Verbal Behavior in the Measuring Process

Lawrence E. Fraley
West Virginia University

The behavior called "measuring" generates new stimuli that intraverbally evoke new and potentially more effective responding to the situation under investigation. The nature of the measurement-produced contribution to these supplementary antecedent controls is examined, particularly with respect to changes in what can then be said or known. A simple problem (fitting a tablecloth to a table) is analyzed with measuring prohibited. Autoclitically related tacts are seen to emerge and form statements intraverbally. The conclusion is that only when quantitative statements evoked by measurement records supplement the statements featuring autoclitically related tacts can a new and more effective level of responding occur.

If we can already respond effectively and sufficiently to a situation, it tends not to stimulate measuring. But if our behavior proves ineffective, measuring practices represent one class of behavior that such an impasse tends to evoke. Those measuring practices, in turn, provide a new class of stimuli, relevant to the situation, to which we can exhibit previously conditioned responses from our pre-conditioned quantitative repertoires. This general observation pertains to the measure of any kind of phenomena including the measure of behavior, which is performed in different ways depending on the nature of our interests and the analytical level of our approach.

New stimuli can bring new behavior to bear on a situation. Measuring produces such a new class of stimuli. Those stimuli then share in evoking previously conditioned behaviors that could not otherwise be evoked in the current situation. The new set of responses are usually more effective than responses to the stimuli otherwise already available. We prepare ourselves in advance for this kind of measurement-enabled improvement of behavior through our study of quantitative relations in general, mainly through a broadly ranging mathematics curriculum. That history conditions a large repertoire of environment/behavior relations having quantitative implications. The stimuli produced

from measurements will then selectively evoke behaviors from that general quantitative repertoire. For example, after measuring the floor of an elevator cab and recording "60" x 72", that recorded measurement might quickly evoke such intraverbal responses as "60 inches times 72 inches equals five feet times six feet – equals 30 square feet." The situation in general could also intraverbally evoke a reiteration of the fact that "on average, each standing adult requires a minimum of two square feet of floor space." These responses, in turn, could then quickly share in evoking, intraverbally, the observation that "concurrently, a maximum of 15 average adults could theoretically stand upright on the 30 square foot floor of that cab."

We often refer to the new measurement-produced stimuli as the "records" from our measurements – for example, the "33" that we might jot on paper as the range of motion in an arm swing after we have measured it, or the "14 hand raises" recorded as the total count of hand raisings during a classroom lesson. In response to such new stimuli we hope to have ready a pre-conditioned repertoire of behaviors that are more effective than those evoked by the previously available non-quantitative stimuli, as illustrated in the previous example. Usually, we can respond differently, and often more effectively, to "a 33

degree arm swing" than to "arm swing" (which is all that we had before we measured¹). A measurement practice, then, like probing and prompting, is a kind of intervention that enhances the evocative capacity of antecedent stimuli. Functionally, a measurement yields a kind of supplement to the antecedents that share in controlling subsequent behavior – hopefully yielding more effective forms of behavior.

TO MEASURE AND NOT TO MEASURE

The Nature of Measurement-Produced Stimuli

A person's behavior always produces some kind of effect on the environment that might, in turn, control that person's subsequent behaving. We have noted that data collected during the process of measuring fall into that category. Consider an analysis of an episode of measuring at a point before the measurement has occurred. Feedback from probes of the environment is occurring, but it is not evoking effective responding. For example, we might peer into the gas tank and respond verbally under stimulus control of the light reflected from the liquid surface: "Gasoline." Suppose that, in this case, effective responding would involve going to get more gasoline. But so far, all we have is our operant seeing (Skinner 1953, pp. 270-275) and the utterance of the name – two tacts each featuring a common evocative stimulus but different kinds of behavior. Neither seeing gasoline nor saying its name, nor both, evokes going to get more of it. Some enhancement to the antecedent controls on our behavior is needed if that more appropriate kind of responding is to be evoked, and as noted, the records produced through measuring constitute such enhancements. For example, the response "two and one-half gallons of gasoline" evokes a different repertoire of responses than "some gasoline." And, importantly, responses to the former can be

much more effective in many critical situations.

The datum produced by making a measurement is preserved as some kind of record. However, a record is not the same as the event to which it pertains. Thus, a measurement datum *per se* is not a property of the phenomena under study. Only the *dimension* of the measured variable is a property of that phenomena. For example, an environmental phenomenon might have points separated by distance and, thereby, the property called displacement (distance, length, etc.). But our statement occurring under stimulus control of that particular property measurement record – for example, that the given pair of points are separated by 27 centimeters, is a response to the result of a comparison performed by the measurer. The displacement of the points embedded in the subject phenomenon is aligned with a set of points separated by a standard distance (e.g., the standard meter). The measurement record symbolizes a tact of their difference. Thus, while the phenomena under study are intrinsically possessed of the property of linear displacement, the measurement record ("27 centimeters") is a measurement-produced stimulus that is a property, not of that being measured, but of the relation between a feature of the phenomenon under study and the standard meter (as represented by a ruler).

To summarize, once the measurement record is available, it represents a change in the antecedent stimuli controlling behavior with respect to what has been measured. Instead of responding exclusively to a stimulus embedded in the phenomenon under study and consisting of two salient displaced points without quantitative implications, we now respond partly or completely to the product of the measuring process. That record can occur in the form of a written or electronic recording of "27 centimeters," or as an intraverbally re-evocable verbal behavior. This record is a symbolic model of some comparison behaviors by the measurer and constitutes a stimulus different from a pair of displaced points embedded in the phe-

¹Note that two kinds of measurements are implicit in "a 33° arm swing," namely, counting the behavioral events (there was one) and measuring the extensity of that move. The indefinite article "a" implies the property of singularity and is an implicit tact of the integrity of the behavioral event of concern (arm swing).

nomena under study. The "27 centimeters" is a measurement-produced stimulus to which we have an extensive pre-conditioned repertoire of effective behavioral responses – a flexible and ready package of previously refined intraverbal statements and other practices pertinent to quantitative relations. (Recall that our study of mathematics prepares us through programs of conditioning that functionally capacitate such general packages of pre-conditioned environment/behavior relations.) In response to the measurement records, we can then exhibit different behavioral repertoires than we exhibit in response to the non-verbal environmental events to which the records pertain. We predict that the new behavioral repertoire, which the measurement record will share in evoking, will, in turn, help evoke our more effective behavior toward the phenomena under study.

Life Without Measurement

Consider the counter-example of a person constrained to perform a simple task without benefit of the behavioral controls produced through measuring. Assume that this person lives in a world without measuring – a world in which no quantitative implications can be pursued. While it is nearly impossible for a mature human being in our world not to engage immediately in at least crude measuring practices, suppose our hypothetical subject, who must find a properly fitting tablecloth, may not measure while accomplishing this task. The person must work alone and thus cannot circumvent this restriction by enlisting others to perform measurements. To preclude the trial-and-error approach, we will impose the requirement that the table remain remote from the stash of various tablecloths from which a selection must be made, and we will allow only a single selection to be made.

The person approaches a table featuring a nearby salient point formed by the intersection of three planes, which form the table top and two of its vertical sides. This feature evokes the response "corner." The person's behavior next comes under stimu-

lus control of another similar point which also evokes the tact "corner." Next, the optical scanning (eye movements) plus the turning of his own neck and head between those two reports evokes the response "displace." But the person cannot say by how much nor even know that there is a quantitative implication in this discovered property of displacement. The next tact, "straight line," emerges under control of the structurally defined path between these points as the person's gaze moves back and forth. As the person's observations come somewhat imprecisely under control of the general construction details of that line, the 90° relationship between the vertical plane and the plane of the table top then evokes "edge."

Our behavior is generally conditioned such that a family of isolated tacts (which we might call pure observations) will evoke autoclitics, which link the tacts with relational connotators. Those who speak in the familiar language of purpose and agency would say that these autoclitics are needed "to make sense" of these verbal events, that is, to involve the various tacts in a new stimulus form to which effective responses may be made *to the whole set of events in relation to one another*.² Our subject says, "these corners are displaced along an edge" (the autoclitics are underlined).

Note, however, that this synthesized product (which can function in subsequent intraverbal relations as a new composite verbal stimulus) amounts to more than just tacts with autoclitics that imply their controlling relations. The statement has a logical flow insofar as its terms are sequenced in a way that permits its designation as an English sentence. That sequential arrangement occurs under intraverbal control of the assorted tacts and autoclitics of which the statement is composed.

²Because behavior is not "performed" (for lack of a director) but rather "occurs" on each given occasion as an inevitable and natural event, the autoclitics are not "inserted"; they are merely evoked. The capacitation (conditioning) of those behavior-controlling relations occurred through a history of differential reinforcement by audiences – the kind to which we refer as teaching/learning a language. Thus, on any occasion, the relational autoclitics occur naturally among the tacts in our subject's verbal behavior.

Pages would be required to complete the example as this person finishes exploring the setting. Note that under the prohibition of measurement techniques this person is limited to tacts connected with autoclitics and the composite intraverbal statements that they evoke. The reader is being asked here to evaluate the person's progress toward effectiveness in solving his tablecloth problem without measurement techniques. Remember what this implies. The person cannot count. For example, he cannot say "there are two corners here." Nor can he rely on previously effective responses to similar situations by comparing relative sizes (a measurement technique). For instance, he could not even say, "it is *rather far* between these corners." That statement would be based on a measurement in which the standard distance is an inexplicit average of his prior responses in similar situations.

After tacting all of the important properties of the table – which, in turn, evoked autoclitics that, when combined with the tacts, intraverbally controlled statements that made some relational sense of those properties – the person might do the same thing with respect to tablecloths. By identifying similarities in the intrinsic relationships among the various parts of tables and cloths, he might arrive, without measuring, at comparative statements such as "a cloth can hang over the edge of a table," or perhaps even "a cloth and a table top can have a similar shape." Although he might become able to make a number of such comparative statements about properties and the non-quantified relations among them – and although those kinds of

statements might in turn initiate an intraverbal chain of statements to which some would refer as his pondering the problem, it appears that he would not find such statements effective in guaranteeing that a chosen tablecloth would properly fit the table when he brought the two together.

To generate the stimuli necessary to evoke more effective behavior, we can return to the beginning of this example and relax the prohibition against measuring. Upon tacting the two displaced corners, the person now responds to those stimuli with some measuring behavior. A record is created: "96 centimeters." A new response can now occur under multiple stimulus control of (a) the initial tacts, (b) this verbal or non-verbal measurement record, and (c) the relevant mix of relations both among the properties, and among the properties and the measurement records: "These corners are separated by 96 centimeters."

As a result of this stimulus supplementing operation, the subject can now respond much more effectively to an assortment of different sized table cloths. Only when quantitative statements supplement the autoclitically related tacts can an effective tablecloth selection be made. Through the stimulus supplementation from measuring there has been a substantial improving and refining of how the environmental phenomena of concern can control the person's behavior.

REFERENCES

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