

## Citation Analysis of Skinner's *Verbal Behavior*: 1984–2004

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The present study undertook an updated citation analysis of Skinner's (1957) *Verbal Behavior*. All articles that cited *Verbal Behavior* between 1984 and 2004 were recorded and content analyzed into one of five categories; four empirical and one nonempirical. Of the empirical categories, studies that employed a verbal operant from Skinner's analysis were assigned to either basic, applied, or observational categories. Empirical studies that did not employ a verbal operant were categorized as other-empirical. The total number of citations remained stable across the review period and averaged just over 52 per year. Of these, 80% were from nonempirical articles, 13.7% were from other-empirical articles, 4% were from applied articles, 1.4% were from basic articles, and 0.9% were from observational articles. An "obliteration" analysis was also conducted to identify articles that employed Skinner's verbal operant terms but did not cite *Verbal Behavior*. This analysis identified 44 additional articles, suggesting that a degree of obliteration had occurred in the half century since the publication of *Verbal Behavior*. In particular, the analysis suggests that the verbal operant of manding has sufficient presence in the applied empirical literature to render citation of *Verbal Behavior* redundant. Overall, *Verbal Behavior* continues to make an important contribution to the psychological literature.

*Key words:* citation analysis, obliteration, B. F. Skinner, *Verbal Behavior*

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In recent years, longitudinal bibliometric or citation analyses of trends in journal publications have become increasingly popular in all areas of science (Cronin, 2001). In behavior analysis, bibliometric analyses of citation patterns have revealed important trends in research, such as patterns of citations among behavioral journals (Carr & Britton, 2003; Critchfield, 2002) and detailed authorship trends (Dymond, Clarke,

Dunlap, & Steiner, 2000; Dymond & Critchfield, 2001, 2002).

Citation analyses also provide an approximate measure of the impact of a particular source on research. For instance, McPherson, Bonem, Green, and Osborne (1984) employed citation analysis to formally investigate the impact of Skinner's (1957) *Verbal Behavior* on research (see also M. L. Sundberg & Partington, 1982). McPherson et al. recorded the number of citations and the subject areas in which the citations occurred between January 1957 and August 1983. The authors noted a total of 836 citations of the book during the review period, with the data showing a steady increase across years. Interestingly, less than 4% of the total citations were classified as empirical investigations, and even fewer citations (2.2%) consisted of experimental analyses. These findings suggest that the book had a limited direct

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influence on empirical research up to 1984.

More recently, Critchfield, Buskist, Crockett, Sherburne, and Keel (2000) conducted a citation analysis of sources cited at least 10 times over the 10-year period between 1990 and 1999 in four journals, the *Journal of the Experimental Analysis of Behavior*, *The Psychological Record*, *The Analysis of Verbal Behavior (TAVB)*, and the *Experimental Analysis of Human Behavior Bulletin*. These journals were considered to be the foremost sources of papers on the experimental analysis of human behavior. The authors identified 98 sources that were cited at an average of one citation per year during the decade in question. Of these, Sidman and Tailby's (1982) seminal article on stimulus equivalence classes was the source most often cited (73 citations). Skinner's (1957) *Verbal Behavior* was the second most frequently cited source (54 citations). This was a high rate of citation for a book that was over 30 years old at the beginning of the review period.

In fact, the high rate of citation observed by Critchfield et al. (2000) may have been artificially low due to obliteration (Garfield, 1977). *Obliteration* refers to the use of concepts provided by a source without citation because the contents of the source have become common knowledge within a discipline. For example, biologists rarely cite Darwin when suggesting evolutionary bases for behavior or Mendel when discussing genetics. It is possible that some sources in the Critchfield et al. dataset conducted analyses on *tacts* and *mands*, terms based on Skinner's book, without citing *Verbal Behavior*. McPherson et al. (1984) highlighted this issue and mentioned one paper (Rogers-Warren & Warren, 1980) that used a mand intervention but did not cite Skinner's book. However, due to software and data limitations, they were unable to analyze their data further to investi-

gate how many more similar papers existed in the literature.

The current paper provides an update of McPherson et al.'s (1984) citation analysis of *Verbal Behavior*. Two decades have passed since the publication of McPherson et al.'s analysis, and Skinner's book is now almost 50 years old. It is a fitting time to examine its continued influence on research. In addition, McPherson et al. found that relatively few sources that cited *Verbal Behavior* were empirical investigations. The current paper employed the Institute for Scientific Information (ISI) citation index and *TAVB* to analyze the continuing contribution of *Verbal Behavior* to the literature. Papers that cited Skinner's book were then assigned to one of five content categories. Finally, using advanced functionality afforded by the ISI citation index, an obliteration analysis was conducted to identify sources that employed the verbal operants described in *Verbal Behavior* without citing it.

## METHOD AND RESULTS

We undertook cited reference searches of the ISI Web of Knowledge (Web of Science Version 1.2; Cronin, 2001; Sevinc, 2004) databases *Science Citation Index Expanded* (1981–), *Social Sciences Citation Index Expanded* (1981–), and *Arts and Humanities Citation Index* (1981–) from 1984 through 2004. All articles, including book reviews, commentaries, and editorials, that cited Skinner's (1957) *Verbal Behavior* were included.

It should be noted that the ISI databases do not include one journal notable for research on verbal behavior, *TAVB*. This journal was included in the current analysis because it is intended primarily for the original publication of experimental or theoretical papers relevant to a behavioral analysis of verbal behavior. In addition, Critchfield et al.

(2000) showed that *Verbal Behavior* was the source cited most frequently in *TAVB* between 1990 and 1999. To include *TAVB* in our analyses, the reference sections of *TAVB* articles published between 1997 and 2004 were obtained from the PsychInfo database, and the remaining volumes (1984–1996) were obtained in hard-copy form.

A total of 1,093 citations<sup>1</sup> of *Verbal Behavior* were recorded during the census period of 1984 to 2004—942 from the ISI citation index and a further 151 from *TAVB*. Each article that cited *Verbal Behavior* was then independently content analyzed by two assessors (the first and second authors) who first read the article title, journal source, abstract, references, and main text and assigned them to one of five descriptive categories based on McPherson et al.'s (1984) criteria. The five categories of articles employed, along with representative examples of articles from each category, were as follows.<sup>1</sup>

*Basic articles.* These cited *Verbal Behavior*, employed at least one of Skinner's (1957) verbal operants as dependent or independent variables, and focused on the empirical analysis of controlling variables involved in participants' behavior. Horne, Lowe, and Randle's (2004) analysis of tacting and listener behavior in young children was one example of a study in this category.

*Observational articles.* These cited *Verbal Behavior*, employed at least one of Skinner's (1957) verbal operants as an observational variable, and collected descriptive data. Mac-Greene and Hafer Bry's (1991) descriptive analysis of family problems was one example of a study in this category.

*Applied articles.* These cited *Verbal Behavior*, employed at least one of

Skinner's (1957) verbal operants as dependent or independent variables, and focused on the improvement of participants' behavior, verbal or otherwise (D. M. Baer, Wolf, & Risley, 1968). One example of a study in this category was Eikeseth and Nasset's (2003) work on echoic behavior with children with phonological disorder.

*Other-empirical articles.* These cited *Verbal Behavior*, did not employ one of Skinner's (1957) verbal operants, and focused on the empirical analysis of controlling variables involved in participants' behavior. This category included both behavioral studies of stimulus control other than in accordance with Skinner's operants (e.g., Mackay, Soraci, Carlin, Dennis, & Strawbridge, 2002) and nonbehavioral studies that systematically manipulated independent variables to change behavior (e.g., Muller, Kleinmans, & Courchesne, 2003).

*Nonempirical articles.* These cited *Verbal Behavior* but did not systematically manipulate variables to change a participant's behavior. The majority of articles in this category consisted of conceptual, review, or position pieces (e.g., Dymond, Roche, & Barnes-Holmes, 2003), but articles that employed content analysis, focus groups, or other qualitative methodologies were also included (e.g., Marlowe, Merikle, Kirby, Festinger, & McLellan, 2001).

#### *Reliability Analyses*

Agreement was defined as both raters assigning an article that cited *Verbal Behavior* to an identical content category. Overall categorization agreement (number of agreements over total number of citations) for all citations was just over 92%. To examine individual categories, the mean percentage agreement (lower count divided by the higher count and multiplied by 100%) was obtained and Pearson (*r*) correlations

<sup>1</sup>The term *citation* is used to refer to one article in which Skinner's (1957) *Verbal Behavior* was included in the reference section.

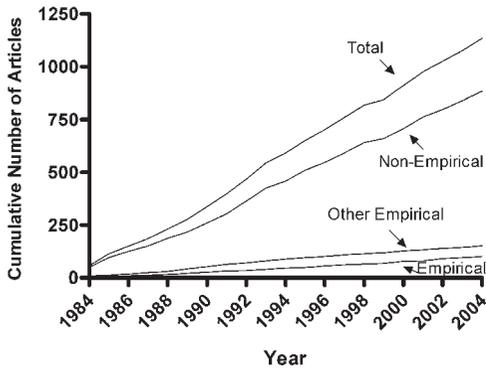


Figure 1. The cumulative total number of articles that cited *Verbal Behavior* from 1984 through 2004. Also shown is the cumulative number of articles from nonempirical, other-empirical, and empirical (observational, basic, and applied articles) categories.

were conducted on the year totals for each category. Interrater reliability was high for all categories: basic (93%,  $r = 0.83$ ), observational (91%,  $r = 0.8$ ), applied (93%,  $r = 0.9$ ), other-empirical (82%,  $r = 0.83$ ), and nonempirical (97%,  $r = 0.99$ ). Lower numbers of articles in the basic, observational, and applied categories accounted for the relatively lower levels of agreements compared to the nonempirical category, because individual disagreements had a greater effect on the obtained percentage agreement and correlation scores. Lower agreement in the other-empirical category was due to difficulties categorizing descriptive and qualitative research designs as other-empirical or nonempirical. The large number of nonempirical articles insulated the reliability of this category from this lack of clarity. Following the initial categorizations, 91 disagreements remained. Both raters reread each of these initial ratings and then discussed and agreed on the categorizations of the articles.

#### *Number of Citations and Content Analysis of Citations*

Of the 1,093 citations, 874 (80%) were classified as nonempirical, 150 (13.7%) as other-empirical, 44 (4%)

as applied, 15 (1.4%) as basic, and 10 (0.9%) as observational. Figure 1 shows the cumulative number of citations of *Verbal Behavior* over the past 20 years. The cumulative number of citations has risen steadily over this period to a total of 1,929 citations (including 836 from the analyses of McPherson et al., 1984) since *Verbal Behavior* was first published. Thus, it appears that *Verbal Behavior* has had a substantial influence on academic writing that continues to the present date. As can be seen in Figure 1, the trend across years in the total number of citations primarily consists of citations from nonempirical articles. Other-empirical articles were the second most common category of articles, whereas empirical studies of verbal operants (both basic and applied) have remained at relatively low levels throughout the period.

Of the 67 articles that cited Skinner (1957) and employed a verbal operant as either an independent, dependent, or observational variable, 64.2% were categorized as applied, 22.4% as basic, and 13.4% as observational studies. This distribution is probably due to the large numbers of behavior analysts employed in the applied arena. Figure 2 shows the cumulative distribution of these articles over the 20-year period.

#### *Obliteration*

To assess whether obliteration had occurred in citations of *Verbal Behavior* (1957), features of the ISI citation index were used. A number of searches were conducted using terms from Skinner's analysis outlined in the book. The search terms included were *tact*, *tacting*, *mand*, *manding*, *autoclitic*, *intraverbal*, *echoic* and their plurals. Although Skinner described additional operants including textual behavior, transcription, and dictation taking, these terms were felt to be too close to everyday parlance to be usefully employed. Using the

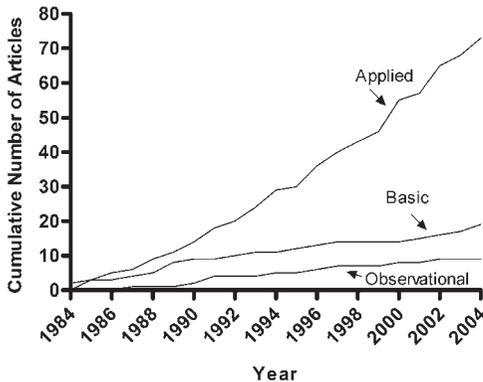


Figure 2. The cumulative number of articles that cited *Verbal Behavior* from 1984 through 2004 from applied, basic, and observational categories.

ISI citation index's "combine searches" function, it was then possible to remove all the sources that had cited Skinner's book from the obtained results. The remaining articles in these searches were then double-checked to ensure that they had not cited *Verbal Behavior*. The obliteration analysis of articles published in *TAVB* involved consulting the reference sections of all articles and recording whether or not *Verbal Behavior* was included. Using this procedure, 39 additional articles were found in the ISI databases. Copies of *TAVB* were also checked, yielding five obliteration articles. Of these total 44 obliteration articles, 34 were empirical articles that used at least one of Skinner's verbal operants.

The 34 empirical articles obtained from the obliteration analysis, as well as the 67 empirical nonobliteration articles and the verbal operants addressed by each, are listed in Table 1. Of the 101 empirical obliteration and nonobliteration articles, 34 mentioned tacts, 63 mands, 25 intraverbals, and 15 echoics (note that these figures do not tally because each article may have mentioned more than one category of verbal operant). Figure 3 shows the cumulative number of obliteration and nonobliteration empirical sources that addressed tacts, mands, intra-

verbals, and echoics. Empirical research on Skinner's verbal operants has continued over the last 20 years and continues to this day, and the majority of empirical research appears to focus on the mand.

## DISCUSSION

The present study updated McPherson et al.'s (1984) citation analysis of Skinner's *Verbal Behavior* (1957) by providing the number of citations from 1984 through 2004. The findings show a steady pattern of citation, with the majority of citations coming from nonempirical articles. An obliteration analysis uncovered 44 additional articles that referred to verbal operants specified by Skinner without citing the book.

The current findings show that the average number of citations of *Verbal Behavior* has increased since McPherson et al.'s (1984) analysis from 32 to 52 per year, representing a 61% increase. When we examine the change in the proportion of empirical articles that cited the book, we see that McPherson et al. found that 31 of 836 (3.7%) citations were deemed empirical articles. The corresponding finding from the present study, that 67 of 1,093 (6.1%) citations were from empirical sources, demonstrates a 119% increase in empirical research on verbal behavior since the last census. If the empirical obliteration sources are also included, then the proportional increase is 325%. However, due caution should be exercised in interpreting the latter increase because McPherson et al. did not conduct an obliteration analysis.

Another important difference between the methods of the current analysis and those of McPherson et al. (1984) is that the search parameters of the present study were restricted to databases covered by the ISI Web of Science and to hard copies of *TAVB*. These search parameters hence omitted sources such as *Dissertation Abstracts International*

TABLE 1

**The empirical obliterated (marked with an asterisk) and nonobliterated articles that cited Skinner (1957) and the verbal operants employed (T = tact, M = mand, Iv = intraverbal, and E = echoic)**

Authors	T	M	Iv	E
Alpert & Kaiser (1992)*		✓		
Arntzen & Almås (2002)	✓	✓		
Baer & Detrich (1990)	✓	✓		
Y. Barnes-Holmes et al. (2001)*	✓			✓
Bourret et al. (2004)		✓		
Bowman et al. (1997)		✓		
Braam & Sundberg (1991)	✓	✓		
K. A. Brown et al. (2000)*		✓		
Browngorton & Wolery (1988)*		✓		
Calculator (2002)*		✓		
Carroll & Hesse (1987)	✓	✓		
Chambers & Rehfeldt (2003)		✓		
Charlop et al. (1985)		✓		
Charlop & Trasoweck (1991)		✓		✓
Charlop-Christy et al. (2002)		✓		
Chase et al. (1985)			✓	
Daly (1987)			✓	
DeLeon et al. (2000)*		✓		
Derby et al. (1997)*		✓		
Derby et al. (1998)*		✓		
Didden et al. (2004)*		✓		
Drasgow et al. (1998)*		✓		
Drasgow et al. (2001)		✓		
Drash et al. (1999)		✓		✓
Duker et al. (1993)		✓		
Duker et al. (1994)		✓		
Duker et al. (2002)	✓	✓		✓
Eikeseth & Nasset (2003)		✓		✓
Ewing et al. (2001)		✓	✓	
Farmer et al. (1991)*			✓	
Finkel & Williams (2001)			✓	✓
Finkel et al. (2004)*		✓		
Gobbi et al. (1986)		✓		
Goh et al. (2000)*		✓		
Hall & Sundberg (1987)		✓		
Hancock & Kaiser (1996)*			✓	
Henry & Horne (2000)	✓	✓		✓
Hersh (1990)	✓	✓	✓	✓
Horne et al. (2004)	✓		✓	
Howard & Rice (1988)	✓			
Johnson et al. (2004)*			✓	
Kahng et al. (2000)		✓		
Kaiser & Hester (1994)*			✓	
Kern et al. (1997)*			✓	
Kritch & Bostow (1993)	✓		✓	
Lalli & Browder (1993)	✓		✓	
Lalli et al. (2000)*			✓	
Lamarre & Holland (1985)	✓	✓		
Leigland (1996)			✓	
Lerman et al. (1994)*			✓	
Leung & Wu (1997)	✓		✓	✓
Lodhi & Greer (1989)	✓	✓	✓	
Lowe et al. (2002)*	✓			
Lowenkron & Colvin (1992)	✓			
Luciano (1986)			✓	
MacGreene & Hafer Bry (1991)	✓	✓	✓	✓
Marcus & Vollmer (1996)*		✓		

TABLE 1

Continued

Authors	T	M	Iv	E
Marion et al. (2003)*		✓		
Miguel et al. (2001)				✓
Nuzzolo-Gomez & Greer (2004)	✓	✓		
O'Connor et al. (2003)*		✓		
O'Neill et al. (2000)*		✓		
Partington & Bailey (1993)			✓	
Partington et al. (1994)	✓			
Peck et al. (1996)*		✓		
Polson et al. (1997)			✓	
Potter et al. (1997)	✓		✓	
Ribeiro (1989)	✓	✓		
Richman et al. (2001)*		✓		
Robbins et al. (1995)	✓			
Romer et al. (1994)		✓		
Ross & Greer (2003)		✓		
Schussler & Spradlin (1991)		✓		
Sigafoos (1998)		✓		
Sigafoos & Couzens (1995)*		✓		
Sigafoos et al. (1989)	✓	✓		
Sigafoos & Meikle (1996)		✓		
Sigafoos et al. (1990)	✓	✓		
Sigafoos et al. (1994)	✓	✓	✓	✓
Sigafoos et al. (2000)		✓		
Smith et al. (1996)				✓
Sprague & Horner (1992)*		✓		
Stafford et al. (1988)	✓	✓		
C. Sundberg & Sundberg (1990)	✓		✓	
M. Sundberg (1985)	✓	✓		
M. Sundberg et al. (1990)	✓	✓	✓	
M. Sundberg et al. (1996)				✓
M. Sundberg et al. (2000)	✓		✓	
M. Sundberg et al. (2001)		✓	✓	
Tenenbaum & Wolking (1989)			✓	
Tiger & Hanley (2004)*		✓		
Tincani et al. (1999)*		✓		
Twyman (1996)	✓	✓		
Vollmer et al. (1999)*		✓		
Warren et al. (1984)*		✓		
Watkins et al. (1989)			✓	
Winborn et al. (2002)*		✓		
Woods (1984)*	✓			
Yamamoto & Mochizuki (1988)		✓		
Yoon & Bennett (2000)				✓

and *Conference Papers Index*. Although this may have resulted in some citations being overlooked, the objective of the current study was to assess the impact of Skinner's book on the citation practices of peer-reviewed published articles.

Similar to McPherson et al. (1984), the current analysis found that the majority of citations of *Verbal Behavior* were from nonempirical articles. One possible reason for this, as

suggested by McPherson et al. (p. 164), is that conceptual analyses such as Skinner's do not always lead to a direct impact on empirical research. Indeed, given that Skinner himself was clear that the purpose of *Verbal Behavior* was "an exercise in interpretation rather than a quantitative extrapolation of rigorous experimental results" (1957, p. 11), it is perhaps then not surprising that the majority of citations originate from

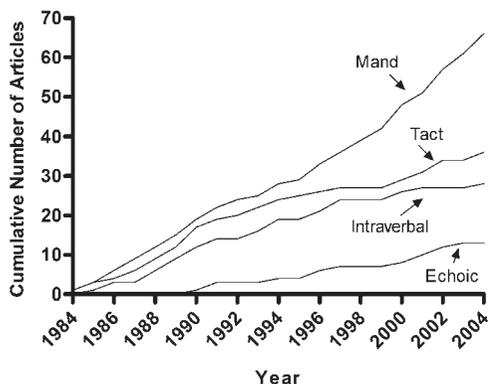


Figure 3. The cumulative number of empirical obliterated and nonobliterated articles that employed tacts, mands, intraverbals, and echoics. See text for an explanation of obliteration.

similar nonempirical works. In fact, there may well exist a tendency for nonempirical articles to cite other nonempirical sources to compare and contrast various theoretical positions, whereas empirical works usually cite similar studies as a context for their own findings. The high level of citation of Sidman and Tailby's (1982) work in the experimental analysis of human behavior reported by Critchfield et al. (2000) provides putative evidence of this.

One more controversial explanation for the comparatively low number of empirical citations is that deficiencies in Skinner's account actually impede empirical research on language. More specifically, some authors have argued (e.g., D. Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Hayes & Barnes-Holmes, 2004; Hayes, Blackledge, & Barnes-Holmes, 2001; McPherson et al., 1984, p. 164) that Skinner's definition of verbal behavior, as behavior reinforced by a listener trained to do so, is too broad. For example, imagine a study on tacting in a pigeon, in which a human experimenter provides reinforcement for pressing a key marked "Red" in the presence of a red light (e.g., M. L. Sundberg, 1985). The pigeon's behavior is under control of a mediating

organism that has been trained to respond by a verbal community and is thus verbal behavior according to Skinner's definition. However, this type of responding is common to all existing research on stimulus control. Consequently, researchers in the behavioral tradition attempting to "apply the analytic categories described in the book lead basic behavior analysts inexorably back to what they were already doing in the [animal] laboratory" (Hayes et al., 2001, p. 15). As a preliminary test of this position, we searched all the sources that cited Skinner's book for mention of *metaphor*, *grammar*, *syntax*, and *memory*, and no search results were found. Thus, it seems that researchers have found it difficult to use *Verbal Behavior* to undertake a new research agenda in the analysis of these complex language behaviors. Nevertheless, the stable output of empirical research and the increasing number of studies on mands in recent years suggest that *Verbal Behavior* has and continues to guide empirical research.

Although a substantial number of studies have been conducted using the concepts outlined in *Verbal Behavior* (1957), revisions of Skinner's approach have been conspicuous by their absence. No theory of language can or, perhaps, should remain unchanged almost 50 years after its original publication, and in that time research on derived stimulus control has grown to become the most studied area in the experimental analysis of human behavior (Dymond & Critchfield, 2001, 2002). This area, many argue, has implications for a contemporary approach to verbal behavior (Hayes et al., 2001; Leigland, 1997), and several researchers have sought to provide revised concepts based on derived stimulus relations (e.g., Hayes et al., 2001; Sidman, 1994) and to integrate those concepts with Skinner's work (e.g., D. Barnes-Holmes et al., 2000; Chase & Danforth, 1991; see also Rehfeldt

& Root, 2005). It remains to be seen, however, whether these developments will lead to any new behavioral account of language and cognition becoming as widely accepted as Skinner's.

There exists the possibility that regardless of the citation methods employed, certain works may become obliterated. Our obliteration analysis identified 40 articles. Thus, some degree of obliteration has occurred in the half century since the publication of *Verbal Behavior* (1957). The majority of these articles were empirical studies, which suggests that, to a degree, obliteration resulted in an underestimation of the impact of *Verbal Behavior* on citations in empirical articles. In fact, almost as many applied articles did not cite Skinner as did so. In particular, these articles reported a high proportion of studies on mands, suggesting that this concept has been incorporated to some degree into the everyday parlance of basic and applied researchers. This provides a relative measure of the empirical utility of these concepts. Unfortunately, the terms that either did not give rise to any hidden sources or to only a few (e.g., *autoclitic*, *echoic*, and *intraverbal*) have arguably demonstrated considerably less empirical utility. It is hardly a surprise, however, that a book as ambitious as *Verbal Behavior* provides some concepts that are more useful than others. Finally, it is important to note that obliteration is the ultimate outcome for any influential book, and the number of articles uncovered by our obliteration analyses was relatively small. Only further analyses will reveal whether the relatively low level of obliteration of *Verbal Behavior* almost 50 years after its publication should be a cause of concern for behavior analysis.

Future research may consider assessing the impact of *Verbal Behavior* (1957) relative to Skinner's other writings (Pilgrim, 2003; Thyer, 1991) and to other psycholog-

ical theories of language. Although a comprehensive analysis of such impact was beyond the scope of the current paper, the 1,093 citations of *Verbal Behavior* over the last 20 years compares favorably to the number of citations of *The Technology of Teaching* (1968; 229 citations) and *Contingencies of Reinforcement* (1969; 554 citations) but is less than the 1,680 citations of *Science and Human Behavior* (1953) and the 1,323 citations of *The Behavior of Organisms* (1938). Relative to other approaches to language, *Verbal Behavior* was cited more often during the review period than *Language and Mind* by Chomsky (1968; 250 citations) but less than R. Brown's *A First Language: The Early Stages* (1973; 1,343 citations). Obviously, these are rudimentary comparisons, but they suggest that *Verbal Behavior* has had a considerable impact. Additional detailed analyses of relative impact would be of interest because they would provide a useful context within which to evaluate the present data and may yield important insights about citation patterns from different fields of science.

### *Conclusions*

*Verbal Behavior* (1957) continues to make an important contribution to the psychological literature. The number of citations has remained steady across the past 20 years, although it appears that the book is more likely to be cited in nonempirical works than in basic or applied articles. Although Skinner himself was clear that the analysis offered in *Verbal Behavior* was purely conceptual, the "formulation is inherently practical and suggests immediate technological applications at almost every step" (p. 12). Although citations from empirical research are increasing, they are still at a relatively low level, and only future analyses will reveal what this trend might mean for behavior analysis. As re-

gards its main aim, *Verbal Behavior* can be considered an immense success because it has engendered debate on the nature of human language across many disciplines for almost 50 years.

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