimed that verbal behavior "supplies especially good examples of the need to consider . . . atoms. An enormous number of verbal responses are executed by the same musculature. They are responses, therefore, which are presumably composed of a fairly small number of iden-

tical elements" (p. 94). This is a structural analysis into elements defined by the activation of corresponding musculature. Such a position on the basic elements of verbal behavior belongs more with a mechanistic position than with Skinner's pragmatic selectionism. Skinner (1972, p. 261) also reverted to an S-R or S-O-R formulation in 1956.

PRAGMATIC SELECTIONISM

The term *pragmatic selectionism* has origins in the selection by consequences of Darwin's natural selection and Peirce's pragmatism. The pragmatic selectionism of Skinner is distinguished by an emphasis on probability, contexts, and consequences in recursive, ongoing processes of change. Skinner sharply departed from his previous requirement of necessity when he used the term *contingency* for the three-term formula of operant behavior in 1945. In conjunction with that formula, what was new here was not simply the use of the term *contingency*, which he (1972, p. 490) had previously applied to both operant and respondent behavior, but the use of the term *contingency* for probability in stating, "The contingency need not be invariable" (p. 373). In addition, When Skinner (1972) introduced his concept of *radical behaviorism* for the first time (Day, 1987, p. 19) he explicitly extended the coverage of behavior analysis to private events, which embraced potential or conceivable events as Peirce had. In itself, this is a considerable enlargement of the contexts for behavior. Skinner (1972, p. 383) also advanced a pragmatic epistemology by explicitly giving more importance to effective consequences than to agreement in observation; he distinguished between logical rules for the use of a term and more pragmatic functional relations:

> [The psychologist] cannot, unfortunately, join the logician in defining a definition, for example, as a "rule for the use of a term" (Feigl); he must turn instead to the contingencies of reinforcement which account for the functional relation between a term, as a verbal response, and a given stimulus. This is the "operational basis" for his use of terms; and it is not logic but science (1972, p. 380)

The reference to Feigl, "a member of the Vienna Circle of Logical Positivists" (Skinner, 1983/1984, p. 248) represents a distancing from positivist views. Probabilistic contingencies underlie rules. Rules do not underlie contingencies. This view extends to logic, and if it "invalidates our scientific structure from the point of view of logic and truth-value, then so much the worse for logic, which will also have been embraced by our analysis" (Skinner, 1972, p. 380). This passage and other views expressed by Skinner in "The Operational Analysis of Psychological Terms" were cited with approval by Dewey and Bentley (1947).

SKINNER'S VIEWS OF VERBAL BEHAVIOR IN 1945

There are some suggestive discrepancies between what Skinner said during his early work on the language book and what he said later on. Despite what he (1979/1984, p. 159) had suggested in his letter to Richards in 1934, there is no reference to Carnap in Skinner's chapter on "Thinking" in *Verbal Behavior*. Further, in contrast to the "minor differences between behaviorism, operationism, and logical positivism" that Skinner (1979/1984, p. 161) found when he had written to Keller in the 1930s, Skinner (Blanshard & Skinner, 1966–1967) said his 1945 paper testified to a major difference: "The physicalism of the logical positivist has never been good behaviorism, as I pointed out twenty years ago (Skinner, 1945)" (p. 325). Nor is there a formal postulatory approach or a way of seeing the verbal summator as a deduction from it. There was also a slowdown in Skinner's publications as a whole (see Skinner, 1999, p. xxix). This may not demonstrate a serious reformulation of verbal behavior from his original manuscript, but it does show an extended opportunity to do so, and this opportunity entailed more than one revision.

Instead of staying with 1934 for the writing of the best part of a book, Skinner (1980a) said, "The greater part of a manuscript was written . . . in 1944–1945, from which the William James Lectures at Harvard in 1947 were taken" (p. 198). Writing to Keller near the time of his William James Lectures, Skinner (1979/1984) said he was "spending a number of hours each day at my desk working on what I'm sure this time will be a final draft of *Verbal Behavior*" (p. 324). The reference to "this time" may indicate more than one undertaking of a final draft. The supposition that Skinner importantly revised his original theory of language gains further support in examining the new positions in "The Operational Analysis of Psychological Terms," which was derived from his verbal behavior manuscript: "I wrote the 1945 paper just after spending a year on my verbal behavior manuscript. As a matter of fact, it was a section of that manuscript which I touched up to fit that particular issue of *Psychological Review*" (Skinner, 1979, p. 47).

The subject matter and tenor of Skinner's 1945 paper were different from his earlier work on verbal behavior. Instead of his previous concern with word structures, their frequency, and the meaning attached or not attached to them, Skinner's (1972) theory of verbal behavior now emphasized functional relations and the determiners (or contingencies) that accounted for the use of a word: "Meanings, contents and references are to be found among the determiners, not among the properties, of response" (p. 372). Identifying sources with whom he disagreed rather than sources with whom he agreed, Skinner (1972) distanced his account from "adherents of the 'correspondence school' of meaning" (p. 376). Speaking in reference to a *sign*—a term frequently and centrally used by Peirce—Skinner (1972) disagreed with those who viewed words as substitute stimuli: "It is simply not true that an organism reacts to a sign 'as it would to the object the sign supplants' " (p. 371). If there was any doubt whose views he was opposing, Skinner (1979/1984) later said, "It was not true, as Watson, Russell and others had said, that one responded to words as if they were the things the words stood for" (p. 335). Skinner (1957) illustrated:

> The verbal stimulus fox does not, because of simple conditioning, lead to any practical behavior appropriate to foxes. It may, as Russell says, lead us to look around, as the stimulus wolf or zebra would have done, but we do not look around when we see a fox, we look at the fox. (p. 87)

Again echoing what Russell had claimed and rejecting it, Skinner (1974) said, "Meaning is not properly regarded as a property of a response or a situation but rather of the contingencies responsible for both the topography of behavior and the control exerted by stimuli" (p. 90). In another echo of Russell, this time Russell's *cat*, Skinner (1980b) said,

> The sounds represented in English orthography as *cat* or the marks CAT have no meaning *in* them; nor is it possible to put meaning *into* them, to invest them with meaning. . . . As responses, the circumstances controlling their appearance *are* their meaning. As stimuli, their meaning is the behavior under their control. (p. 114)

Control for Skinner, of course, now implied a probabilistic three-term contingency. He worked hard to separate himself from Russell, the man who had converted him to behaviorism and who had analyzed verbal behavior in terms of conditioned reflexes in emulation of Watson.

Not surprisingly, Skinner (1957) also rejected the possibility of reforming language so that it would be composed of the basic elements for an ideal language:

> Under the conditions of an ideal language, the word for *house*, for example, would be composed of elements referring to color, style, material, size, position, and so on. Only in that way could similar houses be referred to by similar means. The words for two houses alike except for color would be alike except for the element referring to color. If no element in the word referred to color, this part of the conditions of an

> ideal language could not be fulfilled. Every word in such a language would be a proper noun, referring to a single thing or event. Anyone who spoke the language could immediately invent the word for a new situation by putting together the basic responses separately related to its elements. . . . Such a language is manifestly impossible. (pp. 123–124)

This illustrates a further distancing of his views from Russell and Carnap, although the above example appears closer to the semantic theories of some linguists (e.g., Chomsky, 1987, p. 421, 1988, p. 191; Harris, 1951/1960, p. 190; Katz, 1971, p. 299).

But perhaps the most remarkable characteristic of Skinner's 1945 publication is the similarity of its views with those of Peirce. Skinner (1979/1984, p. 41) said his growing library, apparently by the late 1920s, included *Chance, Love and Logic* by Peirce (1923/1998). This book, which had been recommended to Skinner by Crozier for the essay "Man's Glassy Essence," also contained the seminal essay for Peirce's pragmatism, "How to Make Our Ideas Clear." In addition, there were several opportunities for Skinner to flesh out his understanding of Peirce. Skinner (e.g., 1979/1984, pp. 92, 151, 158, 213, 281) had discussions with the pragmatist Quine, read *The Meaning of Meaning* by Ogden and Richards (1923/1989) in the early 1930s, and had a series of discussions with Richards. *The Meaning of Meaning*, which Skinner (1979/1984, pp. 92, 213) bought and discussed, included a favorable presentation of pragmatic views and also included selections from Peirce in Appendix D. Ogden had been a protege of Lady Welby, who corresponded with Peirce, and Ogden was regarded by Hardwick (1977, p. xxxi) as a disciple of Peirce.

Although Skinner (1972, pp. 370–384) did not reference Peirce as a source for his views on meaning, he spoke favorably of him later in a published interview. In response to the question, "Do you see operant conditioning as close to any existing philosophical system?" Skinner (1979) identified pragmatism and said in part,

> The method of [Peirce] was to consider all the effects a concept might conceivably have on practical matters. The whole of our conception of an object or event is our conception of effects. That is very close, I think, to an operant analysis of the way in which we respond to stimuli. . . . [Peirce] was talking about knowledge shaped by consequences. (p. 48)

Skinner's accurate rendering of Peirce's position during an interview suggests a careful study of at least some of Peirce's views.

In "How to Make Our Ideas Clear," which was included in the book of Peirce's essays that Skinner (1979/1984, p. 41) bought, Peirce (1878/1992) explained meaning in terms of habits:

> What a thing means is simply what habits it involves. Now the identity of a habit depends on how it might lead us to act, not merely under such circumstances as are likely to arise, but under such as might possibly occur, no matter how improbable they may be. (p. 131)

And Peirce explained habits in relation to antecedent stimuli and consequences:

> What the habit is depends on *when* and *how* it causes us to act. As for the *when*, every stimulus to action is derived from perception; as for the *how*, every purpose of action is to produce some sensible result. (p. 131)

The three terms in this contingency are *stimulus*, *act*, and *result*. Peirce continued, arriving at his well-known definition of pragmatism: "Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object" (pp. 131–132). It is not difficult to see why Skinner (1979) said that Peirce's view "is very close . . . to an operant analysis" (p. 48).

Peirce (1998) used different variants of terms for his formulation of habit, such as *conditions*, *act* and *result*: "Under given conditions, the interpreter will have formed the habit of acting in a given way whenever he may desire a given kind of result" (p. 418), which was restated in terms of *conditions*, *action*, and *motive*: "How otherwise can a habit be described than by a descrip-

tion of the kind of action to which it gives rise, with the specification of the conditions and of the motive?" (p. 418). Peirce restated this formulation in terms of *circumstances*, *act*, and *motives*: "[To] believe the concept in question is applicable to anything is to be prepared under certain circumstances, and when actuated by given motives, to act in a certain way" (p. 432). Peirce (1985) also addressed the habit of *belief* in terms of *occasion*, *act*, and *consequence*: "A state of *belief* in a proposition is such a state that the believer would on every pertinent occasion act according to the logical consequence of that proposition" (p. 912). All of this gives the following terms in probabilistic relations for his habits: *stimulus/conditions/occasion/circumstances, action/act,* and *result/motive/motives/consequence*. These terms are similar to some of the alternative terms that Skinner used for the contingencies of operant behavior. For example, Skinner (e.g., 1938/1966, pp. 37, 41, 1947, p. 36, 1956, p. 82, 1972, p. 72, 1977/1978, p. 115) often used *act* or *action* in place of *behavior*.

Not only do Peirce and Skinner use similar terms for a triadic relation, they have similar relations among the terms. In his "Minute Logic" (1902), Peirce had generalized three-term probabilistic relations as cutting across the discovery of laws of nature, the improvement of inventions, and natural selection:

> We here proceed by experimentation. . . . What if we were to vary our procedure a little? Would the result be the same? We try it. If we are on the wrong track, an emphatic negative soon gets put upon the guess, and so our conceptions gradually get nearer and nearer right. The improvements of our inventions are made in the same manner. The theory of natural selection is that nature proceeds by similar experimentation to adapt a stock of animals or plants precisely to its environment, and to keep it in adaptation to the slowly changing environment. . . . Just as a real pairedness consists in a fact being true of A which would be nonsense if B were not there, so we now meet with a Rational Threeness which consists in A and B being really paired by virtue of a third object, C. (Hartshorne & Weiss, 1931–1963, 2.86 [Vol. 2, par. 86])

Applied to natural selection, the relation between (A) the environment and (B) the stock of animals adapted to it exists because of (C) the consequences that occurred for previous AB (environment–animal) relations. Applied to inventions, the relation between (A) the environment or conditions and (B) the improvements of our inventions exists because of (C) the consequences that occurred for previous AB (conditions–improvements) relations.

Skinner (1972) also expressed the relations in his three-term contingency in a way that was similar to Peirce's relations: "The contingencies of reinforcement . . . account for the functional relation between a term, as a verbal response, and a given stimulus" (p. 380). The causal or explanatory role established by "account for" is not given to the antecedent stimulus as it is in if-then S-R accounts; instead the causal role is given to the consequences. In addition, Skinner's phrasing on page 380, although reversing Peirce's sequence, has a further relation that agrees with Peirce's general AB-because-of-C-formulation. For Skinner, "The contingencies of reinforcement" (C) "account for the functional relation between . . . a verbal response" (B) and "a given stimulus" (A). Converting this back into Peirce's sequence of phrases, the AB relation (between stimulus and response) is because of C (the contingencies of reinforcement). Skinner has given Peirce's AB-because-of-C formulation as his unit for operant behavior.

Applied to Skinner's later operant formulation, the relation between (A) the setting and (B) the behavior exists because of (C) the consequences that occurred for previous AB (setting-behavior) relations, for example, "Operant conditioning is studied in the laboratory by arranging complex and subtle relations among setting, behavior, and consequence" (1983/1997, p. 156, see also 1973, pp. 257–258; Catania & Harnad, 1984/1988, pp. 215, 265; Skinner, 1989, p. 62). By using a highly inclusive term such as *setting,* Skin-

ner brought his three-term contingency of *setting, behavior,* and *consequences* into closer alignment with Darwin's (1859/1958) *conditions of life, variation,* and *selection,* for example, "Natural Selection, or the Survival of the Fittest. . . . implies only the preservations of such *variations* as arise and are beneficial to the being under its conditions of life" (p. 88). Darwin acquired an enhanced status with Skinner after 1945. Before 1945, Skinner (1938/1966) had referenced Darwin critically for attributing "mental faculties to some subhuman species" (p. 4). After 1945, Skinner increasingly identified similarities between his views and those of Darwin's natural selection.

In addition, preparation for Skinner's acceptance of a probabilistic three-term contingency may have come from another source. In *An Outline of Philosophy*, Russell (1927/1970) had said,

> Thorndike's law, as it stands, does not belong to objective psychology, and is not capable of being experimentally tested. This, however, is not so serious an objection as it looks. Instead of speaking of a result that brings satisfaction we can merely enumerate the results which, in fact, have the character which Thorndike mentions, namely, that the animal tends to behave so as to make them recur. The rat in the maze behaves so as to get the cheese, and when an act has led him to the cheese once, he tends to repeat it. We may say that this is what we mean when we say that the cheese "gives satisfaction," or that the rat "desires" the cheese. That is to say, we may use Thorndike's "Law of Effect" to give us an objective definition of desire, satisfaction, and discomfort. The law should then say: there are situations such that animals tend to repeat acts which have led to them; these are the situations which the animal is said to "desire" and in which it is said to "find satisfaction." This objection to Thorndike's first law is, therefore, not very serious, and need not further trouble us. (pp. 35–36)

Thorndike's law of effect was in terms of situation, response, and satisfaction (or dissatisfaction), but situation and response, an S-R relation, were the only objectively observed terms. Russell reformulated satisfaction as "the animal tends to behave so as to make [results] recur" and a couple of pages later as "the animal tends to repeat acts" with "certain results" (pp. 37–38). This left a probabilistic three-term contingency that must have some repetition in order to show a tendency to recur. Inasmuch as Skinner (1976/1977, p. 299) refers to pages 33 and 34 that he had previously marked in Russell's (1927/1970) book and quotes from pages 33, 34, and 36, we may reasonably assume that Skinner had probably read Russell's objective reformulation (pp. 35–36) of Thorndike's law of effect even though Skinner badly misrepresented what Russell had said about that law (cf. Moxley, 1998b, p. 75). Skinner may have been thinking of Russell's account of meaning.

If Skinner read Russell before Peirce, Peirce's account may have served as a reminder, illustration, and argument that made the three-term probabilistic contingency finally click. This may not have been an instantaneous insight, of course, but a process that developed over time through an accumulation of relevant readings and discussions, coming to a head when Skinner became bogged down in writing his original manuscript on verbal behavior. Skinner could now see this formulation as unifying both verbal and nonverbal accounts of operant behavior. Subsequent readings and discussions of Peirce and perhaps of Thorndike's (e.g., 1911/1965, pp. 282–294) references to Darwin and how "an act is selected from all those performed" (p. 294) could have solidified such an account.

Realizing that he was participating in a major paradigmatic shift, Skinner (1981) later presented a general account for explanations in terms of selection by consequences that replaced the more traditional antecedent causal explanations of classical mechanics:

> Selection by consequences is a causal mode found only in living things, or in machines made by living things. It was first recognized in natural selection, but it also accounts for the shaping and maintenance of the behavior of the individual and the evolution of cultures. In all three of these fields, it replaces explanations based on the causal modes of classical mechanics. (p. 501)

Skinner saw shared similarities among the newer explanations for feedback mechanisms, natural selection, and operant behavior in contrast to the older explanations of classical mechanics.

CONCLUSION

The changes in Skinner's views from 1945 onward can largely be seen as bringing his behavior analysis increasingly into a pragmatic-selectionist orientation. Skinner's interest in and reconceptualization of verbal behavior led the way. This reconceptualization was not an empirical derivation from his experiments with verbal behavior, nor was it an application to verbal behavior of the reflexological framework he had been using in his experimental work. The suggestion proposed here is that Skinner's views on verbal behavior from 1945 onward, as well as the origin of his probabilistic three-term contingency, probably owed more to the conceptual contributions of others than Skinner acknowledged. At the very least, there were sources of support, or near relations, for Skinner's pragmatic selectionism in the views of Peirce that Skinner might have acknowledged at the time. His first commitment to an unequivocal probabilistic three-term contingency occurred in 1945 in an article on verbal behavior that included an explicit and detailed example of Peirce's AB-because-of-C formulation for a three-term contingency, that introduced probabilistic relations for the first time for his central unit of behavior without invoking a requirement for necessity somewhere, that extended the contexts for a behavioral analysis to private events in his first use of the term *radical behaviorism,* and that also introduced commitments to pragmatism that were cited with approval by Dewey and Bentley (1947). This is suggestive evidence for an influence of Peirce on Skinner. All these characteristics are distinctive of Peirce's views.

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