Protocol Analysis and the "Silent Dog" Method of Analyzing the Impact of Self-Generated Rules

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Within the cognitive literature, verbal protocols of cognitive events are plagued by difficult questions of unconsciousness, completeness, reactivity, and validity. In this paper we argue that these concerns apply with much less force or not at all when protocol analysis is used to determine whether a given instance of behavior is governed by self-generated rules. When adequate controls are used, some patterns of results allow this question to be answered unambiguously and in a manner untouched by the philosophical hurdles encountered within the cognitive literature on protocol analysis. We argue that in at least some circumstances a slightly modified version of protocol analysis allows us to know, in a functional sense, what a person was thinking. Protocol analysis can be very useful to behavior analysts who are interested in determining whether task-relevant behavior is controlled by self-generated rules or is purely contingency shaped.

The use of verbal reports as data has been the subject of renewed scientific scrutiny, within both cognitive and behavioral psychology (e.g., Russo, Johnson, & Stephens, 1989; Short, Evans, Friebe, & Schatschneider, 1991; Trabasso & Suh, 1993; Wulfert, Dougher, & Greenway, 1991; Wulfert, Greenway, & Dougher, 1994). Ericsson and Simon's (1993) *Protocol Analysis: Verbal Reports as Data* has structured some of the recent thinking in the area (see Hayes, 1986, for a behaviorally oriented review of the first edition of this book). They describe how to use verbal reports of ongoing tasks (e.g., a subject reporting aloud what he or she is already saying privately while performing a task or solving a problem) to construct *protocols*: scored transcripts to be studied with a particular purpose in mind.

As cognitive psychologists, Ericsson and Simon (1993) want to use overt verbalizations to assess underlying cognitive processes. The core of their argument, therefore,

is to justify the analysis of verbal protocols as data. The authors present considerable evidence that requiring verbal reports will usually not influence task performance under properly crafted conditions, using "talk-aloud" instructions that ask subjects to say in a continuous stream whatever they are saying to themselves at the moment. They also show that talk-aloud procedures produce no noticeable slowing of most types of task performance, but that modifying continuous talk-aloud instructions (e.g., telling the subject to report what he or she has been saying over the last 30 s) does alter the content of verbal reports.

THE BEHAVIORAL INTEREST IN PROTOCOL ANALYSIS

There has been an interest in developing methods to observe thinking since Watson, who was the first to ask subjects to think out loud while trying to solve a problem (Watson, 1920). What behavior analysts often see when they examine human cognition as a contextually situated action is a process of formulating and following verbal rules. To behavior analysts, rule-governed behavior is not merely a behavioral regularity that can be described by a rule (often a meaning of the same term in the

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cognitive tradition, Reese, 1991) but is instead behavior that is actually regulated by verbal antecedents (see Hayes, 1989, for a book-length review).

Early behavioral work on instructional control (Ayllon & Azrin, 1964; Kaufman, Baron, & Kopp, 1966) illustrated the powerful effects that rules can have on behavior. A series of studies in the 1980s showed that rules greatly alter the degree to which experimentally manipulated contingencies affect behavior (e.g., Catania, Matthews, & Shimoff, 1982; Hayes, Brownstein, Haas, & Greenway, 1986; Shimoff, Catania, & Matthews, 1981). For example, humans exposed to extinction schedules can show remarkable persistence if their behavior is rule governed, demonstrating that a change in the impact of direct contingencies is a "defining property" of instructional control (Shimoff *et al.*, 1981, p. 207).

The changes in performance produced by rules compared to control conditions can provide indications that behavior is rule governed even when no rules are explicitly provided by the researcher. Most behavioral researchers agree that rules need not be provided by others to have impact; they can be self-generated. Skinner, for example, argued that self-talk occurs as overt talk recedes in magnitude, and that speaking and listening can occur in the same person (Skinner, 1945, 1957). Thus, humans can formulate verbal rules privately and follow them while performing tasks.

An analysis of the impact of self-generated rules presents a special empirical challenge, however, because self-generated rules are private. This is the core of the same problem that led methodological behaviorists to reject self-reports of private events as unscientific. Skinner rejected that idea on behavioral grounds in the case of one's own private events (1945), but he did not do so in the case of another person's private events. It is not uncommon to hear behavior analysts say, "we can never really know what another person is thinking." In this paper we argue otherwise. We will describe how protocol analysis can, with the proper controls, permit the functional detection of some self-rules, and we will distinguish the kinds of controls needed for this purpose

from those needed for other purposes more common to the cognitive tradition.

COGNITIVE AND BEHAVIORAL QUESTIONS

Cognitive and behavioral psychologists ask different questions, and their interest in protocol analysis differs for that reason. Cognitive psychologists want to know (a) whether underlying cognitive processes are revealed in verbal reports, and (b) if so, whether those processes are the same as would be occurring without verbal reports. In other words, the cognitive interest in protocol analysis is focused on "verbal reports and the thoughts that generate them" (Crutcher, 1994, p. 243). We will term this the "do verbal reports reveal thought processes?" question. Conversely, behavioral psychologists want to know (a) whether ongoing task-related behavior is governed by covert verbal rules, and (b) if so, whether the overt verbalization is functionally (not literally) equivalent to these rules. We will term this the "are verbal reports functionally equivalent to rules?" question.

The differences in these questions reflect fundamental philosophical differences between the two approaches and consequently affect the use of protocol analysis in different ways. Much of Ericsson and Simon's (1993) book and the many objections to it that have arisen in the literature are relevant only in the context of the "do verbal reports reveal thought processes?" question. Ericsson and Simon develop a very specific methodology that links verbal reports to underlying cognitive processes: The verbal report must be task relevant, subordinate to the task, concurrent, and guided by the proper instructions. They essentially argue that the "do verbal reports reveal thought processes?" question can be asked and answered using protocol analysis when these methods are followed. However, additional controls to Ericsson and Simon's methodology are necessary to answer the "are verbal reports functionally equivalent to rules?" question. We will review the recent objections to protocol analysis from within the cognitive psychology tradition and consider their relevance to the analysis of self-generated rules. We will attempt to show that

these criticisms are deflated when considered from a behavioral position because the questions being asked differ. We will then address the necessity of several important controls that are required when using verbal protocols to assess rule governance.

OBJECTIONS TO ERICSSON AND SIMON'S PROTOCOL ANALYSIS

There have long been well-argued objections to the use of verbal reports as data. Nisbett and Wilson (1977) argued that people are largely incapable of revealing their cognitive processes and that, alternatively, their verbal reports are based on longstanding or socially desirable causal theories. Recent cognitive concerns about the use of protocol analysis (e.g., Crutcher, 1994; Payne, 1994; Wilson, 1994) have received wide consideration in psychology. For that reason we will briefly review the most important of these criticisms. In each case, the criticism is simply not relevant to the question behavior analysts wish to ask and answer with protocol analysis, although they may be relevant to the questions cognitive psychologists ask.

Objection 1: Unconscious or Automatic Processes May Not Be Accessible

Ericsson and Simon (1993) acknowledge that highly automatic thought processes or those not in verbal code (such as images) are difficult or impossible to report using talk-aloud procedures (Wilson, 1994). Although Ericsson and Simon minimize and others (e.g., Wilson, 1994) emphasize the centrality of this problem, it is only a problem if one wishes to study unconscious or nonverbal thought processes using verbal report. In contrast, the issue of unconscious activities does not adversely affect the "are verbal reports functionally equivalent to rules?" question. Many behavioral psychologists agree that "without the help of a verbal community, all behavior would be unconscious" (Skinner, 1971, p. 191) in the sense that it would be contingency shaped, not rule governed. In that case, however, self-rules are not immediately present and functionally important. Thus, although it may be true that protocol analysis does not provide

access to unconscious behavior, that is not a barrier to the behavioral use of this method.

Objection 2: Verbal Reports May Not Be Accurate or Complete

Another objection is that of the accuracy and completeness of verbal reports: Does the report give a full and exact description of the supposed underlying mental processes (Payne, 1994; Wilson, 1994)? From the cognitive perspective, the question of completeness is both important and problematic. Original "encoding" may be limited by the capacity of short-term memory, "depth of processing," location or storage of information, and the degree to which stimuli are heeded. Retrieval from memory may be further confounded by the need for proper retrieval cues, memory storage capacity, and so on. It is difficult but important to show that these details about cognitive processes are reflected accurately in verbal protocols.

The adequacy of verbal protocols to answer the "are verbal reports functionally equivalent to rules?" question is less difficult to demonstrate, however. From the behavioral perspective, rules are viewed as *functional* entities, and thus it is only necessary to determine whether self-generated rules and verbal reports have the same behavioral function, not that they are literally (word for word) identical to some private events. With some additional controls, described later, we believe that protocol analysis is fully adequate to address this empirical question.

Objection 3: Verbal Reports May Change Underlying Thought Processes

It is very difficult to know when a verbal report changes an inferred ongoing cognitive process or when it tracks such processes in a point-to-point fashion. Ericsson and Simon (1993) argue that the threat of reactivity is real, but is due to the nature of the individual task involved. Reactivity, however, is not a difficult issue for the "are verbal reports functionally equivalent to rules?" question because the issue is again one of functional equivalence, not topographical correspondence. From the behavioral perspective, when reactivity of verbal report is found, the utility of the resulting protocols

for an analysis of self-rules simply ceases. It is not necessary to take an a priori position about whether or how often this will occur. The controls needed to detect reactivity can simply be put into place, and the conditions under which protocols are useful can be determined empirically.

We know of no criticisms in the literature that have shown that protocol analysis is confounded or illogical when it is applied to the purpose behavior analysts have for it. Many of the logical problems described above come more from the vague qualities of mentalistic questions than they do from the method per se. Behavior analysts should not feel reluctant to use protocol analysis, provided that proper controls are used. It is to these controls that we now turn.

THE SILENT DOG METHOD

The senior author earlier described some of the additional methodological controls needed to use protocol analysis to answer the "are verbal reports functionally equivalent to rules?" question (Hayes, 1986). Because they were presented in a review of Ericsson and Simon's book, some readers mistakenly thought these points were Ericsson and Simon's, but they were not. In this paper we describe these controls in more detail so that behavior analysts may use them in their research program.

The method is labeled the *silent dog* method, after the Sherlock Holmes' mystery *Silver Blaze* in which Holmes knew the identity of a murderer because the dog in the stable had not barked when a horse was removed (Doyle, 1892/1986). In the silent dog method, it is the *lack* of a behavioral effect of self-report that suggests that performance is governed by a self-generated rule and that the verbal report is functionally similar to that rule.

There are three controls in the silent dog method, and all three must be present. First, it must be shown that performance on a task with continuous, concurrent talk-aloud procedures is functionally equivalent to performance without talk-aloud reports. Second, it must be demonstrated that task performance is functionally altered whenever modifications in the talk-aloud instructions

alter the ongoing stream of talk-aloud reports. Third, it must be shown that the verbal report produced in Control 1, when subsequently used as an external rule with other subjects, produces alteration in their task performance. If all three controls are employed, and the pattern of results is as described, then the performance can be said to be governed by rules and the talk-aloud protocols can be treated as the functional equivalent of these self-rules. In a functional sense, in these circumstances we can say that we know what a person was thinking.

Control 1: Functional Equivalence With and Without Talk-Aloud Reports

Requiring continuous talk-aloud report creates a myriad of verbal stimuli that could regulate behavior. If the dog barks – if a difference in task performance is detected between the two conditions – then protocol analysis cannot be used in this instance to determine the functional nature of self-rules, should any even exist. If the resultant task performance is identical under the talk-aloud and no-talk-aloud conditions, however, then we must deal with why these stimuli made no functional difference. One possibility is that (a) self-talk is functioning as a self-rule, and (b) there is no functional difference between the verbal report of self-talk in the talk-aloud condition and the self-rules in the no-talk-aloud condition. Consider, for example, a person who is covertly subtracting serial sevens. Asking that person to say out loud what is being said privately will in all likelihood not alter performance compared to a silent performance, because this is a heavily rule-governed process.

There are other possibilities, however, and thus other controls that are necessary. It is possible that concurrent verbalization is functionally irrelevant and the two performances are similar because of it. This could happen if the verbalization was task irrelevant, or only reported performance rather than governed it. For example, a person playing a well-practiced piano piece, such as *The Flight of the Bumblebee*, might be able to discuss something about the piece without impact ("now I'm playing the slow part") because playing the piece is contingency shaped and continues automatically

in the presence or absence of such verbalization. The other two controls provide protections in this case.

Control 2: Disrupting Ongoing Self-Talk Alters Task Performance

Suppose a person is asked whenever a bell rings to say out loud what he or she thought about over the last minute. Such instructions will surely change any self-talk that would otherwise be present because they demand summary statements, encourage self-evaluation, and shift the topic. If the performance is governed by self-rules, this new instruction must change performance compared to the no-talk-aloud condition. If no change in performance occurs, then there is no reason to suspect that the verbal protocol from the continuous talk-aloud condition is functionally a self-rule.

For example, in a talk-aloud condition with instructions "to summarize the last minute," the piano player may say, "I played well over the last minute," while continuing to roll out this well-practiced performance. Change in the talk-aloud instruction (from continuous report to summary report) does not matter in this instance, because the behavior is not rule governed to begin with. Conversely, a person who is covertly subtracting serial sevens will probably see his or her performance degrade if he or she has to describe the overall strategy followed over the last minute rather than saying out loud the actual sequence of verbal events ("76 minus seven, carry over the one, that makes it 69," etc.). Instructional modifications are necessary as a control in any study that employs protocol analysis to answer the "are verbal reports functionally equivalent to rules?" question, because there is no basis beforehand to know if a performance is rule governed.

It is important to remember that the nature of a task may evolve over time. Self-generated rules may contextually control behavior at the outset of an experiment, but they may not be utilized during the task-completion phase. It is likely, therefore, that task performance would vary as a result of any modification in talk-aloud reports, depending on the particular phase of the task in question. The more modifications that can

be made in continuous talk-aloud instruction, each with a similar result, the more this control applies with precision. For example, the subject might be asked to evaluate the performance, to relate it to other topics, or to report on only one aspect of ongoing private events (e.g., what the person's body feels like). A person who is covertly subtracting serial sevens will probably see his or her performance degrade in all these cases but not if continuous talk-aloud report is used (Control 1). The piano player may not see the performance degrade. If the behavior is rule governed, *all* modifications to the ongoing stream of self-verbalizations should alter performance. If none do, or some do and some do not, no firm conclusion can be reached.

Control 3: The Verbal Report from Control 1 Must Alter Others' Performance

This third control ensures that the lack of an effect in talk-aloud conditions compared to no-talk-aloud conditions (the result of Control 1) is not because the task is contingency shaped and the verbal report is itself automatic or task irrelevant. This is accomplished by utilizing the verbal report (from Control 1) as an external rule in another context, with different subjects. If the performance is rule governed and the self-reports are task relevant, then presenting them as external rules should alter performance.

For example, suppose a person doing serial sevens is simultaneously told out loud "76 minus seven, carry over the one, that makes it 69. ..." These external instructions will probably synchronize the performance to the external rule, eliminating some of the variability in unaided performances (it would be very hard for person fast at math to finish faster than the external rule without making errors). If the original verbal protocol contains errors, subjects hearing them will tend to make similar errors. The impact of these external rules helps to show that the verbal protocol is task relevant and thus makes it more likely that the silent dog in Control 1 reveals the functional impact of a rule. Conversely, a piano player who is given the instructions, "Please say anything that comes into your head as you play this piece of music," might talk about a wide

variety of things, none of which might alter the well-practiced performance of a second piano player.

CONCLUSION

If all three controls are used and the needed pattern of results is obtained, then we can conclude (a) that the task performance is governed by rules and (b) that the overt verbalizations (verbal reports) in the talk-aloud condition and the covert verbalizations (self-rules) in the no-talk-aloud condition are functionally the same. Under these conditions, we know what a person is thinking in a functional sense.

In the silent dog method, the intellectual and methodological burden of protocol analysis is much more limited than in the usual cognitive psychology situation. For that reason, it is not necessary to suppose that thinking aloud never changes cognitive behavior, that unconscious behavior is uncommon, or any of a number of such issues. It is only necessary to demonstrate a pattern of empirical results that can best be explained by self-generated rules that are functionally identical to the verbal protocol.

The controls necessary to satisfy the "are verbal reports functionally equivalent to rules?" question require considerable effort to mount and analyze, however. They are needed only when it is critical to determine that verbal protocols are functional rules. There are times, however, when verbal protocols are useful without the elaborate controls provided by the silent dog method. For example, sometimes self-talk is interesting in itself as a behavior and not because it necessarily controls anything. Suppose a researcher manipulates contextual variables and shows that talk-aloud protocols change as a result. If the researcher is truly interested in verbal reports per se, there is no need for the additional controls envisioned here: The behavior stands on its own.

When the controls are used, a failure to find the pattern needed for firm conclusions that the performance *is* rule governed does not mean that the performance is *not* rule governed. To take but one example, talk-aloud instructions might change performance (Control 1) because the material being discussed is socially valenced and the

person actively censors the resulting report. This self-censoring process might disrupt performance. In this case the "barking dog" is not grounds for a conclusion that the unaided performance is not rule governed. We do not know beforehand how often the silent dog method will lead to meaningful data about rule governance.

The analysis of verbal protocols may provide a useful contribution to the behavior-analytic study of rule-governed behavior and verbal behavior. If it can be determined that a verbal protocol is functionally equivalent to a rule, then the more normal behavior-analytic questions can be mounted. Behavior analysis needs to encompass behavior-behavior relations (e.g., between a self-rule and task performance) but the unit of analysis in behavior analysis is the action of a whole organism, situated in a current and historical context. Thus, the goal is to apply this unit of analysis to all behavior, including covert behavior. For example, if we can gain access to self-rules via the silent dog method, we can then ask in what contexts do particular self-rules occur, and in what context do self-rules guide performance in particular ways. Self-rules are not independent variables; they are dependent variables consisting of the speaking and listening of human organisms. Because they are covert, however, behavior analysts have not had a way to gain access to this important class of dependent variables. Protocol analysis, combined with the silent dog controls, provides a difficult but logical way to determine at least some portion of the self-rules that subjects generate and follow.

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