

Murray Sidman: A life of giving

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Murray Sidman's contributions to the science of behavior span many areas including avoidance behavior, coercion and its effects, stimulus control, errorless learning, programmed learning, stimulus equivalence, and single-subject methodology. He was also a great mentor to many and helped shape the discipline we now call behavior analysis. In this memorial, we briefly highlight his scholarly legacy and share some personal anecdotes.

Key words: avoidance, coercion, Sidman, single-subject methodology, stimulus control, stimulus equivalence



Murray Sidman passed away on May 18, 2019 at the age of 96 after a long career in which he gave so much to the field of behavior analysis. He completed his Ph.D. at the Faculty of Pure

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Science at Columbia University under the supervision of Fred Keller and William (Nat) Schoenfeld in 1952. He worked at many renowned research institutions, including the Neuropsychiatry Division at the Walter Reed Army Institute of Research with Joseph V. Brady, the Neurology Department of the Massachusetts General Hospital, and the E. K. Shriver Center for Mental Retardation and Developmental Disabilities, where he was the Director Emeritus in the Behavioral Sciences Department. Sidman also taught at numerous universities, including Columbia University, University of Virginia Medical School, University of Nevada, and Johns Hopkins School of Medicine. He served on the faculty for 10 or more years at both Harvard Medical School and Northeastern University. In 1984, he retired from academia as Emeritus Professor in psychology at Northeastern. From 1987-2002, Sidman served as Senior

Research Associate at The New England Center for Children (NECC) where he held weekly lab meetings and conducted and supervised stimulus control research.

Together with P. B. Dews, C. B. Ferster, and N. Schoenfeld, Sidman was a founder of the *Journal of the Experimental Analysis of Behavior* (JEAB). He was one of the influential leaders who shaped our discipline from a small niche in psychology to a separate field. He is considered by many to be one of the founders of behavior analysis as an independent discipline.

Sidman received numerous awards in his lifetime. From the Association of Behavior Analysis International, he received the Award for International Dissemination of Behavior Analysis, for Distinguished Service to Behavior Analysis, and for Impact of Service on Application from the Society for the Advancement of Behavior Analysis. From the Experimental Analysis of Human Behavior Special Interest Group, he received the Distinguished Career Award. From the American Psychological Association, he received the Dole Award and the Ernest R. Hilgard Lifetime Achievement Award. Finally, he received the first annual Murray Sidman Award for Enduring Contributions to Behavior Analysis from the Berkshire Association of Behavior Analysis and Therapy.

Sidman's contributions to the science of behavior span many areas including single-subject methodology, avoidance behavior, coercion and its effects, stimulus control, errorless learning, programmed learning, and stimulus equivalence. We are fortunate that Sidman's large body of published work survives and will continue to influence current and future scientists and practitioners in behavior analysis and other disciplines. When asked what led him to author each of his books (e.g., *Tactics of Scientific Research: Evaluating Experimental Data in Psychology, Coercion and Its Fallout, Equivalence Relations: A Research Story*), Sidman (2009a) replied that he had something to say that other people might find interesting. His books, book

chapters, and over 100 peer-reviewed publications are gifts he left to all of us. Sidman's interpersonal interactions with others were also gifts, which included his comments, his nods, his quiet, whole-body laughs, and his probing questions. These are not tangible products on a shelf, but they influenced our behavior. In this memorial paper, we provide an overview of Sidman's major contributions to our understanding of experimental methodology, avoidance and coercion, stimulus control, stimulus equivalence, and his far-reaching and lasting contributions in the mentoring of others. We end with personal anecdotes of Murray and Rita Sidman.

Experimental Methodology

Sidman's methodological contributions are a significant component of his legacy. His book *Tactics of Scientific Research: Evaluating Experimental Data in Psychology* (Sidman, 1960) is recognized as the authoritative source for a Skinnerian view of research. It has been described as a treatise on behavior analytic methodology (de Rose & McIlvane, 2019), and one of the most important books in behavioral psychology (Moore, 1990). Sidman himself recognized that *Tactics* would likely be his most important contribution (Holth, 2010).

In offering his book to the student of experimental psychology, Sidman was addressing his concern with the methodology used and taught by most of psychology. To this end, Sidman offered a text that provided a systematic approach to behavioral investigation and its rationale, following the path initiated by Skinner and by his own advisors, Fred Keller and Nat Schoenfeld. His approach was one that could answer questions about causality rather than just correlation.

The main features of the approach diverged considerably from the practices in experimental psychology at the time (i.e., tests of hypotheses derived from theories). These features included the basic assumption that behavior as a natural

phenomenon is ordered and subject to laws (as opposed to intrinsically variable). The book also assumed that the goal of research is to find order or functional relations between behavior (i.e., dependent variables) and the environment (i.e., independent variables). His approach assumed that the understanding of complex behavioral phenomena can emerge from the intensive experimental analysis of individual behavior, by controlling the multiple variables of which a behavior is a function. Finally, his approach assumed that validity, reliability, generality and significance of scientific data are found in the experimental control of behavior and the systematic replication of findings, rather than in statistical evaluation.

In *Tactics*, Sidman articulated that an investigation is a step-by-step process in search of ordered data, not the rote implementation of a prescribed plan. Scientific investigations, he argued, involve rigorous (not rigid) experimental control in manipulating the independent variables and the precise measurement of the dependent variables. Sidman emphasized that throughout the process, the experimenter's behavior must also be under the control of the data generated in the investigation. In the optimal experimental arrangement, the experimenter controls the subject's behavior, while the subject's behavior controls the experimenter's behavior simultaneously. The experimenter's onus is to find regular patterns of behavior. Being guided by the data requires continuous evaluation and experienced decision-making. In Sidman's (1960) words: "In our search for new information we must be prepared at any point to alter our conception of what is desirable in experimental design... each new problem of investigation requires its own techniques" (p. 214).

Whereas an analysis of all the issues and concepts Sidman elucidated in *Tactics* is beyond the scope of this memoriam, those interested in the experimental analysis of behavior, especially young behavior analysts who are looking to find answers to conceptual or applied questions, are

strongly encouraged to read it. Despite becoming a sexagenarian in 2020, this book remains a precious source on methodology for behavioral science. In his autobiography, Skinner (1983) spoke to the importance of Sidman's text:

In 1960, Murray Sidman published *Tactics of Scientific Research*. I sent him a telegram—BRILLIANT JOB. SURE TO HAVE LASTING EFFECT ON PSYCHOLOGY. CONGRATULATIONS—and I wrote: 'You have written a remarkably good book, and one which is going to be useful to all of us. I hope it gets the attention it deserves from scientific methodologists...What is more important is that young people in the field will now have the chance to consider quietly and thoughtfully the many practices which have become a standard part of our behavior.' The book became a kind of Bible among operant conditioners. (p. 266)

From Avoidance to Coercion

Sidman first became famous for his work on avoidance. The procedure and the behavioral phenomenon called unsignaled avoidance or free-operant avoidance is better known as Sidman avoidance. The basic procedure was first reported in two papers that were parts of Sidman's doctoral dissertation. In his first paper, published in *Science*, Sidman (1953a) argued that the data obtained from the standard signaled avoidance procedure were "gross," limited to the occurrence or non-occurrence of an avoidance response. He went on to report his new "technique" which allowed the use of response rate as a sensitive, continuous measure of avoidance behavior as a function of independent variables. The technique freed avoidance behavior from the restrictions of trials initiated by warning signals, paralleling Skinner's free operant, which led Sidman (1966) to argue for the procedure to be called "free-operant avoidance." Avoidance

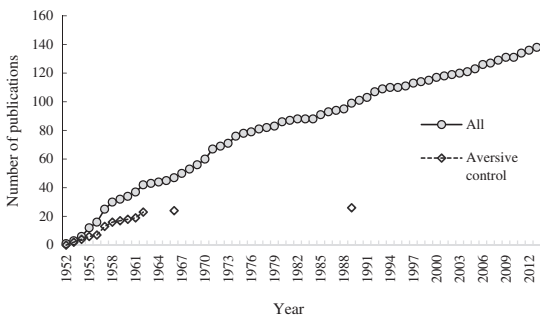
was effectively established when responses postponed shocks otherwise delivered at fixed intervals. In his second paper (Sidman, 1953b), he presented a parametric study of delay intervals, showing very orderly results from three rats. As Sidman (1989a) later reported, it did not occur to him that anyone would ask for more than the three subjects, considering the orderliness of the data. According to Sidman himself, at that time nobody did.

When reflecting upon his early work, Sidman (1989a) emphasized that “avoidance was in the air” (p. 191) for both theoretical and applied reasons. First, avoidance was considered a theoretical puzzle. An effective avoidance response was followed by nothing. How could “nothing” be a reinforcer? In his first paper on the issue, Sidman (1953a) concluded that something indeed happened when the avoidance response occurred. Incompatible behavior that had been paired with shock was terminated. Second, there was the growing conviction that aversive control was fundamental to many clinical problems, and that empirical investigation of the basic behavioral principles might contribute to improved practices.

Sidman’s groundbreaking experiments on avoidance marked the beginning of his 10-year period of research in that area. Figure 1 depicts the number of publications related to avoidance by Sidman himself over this relatively brief

time period summed up to approximately 20. Following Sidman’s work, free-operant avoidance has been replicated and shown to produce very consistent response patterns in a variety of species, and it has been used widely in behavioral pharmacology. He published an overview a few years later (Sidman, 1966) and then returned to the field of aversive control with his powerful book titled *Coercion and its Fallout* more than 20 years later (Sidman, 1989b). His book makes a strong position statement against the widespread use of aversive control in personal affairs as well as in society at large. He wrote that “When we look at the general picture, portrayed in subsequent chapters, whether or not to punish disappears as a genuine problem. The clear answer is ‘No.’” (p. 5). Sidman warned that even when punishment seems justified as an effective means to treat serious aggression or self-injury, beware of the effect upon the person who uses punishment (i.e., the behavior of punishing is reinforced by the effects of the punishment). In sum, Sidman made a strong argument for replacing aversive control with positive reinforcement in education, child rearing, government, law enforcement, diplomacy, human relations, therapy, and other areas. Having learned from his own research on aversive control, he was a very kind and generous person who practiced what he preached.

Figure 1
Cumulative Publications by Sidman from 1952 to 2013.



Stimulus Control

Murray Sidman’s contribution to stimulus control research is unparalleled in behavior analysis. His research on stimulus control spanned his entire career, from his thesis in 1949 to his last papers, flourishing from the mid-1960s to the 1980s. Sidman and his colleagues endeavored to identify and rectify stimulus-control deficiencies in people who had brain abnormalities, such as those who had suffered a stroke. Sidman later stated that “behaviorists could gain much by working the central

nervous system into their formulations instead of ignoring it” (Sidman, 2008, p. 129). He also lamented that not enough follow-up research had been done to develop stimulus-control methods that might alleviate some of the behavioral effects of brain abnormalities.

Throughout his career Sidman argued that, because a simple stimulus has many properties, the true sources of stimulus control were not always evident. The stimulus property that effectively controls the response is not always the one intended by the experimenter. Determining which aspect controls behavior requires careful methodology. The core of Sidman’s concern was the nature of the data required to claim the existence of a particular stimulus-control relation. Later in life, Sidman (2009b) related: “Whenever I see an author claiming that an accuracy of 75% (even 80%) indicates that a subject has learned a two-sample two-comparison conditional discrimination, I stop reading that paper” (p. 12). Sidman was not satisfied with his own data unless the accuracies were 90% or above, depending on the experimental situation. Sidman (1980) outlined these complex problems in detail, summarizing them this way:

... accuracy does not provide an orderly scale of measurement. Dependence on accuracy to evaluate a conditional discrimination, particularly at intermediate levels of accuracy, can generate erroneous conclusions about the extent to which the controlling relations are those specified by the experimenter. (p. 285)

Sidman and his colleagues, most notably Larry Stoddard, Barbara Ray (e.g., Ray, 1969), William V. Dube, and William J. McIlvane (e.g., McIlvane & Dube, 2003), developed the concept of stimulus-control topography. The research and concept are complex and beyond the scope of this paper. Yet, the intricacies of stimulus control are evident in this statement in Stoddard and Sidman (1971):

The term [stimulus-control topography] focuses attention on the *truly* controlling properties of the stimulus (and on the *actual* controlled response) rather than the stimulus and response as operationally defined in the reinforcement dependency. When the experimenter’s definition and the actual controlling events are identical, “stimulus-control topography” and “controlling stimulus–response relation” are synonymous. (p. 143)

The considerably advanced methodology and conceptual framework Sidman and his colleagues developed in stimulus-control research formed an important background for developing methods that enabled the experimenter to establish new stimulus–stimulus–response relations that were not directly trained, but were instead products of learned relations related by equivalence.

Stimulus Equivalence

Murray Sidman’s name will forever be associated with the concept of equivalence classes. Stimulus equivalence has become a fruitful area of research and application with hundreds of publications by a variety of researchers. Sidman witnessed the growth of equivalence research spanning almost five decades from his early work in 1971 up to his death in 2019. He treated the stimuli in a class according to the mathematical concept of equivalence such that a class of equivalent stimuli should have the properties of reflexivity, symmetry, and transitivity (i.e., the stimuli in a class should be substitutable). Sidman designed an experimental methodology that enabled researchers to test each of these three properties of classes of stimuli.

Sidman (1971) was a remarkable study in many ways, but we will point out two. First, this study was an applied demonstration of stimulus equivalence 11 years before the theory would be articulated (Sidman & Tailby, 1982).

Sidman summarized this complex experiment in his brief and elegant abstract:

A retarded boy, unable to read printed words orally or with comprehension, could match spoken words to pictures and could name pictures. After being taught to match spoken to printed words, he was then capable of reading comprehension (matching the printed words to pictures) and oral reading (naming the printed words aloud). (p. 5)

Second, Sidman (2007) shared the personal excitement he and others in his lab experienced at the time:

As the tests progressed, we could not believe what we were seeing. . . The lab technician, sitting behind Kent in the experimental room, could hardly contain himself. At the end, he leaped up, grabbed the boy in a bear hug, and shouted, “Dammit, Kent, you can read!” Outside the room, where the rest of us were watching through a one-way window, I was dancing the twist; my son, who happened to be in the lab at that moment, said to me later, “Dad, I’ve never seen you like that before!” (p. 315)

This original demonstration of stimulus equivalence stands out as a golden example of using a single-subject design as a method of proof. The outstanding results have been replicated over and over resulting in the development of a whole new field of research and application. The economy of teaching benefits demonstrated in the research literature (i.e., after teaching a few stimulus–stimulus relations, other stimulus–stimulus relations and naming performances emerge) gave rise to Equivalence-Based Instruction (EBI) which has been used to teach a variety of symbolic repertoires to a range of learners, including children with autism spectrum disorders and college students (Pilgrim, 2020).

For a thorough coverage of Sidman’s equivalence research, the reader can consult his book *Equivalence Relations and Behavior: A Research*

Story (Sidman, 1994), which reprinted his many experimental articles on the topic along with his descriptions on how the research developed and what he considered to be applications and implications of the research. Readers interested in an introduction to this area are advised to read his tutorial (Sidman, 2009b). Sidman (2008) was clearly aware that his equivalence research had implications for phenomena customarily studied in cognitive psychology:

In studying equivalence relations, behavior analysts may be showing cognitive psychologists the way. The power of reinforcement is not to be denied or minimized, but it is also clear that much stimulus control comes about without being directly generated by a reinforcement contingency and without any possibility of being a product of primary stimulus generalization. (p. 129)

Mentoring Others

Sidman travelled the world and gifted many with his kindness and knowledge. He always embraced the culture and customs of the people around him. He learned how to speak, how to laugh, what to eat and drink, when and how to hug or bow. He was able to fit in and make anyone who spent time with him feel special. He found ways to highlight things that were important to others and he made himself a valuable reinforcer.

He often travelled to Brazil. His first visit was in 1985, where he was invited to a conference and contributed a paper (Sidman, 1985) to a local journal (*Psicologia*) that has since become a classic reference on teaching individuals with intellectual disabilities. In 1987, Sidman visited the University of São Paulo (USP) as a Fulbright Scholar. He taught a class on stimulus control that was attended by graduate students and several professors from USP and other universities. Those were memorable

Thursday afternoons, in which he told the story about the decisions that preceded each experiment and the reasons why each had been conducted. His visits were repeated many times in the following years and Sidman's attendance at national conferences (e.g., Brazilian Society of Psychology [SBP], Brazilian Association of Psychology and Behavioral Medicine [ABPMC]) made them huge events. Many students of psychology in São Paulo and other cities would count the days until they could again spend time learning from him. Many professors had the privilege of learning and collaborating with Sidman when he lived in Brazil, and many Brazilian students followed him back to the United States to learn more. Some of them studied under his guidance in Northeastern University's Master's Program in Applied Behavior Analysis.

Sidman's teaching and influence was likely as profound in the other countries to which he travelled, including Japan (as a Visiting Professor of Psychology at Keio University in 1993) and New Zealand (as an Erskine Fellow at the University of Canterbury, Christchurch). Sidman was a great mentor to many around the world, guiding students in a graceful way and steadfastly modeling and shaping the behavior of future scientists. When analyzing data, Sidman encouraged his students to apply scientific doubt and the law of parsimony. He never questioned the outcome data; he did, however, question interpretations of those data. When asked by Holth (2010) how education would benefit from a science of behavior, Sidman replied that he "would ... support the principle that teachers should be evaluated by the performance of their students and that teachers receive training in how to increase the level their pupils' performances reach" (p.185). Applying this view, we can only conclude that Sidman was an exceptional mentor, as evidenced by the empirical and applied products of his students and colleagues, and by those whom they later mentored.



Murray and Rita

When remembering Murray, we also remember Rita, his wife and life partner of 48 years. They met at Massachusetts General Hospital, where Rita was a head nurse. We remember her as a beacon of kindness and an honorary behavior analyst. If Murray was not in the lab when a session was conducted, he wanted a phone call as soon as the session ended. Rita always answered the phone and made the caller feel as though Murray was waiting for their call, as though nothing was interrupted, and nothing was more important than the call, even when the call came during the dinner hour.

Rita read Murray's papers and books when in manuscript form and listened to his talks when he was preparing them at home. When Murray decided to republish *Tactics*, he eventually settled for publishing it himself, resulting in the foundation of Authors Cooperative, which published books by other authors as well. Rita played an important role in the early successes of Authors Cooperative. In no small way, Murray recognized Rita's influence in his work and dedicated his book on *Coercion* to Rita with these words: "For my wife Rita, who is very possibly the least coercive person in the world."

Murray always travelled with Rita, and you could spot them from a distance because they always walked hand in hand. Murray was a frequent presenter at the Association for Behavior Analysis conventions and drew large audiences at his presentations. Rita would be the last one by his side before he spoke and the first by his

side when he finished. When one of Murray's students or colleagues was presenting, he and Rita would sit in one of the front rows, and smile and nod contingently during the presentation.

After Murray left NECC in 2002, he and Rita moved full-time to their lovely condo in Sarasota with a view of the Gulf of Mexico. The Sidmans continued to travel in retirement, and Murray still wrote invited academic papers. As they had in Boston, Murray and Rita hosted many visitors to Sarasota and loved to show them the city. When one spent private time with the Sidmans, it was common to hear them converse in great detail about a variety of topics, trying to remember events and people. Murray often fondly said "Rita is my hard drive" as he could always rely on her to produce the names of people they knew, where they last met them, their spouses' names, and sometimes the most recent conversation shared with them. Sometimes they would engage in precurrent back-and-forth conversations in which Rita would provide potential names, one at a time. Murray would shake his head, "no it is not him, it is that other guy ..." until the right name was said and affirmed.

Eventually, in 2006, they moved to a retirement community in Sarasota. When Murray and Rita no longer wanted to travel to conferences, Iver Iversen and Per Holth brought a conference to them. A group of about 20 former collaborators were invited to the Sarasota Symposium of Behavior Analysis. Each person presented for 10 minutes, followed by group discussion of the topic for the next 20 minutes. The discussions were lively and informed. What was intended to be one or two annual meetings became a total of six meetings with different attendees between 2011 and 2018. Murray presented his ideas at the first four meetings and made general comments at the last two. Here follow some observations on his own life, as transcribed from a video recording from the fifth meeting in 2016:

It is a great honor to be the guest of honor, as I was called at this meeting. But the honor belongs to all of you people, not to me. I have done my producing, and I am finished. The hardest work in the world is thinking creatively. And I am not capable of it anymore. I am too old. I am halfway through my 93rd year. I am not going to be able to do this anymore. And I hope my friends will allow me to retire and stop asking me to write papers and give talks. (Audience laughter)

But my work is done, as I said. I am very delighted that people, like you and others, find that work useful. To me, the purpose of living is to affect the behavior of the people who come after us. We don't know why we are here if there is any reason at all beyond just evolution. And if there is a reason it is going to show up in later generations, not in ours. And I am delighted that people of the current generation find my work useful, if it has changed their behavior in some way.

Sadly, Rita passed away in 2013 after several years of battling cancer. Sidman was by her side all the time and pushed her in her wheelchair the last years of her life. Shortly after she passed away, Sidman realized that he, too, had problems walking. To friends he would say "Rita was my walker the past few years." Sidman was in relatively good health in his 90's and was delighted when he had visitors. He was a very good listener, and the speaker would surely be told if he or she wasn't clear. During his last years, his vision problems prevented use of his computer. He lamented that he was unable to read the titles and abstracts in *JEAB* and other journals and that he couldn't read his emails and reply to his friends. He also had hearing problems, but his hearing aids improved communication considerably and he was delighted to hear about his visitors' research and their life in general. He remained sharp to the end of his long and productive life.

Murray Sidman will be remembered for his extraordinary contributions in forging the new field of behavior analysis, for his kindness and willingness to mentor others, and for being extremely thoughtful and systematic when addressing scientific questions that continue to influence further scientific inquiry and the application of the science in solving societal problems.

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