

This is the peer reviewed version of the following article: Catania, A.C. "Prolegomena to any future philosophy of behavior analysis as a science" *Jrnl Exper Analysis Behavior* 119, no. 1 (03 Jan 2023): 209-230. <https://doi.org/10.1002/jeab.807>, which has been published in final form at <https://doi.org/10.1002/jeab.807>. This article may be used for non-commercial purposes in accordance with Wiley Terms and Conditions for Use of Self-Archived Versions. This article may not be enhanced, enriched or otherwise transformed into a derivative work, without express permission from Wiley or by statutory rights under applicable legislation. Copyright notices must not be removed, obscured or modified. The article must be linked to Wiley's version of record on Wiley Online Library and any embedding, framing or otherwise making available the article or pages thereof by third parties from platforms, services and websites other than Wiley Online Library must be prohibited.

Access to this work was provided by the University of Maryland, Baltimore County (UMBC) ScholarWorks@UMBC digital repository on the Maryland Shared Open Access (MD-SOAR) platform.

Please provide feedback

Please support the ScholarWorks@UMBC repository by emailing scholarworks-group@umbc.edu and telling us what having access to this work means to you and why it's important to you. Thank you.

Catania, A. C. (2023). Prolegomena to any future philosophy of behavior analysis as a science. *Journal of the Experimental Analysis of Behavior* (special Rachlin issue), **119**, 209-230. doi: 10.1002/jeab.807

Prolegomena to Any Future Philosophy of Behavior Analysis as a Science

A. Charles Catania

University of Maryland, Baltimore County

Abstract

This tribute to Howard Rachlin speculates about scholarly work that might have been. It explores how behavioral data might bear on philosophical issues, with examples that might be called case studies in experimental philosophy. In 1964, an issue of the *Proceedings of the American Philosophical Society* served a similar function. It was entitled “Psychology: A Behavioral Interpretation”; the papers included “Will,” “Experience,” “Appetite,” “Humans,” “Anxiety,” and “Man.” This presentation imagines what a contemporary project devoted to philosophical and behavior analytic perspectives on the topics of causation, freedom and volition, good and evil, time, words, and mind might have looked like. Along the way it notes how the project would have benefited from Howard Rachlin’s seminal contributions to both behavior analysis and philosophy. If ever such a project comes to pass, it will inevitably bear the stamp of his contributions.

End of Abstract

Author Note: Address correspondence to A. Charles Catania at *catania@umbc.edu*. Many colleagues contributed to this manuscript in many ways, of course including Howard Rachlin. It would be difficult to list them without serious omissions, but at least most of them are cited in the references, and the exceptionally comprehensive reviewer comments and editorial recommendations led to a revision with many substantial improvements. I thank Nancy Neef who, without knowing it, wrote something that helped me resolve a knotty problem of wording, and Mirela Cengher for calling my attention to a vital citation.

Key words: Howard Rachlin, causation, time, volition, mind

Running head: Behavior Analysis and Philosophy: Prolegomena

This tribute to Howard Rachlin's life and contributions speculates about scholarly work that might have been. It explores how behavioral data might bear on philosophical issues, with examples that might be called case studies in experimental philosophy. Our title is, of course, a riff on Immanuel Kant's "Prolegomena to any future metaphysics that can qualify as a science" (Kant, 1783/1950). *Preliminaries* would have done as well, but along with its pretentiousness *prolegomena* carries substantial historical precedent (e.g., McDougall, 1922; Richards, 1980; Titchener, 1912, 1929). Besides, we cannot fault the historical and philosophical credentials of Howard Rachlin, or Howie as known to his friends, and on those grounds I hope he would have liked it.

In 1964, the December issue of the *Proceedings of the American Philosophical Society*, entitled "Psychology: A Behavioral Interpretation," was devoted to a set of papers presented at its April 24 annual meeting. Its cover and its contents page are shown in Figures 1 and 2. At the time, the issue seemed a major event: it demonstrated that philosophers were taking behavior analysis seriously (but see Harzem, 1987, p. 178). From time to time over subsequent years, I broached with colleagues the possibility of updating the project based on contemporary developments in behavior analysis. Topics not covered in 1964 that seemed appropriate included time, causation, freedom, and mind. Over some decades I recall specific conversations or correspondences about the project with Tony Nevin, Peter Killeen, Phil Himeline, Allen Neuringer, José Burgos and a few others.

—Insert Figures 1 and 2 about here—

I hesitate to include Howie in my list mainly because I'm unsure about the details of our conversations on the topic. Howie was a relatively infrequent attendee at professional meetings, so unfortunately I didn't get to see him often, but I'm pretty sure it was at least mentioned at a

1992 international conference held in the foothills of Mount Fuji in Japan (Hayes et al., 1994).

The project could easily have ended there, at least for me. I became profoundly indebted to Howie when I aspirated some food during a lively luncheon conversation. He was seated next to me and without hesitation performed the Heimlich maneuver, so I survived to tell the tale (perhaps my uncertainty about what we discussed is an instance of retrograde amnesia).

The event proved Howie to be a person of quick action as well as words. I don't have a good example of his quickness with words here, but he admired that quality in others, so I will instead include one he loved to tell. It is about his philosophy professor, Sidney Morgenbesser, whose response to a speaker who claimed that two negatives make a positive but two positives never make a negative was, in a loud well-modulated voice: "Sure, sure."

In any case, it would be difficult to imagine anyone better suited for the project than Howie, and had the project come to pass he was an obvious potential contributor. One major roadblock, however, was finding a member of the American Philosophical Society who would be willing to sponsor the project; the very few philosophers who were approached declined and so it was never realized. This article considers what it might have looked like.

The Proceedings

The papers in the *Proceedings* were introduced by E. G. Boring (1964). He saw the psychology of that time as having gradually rejected dualism and he emphasized the movement toward behavioral accounts and away from introspection and other early mentalistic positions; he regarded the new approaches as mechanistic, not organismic. Those were early days for cognitivism as an additional category, and perhaps for that reason cognition was mentioned only in passing. Had Boring encountered Rachlin's language of teleological behaviorism, he would most likely have been troubled by it, but though the terminology invokes temporal events

extended in time it does not imply that events yet to come can retroactively cause or influence current events. The account, however, does not preclude contemporary surrogates of potential future events in verbal behavior or other anticipatory actions. Unfortunately, the alternative *teleonomy* has not caught on: “Teleonomy is teleology purged of all its pretensions to providing causal explanations, and restricted exclusively to putting on record the purposes which biological structures and performances do in fact fulfill” (Medawar & Medawar, 1983, p. 256).

The titles in the 1964 Proceedings were drawn from philosophical language. The rationale was to link those traditional concepts to the new perspectives offered by behavior analysis. Translated into the behavior analytic vocabularies of the time, “Will” corresponded roughly to reinforcement contingencies, “Experience” to stimulus control, “Appetite” to establishing operations, “Humors” to psychopharmacology, and “Anxiety” to aversive control. Skinner might have entitled his contribution “Humans” instead of the now sexist “Man” had he written it a decade or two later. The following is excerpted from his closing paragraph:

It is not easy to abandon notions like a sense of justice, a sense of freedom, and personal responsibility or to accept a new interpretation of man’s individuality and his power to control his own destiny. Yet it would be remarkable if any conception of man did not occasionally need revision.... The hard fact is that the culture which most readily acknowledges the validity of a scientific analysis is most likely to be successful in the competition between cultures which, whether we like it or not, will decide all such issues with finality” (Skinner, 1964, p. 485).

It is perhaps time to try again to persuade philosophers that behaviorism is both philosophically viable and scientifically sound, that it remains legitimately relevant to contemporary issues and, perhaps most important in this context, that it has something to offer to philosophy. What follows proposes a new table of contents addressing fundamental issues in which both philosophy and behavior analysis share common interests. The increasing sophistication of our treatment of verbal behavior suggests that behavior analysis may now be better prepared to contribute to philosophy rather than simply awaiting contributions from it (cf. Stahlman & Catania, 2020). With a nod to what Howie might have liked to see, I here nominate six new categories: “Causation,” “Good and Evil,” “Freedom and Volition,” “Time,” “Words,” and “Mind.” Each is discussed in the sections that follow.

Causation

Discussions of causation in philosophy often begin with Aristotle. He proposed four kinds of causes, perhaps better translated as explanations or *because*s: as kinds of explanation they provide a useful framework for organizing the structural and functional aspects of behavioral phenomena (see especially Killeen, 2001; Killeen et al., 2011). In their typical order, they are: material causes (those from which things are made, as in marble being a material cause of a statue); formal causes (structure, as in the form that makes it a sculpture rather than an unfinished block); efficient causes (events, as in what the sculptor did to create it); and final causes (purposes, as in the aesthetic role the sculpture will play once placed in its setting). Of those four, Aristotle’s efficient causes have most in common with the everyday billiard-ball conception of causality. As behavior analysts, we are often likely to treat them not as causes of things but rather as causes of our verbal behavior with respect to them (i.e., their names).

Selection by Consequences as a Different Causal Mode

Despite their prestige and longevity, the language of causation need not be limited to these four. When Skinner (1981) made the case that selection by consequences is a different causal mode not subsumed by the others, it was easy to overlook how radical his proposal was. The adventitious evolutionary contingencies that produced giraffes and star-nosed moles and us involved those other causes but are not reducible to them. The selection of each organism came about as a product of genetic processes in the context of selecting environments over evolutionary time. Many features of their selection were accidental, in the sense that they depended on details of the history of our planet (e.g., movements of its tectonic plates and impacts from extraterrestrial objects, to mention just a couple).

Hull et al. and commentaries (2001) initiated a debate about what to count as selection and whether it operates not only in phylogeny but also at the levels of ontogeny and sociogeny (cultural selection); they saw immune systems as qualifying but not sociogeny. But instead of reading their treatment as a debate about what counts as selection, it can be read instead as one about whether, as a process extended over time, selection can meaningfully be reduced to efficient causation (Catania, 2001a). I believe not, and I'm confident that Rachlin would have agreed.

Selection as the Cause of Classes

Rachlin's teleological behaviorism appeals to final causes, but not in the sense that future events are efficient causes of current ones. Final causes, or purposes, define classes of behavior over extended ontogenic time and provide a behavioral taxonomy that is paralleled by classes selected over phylogenic time (roughly, species). Both Skinner's (1935) account of operants and Darwin's (1859) account of species treated them as classes with temporal extension and fuzzy

boundaries. For Skinner, if all response properties count in detail, then each response is unique and behavior consists of infinitely many response classes; if minimal properties are chosen, however, virtually all responses will be class members, with no differentiation among separate instances. The defining properties of class membership must be chosen at some intermediate level effective for the problem at hand (cf. Catania, 1978, p. 25). Compare Darwin:

What, then, is a species? It would seem thus far to be the whole of any one series of breeding populations.... The definition as it stands unfortunately puts all living and fossil animals in one species.... [This] is of little use to the practicing taxonomist.... [Let] us redefine the species as the whole of any one series of breeding populations as it exists at any one time. This definition merely lands us in an exactly opposite difficulty, for we now have an infinity of species.... [We] are forced to bring into the definition a discrete unit of time. As soon as we do this, we are, of course, being arbitrary.... Species and subspecies are the units with which the taxonomist deals, but they are merely convenient labels for arbitrary groupings" (Darwin, 1859, pp. 233-234).

We could say that the causes of species or of operants are their selecting environments, but is it helpful to call these efficient causes? No single event is adequate, so we must turn to multiple causation, but in doing so we must deal with the complexity and interaction of these selecting events over time. The extinction of the dinosaurs was no doubt crucial for our species because it created a niche for the evolution of our mammalian ancestors, but then to label their

extinction as an efficient cause of the eventual emergence of hominids is too much of a stretch.

We must shift to a more manageable human time scale.

Events as Causes (Conjunctions) versus Us as Central to Causes (Contingencies)

Newton's mechanics moved us from spiritual and immaterial causes to physical ones, and later Hume argued that we have nothing more to go on than conjunctions of events. In quantum physics, Heisenberg's Uncertainty Principle made even those conjunctions untenable grounds for the concept, and it brought new grounds for arguing about whether causation is even a legitimate concept. At our human scale, however, the foundations for our causal principles come from us; they are provided by contingencies in our interactions with environments, not by contingencies merely observed in our environments. Our concept of causation (our verbal behavior in our accounts of why things happened) most likely evolved from the distinction between events caused by our behavior and those accidentally correlated with our behavior. Contiguities will not work, because the relevant correlations cannot exist unless we examine behavior extended over time.

It is one thing to observe conjunctions of environmental events; it is another to initiate behavior and then observe its conjunctions or correlations with environmental events. For example, pigeons are sensitive to differences between events produced by their own behavior and those that are not: they keep pecking even if their pecks are followed only after variable delays by infrequent reinforcers but they stop when reinforcers arrive independently of their pecking (Catania & Keller, 1981).

The difference matters, by the way, whether or not behavior can be predicted from readiness potentials or other neural activities (e.g., Armstrong et al., 2018; Nachev & Hacker, 2014); the issue here is what behavior causes, not what causes that behavior. Many things move

because we move them; it is therefore ironic that some so strongly resist the view that a major cause of climate change is human behavior.

Skinner's (1948) superstition demonstrations notwithstanding, substantial evidence supports the conclusion that organisms are exquisitely sensitive to the difference between contingencies in which their behavior modifies events and those in which events occur independently of their behavior, even when schedules are designed to produce features (e.g., distributions of delays between responses and reinforcers) similar to those found in response-independent schedules (Catania, 2005; Katz & Catania, 2005). We arrange contingencies precisely to show what happens when the behavior of organisms causes certain events. Response-independent reinforcers do not create operants (cf. Ayllon & Azrin, 1965). They have effects but those effects are typically transient, and when they are not they typically involve cases in which the maintained response shares properties with the responses occasioned by the reinforcer (e.g., pecking: Brown & Jenkins, 1968; Neuringer, 1970; Staddon & Simmelhag, 1971).

Words as Causes

We must add that we humans are least likely to show this sensitivity to contingencies, but that finding is a side-effect of verbal governance. When most children are taught to follow instructions, they are rarely asked to do what they were about to do anyway, so they must learn to ignore the contingencies and do as they are told (e.g., Catania et al., 1982; Matthews et al., 1987; Shimoff et al., 1981). Thus, over time words can get more and more in the way of direct contact with contingencies. Then the words rather than the contingencies can become the causes.

Initial or Initiating Causes and Intermediate Causes

Another variety of causation not included in Aristotle's list consists of initial or first causes. Deities and the Big Bang are of course beyond our present scope, but we are often caught up by questions about origins. The early acceptance of Darwinian selection was hampered because Mendelian genetics did not provide the variations necessary for natural selection; genetic research on mutations eventually came to the rescue. Early in his formulations of operant behavior, Skinner (1979) also struggled with origins, eventually dispensing with eliciting stimuli and allowing responses to be emitted. Operant behavior is emitted in the same sense that energy is emitted by radioactive elements (recording a particular response or a particular alpha particle does not depend on identifying its cause). In what began as the S-R-S¹ notation (Skinner, 1938, pp. 51-52), the causal initial S first became lower case and then eventually disappeared.

Skinner (1984) explicitly distinguished between initiating causes and intermediate causes when he was asked about the status of private events as causal:

[P]rivate events can be brought under the control of (especially public) behavior. In that case they may be called causes, but not initiating causes. The only possible exceptions I can imagine would arise if, when someone had acquired extensive public behavior, a set of private events (serving as stimulus, response, and consequence) would resemble a public set well enough to come into existence through generalization. We do engage in productive private verbal behavior in which some initiation certainly occurs, if that term means anything, but if my analysis is correct, public versions must have been established first. In that case, the initiation passes to the environment. (p. 719)

After discussing whether organisms are active or passive, he concluded: “Whatever the ultimate consequences, the origination of behavior is still to be sought in natural selection, operant conditioning, and the evolution of cultural practices” (Skinner, 1984, p. 719). We are not likely to improve much on Skinner’s recommendation about how far back to go in our search for first causes of behavior. Following his lead would be dedicating ourselves to a good cause.

Good and Evil

To the Europeans of the eighteenth century, the 1755 earthquake that killed thousands and destroyed Lisbon may have been a watershed event marking the beginning of a shift from including natural disasters among the evils of the world to assigning the responsibility for evil primarily to human action. The Lisbon earthquake came to be treated as tragic but not as evil. Evil requires agency and Western culture is now more likely to locate that agency in the human and the mundane than in the divine (Neiman, 2015), though the details, especially in mechanisms of blame and atonement, vary widely across cultures (e.g., see Neiman, 2019, for comparisons of the American South after it lost the Civil War with both East and West Berlin after the fall of the Third Reich).

As of this writing, the Wikipedia entry on genocide calls it “the epitome of human evil.” Many of us can identify the Holocaust and the Cambodian and Rwandan genocides and a few others within our own lifetimes; the entry, however, estimates 43 genocides that led to about 50 million deaths between 1956 and 2016. How many others to this day have been denied or covered up? But shouldn’t we add to the list slavery (e.g., Hannah-Jones, 2021) and its aftermaths in racism and caste (e.g., Anderson, 2016; Wilkerson, 2020) and most if not all

varieties of contemporary warfare (e.g., Hastings, 2011; Weinberg, 1994)? If all of these are not instances of evil what would be?

Relevance

The problem of good and evil has been a concern of philosophy throughout its history, but how are these issues the concerns of behavior analysis (cf. Rachlin, 1985a)? Psychology only rarely appeals to evil even as a construct, much less as a causal entity (but see Zimbardo, 2011). I suggest we need look no further than verbal equivalences, with one class encompassing a semantic network of terms such as *good*, *virtuous*, *reinforcement* and *positive* near one end of a continuum and another encompassing a network such as *bad*, *evil*, *punishment* and *negative* near the other. We can identify relevant verbal clusters in key words of articles and in the contents and indexes of books. For example, check out Sidman's "Coercion and its fallout" (1989) for frequent juxtapositions of *escape*, *avoidance*, *punishment*, *suppression*, *anxiety* and other terms related to aversive events.

Behavior analysis has gradually become a force for good, in the sense that applications of our science that incorporate the good (e.g., positive reinforcement) are increasingly favored over those that incorporate the bad (e.g., punishment). Even procedures that simply omit the good (in particular, extinction) have come to be aligned with aversive control. In this context the reinforcement-punishment distinction might seem akin to Manicheism, with the reinforcement-extinction distinction reflecting the opposing view that evil is merely the absence of good. In any case, and in other words, the practice of behavior analysis has been evolving to conform to historical judgments about the good and the bad. We have not yet established an ethics based upon behavioral foundations, but might functional aspects of the contingencies we call aversive

have given rise to these affinities and favored placing them close to one or the other end of this verbal continuum?

Side Effects of Aversive Contingencies

We have long known about side-effects of punishers. In the study of punishment, it is usually necessary to assess the effects of punishers delivered independently of behavior, to provide an appropriate baseline against which to assess behavior reduction and other effects of contingent punishers (e.g., Camp et al., 1967). One side effect of punishment, in other words, is necessarily the behavior produced by the punisher. In other side effects, punishers may elicit aggressive behavior (e.g., Azrin et al., 1967; Azrin et al., 1965; Lloveras et al., 2022); those who deliver punishers may themselves become aversive, so children whose parents mainly apply punishment contingencies will probably be more likely to leave their households as soon as circumstances permit; and punishers may become discriminative stimuli when correlated with reinforcement contingencies (Holz & Azrin, 1961), so that one who then works for such stimuli is called a masochist. (Schuster & Rachlin, 1968)

Negative reinforcement has been relegated to the dark side too, but distinguishing it from positive reinforcement is sometimes ambiguous. Thermoregulation (Weiss & Laties, 1961) provides a case in point. A rat in a cold enclosure learns to turn on a heat lamp by pressing a lever. The case for positive reinforcement is that turning on the lamp adds heat energy. That for negative reinforcement is that temperature receptors respond to cold and cold is aversive, so turning on the lamp removes this aversive stimulus. But a physical criterion, whether stimuli are presented or removed, is less satisfactory than a behavioral one. What is more important than the physical criterion is that rats in cold environments are likely to curl up and shiver rather than pressing a lever; the cold environment, the establishing operation that makes removal of cold a

reinforcer, is a side effect that produces behavior that competes with the response to be reinforced. In shock escape or shock avoidance procedures using levers, for example, shock may induce jumping or other behavior that competes with pressing; more effective procedures are those using responses like jumping over a barrier, in which the behavior produced by the aversive stimulus and the behavior to be reinforced are compatible (Bolles, 1970).

When the target behavior competes with behavior produced by the aversive stimuli, avoidance behavior may be hard to establish (Sidman, 1953). A further problem is that reinforced responding is followed by nothing happening: the aversive event only occurs after periods without responding. That is probably why compliance with medical directions is so often unreliable: when vaccination is successful, nothing happens. As with positive reinforcement procedures, avoidance behavior is sensitive to changes in contingencies whether they involve postponing individual aversive stimuli or reducing their overall rate (Herrnstein & Hineline, 1966; Hineline, 1970, 1977). Here again, mere contiguities are not helpful. The correlations between behavior and aversive events can only be seen when we examine behavior extended over time.

It may be hard to get avoidance behavior started, but once established it is typically easy to maintain. If it becomes so successful that aversive events rarely occur, a continuing avoidance contingency differs little from its discontinuation, so standard extinction is often a prolonged affair. But standard extinction is typically mere removal of the aversive stimuli rather than breaking the contingency while allowing the aversive stimuli to keep coming. The latter would probably work quickly. Should it then become the proper extinction procedure for negative reinforcement? If this is not complicated enough, add in combinations of negative reinforcement

with response-independent presentations of pre-aversive stimuli (e.g., Derrickson et al., 1993; Sidman, 1958). The potential side-effects become ever more complex.

Side Effects of Extinction

Now consider extinction. Terminating a reinforcement contingency does two things: responses no longer produce reinforcers and reinforcers are no longer presented. Because of the former, responding occurs less often; it extinguishes. Because of the latter, aggressive behavior such as biting may emerge (Azrin et al., 1966; Lloveras et al., 2022). The first of these effects depends on a change in contingencies. The second depends on the termination of stimulus deliveries. We know this because in the transition from a reinforcement contingency to the response-independent delivery of reinforcers responding also occurs less often, but that decrease is not accompanied by aggressive behavior. Aggression elicited by extinction might seem highly relevant to correlations between violent crime and poverty, but this didn't stop politicians like Senator William Proxmire in the 1970s from designating research on elicited aggression as frivolous by bestowing one of his Golden Fleece awards upon it (see *Hutchinson-Proxmire* in Wikipedia). Such examples imply that the diminution of behavior analytic research on aversive control over more than half a century (Catania, 2008) had external political causes as well as internal ones that depended on the evolution of our science.

Side effects are probably why extinction is typically relegated to the dark side. They tell us that something is wrong, especially when extinction elicits aggression or other behavior similar to that produced by punishment (Azrin et al., 1967). Suppose a child engages in severe self-injurious behavior such as head-banging or eye-poking and a functional analysis tells us that the behavior is in large part maintained by attention as a reinforcer. The attention must be really important if it generated such disturbing behavior, so taking it away may not be the method of

choice for getting rid of the behavior that it supported and perhaps even created. Giving the child attention independently of the self-injurious behavior is one possibility; another is using attention to reinforce alternative responses, and especially ones incompatible with self-injury. Presumably because of its side effects, the literature from applied settings includes relatively few examples of using extinction alone to get rid of problem behavior.

Political Correctness, Cancel Culture and Other Aversive Social Contingencies

Once we have rejected the dark side in the domains of application and research, should we also extend our preferences to professional behavior? If we had to categorize cancel culture and political correctness in terms of contingencies, we would most likely count them as examples of punishment. Suppose the microphone and lights are turned off on an academic speaker who has just joked about admissions committees in the old days questioning whether women applicants might be poor investments because after earning their degrees they might only go on to marry and have babies. What if the speaker had planned to continue by noting that the women were admitted anyway and that, yes, some married and had babies, but all also worked hard at behavior analysis and became leaders in the field.

Suppose a book is dropped from adoption in a course because of fear that some image or statement in it might offend a student. Does the protection from potential offense balance the overall cost to the class, which will now instead use a less appropriate and more expensive textbook? How about the effects on trust and collegiality if such issues can be raised anonymously? And what about the implications for academic freedom if the decision was not made by the instructor but was instead imposed by an administrative group? Even if a signal-detection assessment could be used to judge the costs and benefits of such decisions (Nevin,

1969; Swets, 1992), should these social contingencies be part of our professional practices if they count as instances of aversive control?

When Bad Becomes Good

When we try to change behavior with punishment or negative reinforcement or extinction, behavior usually changes in the expected ways but carries with it the baggage of side-effects that are often more than bargained for. It might be good, or at least just easier, if we could say that positive reinforcement is always the better way. Maybe we're moving in that direction. But sometimes our focus on accentuating the language of the positive may get in the way of seeing the effectiveness of procedures that don't enjoy the positive label. For example, after participants in a learning task received either positive feedback (telling them when they were correct) or corrective feedback (telling them what they had done incorrectly), they came to prefer the corrective feedback over the positive feedback (Simonian & Brand, 2022). If this seems surprising, the surprise may be driven only by our preconceptions (our verbal histories) about procedures labeled positive and those involving the presumably aversive alternative of telling participants they are wrong. Were similar verbal and social variables at play when, based on effects of feedback on human verbal learning, Thorndike (1921) modified his Law of Effect, so that it no longer included a component analogous to punishment (cf. Schuster & Rachlin, 1968)? We should use corrective feedback, even though its label relative to positive feedback seems to put it at the wrong end of the good-bad continuum.

Teaching Reinforcement Versus Teaching Punishment

One more major problem with aversive control is that it is easier to teach how to use punishment than how to use reinforcement. Bad may be stronger than good in many ways (cf. Baumeister et al., 2001). That is at least in part because punishment usually has more immediate

effects on the behavior to which it is applied than does reinforcement (Catania, 2000). If a parent strikes a misbehaving child, the child's behavior may quickly change to crying, and the misbehavior stops then and there. With reinforcement, on the other hand, effects may not show up for a while, as when reinforcing homework completion this evening affects its next completion tomorrow. If that makes it easier to teach aversive techniques than those of reinforcement, perhaps that is also why punitive measures are so commonly used to maintain civil order in so many human cultures. We must try instead to make more of our teaching all to the good.

Freedom and Volition

Skinner's "Beyond Freedom and Dignity" (1971) was not about the philosophical issue of determinism versus freedom (free will); it was instead about freedom as the inverse of coercion. "What we call the 'literature of freedom' has been designed to induce people to escape from or attack those who act to control them aversively" (page 30). Coercion limits choices, so an implicit feature of this freedom is the capacity to choose. This sense of the term comes up explicitly in dictionary definitions: e.g., "the capacity to exercise choice; free will" (*American Heritage Dictionary*, 2011). Although the capacity is often linked to free will, questions about preference for opportunities to choose are orthogonal to questions about whether, once in a choice situation, an organism's choices are free or determined (cf. Rachlin, 1992, 2007).

Free Choice Versus Forced Choice

Whatever else is involved in the concept of freedom, it at least involves the availability of alternatives. An organism with no opportunity to choose among alternatives is not called free. The availability of alternatives is called free choice, as when a pigeon can produce food by pecking either of two keys; when only a single key that produces the same amount of food is

available, the pigeon's choice is said to be forced. Given the opportunity to enter free-choice or forced-choice situations, pigeons prefer the former over the latter (Catania, 1975). The preference decreases rather than increases as alternatives increase (sometimes called over-choice); and unsuccessful attempts to reverse the preference imply that it is not learned (Catania, 1980; Catania & Sagvolden, 1980).

But what makes a choice? If two keys each correlated with reinforcement are pitted against two keys only one of which is correlated with reinforcement, pigeons prefer the former, so number of available keys is not a criterion for free choice. Furthermore, those choices are always embedded in the broader context of a panel the entire surface of which is available for pecking. If the question is whether more behavior is available in some choices than in others, another relevant comparison is between two keys and a single key of equal area (or equal circumference, given that some pigeons peck mostly around key edges). When number of keys is pitted against area or other dimensions of a single key, number wins out over the other dimensions (Catania & Reich, 1982; Cerutti & Catania, 1997). Free choice depends on the availability of more than one response class maintained by reinforcers or, in other words, on the number of available operants.

Behavior as an Absolute Quantity or a Relative One

These findings, by the way, also raise the issue of quantity of behavior. Compared to the conversion of all responding to relative rates and dealing with residuals as classes in their own right called not-responding or leisure, advantages may accrue to the assumption that behavior can vary in quantity, so that its total may vary from one moment to another (cf. Catania, 1983; Rachlin et al., 1983).

Volition, Will and Variability

Volition and *will* share etymological roots; so too does *voluntary* (see also Kantor, 1923). All are derived etymologically from the Latin *velle*, to wish or to want, and I will treat them here as essentially synonymous. As we have seen, they imply the availability of options, which in turn implies the opportunity for response variability. This variability provides a key to the linkage between the ordinary language of freedom and volition and their experimental analogs in our behavior analytic treatments of them.

Schwartz (1982) designed an experiment to show that reinforcers produce stereotypy rather than variability; it was apparently intended as a critique of the concept of reinforcement itself (Schwartz, 1981, 1986). When pigeons' pecks on left and right keys drove a light from the upper left to the lower right corner of an array, pigeons came to produce just a few stereotyped sequences among a large variety of options. But the physical array constrained possible sequences (some were impossible). With a procedure allowing all possible sequences, Page and Neuringer (1985) showed that reinforcers could maintain highly variable behavior: in other words, variable responding was a dimension of behavior that could be reinforced.

Reinforcers are produced by individual responses, but properties such as novelty and variability cannot be properties of individual responses. They depend on the context of other earlier responses. A given response might be variable in one context and stereotyped in another. Such findings, of course, draw us once again to the conclusion that organisms are sensitive to populations of responses and consequences over extended time, not merely to individual response-stimulus contiguities (cf. Neuringer, 2002, 2004). It is significant that Page and Neuringer's (1985) title was "Variability is an operant," because this research shows that operants may provide the variations upon which selection depends.

The Language of Volition and Free Will

But there is more to volition. Neuringer and colleagues explored its verbal dimensions by asking observers to attribute properties such as inner control and goal-directedness and predictability to the movements and interactions of computer-generated objects (Neuringer & Jensen, 2010; Neuringer et al., 2007). The stronger these attributions, the more likely also was volitional labeling. In other words, the stimulus properties setting the occasion for verbal responses such as *volition* and related classes were measurable and manipulable. What should philosophers make of that?

At this point let us return to the issue of free will versus determinism. Consider an array of choices ranked in terms of preference for one alternative over another. For our purposes it doesn't matter whether they involve colors, edibles, music or mates. At one end of the continuum are instances in which the first alternative is almost exclusively preferred to the second and at the other those in which the second is almost exclusively preferred to the first. As we approach the middle, preferences approach indifference and it is reasonable to say that the smaller the difference, the less strongly the chooser's selection is determined. Once preferences become roughly equal, and barring new information about the alternatives, this is the region at which our choices are most free, but it is also the region at which we might as well just flip a coin (cf. Moxley, 1997, on probabilistic determinism; 2007; Slife et al., 1999).

Here it is appropriate to quote Neuringer (2014) directly:

The operant has characteristics commonly attributed to voluntary action. Operant responses are goal-directed and consequence-influenced. This describes not only the type or quality of the operant, but also the predictability of operant instances. Because

predictability varies – from repetitions to random – and does so functionally, the operant appears to be internally controlled. It thus satisfies three criterial attributes of volition: appearance of control from within; goal-directedness; and more-or-less predictability, depending upon circumstances. I present an unusual view of the operant, unusual in that it highlights direct control of unpredictability by reinforcement contingencies. (p. 215)

If free will matters most when we could not do much better than leaving the matter to chance, how much should we worry about it? I'd say just enough to see how such choices are consistent with the role of predictability in Neuringer's account of operants and, if you will and that is your wont, volition.

Time

We might begin with Darwin's comment, quoted above in the section on causation, on the need for "a discrete unit of time" if species are not to be arbitrary classes. Neither breeding populations nor operant classes shaped by schedule contingencies can exist without temporal extension (cf. Field & Hinde, 2008; Hinde, 2001). "Rate ... is an abstraction. You can look right through a rate; that is, it can be going on right now, even though none of the events that comprise the rate is occurring at this moment" (Hinde, 1990, p. 305). In passing we may note that the argument that such assumptions were contradicted in early accounts of operant selection rests on a misreading of that history. One problem was that these assumptions are so integral to selection at both the phylogenetic and ontogenic levels that they were rarely spelled out explicitly. From Schoenfeld and Kantor to Rachlin

I was an undergraduate student of Nat Schoenfeld's. He had a style of discourse that was wide-ranging, deeply serious even if often laced with humor, heavily reliant on the cogent

concrete example, and often focused more on the historical evolution of concepts than on their experimental foundations. Some of those characteristics were enhanced by his earlier immersion in the interbehavioral psychology of J. R. Kantor (e.g., 1970), which emphasized the behavior of the organism as a whole and the stream of behavior in time. I have only recently come to appreciate the extent to which these antecedents prepared me to recognize the significance of Rachlin's teleological behaviorism and his views on behavioral units extended over time. Where once I saw vast differences I now see profound affinities.

Action at Spatial and Temporal Distances

In Nat Schoenfeld's undergraduate course in Experimental Psychology, class discussions covered a broad range of topics (Catania, 1997). One to which Nat often returned was action at a distance. He argued that physicists tended to divide into separate camps depending on whether they were comfortable with action at a distance or else felt it was necessary to fill in the gaps. How does the distant moon influence tides on earth? Should the intervening space be filled with something? Nat would have liked how Galison (2003) played Einstein's clocks off against Poincare's maps, not only in explicating the historical incorporation of time into space-time as its fourth dimension but also in reviewing Einstein's history as an experimentalist, as he evaluated clock inventions during his patent-office work. Einstein built many of those devices to see if they worked; he was hardly limited to thought experiments.

The patent work was concerned with synchronizing clocks in railway stations across Europe. The issues involved both spatial and temporal separations. This is relevant here because sometimes Nat extended his questions to action at a temporal distance. Must we trace a stimulus along a path that continues inside the organism and then emerges later as a response, as in the reflex arc of Descartes, or should we see effects of some events on others simply as aspects of

the extended temporal character of events? Howie Rachlin would have felt very much at home in these discussions. The nature of time was not simply the province of physicists (e.g., Hawking, 2009; Muller, 2016; Smolin, 2013). Questions about memory and dreams should be framed for the human time scale, and the concept of time travel implied a higher-level temporal dimension to accommodate changes in events produced by travel to the past (e.g., Dunne, 1927/2021; cf. Yourgrau, 2009).

The Temporal Gap in Delayed Reinforcement

For our purposes, we must return to human scale. One behavior analytic domain particularly concerned with temporal gaps is delay of reinforcement. “In the desire to present a continuous causal account, there has been a considerable tendency to ‘fill in’ intervals of time with behavior presumed to bridge the gap. Much supposed ‘mediating behavior’ has the status of a hypothetical intervening variable or, at best, as for ‘proprioception,’ of an intervening variable with hypothetical properties as a discriminative stimulus” (Dews, 1962, p. 373). It is appropriate to quote Dews further as he elaborates on his insight that a single reinforcer may act upon many responses extended over time: “The reinforced response is followed promptly by the reinforcing stimuli; the preceding unreinforced responses are also followed by the reinforcing stimuli, though not quite so promptly. Indeed, the whole pattern of ... responding is followed by the reinforcing stimuli and so, in a sense, is reinforced” (Dews, 1966, p. 578).

Presumably I’ve made it obvious that Nat was a major influence on my later research on temporal discriminations and on temporal variables within reinforcement schedules (Catania, 1970, 1971, 1991). He was the book editor when years later I submitted the chapter from which the following passage is excerpted, He called me out on the last two sentences, but did not ask that I change them. I remain unprepared to offer a definition of time (in this I am not alone).

It can be argued that duration is given only by progressions of physical events, such as the movement of the hands across the face of a clock or recurring physiological processes within an organism, and therefore that the study of temporal discrimination must be reduced to the study of sequences of behavioral or physiological events. Such events, however, take place in time; they are not in themselves time. They allow time to be measured, but they do not define it. (Catania, 1970, p. 38)

I should have added: “Time is the dimension along which events are arrayed.”

Dimensional Aspects of Time

Once sequences of events are invoked in measurements of time, we must address the question whether time or number of events is primary, and whether their measures are exchangeable. Time and number are dimensions of behavior that are independently amenable to shaping (Catania, 1991), but invariances in the properties of delay-of-reinforcement gradients are found in time rather than in number of responses (Catania et al., 2015). This is convenient, because events in a sequence remain separated in time, so filling in those gaps with still other countable events would invite an infinite regress.

As a fundamental dimension of behavior and environment, duration has some special properties: it is irreversible; it can change only continuously; and it involves no obvious receptor. Details of data presentation may influence our interpretations of temporally extended events. For example, analyses of effects of delayed reinforcers can display response-to-reinforcer delays increasing with movement to the right along the x-axis, or some decaying after-effect of the response such as a memory trace, now instead decreasing with movement to the right (e.g.,

Killeen, 2011). With identical data, these graphs would be left-right mirror images of each other. The delay graph would likely appeal to those who prefer thinking in terms of temporal action at a distance; the trace graph need not involve hypothesized entities (e.g., it could show correlated data from neural activity), but it would in any case likely appeal more to those who prefer to fill in the temporal gaps.

Organisms as Clocks

Accounts of timing often speak of the organism as reading an internal clock (were a search for behavioral mediators to be successful, the clock would have to be called a counter). Saying that the organism reads its clock sounds like talk about behavior, but we are not likely to find any responses in service of that function that would be distinguishable from the temporally distributed ones that characterize behavior under temporal control (cf. Sanabria, 2020).

The relation between organism and experimenter is comparable to that between a watch and someone wanting to know the time, so an alternative is to bring the experimenter into the story. When an experimenter studies temporal discrimination or differentiation in rat or pigeon, it may be better to speak of the rat or pigeon as the clock read by the experimenter instead of saying that the rat or pigeon reads its internal clock. Questions can then follow about what kind of clock the organism is. Can it be started and stopped and reset like a stopwatch? If stopped, will it pick up where it left off when it starts again? Is it limited to one duration at a time? What alarms does it have and how are they set or disabled? And so on.

Deciding what kinds of clocks we humans are may be more difficult than working on rat or pigeon clocks, because we must tease our verbal overlays apart from the temporal capacities that we share with other organisms. When we supplement our temporal capacities with the verbally maintained clocks that we humans have invented, we need to know how they interact

with each other. Do our histories in learning to use clocks matter? Are the interactions relevant to the analysis of temporal discounting, which is often based on verbal estimates rather than real-time contingencies? The distinction between organism as clock and organism as clock reader involves the locus of the observer relative to the clock. In other words, here too relativity reigns, as no doubt it should given that time is always of the essence.

Words

Verbal behavior functions both as a specialization within behavior analysis and, whether philosophers acknowledge it or not, as an indispensable component of philosophy. Philosophers of science may examine what behavior analysts do and say, but too seldom do they turn their attention to their own behavior. Behavior analysts, on the other hand, often look both ways; they examine their own verbal behavior along with that of the philosopher of science (cf. Stahlman & Catania, 2020). Theories and hypotheses are verbal constructions. Rather than asking how theories and hypotheses bear on what the behavior analyst does, we might more profitably ask how an analysis of verbal behavior may bear on the functions of theories and hypotheses.

The Languages of Science

Words do matter, but to see how they may constrain what scientists say, we might better look to historians of science than to philosophers of science. For example, different contributions to the evolution of chemistry very much depended on whether the participants corresponded and published in Latin, German, French, English or Russian, or in other languages less commonly used in scientific communication; and in a figurative scientific Tower of Babel the sharing of findings across nations was affected not only by problems of translation but also sometimes by constraints of grammatical structure (Gordin, 2015). Such historical examples of problems in the languages of science more convincingly show the incoherence of the concept of meaning than

any linguistic arguments. (Many linguists will not even consider accounts of language function that leave out an appeal to meaning, but I'll refrain from discussing the fraught history of conflict between linguistics and behavior analysis here; it would take us too far afield.)

The Evolution of Language as Driven by its Function

It has been argued that the expression of emotions drove language evolution. But evolutionary contingencies rarely create duplicates of functions already in place, and the angry gorilla shows us that nonverbal primates can express emotions very well indeed. Instead, the simplest function of verbal behavior is that it is an efficient way for one individual to get another to do something. Through verbal behavior, we do things via the mediation of others. The consequences may be nonverbal, as when we ask someone to move something for us, or verbal, as when we ask a question. This irreducible function of language is quintessentially social and can emerge only among those whose behavior is sensitive to social contingencies, and it is the key to a behavior analytic account of language origins and language evolution (Catania, 2001b). All other functions, including truth, communication and meaning, are derivative of it.

Problems of Meaning, Truth and Knowledge

The metaphor of words as containers for meanings is ubiquitous, and yet meaning is not waiting to be released from an unread text. If language transmits anything, it is verbal behavior itself; when listening or reading, our behavior re-creates some features of the behavior of the speakers and writers who constitute our verbal community. And once the verbal behavior has occurred, it can, in verbal governance, get people to do things. But neither the expression of emotions nor getting someone to do or say something brings us very close to the verbal behavior of philosophers. Getting from here to there is beyond the present scope, but at least some more

detailed accounts are available (e.g., Catania, 2017; Greer & Ross, 2004; Hineline, 2016; Skinner, 1957)

A behavior analytic philosophy of science must begin with the behavior of the scientist, not with assumptions about truth and knowledge. Too many students start their contact with behavior analysis verbally: they listen to lectures or webinars or they read texts. But that verbal behavior was originally established through direct contact with nonverbal contingencies, especially in the laboratory. The framing of definitions is primarily verbal and cannot be counted on to produce the discriminations upon which the evolution of that verbal behavior was based. For example, if a student has learned to define *reinforcement*, it doesn't follow that the student will discriminate reliably between reinforcement and nonreinforcement in laboratory or real-world settings (Catania, 1993).

Science as the Evolving Stimulus Control of Verbal Behavior

Though the words clearly matter, not all scientific behavior is verbal. Some is derived from new properties of the phenomena under study or, more technically, of new nonverbal stimulus control by features of the experimental environment. When Skinner began watching the behavior of rats, his descriptions of what they did were drawn from existing vocabularies. The rats showed reflexes or produced responses to stimuli, which were said to be elicited or inhibited or conditioned or strengthened. But over time Skinner found that what followed responses mattered more than what preceded them. As described in the second volume of his autobiography, the transition to a vocabulary consistent with these newly evident and relevant properties of behavior was long and arduous (Skinner, 1979). Gradually he changed over from the language of reflexes and eliciting stimuli to writing about emitted responses and their consequences (Catania, 1988). He distinguished the latter kind of behavior from other sorts by

coining a new name: *operant*. Such terms cannot be defined until coined, but they can be coined only after the new behavioral relations have been discovered. The discovery came first; then came the coinage.

Once Skinner began attending to classes of behavior modified by their consequences, he could then begin to define relevant properties: Are functional properties more important than topographical ones? Are some classes easier to create than others? Once the new classes are named, they become sources for theories and models and explanations, which can no more create the relevant discriminations than a textbook can create the contingent interactions by which a student of behavior learns reinforcement and shaping.

Explanation and Theory

At any level, explanation is showing how something works (Catania, 1993). What then about theories and models? Arriving at an explanation often begins with guesses, and though they are weakly determined verbal behavior, they sound stronger when we call them theories or hypotheses. When we formalize theories to explore the implications of our guesses, we may also call them models. Models are often mathematical but need not be. For example, human-scale models of strands of DNA were crucial in establishing the double helical structure of DNA. At what point are correspondences close enough that a model is no longer theoretical? At what point did the double helical structure of DNA stop being theory? The problem is again one of verbal behavior. A word that begins as a theoretical term can evolve into a name for a phenomenon. Here it is enough to make the point that such transitions do occur.

From a behavior analytic perspective, mathematical theories or models are better treated as economical descriptions than as explanations. For example, Kepler's laws do not explain planetary motion; rather, they describe, to a reasonable approximation, the mathematical

properties of the planetary orbits. We need a philosophy of science that deals explicitly with the role of verbal behavior in the behavior of the scientist. In this view, we must not assume that theories drive scientific behavior; they are more likely derivatives of it, with functions yet to be established, and the analysis of verbal behavior provides our best hope for identifying those functions. Theories and hypotheses and models are not initiating causes of scientific behavior; they are its products, and intermediate causes at best (though at their best, even as mere intermediates they can be extremely good indeed: see either the theory of relativity or quantum physics). This is no more an argument against theory than was Skinner's (1950) questioning of its necessity. Instead, it is an argument for questioning traditional assumptions about its role. I hope you will take me at my word.

Mind

Mind was once primarily a verb ("Mind what I say!"). Much of our technical vocabulary evolved metaphorically from everyday sources, and much of the everyday language applying to our own behavior arose through metaphorical extensions. Many esoteric cognitive or mentalist terms have mundane origins (Skinner, 1989); for example, *comprehension* is derived from *prehendere*, the Latin for *to grasp*. These etymologies reveal the concrete sources of many of our fundamental concepts. The creative aspect of metaphor, in other words, is in making the abstract substantial and solid or, to mix more metaphors, in bringing it down to earth.

Environment, Mind and Brain

Although it would once have been unusual, some online dictionaries now list *brain* as a synonym for *mind*. But I find it more interesting and more consistent with behavioral views that some have moved in the other direction, persuasively arguing that instead of looking inward any

adequate concept of mind must include the extended environment along with the organism (e.g., Killeen, 2004; Noë, 2009; Paul, 2021; Rachlin, 1994, 2014).

Rachlin (1992, 1994, 2014) provides indispensable prerequisites for a discussion of mind, grounding it in public and temporally extended patterns of behavior, and illustrating its manifestations in phenomena such as self-control, pain and altruism. His teleological behaviorism treats the phenomena of mind as public events extended over time. Implicit in the public is its inverse, the private, making this an appropriate place to explore some properties of the verbal behavior of privacy.

The Public Sources of the Language of Private Events

Reports of private events depend on the verbal community for their origins and maintenance. The problem is how the verbal community creates and maintain these responses without access to the private stimuli. This raises the practical question of how to turn a private event into a public one. A parent can teach a child color names because the parent sees the colors the child sees and therefore can respond differentially to the child's correct and incorrect color naming. So many varied consequences follow that it usually doesn't matter whether the parent teaches the names explicitly or simply allows them to be learned through casual but nonetheless causal interactions.

In "The operational analysis of psychological terms" (1945) and in a recapitulation in "Verbal Behavior" (1957, pp. 130-138), Skinner described "at least four ways in which a reinforcing community with no access to a private stimulus may generate verbal behavior with respect to it" (Skinner, 1945, p. 131). The first two, (1) common public accompaniment and (2) collateral responses to the private stimulus, differ mainly in whether the kinds of public stimuli available to those in the verbal community who shape the verbal behavior of the potential

speaker are physical events or behavior. The former, such as falls or wounds, are not strictly behavior, whereas the latter, such as cries or winces, are; these can be extended, as when, after having learned the names of body parts, the child reports the pain in a specific place. (Skinner, 1945).

Skinner's third and fourth categories involve more than mere collateral stimuli. The verbal community (3) "may reinforce a response in connection with a public stimulus, only to have the response transferred to a private event by virtue of common properties, as in metaphorical and metonymical extension," or (4) "the response is eventually made to a private stimulus which is similar except in magnitude to private stimuli otherwise accompanied by public manifestations useful to the community" (Skinner, 1945, pp. 131-133). The former involves a transfer from existing terms, as when *sharp*, with origins in the kinds of stimulation produced by knives or other sharp objects, is applied to the pain those objects produce. But the speaker's history provides the dimension along which the transfer occurs, because the pain does not share properties with the knife. The latter involves generalization along some continuum, as when a child who is asked to read quietly drops her voice to inaudible levels. No plausible additions have yet been made to Skinner's list of the four types of access available to the verbal community.

Shared Contact via Different Modalities

A toothache is a discriminable event, but someone with a toothache has different access to it than the dentist called upon to treat it. Both respond to the unsound tooth, but one feels it and the other probes it with instruments. They make different contact with the tooth just as a seeing person and a sightless person make different contact with a geometric solid if one is teaching its name to the other; one does so by sight and the other by touch. Neither kind of

contact need be more reliable than the other. For example, in referred pain a bad tooth in the lower jaw may be reported as a toothache in the upper jaw. In this case, the dentist is a better judge of locus than the patient. The main point here is that shared contact with the private event can be in different modalities; in reports of a common event, we have no need to assume that the two speakers are responding to the same property (colloquially, “feeling the same thing”).

Skinner’s arguments countered the dualism implicit in the language of mental events: “The distinction between public and private is by no means the same as that between physical and mental. That is why methodological behaviorism (which adopts the first) is very different from radical behaviorism (which lops off the latter term in the second)” (Skinner, 1945, p. 161). For Skinner, this was not an ontological problem about the status of public and private events. It was instead an issue for the analysis of verbal behavior: What types of verbal histories can shape the functions of the word *private*? Should the public-private distinction take that history into account (cf. Baum, 2011; Catania, 2011)?

Consider a patient behind a hospital curtain. The patient may presume to do private things behind the curtain, and yet might not be a good judge of whether the curtain has gaps making it ineffective for concealment or of what the shadows cast on the curtain might reveal or of when a nurse or doctor may suddenly sweep in unannounced. If an office door is marked PRIVATE, whether what goes on behind the door is unobserved or unobservable may depend simply on how securely it is locked (cf. Schlinger, 2011, p. 183). The language of privacy doubtless evolved from such mundane contingencies.

Rachlin distinguishes the privacy of the patient behind the curtain (Privacy A) from the privacy of behavior going on inside the head (Privacy B), objecting especially to the invocation of intrinsically private events as explanations for behavior (Rachlin, 2003, pp. 187-189). Except

for the problem of private watchers such as God and Santa Claus, the issues are not only which stimuli are being discriminated and how a verbal community can maintain those discriminations, but also whether speakers, based on such public instances, can learn to discriminate between being watched and not being watched (may they avoid the fate of Polonius, who would have been better off keeping to the public side of the curtain).

Private Events as Intermediate Causes

Suppose we multiply large numbers privately (mental arithmetic). The final product is given by adding the intermediate products. The multiplication problem is an initiating cause, but to the extent that they had stimulus functions in leading to the final product the intermediate products are intermediate causes. Sometimes such stimuli are accessible only to the problem solver (and are therefore private in the ordinary verbal sense of the term). Their public origins in the history of learning to do such multiplication is obvious, however, and it is easy enough to learn to discriminate between doing the multiplication by writing it all down and doing it privately, as mental arithmetic. If the answer is correct, whether the relevant history is regarded as public or private is not germane to whether the mental arithmetic happened. Whether a report of an intermediate product counts as a private event probably depends on where one's preference falls along the continuum of definitions of privacy, but so too does the question of whether behavior analytic questions about privacy count as science.

Generalization of Stimulus Control along Continua of Privacy

In addressing the question of discriminating between what is public and what is private, Skinner wrote the following: "It is impossible to establish rigorous vocabularies of private stimuli for public use, because differential reinforcement cannot be made contingent upon the property of privacy" (Skinner, 1957, p. 150). Yet extensions of verbal behavior do not depend

solely on contingencies. Skinner's third and fourth categories (above) appeal explicitly to generalizations along both physical and verbal dimensions (here, magnitude and metaphor respectively). Even the public-private discrimination itself might sometimes be public and sometimes private.

We might best treat Rachlin's Privacy A and Privacy B not as dichotomous but rather as regions along a continuum. Once someone has learned a discrimination between public and private at one locus on the continuum, why rule out its generalization to other parts of it? Accepting that position would be fitting, because here too we would be defining behavior in terms of patterns extended over time.

Our discriminations between public and private, like so many others, have fuzzy boundaries and vary with context. From a behavioral perspective, how different are they from those along dimensions such as good-bad or free-coerced or mind-body? If they involve human phenomena, what reason could we give for limiting how any of them may become relevant to our science? We are not bound by hypothesis testing or counter-balanced designs or rules for formulating theories or building models. Our research methods include systematic explorations of parameter spaces, demonstrations, experiments designed to see how behavior works, simulations and, yes, even tests of hypotheses. There are many ways to do science. Let us not be trapped by our words. Whatever conclusions we reach, we must at least keep an open mind.

Envoi

To read the work of Howard Rachlin and to learn from his compelling examples is often to be surprised. If you want to defend the significance of units of behavior extended over time, can you improve on the point that a musician may be playing a symphony even when sitting silently during an extended rest between notes? Could you have anticipated that, in support of his

case for the public foundations of pain behavior, he would maintain that contingencies could be arranged for someone who could not feel pain so that a patch of red could take over its properties (Rachlin, 1985b)? In his review of essential features of the philosophies of Plato and Aristotle and others from a behavioral standpoint (Rachlin, 1994), were you prepared for the argument that Plato's parable of the cave did not imply that Plato was a dualist? And were you ready for the conclusion that a partner might have better reasons for saying "You love me" than for saying "I love you" (Rachlin, 2018)?

Ours has been a brief expedition into the territory bridging behavior analysis and philosophy. We've skimmed over or omitted many worthy topics. For example, we've mentioned ethics only in passing, we've hardly touched on structure and function, the sources of novel behavior were mainly implicit in our discussion of volition and variability, and although our behavioral taxonomy includes equivalences and other higher-order classes, we've had little to say about their relevance for categories and classes and sets as they function in philosophy.

These sorties into the realm of philosophy have been mere prolegomena. As such, they are not likely on their own to lead to new research. Maybe they will occasionally provide direction by raising useful questions and maybe they will sometimes help us avoid blind alleys. If there is any overriding message, it is that behavior analytic data, not just behavior analytic talk, can be brought to bear on significant philosophical issues.

Howard Rachlin lived his science and he made that living public. I have no doubt he would have tied up many loose ends still dangling from these preliminaries. His participation would have improved the content of any of the topics we considered here. If in whole or in part an extended project of this sort ever comes to pass, it will inevitably bear the stamp of his contributions.

References

- The American Heritage Dictionary of the English Language*. (2011). (5th ed.). Houghton Mifflin Harcourt.
- Anderson, C. (2016). *White rage: The unspoken truth of our racial divide*. Bloomsbury Publishing USA.
- Armstrong, S., Sale, M. V., & Cunningham, R. (2018). Neural oscillations and the initiation of voluntary movement. *Frontiers in Psychology*, 2509.
<https://doi.org/10.3389/fpsyg.2018.02509>
- Ayllon, T., & Azrin, N. H. (1965). The measurement and reinforcement of behavior of psychotics. *Journal of the Experimental Analysis of Behavior*, 8, 357-383.
<https://doi.org/10.1901/jeab.1965.8-357>
- Azrin, N. H., Hutchinson, R. R., & Hake, D. F. (1966). Extinction-induced aggression. *Journal of the Experimental Analysis of Behavior*, 9, 191-204.
<https://doi.org/10.1901/jeab.1966.9-191>
- Azrin, N. H., Hutchinson, R. R., & Hake, D. F. (1967). Attack, avoidance, and escape reactions to aversive shock. *Journal of the Experimental Analysis of Behavior*, 10, 131-148.
<https://doi.org/10.1901/jeab.1967.10-131>
- Azrin, N. H., Hutchinson, R. R., & McLaughlin, R. (1965). The opportunity for aggression as an operant reinforcer. *Journal of the Experimental Analysis of Behavior*, 8, 171-180.
- Baum, W. M. (2011). Behaviorism, private events, and the molar view of behavior. *Behavior Analyst*, 34, 185-200. <https://doi.org/10.1007/bf03392249>

- Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, 5(4), 323-370. <https://doi.org/10.1037/1089-2680.5.4.323>
- Bolles, R. C. (1970). Species-specific defense reactions and avoidance learning. *Psychological Review*, 77, 32-48. <https://doi.org/10.1037/h0028589>
- Boring, E. G. (1964). The trend toward mechanism. *Proceedings of the American Philosophical Society*, 108(6), 451-454.
- Brown, P. L., & Jenkins, H. M. (1968). Auto-shaping of the pigeon's key-peck. *Journal of the Experimental Analysis of Behavior*, 11, 1-8.
- Camp, D. S., Raymond, G. A., & Church, R. M. (1967). Temporal relationship between response and punishment. *Journal of Experimental Psychology*, 74, 114-123. <https://doi.org/10.1037/h0024518>
- Catania, A. C. (1970). Reinforcement schedules and psychophysical judgments: A study of some temporal properties of behavior. In W. N. Schoenfeld (Ed.), *The theory of reinforcement schedules* (pp. 1-42). Appleton-Century-Crofts.
- Catania, A. C. (1971). Reinforcement schedules: The role of responses preceding the one that produces the reinforcer. *Journal of the Experimental Analysis of Behavior*, 15, 271-287. <https://doi.org/10.1901/jeab.1971.15-271>
- Catania, A. C. (1975). Freedom and knowledge: An experimental analysis of preference in pigeons. *Journal of the Experimental Analysis of Behavior*, 24, 89-106. <https://doi.org/10.1901/jeab.1975.24-89>

- Catania, A. C. (1978). The psychology of learning: some lessons from the Darwinian revolution. *Annals of the New York Academy of Sciences*, 309, 18-28.
<https://doi.org/10.1111/j.1749-6632.1978.tb29439.x>
- Catania, A. C. (1980). Freedom of choice: A behavioral analysis. In G. H. Bower (Ed.), *The psychology of learning and motivation. Volume 14* (pp. 97-145). Academic Press.
[https://doi.org/10.1016/s0079-7421\(08\)60160-7](https://doi.org/10.1016/s0079-7421(08)60160-7)
- Catania, A. C. (1983). Is not-responding behavior? *Behavioral and Brain Sciences*, 6, 321-322. <https://doi.org/10.1017/s0140525x00016198>
- Catania, A. C. (1988). "The Behavior of Organisms" as work in progress. *Journal of the Experimental Analysis of Behavior*, 50, 277-281.
- Catania, A. C. (1991). Time as a variable in behavior control. In I. H. Iversen & K. A. Lattal (Eds.), *Experimental analysis of behavior. Part 2* (pp. 1-19). Elsevier.
<https://doi.org/10.1016/b978-0-444-81251-3.50008-4>
- Catania, A. C. (1993). The unconventional philosophy of science of behavior analysis. *Journal of the Experimental Analysis of Behavior*, 60, 449-452.
<https://doi.org/10.1901/jeab.1993.60-449>
- Catania, A. C. (1997). Remembering Nat Schoenfeld. *Behavior Analyst*, 20, 31-36.
<https://doi.org/10.1007/bf03392761>
- Catania, A. C. (2000). Ten points every behavior analyst needs to remember about reinforcement. In J. C. Leslie & D. E. Blackman (Eds.), *Experimental and applied analyses of human behavior* (pp. 23-37). Context.
- Catania, A. C. (2001a). Selection as a cause and the causes of selection. *Behavioral and Brain Sciences*, 24, 533. <https://doi.org/10.1017/s0140525x01264164>

- Catania, A. C. (2001b). Three varieties of selection and their implications for the origins of language. In G. Györi (Ed.), *Language evolution: Biological, linguistic and philosophical perspectives* (pp. 55-71). Peter Lang.
- Catania, A. C. (2005). The nonmaintenance of behavior by noncontingent reinforcement. *European Journal of Behavior Analysis*, 6, 89-94.
<https://doi.org/10.1080/15021149.2005.11434253>
- Catania, A. C. (2008). The Journal of the Experimental Analysis of Behavior at zero, fifty and one hundred. *Journal of the Experimental Analysis of Behavior*, 89, 111-118.
- Catania, A. C. (2011). On Baum's public claim that he has no significant private parts: A commentary on "Behaviorism, private events, and the molar view of behavior". *Behavior Analyst*, 34, 227-236. <https://doi.org/10.1007/bf03392254>
- Catania, A. C. (2017). *The ABCs of behavior analysis: An introduction to behavior and learning*. Sloan Publishing.
- Catania, A. C., & Keller, K. J. (1981). Contingency, contiguity, correlation, and the concept of causation. In P. Harzem & M. D. Zeiler (Eds.), *Predictability, correlation, and contiguity. Advances in analysis of behaviour, Volume 2* (pp. 125-167). Wiley.
- Catania, A. C., Matthews, B. A., & Shimoff, E. (1982). Instructed versus shaped human verbal behavior: Interactions with nonverbal responding. *Journal of the Experimental Analysis of Behavior*, 38, 233-248. <https://doi.org/10.1901/jeab.1982.38-233>
- Catania, A. C., & Reich, G. M. (1982). Key area versus number of keys in the pigeon's preference for free choice over forced-choice: A preliminary study. *Mexican Journal of Behavior Analysis*, 8, 127-132.

- Catania, A. C., Reilly, M. P., Hand, D., Kehle, L. K., Valentine, L., & Shimoff, E. (2015). A quantitative analysis of the behavior maintained by delayed reinforcers. *Journal of the Experimental Analysis of Behavior*, 103, 288-331. <https://doi.org/10.1002/jeab.138>
- Catania, A. C., & Sagvolden, T. (1980). Preference for free choice over forced choice in pigeons. *Journal of the Experimental Analysis of Behavior*, 34, 77-86. <https://doi.org/10.1901/jeab.1980.34-77>
- Cerutti, D., & Catania, A. C. (1997). Free-choice preference in pigeons: Key number versus key area. *Journal of the Experimental Analysis of Behavior*, 68, 349-356. <https://doi.org/10.1901/jeab.1997.68-349>
- Darwin, C. (1859). *On the origin of species by means of natural selection*. John Murray.
- Derrickson, J. G., Neef, N. A., & Cataldo, M. F. (1993). Effects of signalling invasive procedures on a hospitalized infant's affective behavior. *Journal of Applied Behavior Analysis*, 26, 133-134. <https://doi.org/10.1901/jaba.1993.26-133>
- Dews, P. B. (1962). The effect of multiple S^A periods on responding on a fixed-interval schedule. *Journal of the Experimental Analysis of Behavior*, 5, 369-374. <https://doi.org/10.1901/jeab.1962.5-369>
- Dews, P. B. (1966). The effect of multiple S^A periods on responding on a fixed-interval schedule: V. Effect of periods of complete darkness and of occasional omissions of food presentation. *Journal of the Experimental Analysis of Behavior*, 9, 573-578. <https://doi.org/10.1901/jeab.1966.9-573>
- Dunne, J. W. (1927/2021). *An experiment with time*. Good Press.
- Field, D. P., & Himeline, P. N. (2008). Dispositioning and the obscured roles of time in psychological explanations. *Behavior and Philosophy*, 5-69.

- Galison, P. (2003). *Einstein's clocks, Poincaré's maps: Empires of time*. WW Norton & Company.
- Gordin, M. D. (2015). Scientific babel. In *Scientific Babel*. University of Chicago Press.
- Greer, R. D., & Ross, D. E. (2004). Verbal behavior analysis: A program of research in the induction and expansion of complex verbal behavior. *Journal of Early and Intensive Behavior Intervention*, 1, 141-165.
- Hannah-Jones, N. (2021). *The 1619 project: A new origin story*. One World.
- Harzem, P. (1987). On the virtues of being a psychologist. *The Behavior Analyst*, 10(2), 175-181. <https://doi.org/10.1007/bf03392427>
- Hastings, M. (2011). *Inferno: The World at War, 1939-1945*. Vintage.
- Hawking, S. (2009). *A brief history of time: from big bang to black holes*. Random House.
- Hayes, S. C., Hayes, L. J., Sato, M., & Ono, K. (1994). *Behavior analysis of language and cognition*. Context.
- Herrnstein, R. J., & Hiline, P. N. (1966). Negative reinforcement as shock-frequency reduction. *Journal of the Experimental Analysis of Behavior*, 9, 421-430. <https://doi.org/10.1901/jeab.1966.9-421>
- Hiline, P. N. (1970). Negative reinforcement without shock reduction. *Journal of the Experimental Analysis of Behavior*, 14, 259-268. <https://doi.org/10.1901/jeab.1970.14-259>
- Hiline, P. N. (1977). Negative reinforcement and avoidance. In W. K. Honig & J. E. R. Staddon (Eds.), *Handbook of operant behavior* (pp. 364-414). Prentice-Hall. <https://doi.org/10.4324/9781003256670-14>

Hineline, P. N. (1990). The origins of environment-based psychological theory. *Journal of the Experimental Analysis of Behavior*, 53, 305-320.

<https://doi.org/10.1901/jeab.1990.53-305>

Hineline, P. N. (2001). Beyond the molar-molecular distinction: We need multiscaled analyses. *Journal of the Experimental Analysis of Behavior*, 75, 342-347.

<https://doi.org/10.1901/jeab.2001.75-342>

Hineline, P. N. (2016). *Narrative – A Major Gap in Our Account of Verbal Behavior*. Association for Behavior Analysis International, Chicago.

Holz, W. C., & Azrin, N. H. (1961). Discriminative properties of punishment. *Journal of the Experimental Analysis of Behavior*, 4, 225-232. <https://doi.org/10.1901/jeab.1961.4-225>

Hull, D. L., Langman, R. E., & Glenn, S. S. (2001). A general account of selection: Biology, immunology, and behavior. *Behavioral and Brain Sciences*, 24, 511-573.

<https://doi.org/10.1017/s0140525x01004162>

Kant, I. (1783/1950). *Prolegomena to any future metaphysics* (L. W. Beck, Ed.). Bobbs-Merrill.

Kantor, J. R. (1923). An objective analysis of volitional behavior. *Psychological Review*, 30, 116-144.

Kantor, J. R. (1970). An analysis of the experimental analysis of behavior (TEAB). *Journal of the Experimental Analysis of Behavior*, 13(1), 101-108.

Katz, I., & Catania, A. C. (2005). Concurrent performances: Extinction, noncontingent reinforcement and variably delayed reinforcement. *European Journal of Behavior Analysis*, 6, 95-108. <https://doi.org/10.1080/15021149.2005.11434254>

- Killeen, P. R. (2001). The four causes of behavior. *Current Directions in Psychological Science*, 10, 136-140.
- Killeen, P. R. (2004). Minding behavior. *Behavior and Philosophy*, 32, 125-147.
- Killeen, P. R. (2011). Models of trace decay, eligibility for reinforcement, and delay of reinforcement gradients, from exponential to hyperboloid. *Behavioural Processes*, 87, 57-63. <https://doi.org/10.1016/j.beproc.2010.12.016>
- Killeen, P. R., Tannock, R., & Sagvolden, T. (2011). The four causes of ADHD: A framework. In C. Stanford & R. Tannock (Eds.), *Behavioral neuroscience of attention deficit hyperactivity disorder and its treatment* (pp. 392-425). Springer-Verlag.
- Lloveras, L. A., Slanzi, C. M., & Vollmer, T. R. (2022). New (old) perspectives on self-injurious and aggressive biting. *Journal of Applied Behavior Analysis*, 55, 674-687. <https://doi.org/10.1002/jaba.924>
- Matthews, B. A., Shimoff, E., & Catania, A. C. (1987). Saying and doing: A contingency-space analysis. *Journal of Applied Behavior Analysis*, 20, 69-74. <https://doi.org/10.1901/jaba.1987.20-69>
- McDougall, W. (1922). Prolegomena to psychology. *Psychological Review*, 29, 1-43. <https://doi.org/10.1037/h0071695>
- Medawar, P. B., & Medawar, J. S. (1983). *Aristotle to zoos: a philosophical dictionary of biology*. Harvard University Press.
- Moxley, R. A. (1997). Skinner: From determinism to random variation. *Behavior and Philosophy*, 3-28.
- Moxley, R. A. (2007). Ultimate realities: Deterministic and evolutionary. *The Behavior Analyst*, 30(1), 59-77.

- Muller, R. A. (2016). *Now: the physics of time*. WW Norton & Company.
- Nachev, P., & Hacker, P. (2014). The neural antecedents to voluntary action: a conceptual analysis. *Cognitive Neuroscience*, 5(3-4), 193-208.
<https://doi.org/10.1080/17588928.2014.934215>
- Neiman, S. (2015). Evil in modern thought. In *Evil in Modern Thought*. Princeton University Press.
- Neiman, S. (2019). *Learning from the Germans: Confronting race and the memory of evil*. Penguin UK.
- Neuringer, A. (1970). Superstitious key pecking after three peck-produced reinforcements. *Journal of the Experimental Analysis of Behavior*, 13(2), 127-134.
- Neuringer, A. (2002). Operant variability: Evidence, functions, and theory. *Psychonomic Bulletin and Review*, 9, 672-705. <https://doi.org/10.3758/bf03196324>
- Neuringer, A. (2004). Reinforced variability in animals and people. *American Psychologist*, 59, 891-906. <https://doi.org/10.1037/0003-066x.59.9.891>
- Neuringer, A. (2014). Operant variability and the evolution of volition. *International Journal of Comparative Psychology*, 27, 204-223.
<https://doi.org/10.46867/ijcp.2014.27.02.09>
- Neuringer, A., & Jensen, G. (2010). Operant variability and voluntary action. *Psychological Review*, 117, 972-993. <https://doi.org/10.1037/a0019499>
- Neuringer, A., Jensen, G., & Piff, P. (2007). Stochastic matching and the voluntary nature of choice. *Journal of the Experimental Analysis of Behavior*, 88, 1-28.
- Nevin, J. A. (1969). Signal detection theory and operant behavior: A review of David M. Green & John A. Swets' *Signal detection theory and psychophysics*. *Journal of the*

Experimental Analysis of Behavior, 12, 475-480.

<https://doi.org/10.1901/jeab.1969.12-475>

Noë, A. (2009). *Out of our heads*. Hill and Wang.

Page, S., & Neuringer, A. (1985). Variability is an operant. *Journal of Experimental*

Psychology: Animal Behavior Processes, 11, 429-452. <https://doi.org/10.1037/0097-7403.11.3.429>

Paul, A. M. (2021). *The extended mind: The power of thinking outside the brain*. Eamon Dolan Books.

Rachlin, H. (1985a). Maximization theory and Plato's concept of the good. *Behaviorism*, 3-20.

Rachlin, H. (1985b). Pain and behavior. *Behavioral and Brain Sciences*, 8(1), 43-53.

<https://doi.org/10.1017/s0140525x00019488>

Rachlin, H. (1992). Teleological behaviorism. *American Psychologist*, 47(11), 1371.

Rachlin, H. (1994). *Behavior and mind: The roots of modern psychology*. Oxford University Press.

Rachlin, H. (2003). Privacy. In K. A. Lattal & P. N. Chase (Eds.), *Behavior theory and philosophy* (pp. 187-201). Kluwer/Academic Press.

Rachlin, H. (2007). Free will from the viewpoint of teleological behaviorism. *Behavioral Sciences and the Law*, 25(2), 235-250.

Rachlin, H. (2014). *The escape of the mind*. Oxford University Press.

Rachlin, H. (2018). Is talking to yourself thinking? *Journal of the Experimental Analysis of Behavior*, 109(1), 48-55. <https://doi.org/10.1002/jeab.273>

- Rachlin, H., Battalio, R. C., Kage, J., & Green, L. (1983). The concept of leisure in maximization theory. *Behavioral and Brain Sciences*, 6(2), 330-333.
- Richards, R. J. (1980). Christian Wolff's prolegomena to empirical and rational psychology: translation and commentary. *Proceedings of the American Philosophical Society*, 124, 227-239.
- Sanabria, F. (2020). Internal-clock models and misguided views of mechanistic explanations: A reply to Eckard & Lattal (2020). *Perspectives on Behavior Science*, 43(4), 779-790.
- Schlinger, J., Henry D. (2011). Introduction: Private events in a natural science of behavior. *The Behavior Analyst*, 34(2), 181.
- Schuster, R., & Rachlin, H. (1968). Indifference between punishment and free shock: Evidence for the negative law of effect. *Journal of the Experimental Analysis of Behavior*, 11, 777-786.
- Schwartz, B. (1981). In pursuit of B. F. Skinner. *Swarthmore Alumni Bulletin*, (March), 12-16.
- Schwartz, B. (1982). Failure to produce response variability with reinforcement. *Journal of the Experimental Analysis of Behavior*, 37, 171-181.
- Schwartz, B. (1986). *The battle for human nature*. Norton.
- Shimoff, E., Catania, A. C., & Matthews, B. A. (1981). Uninstructed human responding: Sensitivity of low-rate performance to schedule contingencies. *Journal of the Experimental Analysis of Behavior*, 36, 207-220.
<https://doi.org/10.1901/jeab.1981.36-207>

- Sidman, M. (1953). Two temporal parameters in the maintenance of avoidance behavior by the white rat. *Journal of Comparative and Physiological Psychology*, 46, 253-261.
<https://doi.org/10.1037/h0060730>
- Sidman, M. (1958). By-products of aversive control. *Journal of the Experimental Analysis of Behavior*, 1, 265-280. <https://doi.org/10.1901/jeab.1958.1-265>
- Sidman, M. (1989). *Coercion and its fallout*. Authors Cooperative.
- Simonian, M. J., & Brand, D. (2022). Assessing the efficacy of and preference for positive and corrective feedback. *Journal of Applied Behavior Analysis*, 55, 727-745.
<https://doi.org/10.1002/jaba.911>
- Skinner, B. F. (1935). The generic nature of the concepts of stimulus and response. *Journal of General Psychology*, 12, 40-65.
- Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. Appleton-Century-Crofts.
- Skinner, B. F. (1945). The operational analysis of psychological terms. *Psychological Review*, 52, 270-277.
- Skinner, B. F. (1948). "Superstition" in the pigeon. *Journal of Experimental Psychology: Animal Behavior Processes*, 38, 168-172. <https://doi.org/10.1037/h0055873>
- Skinner, B. F. (1950). Are theories of learning necessary? *Psychological Review*, 57, 193-216.
- Skinner, B. F. (1957). *Verbal behavior*. Appleton-Century-Crofts.
- Skinner, B. F. (1964). Man. *Proceedings of the American Philosophical Society*, 108(6), 482-485.
- Skinner, B. F. (1971). *Beyond freedom and dignity*. Knopf.
- Skinner, B. F. (1979). *The shaping of a behaviorist*. Knopf.

Skinner, B. F. (1981). Selection by consequences. *Science*, 213, 501-504.

<https://doi.org/10.1126/science.7244649>

Skinner, B. F. (1984). Reply to Catania. *Behavioral and Brain Sciences*, 7, 718-719.

<https://doi.org/10.1017/s0140525x00028284>

Skinner, B. F. (1989). The origins of cognitive thought. *American Psychologist*, 44, 13-18.

<https://doi.org/10.1037/0003-066x.44.1.13>

Slife, B. D., Yanchar, S. C., & Williams, B. (1999). Conceptions of determinism in radical behaviorism: A taxonomy. *Behavior and Philosophy*, 75-96.

Smolin, L. (2013). *Time reborn: From the crisis in physics to the future of the universe*. HMH.

Staddon, J. E. R., & Simmelhag, V. L. (1971). The "superstition" experiment: A reexamination of its implications for the principles of adaptive behavior. *Psychological Review*, 78, 3-43. <https://doi.org/10.1037/h0030305>

Stahlman, W. D., & Catania, A. C. (2020). First instances in phylogenic and ontogenic selection as captured by the verbal behavior of scientists and philosophers of science. *Behavior & Philosophy*, 48, 25-33.

Swets, J. A. (1992). The science of choosing the right decision threshold in high-stakes decisions. *American Psychologist*, 47(4), 522-532. <https://doi.org/10.1037/0003-066x.47.4.522>

Thorndike, E. L. (1921). *Educational psychology. Volume II. The psychology of learning*. Teachers College.

Titchener, E. B. (1912). Prolegomena to a study of introspection. *American Journal of Psychology*, 23, 427-448. <https://doi.org/10.2307/1413427>

Titchener, E. B. (1929). *Systematic psychology: Prolegomena*. Macmillan.

<https://doi.org/10.1037/11643-000>

Weinberg, G. L. (1994). *A world at arms: A global history of World War II*. Cambridge University Press.

Weiss, B., & Laties, V. G. (1961). Behavioral thermoregulation. *Science*, 133, 1338-1344.

<https://doi.org/10.1126/science.133.3461.1338>

Wilkerson, I. (2020). *Caste: The origins of our discontents*. Random House.

Yourgrau, P. (2009). *A world without time: The forgotten legacy of Godel and Einstein*. Basic Books.

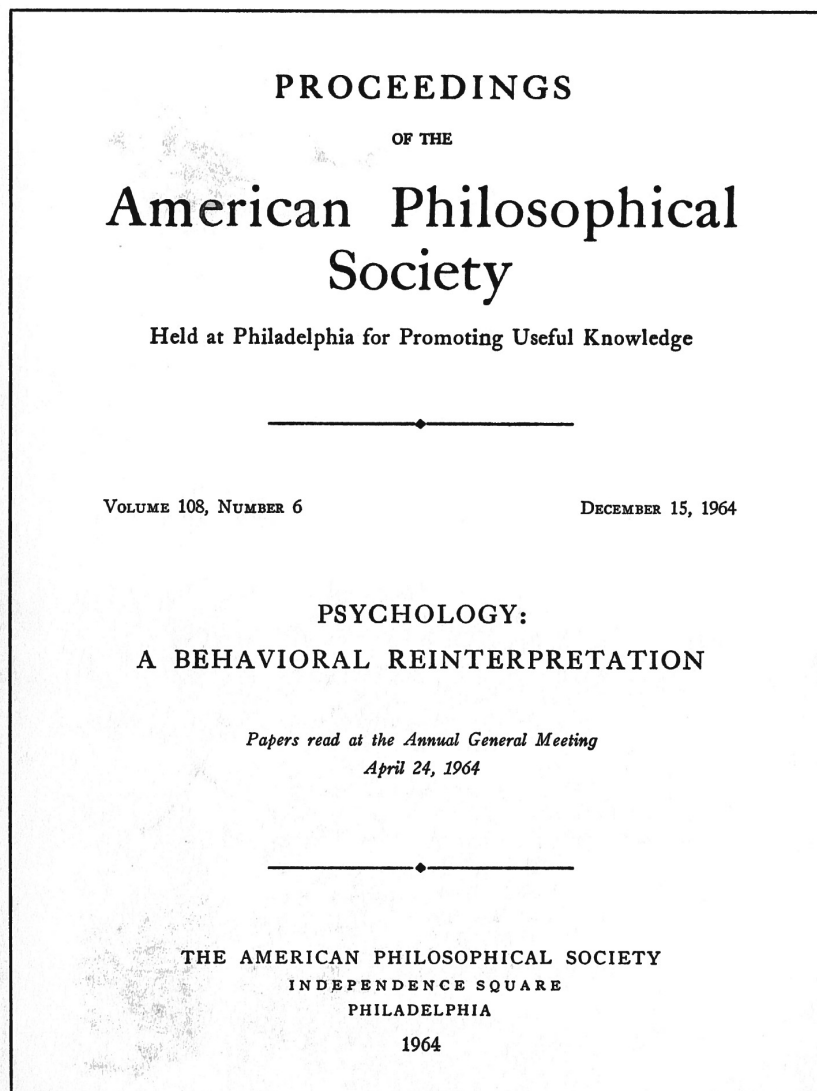
Zimbardo, P. (2011). *The Lucifer effect: How good people turn evil*. Random House.

Figure Captions

Figure 1. Cover of the December 1964 issue of the *Proceedings of the American Philosophical Society* (Volume 108, Number 6).

Figure 2. Contents page of the December 1964 issue of the *Proceedings of the American Philosophical Society* (Volume 108, Number 6).

<Figure 1>



<Figure 2>

PSYCHOLOGY:
A BEHAVIORAL REINTERPRETATION

*Papers read at the Annual General Meeting
April 24, 1964*

	PAGE
The Trend Toward Mechanism. EDWIN G. BORING.....	451
“Will.” R. J. HERRNSTEIN.....	455
“Experience.” NORMAN GUTTMAN.....	459
“Appetite.” PHILIP TEITELBAUM.....	464
“Humors.” P. B. DEWS.....	473
“Anxiety.” MURRAY SIDMAN.....	478
“Man.” B. F. SKINNER.....	482
Index to Volume 108.....	486

<end of MS>