Self-Editing: On the Relation Between Behavioral and Psycholinguistic Approaches

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In Skinner's (1957) conceptual analysis, the process of self-editing is integral to the dynamic complexities of multiply determined verbal behavior, but the analysis has generated little in the way of an experimental analysis. The majority of scientific work on self-editing has taken place within linguistics and cognitive psycholinguistics. Here we compare and contrast behavioral and cognitive psycholinguistic approaches to self-editing, highlighting points of contact that can be identified despite fundamental differences in theoretical styles. We conclude that the two approaches are not mutually exclusive on all dimensions, and suggest that a consideration of cognitive psycholinguistic research may help to spur an experimental analysis of self-editing from a behavioral perspective.
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Human capacity for spoken communication impresses the very individuals who speak. Textbooks and popular press books, for example, emphasize the remarkable creativity, fluency, flexibility, and generativity of language, often stressing it as a uniquely human phenomenon (e.g., Barker, 2002; Deacon, 1997; Finnegan, 1999; Graber, 1976; Huxley, 1940; Pinker, 1999). In his book, *Words and Rules*, the influential psycholinguist Steven Pinker noted, "Language has fascinated people for thousands of years. … To me the first and deepest challenge in understanding language is accounting for its boundless expressive power" (p. 1). Or, as Deacon has effused,

The way that language represents objects, events, and relationships provides a uniquely powerful economy of reference. It offers a means for generating an essentially infinite variety of novel representations, and an unprecedented inferential engine for predicting events, organizing memories, and planning behaviors. It entirely shapes our thinking and the ways we know the physical world. It is so pervasive and inseparable from human intelligence in general that it is difficult to distinguish what aspects of the human intellect have not been molded and streamlined by it. (p. 22)

As wonderful as verbal behavior is, the product that reaches the listener often is flawed in that it does not produce the appropriate listener behavior (e.g., compliance, understanding). Our verbal histories allow us to predict (often covertly) the consequences of our verbal behavior, but sometimes the actual consequences do not match the predicted consequences. It is under such conditions that we are likely to report that we have said something different from what we "intended" and call our utterance an "error." Are such speech errors trivial aberrations, or do they provide insight into the mechanisms that create verbal behavior? At least one thing is clear about speech errors: Speakers often seem acutely attuned to their occurrence, expending considerable effort toward correcting verbal miscues and toward clarifying or expanding on statements that apparently did not turn out as expected (until appropriate

listener behavior is occasioned). Perhaps not surprisingly, lay vocabulary contains numerous terms for speech errors and the process by which they are corrected or repaired as, or even before, they occur. For example, we speak of "Freudian slips" and "eating one's words" and admonish one another to "think before you speak" (Harley, 2001; Motley, 1980; Skinner, 1957). In scholarly terms, the events so labeled are referred to as instances of *self-editing* and, as will be illustrated below, are widely viewed as part of the social function of communication (Bloomfield, 1939; Chaika, 1982; De Laguna, 1927/1973; Deacon, 1997; Skinner, 1957).

At the most general level, then, speech errors demand a scholarly analysis because of their pervasiveness. Not surprisingly in this context, Skinner's (1957) *Verbal Behavior* focused heavily on the production, or composition, of verbal behavior, with two full chapters focusing specifically on self-editing and other chapters invoking self-editing in the analysis of specialized forms of communication such as scientific discourse. Yet Skinner's book lies at the uncomfortable conjunction of two scholarly traditions. On the one hand, many scholars recognize the need for an understanding of speech errors in communication. On the other hand, most scholars interested in language and communication have not embraced Skinner's approach to analyzing verbal behavior (e.g., Chomsky, 1959). Andresen (1992) has suggested that further work in the behavioral analysis of language is needed to properly evaluate not only the viability of Skinner's approach but also, by extension, that of the more general behavior-analytic framework on which Skinner's approach is based. In the following essay, we argue that the analysis of self-editing is an important and potentially productive component of this effort.

Below, we provide a summary of Skinner's analysis of self-editing. To place this analysis into context, we note that the bulk of scholarly work on self-editing has not taken place within behavior analysis. Cognitive psycholinguistic researchers, in particular, have devoted special effort to the theoretical explication and empirical study of self-editing. To provide a window on this work, we then review and critique the cognitive psycholinguistic view of self-editing. We argue that psycholinguistic interpretations, although starkly different from a behavioral approach in style and vocabulary, are not as incompatible with a behavioral view as might be assumed. It is often possible to translate psycholinguistic concepts into behavioral terms, and the translation may lend needed coherence to this area of inquiry. Because cognitive psycholinguists have generated a sizable empirical database on self-editing, we conclude that behavior analysts interested in this phenomenon can advance their own scholarly agendas, and possibly that of behavior analysis as a whole, by inspecting their psycholinguistic colleagues' work.

A BEHAVIOR-ANALYTIC PERSPECTIVE

Autoclitic Verbal Behavior and the Speaker as Self-Listener

According to Skinner (1957), a primary verbal response occurs under the influence of controlling variables appropriate to its circumstances. For example, tacts (speaking loosely, descriptions) occur under antecedent control of some event, whereas mands (speaking loosely, requests or commands) are controlled by a state of deprivation or related establishing operation. Once a primary verbal operant begins, autoclitic responses (roughly speaking, responses to the nascent or incipient primary verbal response) may occur. Specific to the present discussion, if the speaker's history includes punishment of verbal responses similar to that just composed, then the composition "is held

up for review by the speaker" (p. 383), possibly leading to modifications (self-editing) that may include rejection of a previously emitted response, emission of the response "in qualified form" (p. 383), or complete suppression of the verbal response.

Thus, the *autoclitic* is secondary verbal behavior under control of some feature of the primary verbal behavior or of its controlling variables (Skinner, 1957; Winokur, 1976). Autoclitic behavior may be said to modify the speaker's other verbal behavior.[1] Skinner identified many functionally independent categories of autoclitics, including those that describe (e.g., "I think …," "In other words …"), qualify (e.g., "sort of," "likely"), quantify (e.g., "a," "the," "all"), relate (e.g., subject–verb agreement, the possessive *'s*), or manipulate (e.g., "except").[2] Some autoclitic behavior corresponds to what ordinarily is referred to as employing grammar or syntax. But autoclitics may be much subtler. For example, minute changes in intonation may convey urgency or sarcasm that the form of the primary response does not, or a speaker may mumble a verbal response of which he or she is not confident (or that has resulted in aversive conditions in the past).[3]

Central to understanding autoclitic behavior is the notion that individuals are subject to two sets of controlling variables—one as speaker and one as listener. Verbally capable humans acquire dual repertoires, learning both to emit verbal behavior as a speaker and to respond to others' verbal behavior as a listener (Lodhi & Greer, 1989; Palmer, 1998; Skinner, 1957). Speaker and listener repertoires apparently are acquired and sometimes utilized separately, suggesting that the two repertoires are functionally independent (DiCamilla & Anton, 2004; Horne, Lowe, & Randle, 2004; Lamarre & Holland, 1985). Note, for example, that in first-language acquisition in childhood, listener behavior, often called receptive language, is acquired far earlier and to greater levels of proficiency than speaker behavior, often called expressive language (e.g., Tincoff & Jusczyk, 1999). Once both are well established, however, these semiautonomous repertoires may interact within a single individual (cf. Horne & Lowe, 1996; Lowe, Horne, Harris, & Randle, 2002).

Although usually construed as part of the speaker's behavior, self-editing requires that the speaker also has responded to his or her own verbal behavior as listener. Capitalizing on the self-listener repertoire, a speaker may be said to "test" a verbal response on him- or herself while or (by engaging in covert verbalization) before emitting it publicly. Depending on the effect on the self-listener, the verbal response either is released to other prospective listeners or is rejected pending modification (edited). Skinner divided self-editing into two basic forms—heard and not heard. "Heard" describes whether the verbal response was released to a listener other than the speaker as self-listener. If the verbal behavior was not heard, "taking it back" is accomplished simply by not making the verbal response publicly. If the verbal behavior was heard, on the other hand, revoking it requires

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[1] According to Place (1983), the term *autoclitic* derives etymologically from the Greek reflexive term αυτoς, "self," and the adjective κλιυικoς, itself derived from the verb κλιυειγ meaning "to bend," and two Greek grammatical terms, πρoκλιτικoς or proclitic ("bending in front of") and εγκλoτκoς or enclitic ("leaning on").

[2] The particular examples given here commonly function as autoclitics, but of course they are by no means absolute; whether an exemplar is an autoclitic of a particular kind depends squarely on its function in the context of a given utterance.

[3] Of course, *primary* and *secondary* do not necessarily reflect response sequence, as often the autoclitic secondary response occurs first in the verbal utterance released to the listener, as in paraleiptic responses such as "I am not going to mention how ridiculous this argument is." This begs further questions about what it means to compose verbal behavior covertly and overtly.

adding appropriate autoclitics (often manipulative or qualifying). In either case, self-editing functions to increase the probability of executing an effective verbal response.

The self as listener has a generic advantage given the precociousness of receptive language in first-language acquisition (Tincoff & Jusczyk, 1999), and a specific one in that this listener's verbal history is exactly that of the speaker. In the latter case, the listening self participates in exactly the same language, the same experiences, and the same momentary contingencies as those that influence the topic and timing of the speaker's verbal behavior. This unique relationship between speaker and self-listener presumably allows much self-editing that the verbal community never observes. That is, verbal responses that are malformed or likely to be ineffective for whatever reason may be identified by the self-listener and made subject to correction by the speaker prior to their release to an audience. But the process is not foolproof, because neither speaker nor self-listener can perfectly anticipate the history and behavior of other listeners. Thus, although a speaker may understand him- or herself perfectly well (i.e., respond appropriately to his or her verbal behavior), once public verbal behavior is incipient or in progress, the speaker may find it necessary to engage in further editing to make the behavior maximally effective on other listeners. Self-editing thus is part of the ongoing dynamic process of speech production, as each verbal response is examined and altered for effectiveness on speaker and listener.

Origins and Conditions of Self-Editing

Skinner (1957) asserted that self-editing primarily originates as a result of punishment of past verbal behavior and is refined by punishment as well as reinforcement, as edited verbal behavior increasingly occasions appropriate responses from the listeners (self and other). Punishment is part of the fabric of verbal interactions; all speakers encounter it on a routine basis in both subtle (e.g., a listener's disapproving or confused facial expression) and not-so-subtle (e.g., ostracism, ridicule) forms. Punishment in verbal interactions always is contingent on some effect that one person's verbal behavior has on another person. In some cases, the effect derives from very general properties of the verbal response. For example, listeners may punish verbal behavior when its energy level is inappropriate to the situation (as when children talk aloud in church), when its occurrence interferes with reinforcing activities (as when someone talks during a preferred television program), when its properties are unpleasant (e.g., monotone, stuttering), or when it fails to make contact with listener repertoires (e.g., poor diction). In other cases, punishment results from more complex effects on the listener that in everyday parlance might be referred to as the ''content'' of the verbal behavior. For example, listeners often punish verbal responses that exhibit deficient or atypical stimulus control (e.g., lying, illogical speech, exaggeration, and filibustering) or that violate social norms (e.g., political incorrectness). Verbal behavior that produces punishing consequences for the listener (e.g., ''hurts his feelings'') may be punished as well.

Because each speaker has experienced an extended history of punishment and reinforcement, some verbal behavior may become *automatically* self-punishing or self-reinforcing. Automatic consequences arise when a particular response form emitted by one person is regularly paired with aversive or reinforcing consequences mediated by other individuals (Skinner, 1957; Vaughn & Michael, 1982; also see Palmer, 1996). The social consequences have two effects. First,

they directly alter the future probability of similar verbal responses. Second, in a process structurally similar to classical conditioning, they may render the verbal product a conditioned reinforcer or punisher. For example, in spoken verbal behavior, the listener repertoire learns that a particular type of utterance voiced by the speaker repertoire yields reinforcing or aversive outcomes. In more technical terms, an individual's own utterance may come to have effects similar to those of the social consequences with which similar utterances have been paired. Consider an individual with a religious upbringing. Initially, this individual may have discovered that certain verbal responses (e.g., "God damn it") tend to yield punishment from his verbal community. Eventually, merely hearing the words escape his lips may generate aversive conditions similar to those the audience once mediated: The individual may report feeling "guilty" or "ashamed" (e.g., see Smith, Michael, & Sundberg, 1996, and Sundberg, Michael, Partington, & Sundberg, 1996, for experimental illustrations related to this effect).

Skinner (1957) theorized that social and automatic punishment of verbal behavior triggers important effects including recession of verbal behavior to the covert level (where only the speaker may serve as listener), talking to oneself (emphasizing the role of self-listener), and disguised speech (resulting in a variety of edited forms). Nevertheless, in all cases self-editing is an operant that occurs under identifiable conditions. For example, under conditions of defective feedback (e.g., when verbal behavior is rapid, hurried, or masked by noise), effective self-editing is unlikely (although likelihood of errors increases), presumably because the individual's capacity to serve as self-listener has been compromised. When limited time is available to emit verbal behavior, for example, a premium is placed on the primary verbal behavior and little time can be devoted to "saying it perfectly." Conveying the whole message (perhaps imperfectly) is more likely to be reinforced than is conveying a portion of the message in perfect form. Thus, under severe time constraints, verbal behavior is likely to be completely unedited, whereas under unlimited time conditions, verbal behavior may be edited thoroughly.

Some environments or audiences do not promote or demand vigilant self-editing. For instance, when talking or writing to a best friend, a speaker usually is not punished harshly for misspeaking. In therapy, speaking freely (i.e., speaking without concern for the probable consequences) is likely to be reinforced; although the therapist may prompt edits of the client's verbal behavior, the client is not burdened with saying things "just right." Similarly, diaries, journals, and other conditions when the only likely listener is the speaker uniquely tolerate unedited verbal behavior. In marked contrast, a professional audience sets the occasion for carefully edited verbal behavior. Self-editing is profoundly important when one is on an interview, speaking at a conference, or writing a scientific paper. Thus, just as any other operant, differential consequences make self-editing more likely in some contexts than others, and reinforced self-editing is likely to be repeated. (For a more detailed discussion of issues related to speech-for-others vs. speech-for-self, see Di-Camilla & Anton, 2004; Horne & Lowe, 1996.)

Support for the Operant Approach

Given the general importance of verbal behavior in human affairs and the central role that self-editing may play in enhancing communication, developing a thorough understanding of self-editing is a compelling goal.

Unfortunately, few behaviorally oriented empirical studies explicitly on this topic have appeared since *Verbal Behavior* was published nearly half a century ago.

The only basic research expressly investigating self-editing of which we are aware is an author-branded ''preliminary investigation'' by Hyten and Chase (1991). College students could send typed messages to an unseen listener, but were allowed to edit (modify or cancel) messages before sending them. Self-editing was especially likely to occur under a high probability of listener disapproval. More recently, Horne and Lowe and colleagues have systematically investigated the relations between speaker and listener repertoires (e.g., Horne & Lowe, 2000; Horne et al., 2004; Lowe et al., 2002; Lowe, Horne, & Hughes, 2005), a line of research related to self-editing, but the focus of that work has not specifically tackled self-editing as such (the conditions that promote errors and the self-correction of those errors). Applied findings emerging from a growing research program at Teachers College, Columbia University, have shown that self-editing repertoires can be taught and strengthened in children by, for instance, having them serve as editors for peers and more explicitly monitoring their reactions as readers (see Greer & Ross, 2004).[4] These few reports provide encouragement that self-editing is amenable to

laboratory study from the behaviorist perspective, but they do not constitute a systematic body of research such as would be necessary to test or develop theory.

PSYCHOLINGUISTIC PERSPECTIVES

Given the acknowledgment that self-editing is important to effective communication, and given the relative dearth of behavior-analytic work on the topic, it is reasonable to wonder what other scholars have contributed to the understanding of self-editing. Here we focus on the field of cognitive psycholinguistics because it has achieved something with respect to self-editing that behavior analysis has not: theoretical debate fueled by extensive empirical research. In the sections that follow, we provide a synopsis of the psycholinguistic analysis of self-editing. The psycholinguistic perspective is presented, for the most part, in its own terms to give the reader a more authentic sense of the approach. Conceptual translations and potential points of contact between cognitive psycholinguistic and behavioral approaches are offered in the final section.

Empirical approaches to self-editing within psycholinguistics are described here only briefly, because a review and evaluation of this work will be the subject of a separate essay. Numerous studies, however, have been devoted to one of two ends: interpreting naturally occurring speech errors and repairs, or generating them in the laboratory. The former approach depends on recording and transcribing naturally occurring spontaneous speech. Investigators may directly monitor their own or their friends' conversations, television or radio dialogues, and so forth. They also may analyze the data available in previously described corpora, some of which have been dissected by investigators for

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[4] In an ambitious analysis of verbal discourse in a group psychotherapy setting, McLeish and Martin (1975) recorded instances of verbal behavior that could be considered self-editing. Given that the autoclitic is fundamental to Skinner's interpretation of verbal self-editing behavior and that McLeish and Martin identified autoclitic functions among those most frequently involved in both discriminative and reinforcing roles in verbal discourse, their data provide support for the feasibility and importance of a behavioral analysis of self-editing. However, self-editing per se was never mentioned by McLeish and Martin, and certainly was not a focus.

more than 100 years (e.g., see Gold-stein, 1980; Nooteboom, 1980; Shat-tuck-Hufnagel & Klatt, 1980).

Laboratory procedures typically arrange conditions under which speech errors (original utterances, often involving malformed speech, that do not result in the antici-pated consequences)—often referred to as "slips"—are expected to be especially common (Baars, 1992b). Means for inducing errors of writing, signing, and speaking have been de-veloped (e.g., Baars, 1992a; Brow-man, 1980; Newkirk, Klima, Peder-sen, & Bellugi, 1980). For instance, simply enforcing time constraints (e.g., requiring speakers to say tongue-twisters within a specified time frame) increases the likelihood that a speech error will be made, regardless of the particular utterance features (Dell & Repka, 1992; Postma & Kolk, 1992; Postma, Kolk, & Povel, 1990). Researchers debate the ecological validity of laboratory-induced errors, but wide appeal exists in the level of control that can be achieved in the laboratory, and, as Baars (1992a) notes,

to the extent that we can plausibly stimulate the triggering conditions of natural slips in the laboratory, and *to the extent that we can find similar error patterns in consequence*, we can claim a successful simulation of natural slips. We now have a growing body of evidence that some of the causal conditions of real-world slips can be closely simulated in the laboratory. (p. 144)

Of course, accompanying production errors often are repaired (self-edit-ing), and, just as in a behavioral view, procedures that shed light on the conditions of errors are regarded as also shedding light on the conditions of self-editing.

Speech Production and the Theoretical Underpinnings of Psycholinguistic Theories

The bulk of scholarly work in linguistics, psycholinguistics, and cog-nitive psychology tends to view verbal behavior as an external index of cognitive speech production and com-prehension mechanisms. Chomsky (1965) underscores this point:

Linguistic theory is concerned primarily with an ideal speaker-listener, in a completely homogenous speech-community, who knows its language perfectly and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest, and errors (random or characteristic) in applying his knowledge of the language in actual performance. (p. 3)

Chomsky continues,

Hence, in the technical sense, linguistic theory is mentalistic, since it is concerned with discovering a mental reality underlying actual behavior. Observed use of language … may provide evidence as to the nature of this mental reality, but surely cannot constitute the actual subject matter of linguistics, if this is to be a serious discipline. (p. 4)

A linguist in the tradition of Chomsky, then, might consider speech errors to be uninteresting malfunc-tions of the underlying linguistic system. Bierwisch (1981), for example, asserted that "changes in the general circumstances of behavior … must be excluded from consideration" (p. 622). Cognitive psycholinguistic work on self-editing retains an em-phasis on revealing underlying cog-nitive mechanisms but is more grounded in the situational nature of speech errors. Psycholinguistic scholars regard speech errors as informative about underlying cogni-tive mechanisms and attempt to integrate their observations into models that, as is typical in cognitive psychology, hypothesize mental structures and processes as meta-phors for presumed physical pro-cesses in the brain (Anderson, 1995; Steinberg, 1993).

As conceptualized by psycholin-guists, self-editing is the conjunction of three processes: the covert or overt *self-repair* of our *speech errors* de-tected through some system of *self-monitoring*. These components of self-editing are considered to be part

of the more general process of *speech production*. Although cognitive theorists debate the specifics of speech production, most appear to agree with the general framework summarized below (based on Bierwisch, 1981; Finnegan, 1999; Harley, 2001; Levelt, 1989; Postma, 2000; van Wijk & Kempen, 1987). The terminology used here may not conform to that employed in a particular model of speech production, but the general concepts are consistent across many models (and are presented in psycholinguistic terms).

Most psycholinguists assume that language production consists of four processes, each managed by a cognitive system or module specialized for the purpose: conceptualizing, formulating, executing, and monitoring. The conceptualizing process prepares the nonlinguistic conceptual "contents" of speech. That is, the ideas behind what is to be expressed are organized without concern for any constraints on what is permissible within a particular language. The formulating process transforms abstract content into a representation of how the utterance should be articulated. That is, the concepts are put into appropriate syntactic form. Next, the executing process prepares the articulatory form of the utterance in accordance with morphological and phonological rules of the operative language. The monitoring process, postulated to operate during the formulating and executing stages, verifies that the expression of the utterance matches the speaker's conceptual intentions. When the speech output does not match the intention, a *speech error* is committed.

The above is a true symbolic model inasmuch as there is no independent evidence that mental structures believed to manage the four stages of language production actually exist (Julià, 1983; Marx, 1963). Behavior analysts may object to this reliance on hypothetical constructs, but for present purposes, the model is a useful

context into which to place three elements of self-editing as conceptualized by cognitive psycholinguists: speech errors, speech- or self-repairs, and the process of speech- or self-monitoring that oversees the repair of errors.

Speech Errors

At a general level, in psycholinguistic terms, speech errors are defined as discrepancies between communication intentions and overt verbal behavior (Levelt, 1983). Many speech errors fall into four broad categories: semantic, syntactic, phonological, and morphological (examples that follow are from Stemberger, 1989). Semantic errors involve lexical access errors including word substitutions such as, "Are you *hot*? No, I mean are you *cold*?" as well as word blends such as, "I just saw one go zipping *bast* (by/past)." Syntactic errors include lexical shifts and pure syntactic errors such as, "I know *to how*—how to put on my shirt!" or, "Why *he closes* the book (does he close)?" Morphological errors include slips such as, "I had never *connect* them (connected)." Phonological errors include the interference of a sound from one word or within a word with the production of another word. For example, "I found the *fin*—pin" or "do *bolar pairs* swim (polar bears)?" Errors can be broken down further into specific types of blends, substitutions, ordering, contextual, within- or between-word errors, and so forth, but these four broad types map roughly onto the stages of speech production described earlier (see Stemberger, 1989; Wijnen, 1992).

Psycholinguists have proposed many systems for classifying speech errors (e.g., Fromkin, 1980; Harley, 2001; Postma & Kolk, 1990; Stemberger, 1989). Perhaps the simplest distinction is drawn between *systematic* and *unsystematic* errors. This typology most often is associated with

developmental aspects of language acquisition, but for present purposes it offers a basis for understanding what kinds of speech phenomena are included as speech errors.

Systematic errors are those common to a given time period in the acquisition and development of language (Harley, 2001; Stemberger, 1989; Wijnen, 1992). These types of errors are mainly morphological or semantic in nature and involve extensional usage of morphemes, words, or phrases (de Villiers & de Villiers, 1992; Harley; Steinberg, 1993). Systematic errors include overextensions, underextensions, and overregularizations (see de Villiers & de Villiers and Harley for additional systematic errors). For example, children commonly overregularize the *-ed* past tense or *-s* plural formations, resulting in sentences such as "I runned so fast it hurted my foots." Systematic errors such as these are important developmental markers of children's language acquisition (Anderson, 1995; de Villiers & de Villiers; Harley), but to the extent that these kinds of systematic errors rarely occur in normal adult speech, they are not the types of errors usually considered in self-editing research. *Unsystematic errors* are not characteristic of any single period of language development (Harley; Stemberger; Wijnen).[5] Although morphological aspects sometimes are involved, phonological aspects of language appear to play a greater role in unsystematic errors than in systematic errors (Fromkin, 1980; Harley; Stemberger). From this point forward, and unless otherwise stated, the term *speech error* will refer to unsystematic errors.

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[5] To call this second type of error unsystematic or random is a bit of a misnomer, because there are detectable patterns in their characteristics (e.g., see Cutler, 1981; Fay, 1981; Garrett, 1982; Nooteboom, 1969; Stemberger, 1992). What contrasts them with so-called systematic errors it that they are not hallmark occurrences at any particular time in life.

Speech Repairs

Linguists typically make two kinds of distinctions among repairs (Finnegan, 1999). The first is between those that are initiated by the speaker (self-initiated) and those that are initiated by a listener (other-initiated). Self-initiated repairs often occur during the flow of ongoing speech, and, consistent with Skinner's (1957) notions, are held to occur occasionally before the inappropriate speech has become audible to the listener. In the case of other-initiated repairs, the listener appears to have detected an error, but not to have labeled it overtly. For instance, a listener may ask a question to evoke the repaired form (e.g., Bob: "Fred, I saw the new movie from George Jucas last night!" Fred: "The movie by George *who*, Bob?" Bob: "You know, the new *George Lucas* film!" Fred: "Yeah, of course … how was it?").

The second distinction is between repairs that are completed by the speaker (self-repaired) and those that are completed by a listener (other-repaired; e.g., Fred: "You mean George *Lucas*."). Based on this categorization, there are four primary types of speech repairs: self-initiated/self-repaired, self-initiated/other-repaired, other-initiated/self-repaired, and other-initiated/other-repaired. Only a self-initiated self-repaired correction of an utterance is properly called the final step of self-editing.

In their attempts to understand self-editing and speech repairs, psycholinguists tend to focus heavily on the self-monitoring process (perhaps primarily a self-listener repertoire). Indeed, self-repair often is defined in terms of a presumed process of self-monitoring: "Self-repair comprises error detection, interruption, or cutoff, and the correction itself" (Postma & Kolk, 1993, p. 474).

Self-Monitoring

Self-monitoring is the name given to the process of comparing articu-

lated speech (or planned articulation) to intended speech (i.e., a process that relies on a comparison of actual vs. predicted consequences of verbal behavior). According to most models, humans monitor their own speech in terms of syntax, semantics, and phonology (Baars, 1992b; Fromkin, 1980; Harley, 2001). *What* is monitored is assumed to be speech production, but *how* it is monitored is a matter of debate among theorists. In the latter case, theories of monitoring vary in terms of their fit on three dimensions: editing versus boosting, conscious versus automatic process, and production versus perceptual criteria.

Editing versus boosting. Models of monitoring differentiate in terms of the extent to which they emphasize editing or boosting in the control of errors. Mattson and Baars (1992) describe editing as an inhibitory process that decreases the probability of making an overt or covert error (cf. punishment), whereas boosting is an excitatory process that increases the probability of a correct (i.e., appropriate and error free) response (cf. reinforcement). Invoking editing implies at least two mechanisms of speech production: one that produces the utterance (according to the general speech-production model described earlier) and one, the monitor or editor, that detects and corrects errors by comparing the intentions and output of the first. Some psycholinguistic theories rely solely on boosting (i.e., they include no editor), whereas others assume the presence of one or more editors.

Conscious versus automatic processes. Models also differentiate along the dimension of consciousness, where conscious editing reflects awareness of the error and its deliberate correction (but not necessarily of the processes; Mattson & Baars, 1992; Postma, 2000). Models that propose a single editor typically involve conscious editing. Models that rely on boosting or propose several different editors often involve independent but largely automatic, nonconscious processes in monitoring and editing.

Production versus perceptual criteria. A third dimension that differentiates models involves the criteria used for editing. Some models (i.e., boosting models, automatic multi-editor models) stress production criteria; that is, the same processes used to produce the utterance (cf. speaker repertoire) are presumed to underlie the monitoring and editing of the utterance. Models that involve conscious editing, on the other hand, tend to stress perceptual criteria. In these models, monitoring and editing originate from the same processes that guide the perception, evaluation, and comprehension of other people's speech (cf. listener repertoire).

Varieties of theoretical models. Many models have been developed over the past 20 years or so, three varieties of which have garnered considerable attention (Mattson & Baars, 1992; Postma, 2000; Sellen & Norman, 1992). These include the neurolinguistic control model (Laver, 1973, 1980), the perceptual loop model (Levelt, 1983, 1989), and spreading activation models (Dell, 1985, 1986; Dell & Reich, 1980, 1981; Dell & Repka, 1992; Mattson & Baars, 1992). It is impossible to delineate these models in detail here (see Postma, 2000, for a recent review), but the continua described above help to distinguish among them. The neurolinguistic control model involves multiple editors that are primarily automatic and reliant on production criteria plus a final, primarily conscious editor that emphasizes perceptual criteria. The perceptual loop model promotes a single editor that consciously filters certain endpoint perceptual criteria. Finally, spreading activation models subscribe to a monitoring system based on boosting (no explicit editor): Combined activation and inhibition of production structures result in

a bias toward the particular "correct" output, thereby minimizing errors. The mechanisms are focused on production criteria and are essentially all automatic.

A CRITIQUE

Pepper (1942) argued that meaningful debate is impossible across the boundaries of contrasting theoretical styles, or world hypotheses, and it has been noted elsewhere that behavioral and cognitive approaches to psychology reflect different world hypotheses (Hayes & Brownstein, 1986). Predictably, adherents to psycholinguistic and behavioral approaches to verbal behavior traditionally have dismissed each other as irrelevant (Horton & Dixon, 1968; Place, 1983, 1991; Richelle, 1976; Skinner, 1977; Vargas, 1991; Winokur, 1976). Pepper predicted that a theorist holding one world hypothesis can never persuade a theorist holding a contrasting world hypothesis. This is not the same, however, as asserting that a field can never profit from considering the efforts of other scholars. Indeed, Harzem and Miles (1978) suggested that one of the greatest assets of behavior analysis is its amenability to conceptual translation and revision of concepts derived from its own science as well as those imported from other scholarly communities.[6]

On Structure Versus Function

In general, cognitive psycholinguists have treated self-editing as a by-product of speech production and speech errors as evidence from which to infer the processes involved in speech production (Baars, 1992a; Norman, 1981; Sellen & Norman,

1992). Rarely has the traditional approach treated or conceptualized self-editing as a subject matter in its own right. From a psycholinguistic perspective, a speaker cannot help but self-edit, because the "wiring" of the relevant speech production modules requires this.

Such a focus on hypothetical constructs has led to a proliferation of theories that are difficult to distinguish empirically (Postma, 2000). Relatively little concern is expressed over the fact that many theories can account equally well for most currently documented error patterns, in part because the theories are abstract and therefore admit interpretative loopholes (Fowler, 1981; Stemberger, 1982). A cynic might suggest that theory building, and not the explanation of data, is the endeavor of primary interest. MacKay (1980) succinctly captured this problem:

An additional, as yet undiscussed problem is that studies of speech errors constitute a type of problem-solving discipline involving proof by adduction. We adduce answers to problems. … The answers provide a satisfactory explanatory fit to the problem they are designed to solve, but since most problems can be solved in many different ways, any one solution may be nonunique. Theories based on adduction must be supplemented by more powerful verification. (p. 324)

Psycholinguistic and behavior-analytic approaches to self-editing thus differ in fundamental ways, the most obvious of which is relative emphasis on structure versus function (by no means a new way of characterizing the difference between cognitive and behavioral approaches; e.g., see Hayes & Brownstein, 1986; Hineline, 1980; Palmer, 1999; Reese, 1991).

Psycholinguists emphasize structural aspects of verbal behavior such as the form of errors produced by different stimulus conditions and the possible underlying mental or linguistic structures that give rise to those errors. Because self-editing is viewed as a marker or a by-product of the presumed modules of the speech

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[6] To his credit, Skinner attempted several translations of psycholinguistic concepts into behavioral language. For instance, Skinner (1986) reasoned that the autoclitic frame evolved due to collateral effects on the listener and that this is tantamount to the traditional concept of universal grammar.

production system, only rarely is the hypothetical status of these modules, and the system they represent, acknowledged (e.g., Fowler, 1981; MacKay, 1980; Stemberger, 1982). Assuming the existence of an autonomous speech production system also prompts the adoption of separate strategies for the investigation of language-related and other behavioral phenomena, an approach that has been challenged only rarely from within the psycholinguistic community (e.g., Bierwisch, 1981; Fowler; Sellen & Norman, 1992).

The traditional linguistic focus on "ideal" systems largely ignores the fact that real speakers must speak at appropriate times in appropriate ways for their language to be effective, and "errors," like "correct" speech, are real behaviors that must have real causes. (And it is worth noting that in that sense, *error* is a misnomer—"flawed" utterances are predictable if the relevant controlling conditions are identified.) Perhaps because of the emphasis on ideal systems, there appear to be no cases in which exceptions to the conclusions of traditional linguistic analysis do not exist (Bloomfield, 1933; Deacon, 1997; Finnegan, 1999; Meara & Ellis, 1981; Whorf, 1956). Presumably this is true with regard to speech errors, but theoretical systems influence empirical efforts, and not all kinds of speech errors are considered in most psycholinguistic analyses (see *On Empirical Potential* below).

By contrast, Skinner (1957) characterized self-editing as "an additional activity of the speaker" (p. 267) rather than a side effect of the speaker's "real" behavior (i.e., the speech-production-gone-wrong perspective) or a phenomenon somehow fundamentally different from other behavior. Consequently, whereas none of the psycholinguistic models inherently accounts fully for the effects of environmental changes on speech production (because they pri-

marily focus on ideal processes), a behavioral analysis is especially well suited for just such a task: seeking to explain what *does* happen, not hypothetically what *should* happen. Skinner's view of grammar, for example, is unencumbered by fixed units based on structure or response form (Mabry, 1993; McLeish & Martin, 1975; Richelle, 1976; Skinner, 1957, 1986). In the Skinnerian framework, there can be no exceptions to which the general processes of verbal behavior do not apply. Skinner's (1957) emphasis on pragmatic epistemology, requiring one's explanations to remain close to one's observations, makes paramount the study of individual variation as a function of environmental stimuli (Leigland, 1989; Skinner, 1966; Winokur, 1976).

On Speech Production

The general process of self-editing as explained by Skinner (1957) contains parallels to the modal model of speech production that provides the context for psycholinguistic investigations. Skinner contended that self-editing begins with the production of raw verbal behavior according to the basic behavioral principles that control emission of verbal operants (e.g., mands, tacts). This initial raw stage bears theoretical similarity to the conceptualizing stage in the typical psycholinguistic model. Of course, the presumed origin of the raw conceptions differs between approaches. In the psycholinguistic account, initial raw verbal material is treated as symbolic of an individual's "ideas," whereas in the behavioral account it is viewed as a function of environmental stimuli and contingencies. Nevertheless, both approaches recognize a raw, unformed quality in the beginning of the process.

Next, according to a Skinnerian account, autoclitic responses occur that provide the "grammar" and

form to the verbal behavior. Similarly, the second stage in the general psycholinguistic model is the formulating stage, in which the conceptual contents are formed into plausible (i.e., grammatical) form.

Once in plausible form, the verbal response advances to the executing stage in psycholinguistic terms, but to the review stage in Skinner's (1957) analysis. In the psycholinguistic account, *executing* simply means releasing the verbal material to a listener, whereupon a monitoring process is initiated in which the speaker monitors online his or her verbal material. If the monitoring process detects errors (verbal behavior not likely to be understood, i.e., not likely to produce appropriate listener behavior), the verbal material is shuttled back to reformulation, reexecution, remonitoring, and so on until the speaker is satisfied with his or her utterance (i.e., appropriate consequences follow).[7] Nothing in this sequence of events directly contradicts the process outlined by Skinner. In Skinner's analysis, the review stage refers to releasing the verbal behavior to, and noting its effects on the self-listener, which may occur prior to or simultaneously with release to an external listener. This parallels the psycholinguist's initial executing and monitoring stages. Once properly reviewed, the verbal behavior is changed (a new response is reformulated) if necessary, via autoclitic responses and then emitted (reexecuted) to the self-listener or other prospective listeners. As long as the emission of verbal behavior makes contact with a listener, self or other, its effectiveness can be reviewed. Thus, as in the psycholinguistic account, the particular verbal behavior can be changed and emitted until the speaker is satisfied, or in behavioral terms, until the speaker's verbal behavior receives appropriate consequences from the listener. Thus, although psycholinguistic and behavioral accounts of self-editing are incompatible in terms of styles of theorizing, at an operational level they have much in common.

On Speakers and Listeners

Psycholinguistic theories assume that the target of self-editing is speaker behavior, that is, the utterance under composition, but a behavioral approach suggests that this use of the term *self-editing* is misleading. Central to a behavioral approach is that the ultimate determiner of verbal behavior is the effect on the listener, and listener behavior looms large in speech errors and their repair:

How is it possible, from the point of view of a functional theory of meaning, for one ever to say "what one does not mean" or "not to say what one means to say"? The autoclitic expression *That is not what I meant to say* is easy to explain when the *listener* has reacted inappropriately, as if to another response. *I meant "light" in the sense of illumination, not as opposed to "heavy"* is a further specification of the variables responsible for the speaker's behavior, which will presumably have a more appropriate effect on the listener. But the speaker is not likely to misunderstand *himself* in this sense. When he discovers that he has not said what he meant to say, he is acting in his role as self-listener. His verbal slip, for example, comes as a surprise, and he reports that he "meant to say" another word. Or when a subtle or difficult state of affairs exerts only tenuous stimulus control, but general conditions of strength nevertheless produce verbal behavior, he may comment upon the inadequacies of his behavior by saying *That isn't quite what I mean*. He reacts to, and comments upon, the appropriateness of his behavior to certain controlling variables. (Skinner, 1957, p. 370, Footnote 3)

Clearly, in Skinner's view, self-editing is speaker behavior that adjusts for listener behavior (i.e., unexpected effects on the listener). From this perspective, the psycholinguistic distinction between *self-edited* and *other-edited* is a spurious one. The pro-

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[7] The prefix *re-* is used here to reflect the self-perpetuating nature of verbal behavior and the consistency of theme or meaning in overtly edited material. It is recognized, however, that overt edits are, in essence, new or additional verbal behavior.

cess by which an external listener corrects a speaker's error bears similarity to—indeed, provides the experiential roots of—the process by which a self-listener influences a speaker's verbal compositions. That the former requires two bodies and the latter one is a detail of physiology, but psychologically speaking, the two cases are largely interchangeable. Self-editing is, in this sense, always other-editing, unique only insofar as the "other" (i.e., repertoire) resides within the same skin as the speaker.

Skinner's (1957) analysis of verbal behavior thus places dual emphasis on speaker and listener repertoires (e.g., Catania, 1980; Holz & Azrin, 1966; Horne et al., 2004; Lodhi & Greer, 1989; Skinner, 1957, 1986). By contrast, much traditional psycholinguistic research has been dominated by topics invoking the perception and comprehension of language, that is, listener behavior (e.g., Cutler, 1981; Harley, 2001; Steinberg, 1993). Because, structurally speaking, self-editing involves the production of speech (cf. Cutler), the study of self-editing has demanded that psycholinguists consider the speaker's point of view. They have done so, perhaps with incautious abandon, as illustrated in the earlier discussion on speech production theories. Most cognitive theories of speech production are unbalanced models that focus exclusively on speaker repertoires.

Skinner's (1957) balanced emphasis on speaker and listener behavior suggests a means of elucidating two vague concepts in the psycholinguistic account: intention and monitoring. In a representative exposition, Norman (1981) asserted that, "For a slip to be … caught … there must exist some monitoring mechanism of behavior—a mechanism that is separate from that responsible for the selection and execution of the [verbal] act" (p. 3). Thereafter, "For a slip to be detected, the monitoring mechanism must be made aware of the

discrepancy between intention and act" (p. 11). In psycholinguistic theories, therefore, intention is viewed as both necessary and given (e.g., Bierwisch, 1981; Norman; Stemberger, 1982), yet little consideration is given to what exactly intention is or how it comes to be. Monitoring, as evidenced in one's reaction to one's own composition, implies evidence of a "monitoring mechanism" whose behavior is inferred, but whose basis in the natural world remains unspecified. This state of affairs is untenable to the behavioristic theorist, but note that Skinner's analysis, too, posits two processes, albeit more mundane ones. "Intention" loses its mystery if (as Skinner argued) it is embodied in the publicly observable controlling variables that underpin the speaker repertoire (e.g., our histories on the basis of which we predict what the outcome of our verbal behavior will be); monitoring requires no special mechanism if it is simply the expression of a listener repertoire. Put another way, intention may be thought of as the reasons why speakers "speak," and monitoring as what self-listeners do. Thus, the natural-world anchors of these concepts exist in the contingencies that control speaker and listener behavior.

On Dimensions of Theoretical Models

The compatibility of psycholinguistic and behavioral approaches to self-editing can be explored in terms of the continua along which psycholinguistic models of monitoring are often described: (a) editing versus boosting, (b) conscious versus automatic, and (c) production versus perceptual criteria. Where does Skinner's (1957) account of self-editing fall along these continua?

Consider the continuum of editing versus boosting. Boosting seems consistent with a Skinnerian account in that it captures the notion of gradually building up an effective verbal

repertoire (i.e., increasing probability of correct responses) through reinforcement (cf. activation in spreading activation models) and punishment (cf. inhibition in spreading activation models). Yet editing models, with their focus on decreasing the probability of making errors, also seem to fit with the premium Skinner placed on punishing contingencies in the (at least initial) control of self-editing. In addition, the two mechanisms required by editing models—one to produce utterances, another to examine the output of the first for errors—echoes the emphasis Skinner placed on an individual acquiring the role as both speaker and listener.

Next, consider the continuum of conscious versus automatic processing. Recall that conscious editing involves awareness of the error and the correction, but not necessarily the processes involved in detection, selection, and editing, whereas unconscious editing involves independent but automatic monitoring and editing processes. Skinner's (1957) account anticipates the near-autonomy of these processes, in that monitoring is primarily listener behavior and editing is speaker behavior (informed by listener behavior). At the same time, an interdependence suggestive of "awareness" is required: the speaker must "know" the self-listener response to the speaker's behavior. In other words, the self-listener's response must function as an effective discriminative stimulus for the speaker's next behavior. Nevertheless, in a behavioral account, the processes must be regarded as largely automatic in the sense that self-editing behavior is a deterministic phenomenon under strict (local and historical) environmental control. As a well-practiced part of an individual's complex verbal behavior, it is unlikely to require conscious deliberation in most cases.

Finally, Skinner's (1957) account speaks to both ends of the continuum of production-based versus perceptually based editing criteria. Production criteria models emphasize that monitoring and editing require the same processes necessary to produce the original utterance, whereas perceptual criteria models stress the importance of the processes that allow monitoring and evaluation of other people's verbal behavior. In Skinner's account there is no conflict between these two possibilities. Production is a speaker-based process, and perception is a listener-based process. The two are interdependent, and both are integral to self-editing behavior. It is clear that by emphasizing speaker and listener repertoires within the same individual—repertoires that are shaped by and sensitive to environmental contingencies—Skinner's account of self-editing avoids potentially false dichotomies while anticipating the key issues with which scholars have wrestled in crafting psycholinguistic theories of self-editing.

On Empirical Potential

Controlling variables. The psycholinguistic literature only rarely discusses what conditions must exist to maintain or disrupt self-editing behavior. Moreover, when functionally relevant conditions are suggested, they are by and large in the form of obscure hypothetical entities (e.g., the speaker's mood, comfort, motivation) with no behavioral anchors offered. On occasions when the psycholinguistic literature does talk specifically about independent variables of error generation or repair (e.g., Baars, 1992a; Butterworth, 1981; Dell, 1986), empirical techniques tend to be characterized in terms of their capacity to create (a) time pressure, (b) competing plans, and (c) overloaded capacity. These concepts perhaps are best considered by discussing the details of relevant experimental procedures, a task that is beyond the scope of the present article. However, it should be noted

that specific methods often combine two or more of these variables to produce changes in the type and rate of errors and editing. For example, Cutting and Bock (1997) used a competing plans technique plus time pressure to induce blend errors. Pairs of idioms were presented to speakers (e.g., "eat your words" and "swallow your pride") and after a brief pause, speakers were prompted to reproduce one of the two idioms (i.e., two competing plans) as quickly as possible (i.e., under time pressure). A "1" prompt indicated the speaker should produce the idiom presented on top; a "2" prompt required production of the bottom idiom. Errors occurred in the form of blends such as "swallow your words," "eat your pride," or "eat your pride words." For present purposes, we note also that Skinner's (1957) analysis of verbal behavior anticipates all three classes of variables, and, in some cases, more fully operationalizes them.

It is widely accepted that psychological processes take time to unfold, and that they unfold incompletely under time constraints. Skinner (1957) explicitly identified time pressure as affecting both the quality of speaker behavior and the opportunity for self-listener behavior. Time pressure also is straightforward to incorporate into experimental procedures, as measuring units of time and manipulating response deadlines generally do not pose major logistical problems.

"Plans" of any sort, competing or otherwise, are difficult to study because, if they exist at all, they often operate within the skin. That is, although observable stimuli may exert control over the various verbal alternatives that we could at any particular moment emit, the alternatives usually are not emitted overtly. Of course, sometimes we talk about "plans" in response to public stimuli such as being asked "What are you doing this weekend?" or "What are you planning to say to him?" but

even then there likely are alternative expressions of the overtly emitted verbal behavior that remain covert. This notion of "competing plans" as paramount in self-editing behavior then seems to be simply a manifestation of the fact that behavior, verbal or otherwise, nearly always occurs in the context of multiple contingencies. Indeed, Skinner (1957) wrote extensively about the importance of "multiple contingencies in near-simultaneous operation," or "multiple causation," in creating unclear, flawed, or ineffective verbal behavior (e.g., see chap. 9).

Cognitive psychologists often assume that mental systems hold "information" but have limited "capacity" (e.g., Navon & Gopher, 1979). "Overloaded capacity" is sometimes invoked as a reason why competing plans create speech errors; too little capacity is available for each plan (i.e., the probable response to a potentially controlling contingency) to be fully considered separately (e.g., Baars, 1992a). In this sense, overloaded capacity is synonymous with multiple causation. In a mundane but important sense, however, all verbal behavior is subject to capacity limitations. The physical apparatus that forms speech and other types of communication can accomplish limited movements at a given instant. Thus, multiple causation creates a challenge for the speaker because not all possible utterances can be expressed simultaneously. Behavioral researchers are experienced in arranging and studying this kind of response competition involving nonverbal behavior (e.g., Kollins, Newland, & Critchfield, 1997). One empirical lesson is that, under many circumstances, response competition creates a "division of labor" between sources of control (e.g., Herrnstein, 1970). At a momentary level, prepotency may alternate rapidly between various sources of control (Hinson & Staddon, 1983; Shimp, 1969; Skinner, 1957), creating, at

a molar level of measurement, a sort of blending of repertoires (e.g., errors such as "go zipping *bast*," blending *by* and *past*; Stemberger, 1989).

Applying an experimental analysis. The preceding discussion notwithstanding, psycholinguistic researchers have devised numerous procedures for inducing speech errors that might be the focus of self-editing. This essential precondition to a scientific analysis of self-editing has been all but ignored in behavior analysis.

Within the context of structural psycholinguistic theories, however, a rich database exists in which potentially informative phenomena are considered to be uninteresting. For example, because of their theoretical emphasis on the structure of language and of language production systems, psycholinguists largely have neglected "content" edits, which function primarily to clarify meaning (e.g., *No, no—I meant "right" in terms of "correct," not as opposed to "left"*), in favor of "form" edits, which function primarily to correct a physical (i.e., structural) error (e.g., *The play was hilarical* [blend of *hilarious* and *hysterical*]—*I mean hysterical!*). This approach leaves much verbal behavior beyond analysis. Form errors are relatively easy to detect and categorize, but content errors are nearly impossible to treat in the same structural way because they require some attention to listener reactions. It is only when the listener (self or other) reacts (e.g., a confused look, inappropriate behavior, or a verbalization that he or she did not understand) that a speaker is prompted to edit in the sense of clarifying or revising the content of his or her verbal behavior.

As an alternative to the traditional psycholinguistic approach, a behavior-analytic approach views self-editing itself as behavior of interest that is malleable by environmental conditions. Because a behavioral approach automatically takes into consideration the consequences of verbal behavior, it is more amenable to handling content- or clarity-oriented editing. A wider range of subtler editing techniques also becomes relevant in a function-based perspective. For example, a behavior-analytic account of self-editing would consider the type of autoclitic editing accomplished by instructions (Skinner, 1986), by paraleipsis (attaching an autoclitic to a verbal response that functions to assert that the verbal response is not really being emitted; e.g., *I will refrain from saying "I told you so," dear!*), by following a slightly audience-inappropriate verbal response with nervous laughter, or by emitting a verbal response that abruptly changes the subject (Skinner, 1957). In essence, the behavior-analytic approach is ideally suited to unveiling the significance of self-editing in relation to its controlling variables, relations that sometimes are obscured in psycholinguistic analyses.

Skinner (1957) did not present any empirical findings to support his analysis, but it is often argued that *Verbal Behavior* is rife with suggestions for empirical investigations (e.g., Sundberg, 1991).[8] For instance, Skinner noted that edited responses often carry a sense of urgency that reflects conditions of perceived time pressure, and that silence often facilitates or sets the occasion for self-editing. Psycholinguistic research clearly has shown that as response-time restrictions increase, the rate of overt errors and disfluencies (e.g., pauses, hesitations) increases (e.g., Dell & Repka, 1992; Nooteboom, 1980; Postma & Kolk, 1990, 1992; Postma et al., 1990). However, given different research goals, psycholinguistic researchers have not investigated directly the impact of time pressure on the latency to correct

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[8] It is worth noting that suggestions paralleling those described here can be found in the works of Bloomfield (1933, 1939), De Laguna (1927/1973), and Whitney (1971).

speech errors. Nevertheless, psycholinguistic research on self-editing illustrates that time pressure is readily manipulable, making Skinner's speculations about the effects of this variable eminently testable.

Skinner (1957) predicted that phrase blends (e.g., *you're probably true* from "you're probably right" and "it's probably true") should occur more often than word blends (e.g., *mizzling* from "misting" and "drizzling") because phrase blends, composed of misordered words but not nonwords, are less likely to be rejected (or have a history of punishment) by listeners. Such a prediction can be evaluated with the sorts of data sets that psycholinguists often generate (cf. Harley, 2001; Stemberger, 1982, 1992). Although psycholinguists have not routinely made frequency comparisons within an error corpus across levels of error types (e.g., syntactic-level errors such as *I'm making the kettle on* from "I'm making some tea" and "I'm putting the kettle on" vs. lexical-level errors such as *It's difficult to valify* from "validate" and "verify"), cross-corpora comparisons of error rates suggest that the relative frequency of phrase versus word blends is actually opposite to Skinner's prediction—phrase blends have appeared less common in natural corpora than word blends (Cutting & Bock, 1997; Fay, 1980; Stemberger, 1982). However, researchers have not specifically addressed the possible controlling variables for such a finding. They have, however, identified the relative frequencies of error types within levels. Specifically, at both the word and phrase levels, substitutions (e.g., *When does the game stop?* instead of "start") are more common than blends (e.g., *Let's go before the rain starps!* blending "start" and "stop"), which in turn are more common than deletions (e.g., *I just wanted to that …* instead of "to ask that"; Stemberger). Furthermore, research suggests that both phrase and word blends share

similar controlling variables such as phonological facilitation; that is, the crossover that results in the blend is likely to occur when the two targets sound most alike (Butterworth, 1981; Harley). On the other hand, a variable such as word frequency, which is plausibly related to strength of reinforcement history, has been shown to influence phonological errors more than semantic errors (e.g., Harley & MacAndrew, 2001).

Skinner also suggested that a functional understanding of verbal behavior would shed light on some of the "peculiarities of aphasias and other damaged speech" (1957, p. 218), a prediction that has been substantiated to some degree by researchers who work outside behavior analysis. For example, patients suffering agrammatism (aphasia distinguished by syntactic processing impairments, including difficulties in forming sentences, inflections, and parsing) make more phonological errors when reading function words compared to content words (Biassou, Obler, Nespoulous, Dordain, & Harris, 1997), and they tend to make more substitution and deletion errors than normal speakers, particularly with respect to low-frequency function words (Stemberger, 1984). Psycholinguistic research on speech errors and editing also has increased understanding of subtle speech differences in special populations such as Alzheimer's and Parkinson's patients (e.g., McNamara, Obler, Au, Durso, & Albert, 1992), schizophrenics (e.g., Cohen, 1978; Davis & Blaney, 1976), stutterers (e.g., Postma & Kolk, 1990; Yaruss & Conture, 1996), developmentally disabled individuals (e.g., van Borsel, 1988), children acquiring language (e.g., Stemberger, 1989; Wijnen, 1992), and second-language learners (e.g., Olynyk, D'Anglejan, & Sankoff, 1987). It stands to reason that behavior-analytic research could contribute in these areas as well.

It seems likely that behavior analysts who are interested in pursuing

an experimental analysis of self-editing could profit from the decades of experience accumulated by psycholinguistic researchers, who have learned how to generate speech errors (and attendant self-editing) in the laboratory without, it might be argued, fully understanding the independent variables that are operating. To be sure, the process of co-opting these methods would not be simple, because they so often have been employed and discussed toward the end of identifying "ideal" processes and hypothetical mental modules and processes. Moreover, these methods have been constructed almost exclusively to serve group-comparison experimental designs in which brief observations from many individuals are aggregated. Still, with some effort, motivated behavior analysts can realize prospects for adapting error-generation techniques to the study of functional processes in the behavior of individuals. One might use a competing-plans task similar to the idiom-blend producing task used by Cutting and Bock (1997) to investigate questions of strength of local reinforcement history. For example, if responding to one idiom over another is first differentially reinforced and then competing-plans tasks are given, will that history affect the rates at which particular blend forms occur? In any case, once the right methods are in place, it should be possible to evaluate self-editing as mundane behavior (e.g., as a pattern resulting from reinforcement schedules, possessing behavioral momentum, and competing with mutually exclusive responses as per the matching law). Such benchmark observations could provide a frame of reference in identifying the ways (if any) in which self-editing is different from other forms of behavior.

CONCLUDING REMARKS

In a generic sense, the task of analyzing verbal behavior is large enough that there is enough work for all who are interested. In addition, this task is complex enough that diverse forms of expertise may be helpful:

[Language] is truly a multidisciplinary problem that defies analysis from any one perspective alone, and where the breadth of technical topics that must be mastered exceeds even the most erudite scholars' capabilities. So it is hard to overestimate the immensity of the task or the risks of superficial analysis, and it is unlikely that any one account can hope to achieve anything close to a comprehensive treatment of the problem. (Deacon, 1997, p. 14)

Behavior-analytic and cognitive psycholinguistic approaches conceptualize the problem of self-editing rather differently and thus ask different types of questions. The fundamental structure–function division between behavioral and cognitive theoretical styles suggests that a hybrid approach to self-editing, incorporating theoretical tenets of both approaches, would be internally inconsistent and thus probably not of benefit (cf. Pepper, 1942; Vargas, 1991). Nevertheless, points of contact can be identified. The present discussion reveals that, beneath the idiosyncratic phrasing adopted by the two approaches, theoretical and experimental concerns are not as discrepant as first might be supposed (for similar observations, see Harzem, 1986; Julià, 1983; Marr, 1984; Morgan & Buskist, 1990; Stemmer, 1992).

It seems reasonable to propose that behavioral and cognitive psycholinguistic scholars may derive something of value from inspecting each other's work. Yet, if communication between scholarly communities is to take place, behavior analysts may have to initiate it. The psycholinguistic community apparently long ago dismissed the possibility of meaningful contributions from a behavioral perspective (Chomsky, 1959; Dulany, 1968; Garrett & Fodor, 1968; Horton & Dixon, 1968; Julià, 1983; Kanfer,

1968; but for a somewhat more optimistic appraisal, see Andresen, 1992). In the search for constructive strategies, it is clear what does *not* work. History shows that little is accomplished by arguing that those who disregard behavior theory simply misunderstand the relevant principles (see Hineline, 1980; MacCorquodale, 1970; also see Dulany; Kanfer; Maltzman, 1968), especially when, as appears to be convention, such arguments are logical rather than empirical in nature, and are promulgated in behavior-analytic outlets that are unlikely to reach the community of cognitive and psycholinguistic scholars (e.g., Donahoe, 1998; Eshleman, 1991; Hineline; Hutchinson, 1998; MacCorquodale; Morgan & Buskist, 1990; Newland, 1992; Place, 1991; Richelle, 1976; Salzinger, 1991; Schnaitter, 1986; Stemmer, 1992).[9]

Social psychology teaches that nothing breaks down stereotyping and prejudice like collaborative effort toward shared goals. To date, conceptual writings on verbal behavior have not convinced psycholinguists that behavior analysis brings anything of value to the collaboration. But data are hard to ignore. Behavior analysts' efforts to foster cross-talk may be most successful if they are anchored by empirical contributions derived uniquely from a behavioral perspective. If behavioral researchers can accomplish the equivalent of building a better mousetrap by generating useful data on self-editing, psycholinguists may not flock to their door, but they may be forced to respond to the theoretical system that spawned the data.

By considering the cognitive psycholinguistic approach, behavior analysts may be able to jump-start

their own experimental analysis of self-editing. Doing so will allow a thorough evaluation of the conceptual analysis offered by Skinner (1957), but the stakes are much higher than accomplishing an analysis of self-editing. Following the lead of Chomsky (1959), many observers have concluded that the analysis of verbal behavior showed behavioral psychology to be inadequate to deal with complex human functioning (Carroll, 2004; Payne & Wenger, 1998). Whether this is indeed the case can only be answered empirically. To be sure, empirical work on verbal behavior does exist (e.g., Critchfield, 2000; Eshleman, 1991; Normand, Fossa, & Poling, 2000), but advancement has been slow and largely isolated. Systematic empirical efforts on any topic in verbal behavior, perhaps particularly those that inspire cross-talk between theoretical camps, will help to advance the behavior-analytic cause.

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[9] Fowler (1981) similarly chastised mainstream researchers in the domain of self-editing and speech errors for not paying enough attention to neighboring areas of research and for publishing in periodicals that reach a restricted audience.

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