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Narrative: Why It's Important, and How It Works

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Abstract Behavior analysts have said little about narrative and storytelling, emphasizing instead the functional/pragmatic aspects of verbal behavior. Nevertheless, these are ubiquitous human activities, and they are important to understand. Stories are prominent in essays on social issues, fund-raising appeals and political speeches, and they are the bedrock of theater. Foundational narratives are at the roots of major religions and of conflicts between them, and narrative has been proposed as an organizing basis for psychological wellbeing as well as a source of empathetic reactions. The ongoing process of reading or hearing a good story entails interlocking relations between establishing stimuli and their related, differentiated reinforcing consequences, with a story's coherence providing a key to its reinforcing effects. What are the behavioral principles that underlie the repertoires involved in all this? Behavior analysts have defined and studied some—the basic verbal classes, of course, although temporally extended sequences require some adjustments in these. Intraverbal behavior needs to be parsed into sub-categories to delineate highly varied sequences such as occur in paraphrase and translation. These two, along with imitation, generalized imitation and re-telling of stories, entail a salient role of complex invariance. The terms pliance and tracking help to balance the roles of speaker and listener, and to account for joint attention, which appears important in early verbal development. Transfer and transformation of function are additional ubiquitous processes, addressed through stimulus equivalence, relational frames, and other higher-order operants, especially naming, which entails the fusion of speaking and listening. Finally, we should consider ways in which a behavioral understanding of narrative can serve both behavior analysis and its surrounding culture.

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B. F. Skinner's masterstroke—one of them, at least—was to adopt the term *verbal behavior* for addressing phenomena that are typically treated as *language* (Skinner, 1957). Accompanying this was his defining and categorizing the behavior of concern in terms of functions instead of symbols, communication, and the like. The resulting terms of analysis support his focused upon what the behavior accomplishes rather than upon the forms it takes, thus bypassing the traditional topics of linguistic analyses. The latter tend to emphasize formal/structural relationships that are typically codified in grammatical terms. In Skinner's account, two actions such as saying "come here" and beckoning with one's finger, are functionally equivalent, for they produce and are maintained (reinforced) by the same class of consequences (the listener/observer approaches the speaker/actor). In structural/grammatical terms the two actions are not even in the same ballpark.

These, of course, are what he called *mands*, defined as a functional class that includes requests (and more, for a child's inarticulate tantrum can also be a mand, reinforced by the caregiver's reaction). In contrast are *tacts*, another functional class, which includes descriptions occasioned by things present. The functionally defining features of tacts concern the stimuli that set the occasion for them to occur and be reinforced (but not consistently by *particular* reinforcers, for this would give them mand properties). Thus, tacts correspond roughly to the ordinary-language terms of naming, labeling and describing. The correspondence is not exact, for one can name or describe something one has never seen; those actions are not tacts (*Naming*, capitalized, also has been given a technical definition, as will be discussed below). As sketched here, mands and tacts both are terms grounded in function-based theory. There are many additional functionally defined terms, but the behavior-analytic account that derives from Skinner's formulation, builds out from these two fundamental classes.

To be sure, in some early, little-known papers Skinner addressed the formal characteristics of rhyme, rhythm, alliteration, and assonance (Skinner, 1939, 1941). For example, he devised an "index of alliteration," computing the conditional probabilities of consonants being repeated in Shakespeare's poetry and comparing these with the probabilities that would be expected to occur by chance. This yielded the surprising result that the two probabilities did not appreciably differ. Whatever the conclusion, Skinner's methodology foreshadowed some of the analyses that literature analysts from other traditions have subsequently undertaken since the advent of digital computers (e.g., van Dijk, 1985; Heritage, 1985). Skinner also proposed a principle of "formal strengthening" to account for some of the patterning in written literature. He touched lightly upon those early efforts in his subsequent comprehensive account (Skinner, 1957), but there, he was rather dismissive of literary traditions as bases for understanding human behavior:

> Scientific verbal behavior is set up and maintained because of certain practical consequences. . . In literature there are no similar practical consequences and metaphorical extensions therefore prevail. No one will deny that they are effective; but the advantage we gain by reading Dostoyevsky or Joyce, in coming to

> share their "knowledge" or "understanding" of human nature, is very different from the advantage gained from scientific study." (p. 99)

Whatever the nature of that alternative effectiveness, one must grant that scholars in the literary traditions have addressed a range of subtleties that have not been captured in a behavioral approach. For example, Davidson (2014) compared different authors' prose styles in a manner that reminds me of the way a musicologist might compare Beethoven to Chopin or Poulenc to Debussy. But Skinner was skeptical about what was to be gained by such analyses:

> Insofar as literature simply describes human behavior in narrative form, it cannot be said to show understanding at all; but the writer often seems to "say something" about human behavior, to interpret and analyze it. (Skinner, 1957, p. 98).

And:

> Literary effects upon the reader do not in general depend upon the maintenance of a correspondence between the writer's behavior and a given state of affairs. The reader does not take practical action, is therefore not seriously misled, and makes no effort to hold the writer to a strict stimulus control. (p. 396).

Reading a fictional story, then, entails a conditional discrimination, effectively disengaging normal stimulus control in, what I learned in high-school, is "willful suspension of disbelief."

Behavior Analysts Have Neglected These Important Phenomena

The present agenda is to take more seriously the behavior of fiction writers and readers, as well as informal storytellers and their listeners. My topic is a category that does not easily fit into the behavior-analytic rubric, nor into the functional/structural distinction. Its identifying terms, *narrative*, or more informally storytelling, carry a variety of dictionary definitions,[1] but none of these delineates a behavior-analytic category. Nevertheless, I hope to show that narrative and storytelling are matters with which we should be concerned. I first became aware of the relevance of storytelling to

[1] 1. For example, in the *American Heritage Dictionary of the English Language*: "Narrative: A story or description of actual or fictional events. 2. The technique or process of narrating. … Narrate: 1. To tell (a story) 2. To give an account or commentary." … "Story: The narrating or relating of an event or a series of events, either true or fictitious. 2. A tale. 3. A short fictional literary composition. 4. The plot of a novel, play, etc. 5. A statement or allegation of facts. 6. An anecdote (Davies, 1969). 7. A lie." And in the *Random House College Dictionary (revised edition)*: "Narrative: 1. A story of events experiences, or the like. 2. A written or spoken work containing such a story. 3. The art, technique, or process of narrating. Narrate: 1. To give an account or tell the story of (events, experiences, etc.) in speech or writing. … Story: 1. a narrative, either true or fictitious, in prose or verse; tale. 2. a fictitious tale, shorter or less elaborate than a novel. 4. the plot or succession of incidents of a novel, poem, drama, etc. 5. a narration of an incident or a series of events or an example of these that is or may be narrated, as an anecdote or joke. 6. A narration of the events in the life of a person or the existence of a thing, or such events as a subject for narration. 7. A report or account of a matter; statement or allegation. 8. *Informal*, a "lie". (Flexner, 1984).

behavior analysis mainly as an irritation: when teaching a course in behavioral principles I learned from the students that one of my colleagues, when speaking of psychological theory, said something like: "Don't give me data. Give me a good story." Thus sensitized, I noted that introductory psychology textbooks were devoting more and more space to inset panels that told the story of how this or that psychologist had come up with his or her theory. My reaction was "Tell me about the science – not about the scientist!" Muttering at a book, of course, is not a very effective reaction.

To discern direct and obvious behavioral effects of narrative I should have attended more closely to *my own* behavior, for I had long since discovered that a good novel or mystery story can make a shambles of my work routine. Too many times, when I've begun reading a novel or mystery story despite having important work to do I read late into the night, becoming ineffective for the following day. I cope with this danger by confining most of my non-professional reading to short stories and nonfiction while reserving novels and mystery stories for vacation time. Expository essays on scientific or political topics carry no comparable risk, however interesting or important they might be.

Eventually I awakened to the question: What is it about stories that make them so addictive? Thus sensitized, I noticed stories everywhere. Most any magazine or newspaper article on a topic of social concern begins with the story of someone whose situation illustrates the problem. Fund-raising appeals that follow natural disasters typically begin with the story of a person who sorely needs help. Indeed, storytelling is an explicit fundraising strategy: A web-search using the phrase, "fund-raising stories" yields many entries, including "Success Stories Raise More Money," and "Fundraising Ideas to Raise Money with a Powerful Story." By both scholarship and common knowledge it is recognized that storytelling was important in myths and early oral histories, and that the written historical record is comprised mainly of stories. Foundational stories are at the core of major religions—the Christian Bible providing a prominent example, and the conflicting Shiite and Suni Muslim narratives providing another. We recognize a role of stories in child rearing: "Read to your child – not only at bedtime;" making up stories is encouraged as a form of creativity; and children's literature is a discipline in its own right. Politicians frequently drag into their speeches people who have achieved heroic deeds or suffered some calamity, and then embarrass them by re-telling the story, presumably with some benefit to the politician. Even Monday-morning discussions that feature humorous or unfortunate events of the weekend are comprised of stories. And then, of course, there's theater: "The play's the thing" in New York, where one can spend a small fortune to witness the enactment of a story.

All of this is commonplace. So much so, that it seems nothing special. But consider how you would react if, reading a scientific publication, you found:

> A biologist, studying an anthill in the desert observed columns of ants arriving single-file at a small sheltered area where they sat in rows and watched a few other ants behave just like ants.

This hypothetical quotation is not original with me, but I have been unable to find the source. Nevertheless, every day countless people behave like those ants, and the

entertainment industry depends upon it. What could be the functions of this behavior? What might be the behavioral processes that sustain it? Some clues as to several roles of narrative, as well as further affirmations of its importance, can be found in the popular press and other general sources: One role, related to that of fund-raising, noted above, is that of persuasion:

> Stories are one of the most powerful forms of persuasion available to us, especially stories that fit in with our view of what the world should be like. Facts can be contested; stories are much trickier . . . (Konnicova, 2015, p. SR 1)

That role can also be indirect:

> Mr. Cruz learned how to read his mostly liberal student judges, tempering his politics and opening with a compelling story instead of a statement of principle. (Horowitz, 2015, p. 1)

Its role in persuasion can involve an additional characteristic, a sense-making role, as illustrated by Supreme Court Justice Sonia Sotomayor:

> The state's case is a narrative: the story of a crime. The defense has only to cast doubts on the coherence of that story. The "why" elements of the story must make sense. . . . (Sotomayor, 2013, pp. 210-211)

But the organizing, or "sense-making," can also be troublesome:

> One of the things I've learned in journalism is to beware of perceiving the world through simple narratives, because then new information is mindlessly plugged into those story lines. (Kristof, 2015, p. A-23)

Or outright pernicious:

> As I write this, Britain's election should be a referendum on a failed economic doctrine, but it isn't, because nobody with influence is challenging transparently false claims and bad ideas. . . . "What nonsense am I talking about? It is a story about Britain that runs like this . . .[2] (Krugman, 2015, p. A 25)

On the other hand, the organizing role of narrative can also be seen as beneficial:

> *Narrative identity* is a person's internalized and evolving life story, integrating the reconstructed past and imagined future to provide life with some degree of unity

[2] The false narrative: "First, the Labour government that ruled Britain until 2010 was wildly irresponsible, spending far beyond its means. Second, this fiscal profligacy caused the economic crisis of 2008–2009. Third, this in turn left the coalition that took power in 2010 with no choice except to impose austerity policies despite the depressed state of the economy. Finally, Britain's return to economic growth in 2013 vindicated austerity and proved its critics wrong. . . . Now, every piece of this story is demonstrably, ludicrously wrong. . . Yet this nonsense narrative completely dominates news reporting, where it is treated as a fact rather than a hypothesis." (Krugman, 2015, p. A 25)

> and purpose. … (narrators) who construct life stories that feature themes of personal agency and exploration, tend to enjoy higher levels of mental health, well-being and maturity. …
>
> Researchers have tracked the development of narrative identity from its origins in conversations between parents and their young children, to the articulation of sophisticated meaning making strategies …" (Adams & McLean, 2013, p. 233, italics in original).

And,

> Recovering from trauma is mainly an exercise in storytelling. As Richard Tedeschhi, a psychology professor at the University of North Carolina at Charlotte has pointed out, trauma is a shock that ruptures the central story that you thought was your life. The recurring patterns that make up life are disrupted. The sense of safety is lost. . . . But some people are able to write a new story. . . . Researchers have found that people who thrive after a shock are able to tell clear, forward-looking stories about themselves, while those who don't thrive get stuck ruminating darkly about the past. (Brooks, 2015, p. A 27)

Narrative has even been formalized into a therapeutic approach:

> Narrative exposure therapy (NET) has been effectively used during the past decade for children and adults (for details see Neuner, Catani, Schauer, Schauer, & Elbert, 2008; Schauer, Neuner, & Elbert, 2011) to break down the fear network and thereby reduce or even eliminate trauma-related symptoms. NET is a short-term intervention for individuals who suffer from PTSD and other trauma-related symptoms. . . . Can be effective in short form of four to six sessions.… (Crombach & Elbert, 2014, p. 2)

And perhaps preventing the need for therapy, narrative is proposed as having role in generating empathetic concern for others:

> Reading is an essential way children learn to empathize with others, and adopt someone else's perspective … (Alter, 2015, p. B-1)

And,

> The story of one drowned Syrian boy washed up in the surf keeps us awake at night with grief. The story of four million refugees streaming out of Syria seems more like a math problem. (Renkl, 2017, p. SR – 7)

This is also implicit in a continuation of a quotation above from Justice Sonia Sotomayor (2013):

> The state's case is a narrative: the story of a crime. The defense has only to cast doubts on the coherence of that story. The "why" elements of the story must make

> sense. . . . ...What would have motivated this person to hurt that person – before you can engage the jurors' empathy, put them in the shoes of the accused or the victim, as needed: . . . (p. 211)

Skinner (1957) hinted at this as well in a comment on the general role of a "narrator" or storyteller:

> Instead of reporting to the listener something which he alone sees, he gets the listener to "see something his way" (p. 269).

Most of the above statements, several taken from newspapers, are not scientifically based, but they reveal a general recognition that narrative plays a ubiquitous role in human affairs. This ubiquity is uncontestable; just listen and look around you.

Much of the formal study of literature is concerned with narrative, and whole books have been devoted to examining how it works or how to use it for some particular agenda. Thus, for example, Boje (2008) has distinguished between narrative and storytelling, with the former being orderly, organized, often formally promulgated, and the latter being the disorderly process of behavior-in-process. His emphasis is upon the organizing role of stories, especially within social groups; he defines a storytelling organization as a "collective storytelling system in which the performance of stories is a key part of members' sense making and a means to allow them to supplement individual memories with institutional memory." (p. 1). Olson (2015), trained as a marine biologist and now a film director, has taken on the task of teaching scientists to present their work more effectively. His focus is mainly upon the organization of stories, in a manner that simplifies presentation with little to say about function.

Addressing These Phenomena as Behavior Analysts

So: How can we engage narrative, storytelling, and story-listening within a functional approach to verbal behavior? I have found only two behavior-analytic articles that come to grips with this: Barnes-Holmes and Barnes-Holmes (2002) and Grant (2005). The latter focused exclusively upon imaginative literature, with an emphasis on "tension" and negative reinforcement and without addressing what is involved in "making indirect contact with the contingencies described in stories" (Grant, 2005, p. 182). The former addressed the problem of indirect contact in terms of relational frames, but provided little detail regarding the dynamics of an unfolding story. I hope the present essay will encourage others to join in engaging the topic as a problem worthy of research, analysis and interpretation. First, I shall suggest some specific behavioral principles that may account for much of the potency of narrative—how it is that a good mystery story can keep me up at night. For this I propose an adjustment in the way we portray behavioral sequences, a graphical configuration that accommodates interwoven contingencies as they progress concurrently over time. In addition, *coherence* will be portrayed as a source of reinforcement. Next, I shall identify likely behaviorally defined processes involved in telling/writing, listening to/reading stories (and most of these processes, it turns out, we have already studied). This yields a rather tangled account, but there surely *are* several component and

prerequisite repertoires, and lots of things happen concurrently when one generates or reacts to a story. Finally, I shall consider ways in which use of narrative can serve our field and our culture.

The Ongoing Process of Reading a Good Story

You may have noticed a common theme in the various quotations presented above regarding the ubiquity of narrative and its various roles as commonly understood. These roles include commonly misleading or oversimplifying journalistic accounts (Kristof, 2015; Krugman, 2015), providing the bases for legal cases (Sotomayor, 2013), and providing bases for personal wellbeing and therapy (Brooks, 2015; Crombach & Elbert, 2014). The common theme is an organizing role, that of providing coherence, a role that was succinctly captured by Watts (1963, 1997):

> To understand anything is to be able to fit various parts into a system which is an integrated whole, so that they 'make sense' (p. 51).

For a tangible and familiar example illustrating coherence and its role in behavioral process as proposed here, consider a jigsaw puzzle. When on vacation without a lot of conflicting contingencies you might find yourself engaged for hours assembling a picture that was already available, intact, on the lid of the box that the puzzle came in! In solving the puzzle, you may begin by searching for pieces with straight edges—those are the initial reinforcers—thus isolating a subset that can be fit together without excessive trial-and-error. The four pieces with *two* straight edges are especially potent reinforcers during the initial search, for they will provide the corners that enable the assembly of a complete frame. Next up are pieces with common distinctive features of color or texture, which enable assembly of coherent patterns that will occupy various areas within the frame. A major reinforcing event arises each time these can be aggregated together or locked into the border. Coherence is operative whenever even just two pieces are seen to fit together, and it continues to be operative as further aggregation progresses. I propose, then, that it is informative to view similarly the parts of stories, arrayed over time instead of simultaneously as pieces of pictures. What remains is to identify behavioral functions of the events in the story that correspond to the pieces of the puzzle, and to devise a method for portraying how the process is organized.

As noted above, Barnes-Holmes and Barnes-Holmes (2002) provided a behavioral account of stories that, in outline, is consistent with the account offered here, organizing their account around the conception of relational frames (Hayes, Barnes-Holmes, & Roche, 2001). Stories may be understood, they asserted, in terms of *relational networks*, which are comprised of language units such as sentences and paragraphs and which can be more or less complete. Most relevant to the present discussion, they observed that: "The reinforcing value of stories is based merely on the properties of developing complex relational networks and transforming psychological functions in terms of these relations." (p. 36). Their adjective "merely" implies that relational frame theory portrays the component processes as simple, or at least straightforward, whereas it actually entails a great deal of complexity. Nevertheless, their relational networks are analogous to the more-or-less assembled pieces of a puzzle, which I offer as an analogy.

In either case, details about how the processes play out as a story progresses need to be spelled out.

My *Eureka* moment for seeing how this is to be accomplished was provided in a masterful one-page essay by Lee Child (2012) who exemplified a key principle even while describing it. Early in the essay, Child sketched his personal experience as a script writer for television situation comedies, mentioning "something that almost no one had in 1980 and almost everyone had in 1990, and it changed the game forever" (unpaginated electronic document). He then teased the reader with several extraneous sentences before revealing the answer: Playing upon the metaphor of writing as cooking, he advised the strategy of making the reader hungry. That being a metaphor, food deprivation was not at issue. Instead, the "hunger" was illustrated by what you, Dear Reader, probably are now experiencing with respect to "something that almost no one had in 1980." So now I offer the affordance for a consummatory response: It was the remote-control device. In 1980, when a television program was interrupted by a "commercial break," changing channels would require getting up off the couch and walking across the room. In 1990, the channel could be changed by mere movement of a finger. The writers' solution was to introduce a question or cliff-hanging dilemma prior to each commercial break. This technique successfully induced the audience to stay with a story, even when the question raised was irrelevant or trivial. The practice has become ubiquitous, and even forthright, as skillfully practiced by certain television commentators in their programs on current political events, who have induced me to endure many boring, repetitive commercial messages. (As a further illustration, did the interrupted quotation from Krugman, a few pages back, induce you to look at the footnote? Applications of the principle have varying degrees of subtlety; note that the parenthetical question here is yet another example.)

What "clicked" for me, relating Child's (2012) argument to behavioral concepts, was the role of establishing operations, or more particularly, establishing stimuli.[3] Raising the question, to be answered "right after the break," in a television program is an establishing operation; the question itself is an establishing stimulus, which potentiates a reinforcing effect of whatever will follow the break. To work this out as it applies to storytelling and listening, I need to first address the way in which we portray and expand the traditional three-term to a four-term relation. The traditional, three-term relation of discriminative stimulus, response, and consequence, is typically portrayed as a linear sequence, perhaps because this is typographically straightforward, when expressed in terms of linear algebra (e.g., Killeen & Jacobs, 2017), although it is also portrayed that way in less formal diagrams (e.g., Cooper, Heron, & Heward, 2007, pp. 265 and 293). Either way, it suggests linearly sequenced events, each at its own moment in time. We need instead a diagrammatic arrangement that portrays the discriminative event as delineating a situation, and, where appropriate, as extended in time. Thus, in Fig. 1, the S^d symbol rides above a pair of brackets; any responses within the situation bounded by those brackets will result in the designated consequence (or lack thereof, if the bracket denotes a situation of extinction); a schedule of intermittent

[3] At the time, I was unfamiliar with Grant (2005), who introduced the term "literary establishing operations," characterizing these as aversive in character, and as operating mainly at the level of a whole story, whereas I see them as equally important at multiple levels, and usually involving positive reinforcement.

Fig. 1 Diagrams of the 3-term relation of discriminative stimulus, which, along with the accompanying brackets, delineates a situation in which a given response can be reinforced

reinforcement might also be operative within such a situation. Also, as shown at the right, this accommodates cases where responses are repeatedly reinforced within an unchanging situation rather than just once.

But often, the reinforcing event is a change of situation, denoted by a new S^d, thus comprising a behavioral chain (Fig. 2).

Fig. 2 Diagram of a behavioral chain

We also need to portray establishing conditions, whereby reinforcers become potent. Reflecting its origins in research with nonhuman animals, the prototypical establishing condition was arranged through deprivation of food or water. This was not typically represented in contingency diagrams since in most experiments the establishing condition was in effect throughout an experimental session. This became problematic when Jack Michael's introduction of *establishing stimulus* into the behavior-analytic lexicon brought verbal responses within the account (Michael, 1982, 2000; for recent elaborations, see Laraway et al., 2014). To accommodate Michael's innovation when teaching, I began introducing the concept to students in the classroom by pulling a five-dollar bill out of my pocket and announcing: "The first person who can tell me how to spell "onomatopoeia," and prove that their spelling is correct, receives this five-dollar bill. Does anybody want a free lunch?" I thus potentiated cell phones, laptop computers, and dictionaries as reinforcers, consequent upon the students' quickly seeking out these tools and engaging in a repertoire that would produce evidence of the correct spelling of the word. My statement was an establishing operation, more recently called a *motivating operation* (Laraway, Snycerski, Michael, & Poling, 2003).[4] Note that, unlike the classic deprivation operations, establishing stimuli (and the converse, abolishing stimuli) can change the establishing condition from moment-to-moment. I could have (although I never did), followed the $5 offer with "I was just kidding," thus effectively

[4] Although I prefer the original, less-loaded term. Also, I reserve "operation" for the explicit production of establishing conditions, and not to such conditions that "just happened" as when a hike in the sun potentiates water as a reinforcer, resulting in an *establishing condition*—a state of affairs whereby a particular class of reinforcers is effective (Hineline & Groeling, 2011)

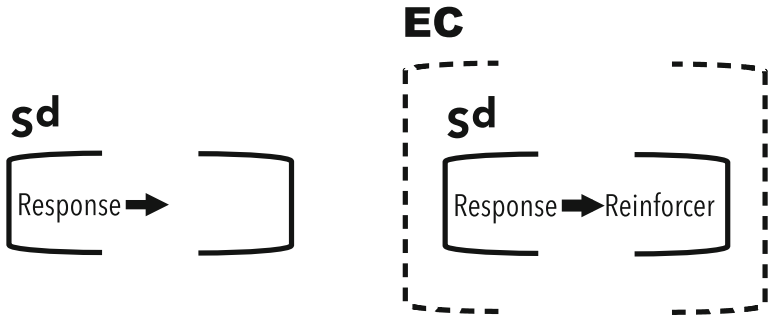


Fig. 3 Diagram indicating the role of an establishing condition

abolishing the establishing condition in a trice. It follows that the temporal extension of establishing conditions is independent of the duration of the discriminative stimuli pertaining to the availability of the reinforcer—hence the dashed brackets that portray an establishing condition in Fig. 3. Note that if there is no establishing condition, there is no reinforcement, regardless of whether the response produces some consequent event.

It is a straightforward matter to diagrammatically portray the temporal relationships between establishing stimuli, establishing conditions, discriminative stimuli, and reinforcing events, left-to-right: For example, for my five-dollar example, the moment of the establishing operation, my announcing the contingency, is denoted by EC and its position (placed at the left above or within the bracket; a similar relation holds for the S^d in Fig. 4). Prior to that moment, a student could have retrieved a dictionary (or its equivalent) at any time, but the dictionary was not a reinforcer. Retrieving the dictionary from a book bag under the chair would be the first response in a behavioral chain, yielding the dictionary, an S^d for the repertoire of looking up the printed word, which would be the discriminative stimulus for carrying the book to the lectern and showing me the printed word. The fact that the student could have fetched the dictionary at any time also shows that my statement was not a discriminative stimulus. Instead, it was an establishing stimulus, producing a motivational condition that ceased with delivery of the reinforcer (Fig. 4). To be sure, the chain could be analyzed into smaller units, but the present scale of analysis suffices for portraying the relationship with the establishing operation, and delineating the duration of the establishing condition that ensues. The dashed brackets can be combined to portray the pattern of establishing conditions within a story, as shown in Fig. 5 a, b.

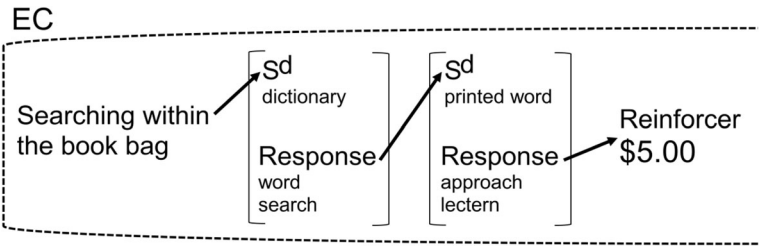
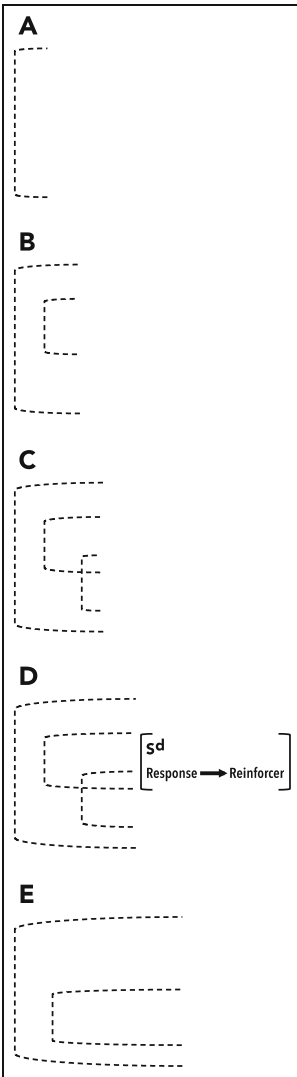


Fig. 4 Diagram showing the establishing condition in a classroom example

Component and Prerequisite Repertoires

While the diagrams and accompanying behavioral terms portrayed here, address the sequential processes that maintain the telling of and listening to or reading a story, these say little about the basic repertoires that enable such remarkable human behavior. Some that are obviously involved are formal verbal classes: echoic behavior (vocal occasioned by vocal), textual behavior (vocal as occasioned by written or printed text), transcription (writing or typing as occasioned by written or printed text), and dictation-taking. It is tempting to take these for granted as merely

a



Initially (A), as indicated by the dashed bracket at the left, "the stage is set" – for example, with the crime to be solved or an explicit "Let me tell you a story," or implicitly, "You wouldn't believe what happened to me yesterday…." Each promises an eventual reinforcer, the completion of a puzzle, which will be the completion of the story.

Soon after (B), as indicated by extension of the original bracket and the addition of another, some question is raised, relevant to the established situation, and thus portrayed as overlapping. Independent plots and digressions would proceed in parallel without overlapping.

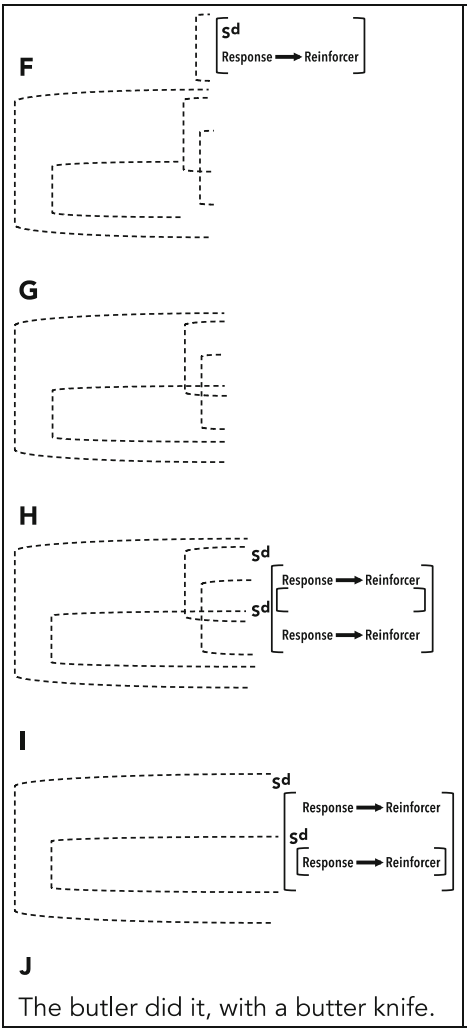
A third establishing condition (C) might be introduced -- the posing of an incidental question, perhaps concerning the history of one of the characters in the story, or setting up a subsidiary matter, perhaps a bit of humor.

But then (D) a bit of the mystery is solved or seen, a suspect is eliminated, or a matter of suspense is neutralized.

Thus, a bit of the puzzle is filled in, or one source of interest is satisfied. This reinforces the reader's or listener's staying with the story so far, but it also eliminates the second establishing condition that had appeared (E).

Fig. 5 **a** Diagrams showing a sequence of nested establishing conditions and discriminative stimuli as they would portray a story. **b** Diagrams as the story continues

b



Left with only two establishing conditions in place, and so not to lose the reader, a couple of new questions or uncertainties might quickly be introduced (F). These are shown as accompanied by something extraneous to the main plot. It may merely provide for a humorous aside, or interesting fact, thus yielding a reinforcer shortly after it appears.

And, of course, it eliminates the establishing condition that was the basis for its effectiveness (G).

Being limited by lateral space here, I must make this a very short story, and thus two of the sub-plots will be resolved simultaneously (H).

Perhaps the death of a suspect eliminates the possibility of her marrying the hero of the piece. This, of course, eliminates the corresponding establishing conditions, leaving the final suspect or component of the unresolved question (I).

With this plot thus simplified, and perhaps the perpetrator unmasked, all that remains is to tell how cleverly the evil deed was accomplished, and summarize the dénouement (J).

Fig. 5 continued

duplicative and not very interesting, but upon close examination the relevant discriminations and response topographies prove to be impressively complex. Acquiring textual behavior is what we call "learning to read," and it can be a struggle if not well taught although it need not be difficult (e.g., see Layng, Twyman, & Stikeleather, 2003). In echoic behavior, the voice quality of the speaker's and listener's voices are likely to be very different (e.g., male vs. female, adult vs. child), with compounded complexity of varying regional accents (e.g., as found in the Mississippi delta vs. DownEast Maine). Analogously, transcription of hand-written script into text on a computer screen entails generalization between

strikingly different physical configurations (see Catania, 2013, pp. 284–292 for a more extensive discussion of these relationships).

These illustrate a concept that is applicable to narrative in various ways and at various scales of description (and degrees of abstraction), that being the concept of *invariance*. As a straightforward example, for a modestly skilled reader various type fonts can all be treated interchangeably as stimuli for textual or transcriptive behavior; for example:

INVARIANCE (Times New Roman)

INVARIANCE (Curlz MT)

INVARIANCE (Monotype Corsiva)

INVARIANCE (Broadway)

Complex invariance is a familiar phenomenon in visual perception, with object constancy being a well-known example: We act in relation to objects as unchanging while we move around them or they move around us, even though they present highly varied patterns of stimulation (Graham, 1951). Regarding the present concern, repeating a friend's tale of a childhood escapade could be discriminated as "the same story" even though many of the words and sentences were not the same. The same goes for the more formalized processes of translation and paraphrase. One might find it a bit of a stretch to treat generalization between type fonts and between extended verbal sequences as illustrating the same phenomenon, but the difference cannot be one of differing complexity, for even nonhuman subjects' combined generalizations and discriminations, which we interpret behaviorally as concept formation, can entail complexity rivaling that of paraphrased stories. For example, Herrnstein and Loveland (1964) prepared for an experiment by forming two classes of pictures—those that included people and those that did not—within a collection that portrayed a wide variety of scenes. Thus, the experimenters discriminated between classes while generalizing within classes. They then arranged for pictures with people to be the occasions for pigeons' key-pecks to sometimes produce food, while pictures not including people accompanied extinction. Even when never seeing the same slide twice, the birds learned the discrimination quite quickly. The experimenters were unable to identify particular physical dimensions correlated with the discriminated categories—the only evident invariance (while countless other features were unsystematically changing) was between the experimenters' discriminations/generalizations and those of the birds regarding the presence, or not, of a person. Even the persons were highly variable—of varying races, gender, and types of clothing. The number of varying features thus rivaled the numbers of features in a typical story. Such complex invariance is to be marveled at not for its rarity, but for the fact that biological organisms cope with it so well.

The Stimuli That Occasion Tacts, Paraphrase, and Translation

Mand and tact functions are discernable in storytelling—either as part of the story or as suggesting characteristics of the storyteller's behavior while the story is being told. For example, the mand function of a story could be simply to keep listeners attending to the storyteller rather than to someone else; on the other hand, the story might be organized around a tact occasioned by some temporally extended pattern of events, such as the differing habits of drivers around Los Angeles vs. those of drivers around Boston. Furthermore, mand and tact repertoires acquired early in an individual's history are integral to general verbal competence, and are likely to be built upon in the progression that eventually includes telling and reacting to stories. However, to bring stories into the technical account requires some adjusting of the standard exposition.

When introducing the term, Skinner defined the tact as a verbal response occasioned by a *nonverbal* stimulus, with the repertoires of identifying colors being straightforward examples. How, then, should we categorize responses that are occasioned by *verbal* stimuli? We can dispense with the one-to-one relationships of echoic, textual, transcriptive and dictation-taking, as covered above. By default, this leaves a huge and varied category identified as *intraverbal behavior:* "a verbal response occasioned by a verbal stimulus, where the relation between stimulus and response is an arbitrary one established by the verbal community" (Catania, 2013, p. 395), and there is no point-to point correspondence, as in echoic or transcriptive behavior (Skinner, 1957, p.71). Commonly mentioned examples are chained sequences such as reciting the alphabet and the memorized pledge of allegiance, as well as conventional sequences of greetings such as "Good morning" ... "Good morning; how are you?" ... "Fine, thank you." But these comprise only a small, limited sample of verbal behavior occasioned by other verbal behavior, and thus some sub-categories are needed. As a relatively simple example illustrating this, Partington, Danville, and Bailey (1996) taught preschool children to appropriately respond to the questions, "What are some . .(fruits, toys, etc)?" thus producing concept formation under verbal (intraverbal) control. Two less straightforward but important examples are translation and paraphrase. Skinner discussed these, acknowledging that they entail complex and overlapping units. He addressed translation at some length, noting that the translator's discriminations would be based partly upon the translator's past experience with situations similar to the original occasioning events of the units to be translated (Skinner, 1957 pp. 77–78). The argument can be delineated more clearly with respect to paraphrase: A paraphrased mand is a statement in alternative words that would be likely to produce the same consequence as by the mand to be paraphrased. A paraphrased tact would be an alternative statement appropriately occasioned by the same stimuli as occasioned the tact to be paraphrased.

These, as noted earlier, are good examples of *complex invariance*, relevant to narrative and storytelling. They are fairly manageable for individuals with fluent verbal repertoires. A detailed account of the component repertoires that this entails, including their origins, is another matter, and should be part of a fully adequate account of storytelling and story-listening. Behavior analysts are well positioned to appreciate the subtle complexity of this problem, having developed techniques for teaching such repertoires when they do not readily occur "naturally"—for example, when teaching

children with autism to generate varied social greetings and then to supply varied but interchangeable answers to "What did you do today?" Such repertoires are so easily learned by typically developing children that it is difficult to discern what is involved, whereas children with autism often require extensive training that requires analytic deconstruction to enable the needed syntheses.

One might argue that translation and paraphrase are to verbal antecedent stimuli as tacts are to nonverbal stimuli. The degree to which this is so depends upon the tacts, paraphrases, and translations' having corresponding discriminative functions for the speaker/writer and listener/reader. As pertaining to the listener/reader, those functions are often obscured in Skinner's account. While he did occasionally portray dyadic sequences, Skinner usually treated the listener as a generalized "audience" or verbal community while focusing on the behavior of the speaker. But when a narrative episode plays out in real time the role of the individual listener is more prominent. Bondy, Tincani, and Frost (2004) acknowledged this by introducing and defining a cluster of compound terms, including *intraverbal tact* and *intraverbal mand*, whereby the "intraverbal" label acknowledges a verbal antecedent (indicating that in these instances the speaker is also a reacting listener). Zettle and Hayes (1982) provided a better solution by introducing distinct labels for listeners' behavior. They proposed *tracking* as the listener's appropriate (likely to be reinforced) response to the speaker's tact, and *pliance* as the listener's appropriate response to the speaker's mand. These terms are helpful, for in most any dyadic exchange, each person is simultaneously both speaker and listener, and a given utterance can have at least two functions. In response to "What color is his shirt?" the reply, "Blue," is a tact (occasioned by wavelengths of light reflected off the shirt), but it also is pliance, reinforcing the first speaker's mand. The Zettle and Hayes terminology helps to keep this sorted out by delineating subtypes of intraverbal behavior without cluttering up discussion with the non-distinguishing term, "intraverbal." At the same time, it makes sense to combine terms in a way that acknowledges speaker as listener and vice-versa. Thus, answers to "What did she say?" could be pliance-echoic ("Pass the salt") or pliance-paraphrase ("She asked for the salt."). Translation could be treated similarly to paraphrase. These terms, then, would apply to a fine analysis of dialogue, as well as to more generic characterizations of verbal exchanges between the characters in a story.

Extended Time and the Context of Tacts

If I describe yesterday's ballgame, or if a cheated purchaser describes last month's sequence of "bait and switch" whereby the cheating occurred, these stories entail both extended sequences of relevant events, and substantial delays after the relevant events occurred. What are the behavior-analytic terms that account for the telling of and the listening to these stories? Regarding the delays: By Skinner's initial account the relevant stimulus must be present while a tact is emitted, with the implication that reacting to stimuli no longer present must be in a different category. Thus, for example, in his glossary of behavioral terms Catania (2013) asserted: "the tact relation includes only responses in the presence of or shortly after a stimulus, so it isn't equivalent to naming or reference" (p. 468). To be sure, responding to past events requires special learning history, as when a child learns to respond differentially (with appropriate autoclitics) to "What are you doing?" vs. "What did you do? "and "Where is the ball?"

vs. Where was the ball?" With these repertoires in place, remembering can be readily taught, as parents intuitively do, by slowly transitioning from brief to progressively longer intervals. As Palmer (1991) argued, responding differentially to past events is not to be understood as overcoming some inferred decay of stimulus effects (e.g., inferred "traces"), but instead as similar in several respects to responding to other distant events. Thus, as the intervening time intervals increase, remembering becomes a form of problem-solving, which is readily addressed with behavioral principles. Palmer stated:

> From this perspective there is no such thing as 'memory' to be studied. (The behaviorist) can study the behavior we engage in when we 'try to remember' something, and the behavior said to show that we did in fact remember something, and can study the behavior of subjects in memory experiments; but there appears to be no reason to distinguish such behavior from any other behavior of the individual. In short, the behaviorist can study, not a state or structure, but an activity, not memory, but remembering. (p. 264)

Palmer enumerated possible bases for decreasing stimulus control (difficulties in remembering) with time since the to-be-remembered stimulus was present: (1) failure to reinstate all of the relevant stimulus conditions, (2) competing responses to the same stimuli, and (3) competing responses to other stimuli. On this basis, Palmer concluded:

> Thus the failure of a discriminative stimulus to occasion a response may be due, not to a loss of control, but to competing responses and missing contextual support. However, demonstrating that decay is not at least partly responsible for a decrement in performance may be impossible, since it is not clear how to put the matter to experimental test. (p. 267)

As to the duration of tacted events: I have argued elsewhere and at length that treating the present as necessarily instantaneous, and causation as necessarily contiguous, is a mistaken characterization of both reality and behavior theory (Hineline, 1990, 1992, 1995, 2006; Field & Hineline, 2008). If rate or frequency is a fundamental dimension of behavior, "now," as an instant of reality, is problematic. If it is truly an instant, having no temporal "width," nothing is happening. So how wide is that instant? The best answer is pragmatic: What width yields an orderly account? How big is the relevant unit of behavior? How broad is its relevant context? Going beyond individual sentences, I propose that we also accept past extended sequences of events as occasioning behavior. Thus, besides being occasioned by stimuli in the speaker's past, the occasioning stimuli for a tact can also be someone's behavior, and even sequences of behavior. "She ran to first base," and "They played well, especially in the second half of the game," are examples of this. A play-by-play account would be a story, whether a series of tacts (first-person account) or of paraphrases (second person account).

To recapitulate, combining the issue of temporal relations with that of the listener's reactions to tacts and paraphrase (I'm putting translations aside, but they will usually have functions similar to paraphrase): Provided that the observer directly observed the event, it makes sense to treat "She hit him" as a tact whether the blow occurred just now or whether it occurred some time ago. With an added autoclitic, "I saw her hit him," it

remains a tact. "She insulted him" might be considered a vague paraphrase, although that shades into the realm of tacts, along with "That was an unkind thing to say." Adding the speaker/listener relations, an appropriate reply to "Why is she angry?" might be "Yesterday he insulted her" (pliance-tact) or "Yesterday he said she is stupid" (pliance-paraphrase). These, then, are functionally similar as a reply to "What color was his shirt?" The reply (including the autoclitic relevant to time delay, in "It *was* blue.") is occasioned jointly by a mand (the question), by characteristics of the discriminative stimulus (his action, his utterance, or his shirt), and by the time relation. The behavior-analytic account of these is straightforward if not hamstrung by presumed necessity of functional relations being based upon contiguous events.

Transfer and/or Transformation of Function

So far, I've been discussing behavior that has clearly defined functions. Thus, for example, tracking, which is occasioned by tacts (as well as by echoics, paraphrases or translations of tacts), is typically reinforced by environmental consequences, although these must not depend upon further behavior of the speaker (which would make it pliance instead of tracking). But what kind of behavior is "reading a story?" Except for presumed reactions to parables, the listener's reaction is not mainly pragmatic. In this respect, the reactions to stories belong with reactions to stimuli typically characterized as aesthetic, which Mechner (in press) proposes are non-pragmatic as well. Here, ordinary-language terms such as surprise or symbolic relations are invoked. What are the repertoires involved in that, and how do we get to those from the basic repertoires of reading and listening?

Part of what must be involved is reacting to a story more or less the same way irrespective of whether one heard it or read it—or even in some respects, react similarly to having directly experienced the events within the story. The processes involved in this have a long tradition of study under the label, *transfer of training*." In its elementary form, this entails substituting one discriminative stimulus for another (Catania, 2013, p. 470), which is to say an "old response" occurs to a new stimulus. A straightforward example is the listener/observer/reader's reactions to "stop." Most likely, a child first learns this as pliance to a vocal command from parent or caregiver. Subsequently acquiring textual behavior, we take for granted that the child will readily learn to stop when encountering the red octagonal signs with that word printed upon them, but note that this assumes transfer of from vocal to textual behavior, and even to the color of the sign. Further transfer will occur with respect to the colors of traffic lights. To the extent that each entails explicit instruction, the term, "transfer of training" is an apt label, and an extensive research literature verifies that transfer can be positive (learning the new relation is easier) or negative (learning the new relation is more difficult than if were unrelated to the earlier discrimination) (Catania, 2013, p, 403). In brief, then, transfer of function entails shift of stimulus control of a specified response or repertoire from a previous discriminative stimulus to a new one. This is especially relevant when the transfer is evident on first-exposure, without any direct training of the new relation.

What often goes unnoticed in this is the fact that the stimulus to which the behavioral control has transferred may have previously controlled some other behavior. Identifying

the difference between the previous functional relation and the transferred one justifies the term *transformation of function* (e.g., see Dymond & Rehfeldt, 2000). This term is more justified, and more salient, when a procedure results in a new relation that differs from "an old response to a new stimulus." For example, saying "George is a liar" changes the way people will interact with George, rather than to the statement itself. Similarly, saying "That's a hot potato," changes the manner in which one handles the tuber (literally or metaphorically). Technically, the two warnings are *function-altering stimuli* (Schlinger & Blakeley, 1987). Transfer is still there in the background, however, for the changed function of George or of the potato, depends upon past histories with liars or with hot objects. Thus, when focusing on the behavior that comes under new stimulus control, we tend to speak of transfer. Focusing upon the new functions of particular stimuli, we tend to speak of transformation. What follows here is consideration of basic behavioral processes upon which these appear to be based.

When one is first learning to read, reading the story appears to be quite purely textual behavior—just figuring out the words without reacting to them as meaning. The latter, of course, is the next step. Behaviorally, the "meaning" of a statement is in the functional relations whereby it occurs, and in the listener's or reader's reactions to it (Skinner, 1957).

"What's that, daddy?" (mand) ... "It's cotton candy." (pliance-tact). . . "Does that mean you can eat it? (tracking-mand) " . . . "yes" (pliance, abstract tact) . . . "Can I have some cotton candy? (tracking-mand). In this example, hearing a new tact leads directly to generating a new mand. In typical child development, this happens without explicit instructional strategies, so it seems unremarkable. However, there's more to it than typically meets the eye (or ear). Lamarre and Holland (1985) ingeniously demonstrated, in normally developing children, the transition from functional independence to interdependence of mands and tacts, catching it on the fly, so to speak, with the phrases, "It's on the left" (or right) and "Put it on the left" (or right). Initially, these were independent, but by the end of their experiment, transfer between the two was beginning to occur, merely as the result of the testing procedures. Individuals with autism often reveal verbal classes with especially robust (or resistant) functional independence as when I once observed identical twins with autism who were progressing within instructional programs that were designed to be comparable for the two individuals but were diverging as results emerged. When asked "Where is" one of the objects on a book shelf, one child readily pointed to the named item, while the other failed to do so. When asked "Please give me" one of those objects, the second child consistently complied, while the first child failed to do so. This disparity occurred even though both children had been able to discriminate the various objects in a different context.

Thus, in contrast to typically developing children, children with autism or other language delays often require explicit training of the various components of social interaction. Through extensive work with these populations of children, behavior analysts have been enabled to discern the repertoires and processes that are obscured within the rapidly expanding repertoires of typical verbal development. The necessary meticulous analysis and cataloging of component skills resulting in detailed curricula (e.g., Partington & Sundberg, 1998) and accompanying slow-motion acquisition of skills in the early stages of intervention when "if you don't explicitly teach it, they don't

learn it" throws light on much that we take for granted—not only component skills of reading and social interaction, but also the combining of, and especially the transfer between repertoires.

Some likely fundamental processes underlying this were elucidated by Sidman et al. (1982) in their groundbreaking study of emergent equivalence classes of stimuli. Using matching-to-sample procedures and stimuli that, by design, did not have physical characteristics in common, they taught their experimental subjects to select particular comparison stimuli, conditionally upon the presence of particular samples. For ease of exposition, I describe this kind of procedure here with stimuli that to us are non-arbitrary: With the numeral "1" as sample, and "one," "two," and "three" as comparison stimuli, selecting "one" is reinforced. Analogously, selecting "two" or "three," respectively, is reinforced in the presence of "2" or "3" as samples. Then in the next phase, with "one," "two," or "three" as samples, conditional selections are taught with "uno," "dos," and "tres" as comparison stimuli. Finally, in the testing phase, the Spanish words are the samples, and the numerals are comparison stimuli. If, with these selections never reinforced, the subjects nevertheless make the corresponding selections, they are demonstrating both emergent symmetry (interchanged stimulus functions, sample vs. comparison stimuli) and emergent transitivity (the numerals and Spanish words had never been presented simultaneously, but each had participated in discriminations involving the English words). Sidman et al. found that despite their using every training technique they could devise, these symmetrical and transitive relations did not emerge in the monkeys or baboons, but they readily occurred with children. Sidman and his colleagues expanded the paradigm further, demonstrating derived contextual relations whereby the training of a few conditional discriminations yielded many more discriminations without their being explicitly trained (Sidman & Tailby, 1982). The "emergent" interchangeability of sample stimuli and comparison stimuli may illustrate the basis of what is commonly called symbolic behavior or symbolic functioning. Notably, this can be accomplished without depending upon verbal instructions, and thus equivalence may be prerequisite to rather than a product of verbal repertoires.

Horne and Lowe (1996) elaborated upon the equivalence paradigm, proposing that fully functional verbal behavior depends critically upon the fusion of speaking and listening repertoires, a process that they labeled as Naming (following Greer & Speckman, 2009, I capitalize it here, to distinguish the term from general usage). In their conception, that fusion extends across the subclasses of behavior within the two domains, thus constituting higher-order classes. In a manner (and methodology) previously developed for equivalence classes, cross-modal relations appear without explicit training, as illustrated by Fig. 6 (Horne & Lowe's Fig. 1).

Hayes and his colleagues also elaborated upon the equivalence paradigm, arguing that equivalence is a special and somewhat limited case of a more general class of relationships, which they call *relational frames* (Hayes et al., 2001; Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001). They noted that while the defining features of equivalence—reflexitivity, symmetry, and transitivity (illustrated above)—enable one thing to stand in place of another, there are many other ways in which arbitrary stimuli can be related. For example, the relations of "greater than" show the characteristics of transitivity but not symmetry; and "opposite of" shows symmetry but not transitivity. These relations are captured under the rubric of "*contextually controlled, arbitrarily applicable relations*"—thus, relational frames. Giving the relations themselves

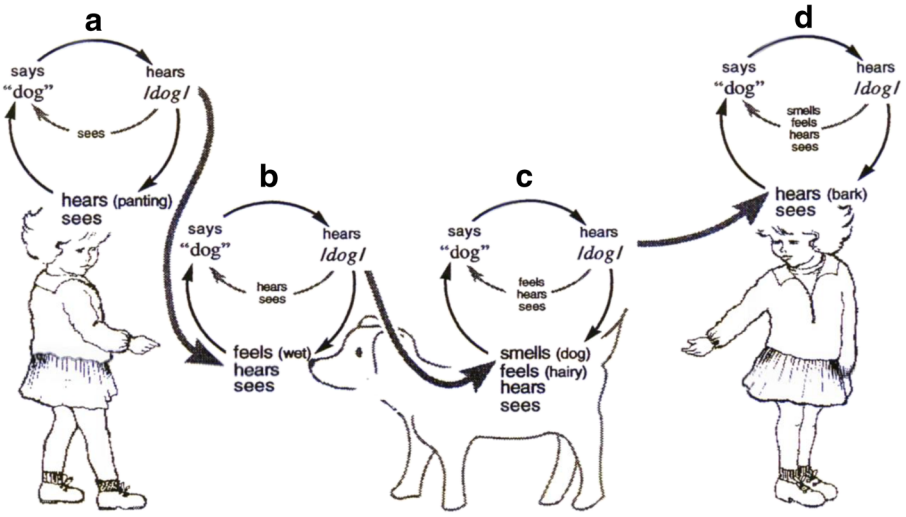


Fig. 6 Ongoing multidevelopment of the name relation: The child in this example has previously learned to say "dog" when seeing pictures of dogs and toy dogs. She next learns to say "dog" also when she sees a real dog; sees it move and hears it pant (**a**), touches its wet nose (**b**) pats its back, smells and feels its coat (**c**), and hears it bark (**d**). The name relation may now be evoked by any one, or some combination of, these new stimuli. In addition (as indicated by the inner gray arrows of name relations **a**, **b**, **c**, **d**), the auditory stimulus/*dog*/comes to occasion seeing feeling, smelling, and hearing of dogs, which may, in turn, evoke saying "dog" and so on. (Figure and caption reprinted from Horne & Lowe 1996, with permission)

discriminative properties, Barnes-Holmes et al. addressed some aspects of the issue that I identified above regarding tacts of temporally-extended relations:

> (Skinner's restriction that tacted events be present) raises the issue of words that superficially seem to be tacts but cannot occur in the presence of what they name. For example when does one actually see governmental units like states or nations, or subject matters like economics or politics? . . . . One solution to this problem can be found, however, . . . From the Relational-Frame-Theory perspective, the verbal tact involves the construction of contextually controlled relational networks of objects and events in the world. Once these have been established, it becomes possible to tact these networks themselves. Barnes-Holmes et al., 2001, p. 78).

Thus, we see that there are several related behavior-analytic conceptions of transfer and transformation of function, each emphasizing or capturing different aspects of relevant, interrelated phenomena.

Putting Oneself in the Place of Another

A transfer with particular relevance to story-reading and story-listening is that of "putting oneself in the place of another," whereby stories have been identified as likely bases for the development of empathy (e.g., Alter, 2015; Renkl, 2017; Skinner, 1957; Sotomayor, 2013). A likely starting point for this, both conceptually and pragmatically, is that of imitation. Complex invariance is again at issue, for the stimulation one receives when observing the behavior of a model is quite different from the stimulation

one receives when imitating the behavior of that model. The remarkableness of this is acknowledged through wide interest in the discovery of "mirror neurons"—neurons that fire both when an animal performs an action and also when the animal observes the same action performed by another. Along with studies using FMRI imaging with human subjects that identified comparable coordination at more gross anatomical levels, the notion quickly gained currency as the likely basis for imitation as well as for empathy regarding the actions of others (e.g., Rizzolatte, Fogassi, and Gallese (2001). However, although this is a fascinating discovery, the phenomenon of mirror neurons does not enlighten us as to their origins, to their functional properties or to how the relevant invariances are discriminated. Indeed, Jarrett (2013) identified mirror neurons as "the most hyped concept in neuroscience." His critique is akin to the longstanding behavior-analytic critique of appeals to physiology in which neurons are given the properties of "little people" or homunculi. (e.g., Skinner, 1963)

It should not be surprising that an organism and, thus, its neurophysiology, would be sensitive to the invariances relevant to imitation, for imitative repertoires surely are important to biological adaptiveness. For example, both birds and primates learn efficient repertoires of food consumption through imitation (Schneider, 2017). In thus providing a basis for accelerating the acquisition of new repertoires, imitation enhances the likelihood of an individual's survival (Catania, 2013). We see the behavioral rudiments shaped from simple to more complex responses in young children—as in "patty-cake" leading later to intricate patterns such as the string-game, "cat's cradle," which can entail cooperation as well as imitation. Component repertoires specifically involving verbal behavior in less structured play were illustrated in an experiment by Lodhi and Greer (1989), who observed four- to five-year-old children at play either with anthropomorphic toys (figurines, dolls and stuffed animals) or with non-anthropomorphic toys (puzzles, coloring books, story books). Conversational patterns occurred in the anthropomorphic condition only, and each of four verbal categories (tacts, mands, autoclitics and intraverbals) occurred much more frequently in the presence of the anthropomorphic toys.

The eventual repertoire, of observational learning such as "doing whatever I do," has been studied under the topic of generalized imitation. In a classic essay, Gewirtz (1971) provided a detailed account of such behavior, subsuming it within the paradigm of conditional responding, an extension of the extensive behavioral literature featuring experiments that employ matching-to-sample procedures. Those procedures lack a key characteristic for this application, however: For the imitator, the to-be-imitated behavior serves as sample, and that individual must generate the matching behavior instead of merely selecting an identical stimulus. Given that the stimulation thus generated differs from that of observing, it is neither arbitrary nor identity matching. Catania (1995) developed the behavior-analytic account still further, in a way that finesses that issue, by describing how novel behavior can be generated and maintained through reinforcement of higher-order classes..[5]

[5] Catania (2013) defines a *higher-order class of behavior* as "an operant class that includes within it other classes that themselves function as operants. . . . Contingencies operate differently on the higher-order-class than on the classes that are its components." Thus, note that if all instances of imitation are reinforced except those within one component class (e.g., jumping whenever the model jumps), that class may change even though it is no longer reinforced.

Imitation, of course, is comprised largely of overt behavior. But when I am reading a mystery story very little of my behavior is overt. Plausibly, "silent reading" evolves from simple textual behavior, but it clearly is not a matter of merely covertly saying the words. So, what kind of behavior is "reading a story" with only oneself as audience? The fusion of reader and listener repertoires, which Horne & Lowe characterized as Naming, is surely part of it. As this applies specifically to stories, a likely precursor of this repertoire may be discerned when an adult and a young child "read a book together," pointing out the pictures relevant to the text. With repetitions, this often results in the child becoming able to rehearse the story without the benefit of the text, as evidenced by protestations whenever the adult skips a page. The child clearly enjoys the exercise, requesting repeat performances of a favorite story. (Note: while adults do not typically re-read the same story multiple times, many adults enjoy repeated performances of a familiar piece of music—a possibly related phenomenon).

A behavioral pattern known as *joint attention*, which is embedded in such social exchanges, may be crucial to the process just described. Joint attention was initially both recognized and characterized within the literature of cognitive development, and was defined, for example, as the triadic coordination of attention between two people and an interesting object or event (Bakeman & Adamson, 1984), or "the capacity of the young child to use gestures and eye-contact to coordinate attention with another person in order to share the experience of an interesting object or event." (Mundy, Sigman, & Kasari, 1994, p. 389). The typical patterns include gaze shifts, pointing, and vocalizations that direct another person to look at some, typically novel, object, or event (Osterling & Dawson, 1994). Dube, MacDonald, Mansfield, Holcomb, and Ahearn (2004) provided a behavior-analytic account of this phenomenon that, while consistent with the developmental literature, deconstructed that literature's appeals to intention, theory of mind and the like, by identifying the functional relations that are involved. They emphasized the role of the adult's behavior that reinforces that of a child in a adult-child interaction, using a brief scenario:

> . . . the child plays alone with a puzzle on the floor. Suddenly a kitten runs into the room. The child's face lights up with surprise and pleasure at the sight of it. Her very next action is not to engage with the kitten in play, however, but rather to look up to her mother's face while pointing to the cat: Does mommy also see it? (p. 197)

In the Dube et al. interpretation, appearance of the kitten is a motivating operation (Larraway et al., 2003), which momentarily establishes the reinforcing capacity of "adult attending stimuli" as conditioned reinforcers. These stimuli reinforce the child's gaze-shift because they predict the adult will react to the interesting event, and the adult's reaction has been related to increased reinforcement. Other possibilities they note are possible adult-mediated consequences, or the adult's reaction indicating that the kitten is safe to play with (sometimes called "social referencing").

Wurstner-Swope (2010) provided an example that is more relevant to story-reading, illustrating a behavior-analytic account that links more closely with the cognitive-

developmental literature. She noted the similarity between "protoimperatives" vs. "protodeclaratives" as described in that literature (Bates, Camaioni, & Volterra, 1975) similar to the behavior-analytic distinction between mands and tacts. She also replaced Dube et al.'s distinction between adult and child roles, with speaker/listener, since as the relevant repertoires develop the child as well as the adult can play either role. Wurstner-Swope added the listener repertoires of pilance and tracking, coordinate with mand vs. tacts as discussed earlier in the present essay. In her account, the key relations operative within joint attention may be those of "pure tacts,"—pure in the sense of being uncontaminated by mand properties, the point being that the reinforcement of a tracking reaction to the initial gaze-shift need not be based upon subsequent behavior of the person who initiated the sequence. Thus, the following example:

> Suppose a hot air balloon is flying in the distance and a father sees it, looks at his child, and then shifts his gaze back upward to the sky, while adding, "A hot air balloon!" With the father's gaze serving as a discriminative stimulus, the child then looks at the balloon. Importantly, this last response is tracking rather than pliance, for the reinforcing result of that response does not depend upon further behavior of the father. (Adapted from Wurstner-Swope, 2010 pp. 19-20).

Comparable sequences are salient when one reads a book to a child; there may be some mands intermixed ("Look at the tiger" and "What's the tiger doing?") but the transition to independent reading surely reflects the transition to reading "for its own sake." Ultimately, the potency of the consequences embedded in a great novel or a gripping mystery story will have become independent of people other than the reader.

Reading for Comprehension

For behavior analysts, words are behavior or products of behavior. As Skinner (1957) pointed out, "meaning is not a property of behavior as such, but the conditions under which behavior occurs. Technically, meanings are to be found among the independent variables in a functional account, rather than as properties of the dependent variable." (pp. 13–14). Furthermore, a reader's understanding of a story goes far beyond textual behavior's discriminations, to discriminations of contexts that might have occasioned the behavior of producing the text (or of telling the story). The problem is not unlike that which confronts a translator, as noted earlier. Having sketched some of the relevant underlying repertoires I should acknowledge some work of colleagues who have undertaken not only to teach reading as synthesis of those repertoires, but also to provide systematic accounts of the synthesis. Thus, in a series of three articles Layng and colleagues (Layng, Sota, & Leon, 2011; Sota, Leon, & Layng, 2011; Leon, Layng, & Sota, 2011) have offered an account of the repertoires that reading for comprehension builds upon, beginning with what constitutes having a "verbal repertoire,"[6] as well as how to expand the vocabulary of textual behavior. They then sketched the techniques that comprise the Headsprout ™ Reading Comprehension program, first teaching the learner to discriminate distinct types of question that are used to assess reading comprehension, and then teaching the repertoires of answering those questions. In

[6] Donahoe & Palmer, 1994, pp. 300–318 discuss additional subtleties and complexities of this part)

doing this, the Headsprout authors explicitly built upon techniques that Sidman and his colleagues had developed for demonstration and study of equivalence relations (Sidman, 1994).

Greer and his colleagues (e.g., Greer & Speckman, 2009; Greer & Longano, 2010) have provided a more comprehensive account, a theory of verbal development that also draws upon much of what has been described here. They present their systematic account as arising from decades of research within the CABAS instructional system (Comprehensive Application of Behavior Analysis to Schooling), whereby they have encountered and remediated many impediments to the acquisition of verbal behavior—impediments that revealed many of the components of verbal competence. In this, they explicitly link these, via Naming, to the repertoires of textual behavior, as indicated by the figure from Greer and Speckman, reproduced here in Fig. 7.

Summing Up

At the beginning of this essay, I promised to identify a complex of overlapping and interacting processes that provide a basis for story-reading and listening as well as

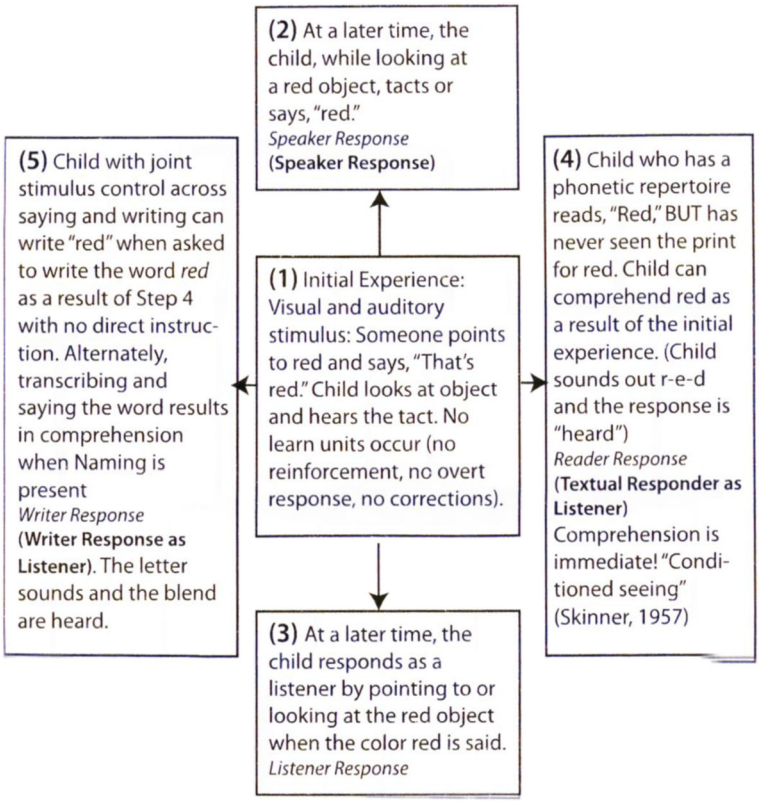


Fig. 7 The joining of print to the Naming capability, where a child with Naming who also has phonemic stimulus control can emit textual and spelling responses without instruction and who will have comprehension as a function of a Naming experience. (Greer & Speckman's Fig. 4, Reprinted from Greer & Speckman, 2009, with permission)

storytelling and writing. Many readers will have already known these individually through acquaintance with both basic and applied behavior-analytic research: textual behavior; tacts occasioned by verbal behavior and extended sequences of events; pliance, tracking, complex invariance, as illustrated by paraphrase and imitation; transfer of response functions and transformation of stimulus functions, through equivalence and relational frames; higher-order operants, especially Naming, which entails the fusion of speaking and listening; joint attention and discriminations relating to self to other, including discriminations of another's viewpoint. All of these underlie the relatively simple diagrams portrayed above in Fig. 5, whereby intertwined establishing stimuli set up the reinforcement of sustained reading or listening whereby we describe stories and narratives as compelling, as entertaining, as making sense.

Storytelling and Narrative in the Service of Behavior Analysis

The pervasiveness and multiple functions of narrative and storytelling throughout human behavior make this topic an important focus for the further development of behavior analysis. A detailed functional account of how these repertoires work can be a major contribution to human understanding and help to expand our place in the community of scholarship. Such an account should also be of practical use—perhaps, for example, enabling a remedy for some of the dysfunctional discourse that permeates today's politics by enabling more people to "walk in one-another's shoes." At the very least, such development should enable us to present our work and its underlying viewpoint more effectively.

Introducing Behavior Analysis to Students

The effectiveness of storytelling for engaging and persuading readers and listeners suggests useful strategies for introducing behavior analysis to students as well as to the world at large. There have already been a few examples of this, using personal stories to emphasize our field as a human activity. Thus, the Cambridge Center for Behavioral Studies has recently been publishing brief biographies under the title, *Behavioral Science: Tales of Inspiration, Discovery and Service* (Holdsambeck & Pennypacker, 2015–2017). While, as described at the beginning of this essay, I used to be irritated by textbooks that intruded scientists' personal stories into the substance of scientific work, I now recognize that those stories may help to engage student readers. Thus, it may be a good thing that Pierce and Cheney, (2008–2017) have followed common textbook practice by providing brief biographical sketches of behavior analysts when describing their work. Malott (2008) has taken a different approach in his introductory book, by cleverly using fictional stories to illustrate basic behavioral principles. Students have told me that this is the only textbook, on any subject, that week-after-week they have looked forward to reading. It would be useful go beyond such informal observations and systematically compare narrative with more conventional expository formats, using measures that address both accuracy of stating behavioral principles and fluency of effectively applying them. Another type of measure would concern a student's likelihood of doing optional reading that elaborates upon required assignments.

Presenting Our Accomplishments

There are additional possibilities, for the within-subject experiments that provide the foundation of behavior-analytic research are, at root, stories. The formalized prose required by core journals tends to obscure that fact, but in other contexts, where appropriate (e.g., TED talks and the like), the prose could be lightened up as illustrated by Skinner's (1956) "Case History in Scientific Method." Writing tongue-in-cheek, Skinner told stories from his experience as an experimenting scientist, contrasting these with the dictates of formalized scientific method and the statistical hypothesis testing that had become Psychology's "business as usual." Less provocatively, one could include some of the informative mis-steps and blind alleys of a project when describing the work—thus placing oneself in a more personal light.

However, a cautionary note was supplied by Chris Chambers (2015), regarding all-too-successful storytelling:

> Sometime in 1999, as a 22-year-old fresh into Australian Ph.D. Programme, I had my first academic paper rejected. "The results are only moderately interesting", chided an anonymous reviewer: . . .
>
> I immediately asked my supervisor where I'd gone wrong. . . . Surely it should be published even if the results were a bit dull? His answer taught me a lesson that is (sadly) important for all life scientists. "You have to build a narrative out of your result," he said. "You've got to give them a story." It was a bombshell. "But the results are the results!" I shouted over my coffee. "Shouldn't we just let the data tell their own story?" A patient smile. "That's just not how science works, Chris."
>
> He was right, of course, but perhaps it's the way science should work. Sixteen years late – on April Fools day – I find myself sitting in a meeting [with] an extraordinary cast of the good and great to debate one of the most serious crises facing biomedicine: too much story-telling, not enough reproducible knowledge." (unpaginated electronic document).

Re-tuning the Narrative of Our Field

Finally, and most importantly, the organizing, sense-making role of narrative suggests a basis for re-working and broadening our own understanding of our field while improving the ways we present it to the intellectual world at large. As to the broadening part of this, Susan Schneider's recent book, *The Science of Consequences* (Schneider, 2017) provides a rich resource. Beginning by placing behavior-consequence effects broadly within a biological context, she links these not only to evolution as commonly understood, but also to epigenetics, neurophysiology, ethology and more. She then proceeds to an exposition of processes revealed by basic behavioral research before going on to address topics of social concern. Schneider's work needs to be recognized as part of a story that places behavior analysis more saliently within contemporary scientific understanding and as a basis for improving the human condition.

As to that story itself: while its practical accomplishments have come to be respected, behavior analysis as a conceptual system has been widely misunderstood or even dismissed thanks to a narrative offered by cognitivists who introduce their viewpoint with a self-congratulatory history of their "overthrow of behaviorism." Their story is anchored upon Chomsky's notorious critique of Skinner's *Verbal Behavior* (Chomsky, 1959). Skinner never replied substantively, although he eventually justified that stance by observing that the review had not seemed worth a reply for Chomsky seemed not to understood Skinner's position (Skinner, 1972). Meanwhile, many people accepted the critique while otherwise unacquainted with Skinner's book or with details of the tradition growing from Skinner's work. On the one hand, we could, and perhaps should ignore this in emphasizing a new narrative focused upon contemporary developments.

On the other hand, the "Chomsky narrative" needs to be re-written, for an alternative, more accurate story is overdue, and its elements, including those that follow, are available albeit not effectively assembled. First, MacCorquodale (1970), as well as others, provided substantive arguments pointing out that Chomsky's critique was a plethora of inaccuracies and unsubstantiated assumptions. Second, today there is a broader understanding of evolutionary selection and of what a valid neuroscientific explanation must be like, which make Chomsky's miraculous "language acquisition device" hopelessly naïve. Third, Harris (1993) provided stories of the goings-on in Chomsky's shop during its heyday, with the message that Chomsky was a brilliant, vicious polemicist who attacked even his own students and set the field of linguistics back by decades. Fourth, according to a linguistic historiographer, by the 1990s, the field of linguistics had become substantially post-Chomskian, and more compatible with behavior analysis (Andresen, 1991, 1992). Indeed, Andresen's account is an alternative narrative, although it addresses behavior analysis only as concerning language. Fifth, Roediger (2004) offered several possible narratives sketching the status of behavior analysis more broadly, doing so from a conciliatory cognitivist perspective. These points provide the basis for a story that could begin with the fact that over the years, thanks to Chomsky and those who followed his lead, untold thousands of classroom teachers have begun their careers while lacking systematic principles for managing their students' behavior. Of course, this narrative should begin with the true story of an out-of-control classroom that, with the help of a behavior analyst, became an orderly, supportive learning environment where the students worked cooperatively to master basic skills and to creatively apply them.

Today the intellectual world may be ready to hear the new and different story about behavior analysis—a story carrying the message that a focus on behavior for its own sake readily yields studies of conceptual as well as practical import. It will be important highlight the variety of topics noted above that Schneider addressed, but somehow bring to light the panoply of behaviorally-defined phenomena (e.g., Catania, 2013, 2017), and in the equally comprehensive array of techniques for application and methods for their evaluation (e.g., Cooper et al., 2007). Furthermore, it is important to show that behavior analysis has been seminal in several widely embraced contemporary developments such as behavioral economics, positive behavioral support, and acceptance and commitment therapy. I mention these three in particular to suggest that our story includes legitimate roles in contemporary developments that have not carried

a behavior-analytic flag. For the good of our field, such an inclusive story must be a story that we tell to each other as well as to others we wish to engage.

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