

Thirty Million Words—and Even More Functional Relations: a Review of Suskind’s *Thirty Million Words*

T. V. Joe Layng¹

Published online: 23 August 2016

© Association for Behavior Analysis International 2016

In the mid 1990s, I met with the President of the Chicago Board of Education. I photocopied portions of a new book—*Meaningful Differences in the Everyday Experience of Young American Children* (Hart & Risley, 1995)—and launched into a discussion of the data. I explained that there were differences in language skills that were likely responsible for the success, or lack thereof, of children within the school district’s standard curriculum. We discussed how this had two implications. First, the standard curriculum may produce different results for children entering with different repertoires. Second, early childhood experience and education were critical. As a result of this discussion, programs were initiated to address the standard curriculum and early childhood experience. Though heartfelt attempts were made, both programs lacked the expertise and procedures required to make anything but a small dent in the performance of Chicago’s children. One problem with the early education effort was that during program design the district turned to developmental psychologists who, while acknowledging the work of Hart and Risley, did not use it as a basis for their recommendations. This is not the case for the program recommended in *Thirty Million Words* by Dana Suskind, a University of Chicago surgeon who specializes in cochlear implants, who describes a program based on the Hart and Risley data and their extension by other investigators. I will return to this shortly.

A few months after my meeting with the board president, I moved to Seattle. I began consulting for the Superintendent of Seattle Public Schools and had a very similar discussion with him. He got it immediately. Deciding that at that time early childhood programs targeting parents would be too difficult an undertaking, we developed a strategy for building thinking and reasoning skills for children beginning in kindergarten that would continue through grade 5. Most attempts at addressing language skill differences tended to be of short duration, intense, and typically not incorporated into the everyday lives of the learners. Our program would be different. Our program was

✉ T. V. Joe Layng
layng@comcast.net

¹ Generategy, LLC, Seattle, WA, USA

designed to provide continuous instruction in increasingly complex language skills for 6 years. It would be very low cost, create little extra work for teachers, and actually produce the type of observable changes in student behavior for which teachers yearn. One night while we were on the phone discussing the program, he mentioned that he was not feeling well and would be going to the hospital the next day for tests. He was diagnosed with cancer and died some months later. Our planned program died with him before it started. We will never know if our approach would have been successful.

Although there have been some short-term successes in helping those who come from language-deprived environments, the longer term prognosis typically is not good. In *Thirty Million Words*, Suskind makes the case that the primary effort must be on early childhood parent-child interactions. Later support programs may help, but the gap will likely remain. I will return to this assumption later as well, and suggest both are needed and both may work. As both a scientist and humanitarian, Suskind is willing to go beyond her medical training to help the children she clearly cares so much about. She begins *Thirty Million Words* by describing her initial excitement and later surprise and disappointment at the outcome of surgically successful cochlear implants. She discovered that hearing sound produced by speaking is not the same as responding to spoken sound as language. Even children who had initial partial hearing and seemed to respond well to the verbal environment showed continuing deficits following surgery. Wanting to understand more about language development, Suskind sought the help of Chicago developmental psychologist Susan Goldin-Meadow and was invited to audit her course Introduction to Child Language Development during a typically cold Chicago winter. She describes it this way:

Often running late from my clinic, I would rush through the Quad, a heavy down coat covering my white lab-coat, which in-turn, were covering my green scrubs. ...I usually sat in the front row, listening as the students enthusiastically debated the Chomsky-versus-Skinner opposing theories of language acquisition. Was Chomsky correct that each of us is born with a “language acquisition device,” an internal hard drive with the grammatical rules already preprogrammed into our brains? Was learning language our innate biological destiny? Or was Skinner correct when he hypothesized that learning language was not innate, but simply a phenomenon of adult reinforcement, eventually guiding children to acceptable language patterns? These were questions far from the cut-and-sew setting of the operating room, but now they were absolutely a part of my world. I was alert, waiting for the insights I needed to help the children I cared for. (p. 20)

I include this quote for two reasons: to show the beginning of the effort described in *Thirty Million Words* and to demonstrate that, far from dead, radical behaviorist positions are a matter of debate in current classrooms, with students vigorously defending Skinner’s position.

From these debates and from discussions with Susan Goldin-Meadow, Suskind was introduced to the work of Hart and Risley, whose names and work (particularly *Meaningful Differences*) will be immediately recognizable to many readers of this journal. In a detailed in-home study of language acquisition, Hart and Risley (1995) discovered that there were great differences in the language environments of young children in low, middle, and high social economic status (SES) families. For example,

children in higher SES families heard an estimated 45 million words by age 3, while the children in lower SES families heard about 13 million, a difference of 32 million words. The children's vocabularies differed substantially at the end of 3 years: an average of 1116 words for higher SES children compared to 525 words for lower SES children (the middle SES children fell in between). Hart and Risley suggested that those differences predict success in typical school programs, and further, that typical remedial programs do little to alleviate the long-term differences. To be clear, it is not economics that define the "meaningful difference," but rather the language environment. Thus, children in lower SES homes with language environments similar to those of higher SES homes can be expected to show accordingly high levels of vocabulary and school success. Suskind provides an informative review of the literature that not only supports but extends and refines that of Hart and Risley. The relevant work apparently has been done largely by developmental psychologists and cognitive neuroscientists whose important and fascinating findings may not be known to most behavior analysts, even whose applied focus is on language development. What is gratifying is that the research Suskind describes is favorable to a behavior analytic account and suggests areas for further investigation. Unfortunately, but perhaps not surprisingly given Suskind's training, there is no discussion of what a consequential contingency analysis could add to understanding the data or of behavioral variables responsible for them, and thus opportunities are missed to propose improvements to the early intervention program described in the book.

The research focus instead is on "brain science" and how a child's language learning environment hypothetically affects the brain. For example, in early segment of the book Suskind writes:

Anne Fernald found when she studied toddlers in a lab that a split-second delay in grasping the meaning of a familiar word in a sentence made it much more difficult for a child to figure out the next one. A simple hundred-millisecond advantage, she says, "buys you the opportunity to learn." For those without that advantage, the loss can be incalculable and permanent.

Her study of children from only low-income backgrounds found a huge variation in how much parents talked: with a range of 670 words per day to 12,000 words per day. It also found a significant relationship between a child's early language environment and the child's language processing speed without the factor of socioeconomic status. At two years of age, children who had heard less talk had smaller vocabularies and slower language processing speeds. Those exposed to more talk had larger vocabularies and faster language processing speeds. And that was true for all socioeconomic levels.

It all came down to how well the brain had been nourished with words. (pp. 48–49).

The main variable in this "nourishing" appears to be the language environment, not socioeconomic status. Suskind emphasizes that the environment interacts with a developing infant brain and that, in the absence of an enriched environment, sophisticated language repertoires fail to develop. A recurrent theme of the book is neuroplasticity in

which brain development is shaped by the language environment. Specifically, early language deprivations may result in brain development that in turn can constrain later language and other skill development. Suskind notes that, "...the language processing speed of a child whose early language environment is poor is slower and less efficient" (p. 52), and suggests that this, in part, accounts for the failure of kindergarten language intervention programs.

The position taken in the book is that genetics lays down the basic blueprint of the brain, and language experience (plus other variables, such as nutrition, exposure to toxins and toxicants, etc.) shapes the brain and builds on the blueprint. Important to the argument is that there are, or may be, important critical periods for certain experiences to have their effect. To address Hart and Risley's (1995) meaningful differences, one must intervene prior to or in correspondence with these critical periods. The literature reviewed appears to substantially support her case not only for vocabulary but also for mathematical reasoning as well.

Some Contingencies in Language Development

While neurodevelopmental variables may very well play a role, a major shortcoming in this account is the lack of a fine-grained analysis of interactions—precisely the sort of account that might be provided by the experimental and applied analysis of behavior. Not addressed are many critical issues such as the repertoire-canalizing effects of cumulatively building a repertoire, the importance of moments of stimulus control transfer (particularly from comparative to absolute matching to sample), the range of stimulus control relations implied in a working vocabulary, and the role of contingency adduction and behavioral cusps. I do not fault Suskind for the omissions because these are topics with which even many behavior analysts may not be familiar. Still, her exciting work could benefit from these analyses, which likely would point the way to more efficient and effective programs.

For example, what does it mean to "know a vocabulary word?" Many of the words people use are what Skinner (1957) called tacts—that is, words that contact their environment such that a verbal response is guided by a nonverbal stimulus. We see a dog, and say "dog." We also use words such as "distant," "other," "larger," and "believes," where the stimuli-guiding behavior may not be so obvious. We did not learn these by being given definitions, nor did we learn them by overhearing a few examples of word use. We learned them through the consequences of discrepancy resolution between how we respond to the world and how others respond. That is, both examples and nonexamples are required. I shall return to this point later.

Many vocabulary words fall into the category of generic or abstract tacts, which are often referred to as "concepts." A child may be said to have the concept of *dog*, *chair*, or *believe* when responding correctly to novel dogs, chairs, or acts of belief with the words "dog," "chair," or "believe," respectively (and not to other, similar stimuli). *Thirty Million Words* does not consider the complexity of these relations, how a child acquires them, and their importance for future performance, and some of the variability it attributes to brain development may, at least in part, result from how well these concepts are mastered.

For a verbal response to be considered an abstract tact or concept, certain features of the stimulus or stimuli guide behavior while others do not. That is, there are “must have” features and “can have” features. Reinforcement is contingent on responding to the must have features. The “can have” features vary from example to example and do not enter into the requirement for reinforcement. Further, the must have features defining the abstract tact may change even though the “stimulus” remains the same. For example, we can respond to color, weight, size, etc. Stated otherwise, a stimulus can be thought of as having a range of features along which one can respond; a contingency requirement specifies the features to which one responds and defines the type of tact involved.

In terminology employed by Layng, Sota, and Leon (2011), responding to one stimulus rather than to another (for example, a chair versus a sofa) may be considered *dimensional* control—in essence reflecting “to what one responds.” The precise features and the response one emits to them may be considered as indicating *instructional* control (not to be confused with control by instructions)—in essence “how one responds.” An example would be saying “chair” in the presence of a novel chair when the three must have features of chair are present. Changes in instructional control may account for changes in how a stimulus may function (see Goldiamond, 1966; Goldiamond & Dyrud, 1968; Goldiamond & Thompson, 2004).

When instructional control is maintained while dimensional control changes, a relation is classified as a generic or abstract tact. Thus, I say “chair” in the presence of never-before-seen chairs having different forms and materials (generic extension on the basis of must have features, and if I do not respond “chair” to stimuli possessing only “can have” features, the relation is classified as an abstract tact extension. What I respond to changes with each new chair, but how I respond (i.e., saying “chair” in the presence of the features that define that concept/abstract tact) remains the same. If there is little variation in stimulus exemplars and reinforcement is made contingent simply on saying a word in the presence of an exemplar, the relation is classified as a simple tact. If I learn to say or use the word chair in reference to a limited universe of chairs (say, those found in my home), I have learned only a simple tact. If someone else learns to respond to a much larger universe of examples and nonexamples, the relation may be a true abstract tact. Even though the word “chair” is in both of our vocabularies, we are not responding to the world in a similar way. When seeing “chair” used in a sentence or confronting a new chair in the environment, my “processing speed” may be quite different from someone who has a history of responding to the larger universe. I will be at a disadvantage.

If we consider that many important abstract tacts are not only intradimensional but interdimensional (Layng, 2014) and can serve as the coordinating tact for autoclitic frames, the differences may be magnified. An interdimensional tact is one in which a contingency specifies the criterion for responding to one stimulus in comparison with another. An example is “larger than.” Bruner, Goodnow, and Austin (1956) defined this type of responding as a relational concept. Other examples of interdimensional tacts include me, you, they, our, farther, distant, wider, etc. These can be quite “abstract” (as per “believes” vs. “does not believe” vs. “knows”). There is no single (intradimensional) stimulus where the properties can be pointed to, but when a group of stimuli are considered the tact can occur.

A more complete analysis of the interdimensional stimuli guiding the use of “to believe” can be found in Layng, et al. (2011), but in brief “believe” is defined when (1) there is an absence of an event and (2) action is taken to affirm the existence of the event. Both conditions are required. If an event is present and (2) occurs, we say we “know.” If an event is present, but fails to occur, we “do not believe.” Again, how a child masters these more nuanced relations will also affect later performance, even if the same “words” are recorded as being a part of each child’s vocabulary. Further, once the abstract tact is acquired, we can construct and respond to sentences such as “X believes Y” and understand it having never seen or heard of X or Y. “Believe” serves as the tact that coordinates the autoclitic frame.

Acquiring interdimensional abstract tacts can be challenging, and those coming from language-poor environments may be at a further disadvantage. Take “distant” and “near” for example. *Distant* (or *far*) indicates (1) a difference between at least two points in space (2) where one point serves as a referent point. *Near* (or *close*) indicates (1) a difference between at least two points in space (2) where one point serves as a referent point. Notice that the critical attributes are the same—so how does one learn such an abstract tact? The two tacts can be learned only as coordinate concepts. In essence, *distant* (or more distant) must be compared to *near* (or nearer), and that difference serves as the basis of the tact. Thus, *more distant* indicates (1) a difference between at least three points in space (2) where one point serves as a referent point and (3) where more space exists between one point than another as compared to a referent point. *Nearer* indicates (1) a difference between at least three points in space (2) where one point serves as a referent point and (3) where less space exists between one point than another as compared to a referent point. The physical stimuli that occasion these responses can be the same in the two instances (e.g., a picture of three objects separated by different distances). Stated differently, the dimensional control remains the same, but instructional control shifts with the requirement to respond with “distant” versus “nearer.” That is, what we respond to (the points separated in space) remain the same, while how we respond, (“distant” or “near”) is guided by the amount of space between points and the referent and the requirement to respond to each. Now, we can juxtapose stimuli with the comparative difference in space being the stimulus governing the response as we specify the referent point. A range of stimuli would be used with *near* stimuli being the nonexamples of *distant* stimuli and vice versa.

This distinction between the acquisition of many vocabulary words as simple tacts and the acquisition of complex abstract tacts may alone have a profound effect on later performance. In homes with high language interaction, in which many examples and nonexamples presumably are available, children with the exact same words in their vocabulary may develop entirely different relations to their environment. We may be tempted to account for subsequent differences in academic performance as indicating differences in brain development when in fact we may be observing the effect of topographically similar but functionally quite different entering repertoires. Similarly, brain development may be impacted by which behavioral relations are in place at what time.

Besides the tact, there are many other important known behavioral relations that encompass functional relations that a topographic description may miss. For example, the frequency of occurrence of language-based behavioral cusps (Rosales-Ruiz & Baer, 1997) likely plays a very large role in language development. Behavioral cusps are

those events in which behavior, or a constellation of behaviors, brings an individual into contact with contingencies not previously available otherwise. Language and related behavioral leaps are likely the result of these developing behavioral cusps. Explicitly identifying them and their relation to subsequent language development is showing to be quite important. Greer and Keohane (2005) provide a comprehensive discussion of the role of cusps and other important behavioral considerations in language development (also see Greer, 2008).

All of this suggests that a “program” of parental interaction in which the input to and output from the child changes over time is of critical importance. Suskind describes it this way: “...language acquisition follows the skills-begetting-skills path, with each learned proficiency laying the foundation for the next. It seems to happen so automatically that we generally take it for granted” (p.67). Suskind goes on to describe how parental talk may influence the acquisition of math, self-regulation, and social-emotional learning, all of which she supports with studies primarily from the developmental neurosciences. One glaring omission from Suskind’s description, however, is the work of Ernst Moerk, whose books and articles were well received by behavior analysts and often favorably reviewed in behavioral journals (see for example Salzinger, 1994). Moerk (1983, 1986, 1990, 1992, 2000) painstakingly described parent-child interactions from birth to about 4 years of age that lead to language acquisition, and was perhaps the first to make many of the observations Suskind describes. Even a quick scan of Moerk’s work impresses the reader with the increasingly complex interactions that occur between parent and child and how those interactions shape the complexity of a child’s language. One element of these interactions is response expansion. For example, a child may go to a door and say “out.” A parent may respond with “go outside?” Soon the child may say, “Go outside.” The parent may then say, “Go outside and play?” This type of interaction is not simply about vocabulary or language input, but the modeling and shaping of increasing behavioral complexity. While Suskind explicitly acknowledges the role of response expansion referencing other sources, her neglect of Moerk is unfortunate because Moerk (Moerk, 1992, Moerk, 2000) described numerous other classes of interactions, and the language repertoires that develop from them. Besides expansion, relevant processes include chaining, self-repetition, buildup, breakdown, morpheme perseveration, substitution, frame variation, transformation, the important role of frequency of input, and the role of corrective feedback. Attention to these processes and how they work together would have enriched Suskind’s accounts and provided an even more informed gateway to the creation of language-focused interventions.

Intervention

This brings us to the second part of Suskind’s book: a description of her effort to develop a program for parents to help ensure that children experience the rich language environment that will prepare them for later learning. From her study of the literature, Suskind became convinced that the early language environment was of paramount importance and that Hart and Risley (1995) were fundamentally correct in asserting that much variance in academic performance is a function of young children’s language

environment. As a result, Suskind spearheaded the design of a parent training program and the Thirty Million Words movement. Her parent training program has three basic components to which Suskind refers as Tune In, Talk More, and Take Turns. The program is not simply about vocabulary. As Suskind notes, “The effect of the Three Ts goes beyond building vocabulary, including such diverse areas as the introduction of math concepts, developing literacy, building self-regulation and executive function, and developing critical thinking skills, emotional insight, creativity, and persistence” (p. 153). It is an ambitious program whose complexity is somewhat masked by saying it is simply about “Three Ts,” as can be illustrated by briefly describing these features of the program.

Suskind describes *Tune In* as carefully observing what a child is doing, what the child is “focused on,” and at “the right time” beginning a conversation “with the child” about what they are doing. Tuning In requires more than simply looking for an opportunity to speak to one’s child; it requires parents to carefully observe what may be guiding the child’s behavior. It attempts to connect language to changes in environmental events currently experienced by the child. Though perhaps sounding easy enough, parents must learn what constitutes the “right time” and what it means to “talk with” a child. Though acknowledging that Tuning In can be quite nuanced and providing some examples, the program used to establish these discriminations and the proper interactions is not described.

In the second T, *Talk More*, “more” extends beyond simple word frequency. The first component is for parents to engage frequently in narration. (They describe what they are doing while interacting with a child). Narration begins as a basic description of what the parent is doing and quickly evolves to including what the child is doing. Suskind (p. 145) provides an example:

”You have Mommy’s purse.”

“The purse is so heavy.”

“Should we see what’s inside?”

“Ah, you found Mommy’s keys.”

“Not in your mouth, please. We don’t chew on keys. They’re not food.”

“Are you trying to open your truck with the keys?”

“The keys open the door.”

“C’mon. Let’s go open the door with the keys.”

Accordingly, narration is yet another repertoire that requires considerable attention to detail and training. As Suskind states, “Both narration and parallel talk are strategies that can be used from birth. These strategies do have qualifications, however. They should never be laden with repetitive questions or long, complicated sentences. At their

best, they include establishing eye contact, talking about things in the immediate environment and, when possible, holding a child close, allowing the child to absorb both language and warmth” (p. 145).

Another component of Talk More has to do with “decontextualized language.” That is, parents are not to only talk about the here and now. References to both the past and the present need to be worked into the narrative. Using decontextualized language “simply entails using familiar words to talk about things that a child and the parent have done together, about a toy recently played with, or about someone he or she knows. The child then has to tap into existing vocabulary to understand, without the support of clues from the immediate environment” (p. 147).

A third component of Talk More is the concept of response expansion, extension, and scaffolding (which as noted earlier is but one of the language patterns described by Moerk). For example,

“Uppie, uppie.”

“You want Daddy to pick you up?”

This exchange, over time, will evolve to:

“Please pick me up, Daddy. I’m tired.” (p. 148)

Accordingly, Talk More is not a simple skill set. The concepts, multiple discriminations, and performances required are quite complex. The training program required may be quite extensive for some parents. This may be particularly true for parents who themselves are products of impoverished language environments.

The third T, *Taking Turns*, is about engaging a child in a conversational exchange. This exchange, of course, would be quite simple initially, and then increase in complexity over time. Included over time is what Suskind calls process-based praise, which targets behavior rather than the child. Instead of “you really are smart,” one would say, “you really did a good job of solving that,” or “you put a lot of effort into that.”

Suskind and her colleagues have developed a program to teach parents the “Three Ts” skills. *Thirty Million Words* identifies the curriculum’s underlying principles but does not describe the curriculum in detail, although the performances required and the examples provided suggest a great deal of analytical and developmental effort. Further, they have as part of their evaluation effort included some interesting technological innovations such as the “language environment analysis system” (LENA), a small digital audio recorder that records an entire day’s language activity and fits into a small child’s t-shirt specifically designed for the device. The data are uploaded daily to a computer for analysis. Baseline versus intervention comparisons can then be made in order to evaluate interventions.

Since Suskind acknowledges the important role of user testing in the Three Ts program development, one assumes that procedures will evolve over time. A careful application of advanced behavioral instructional design procedures (see Layng, 2014) could be beneficial in this evolution. For example, Taking Turns presumably could benefit from well-designed multiple discrimination training (after Tiemann & Markle,

1990). Carefully constructed example and nonexample sets of when a child is “focused” on something, what constitutes the “right time”, and what it means to “talk with” a child might greatly enhance the effort. Once parents can identify all three fluently, practicing with their own children should be much easier and performed with greater confidence. Previously, I identified several other skills (e.g., teaching intradimensional and interdimensional abstract tacts and identifying and encouraging cusp events) that would be valuable components of parent training.

“Critical” Periods

Before concluding, I would like to address the assertion that children who miss certain critical periods for language development are likely doomed to be at a disadvantage regardless of later efforts to address this issue. It is true that many attempts at compensatory programs have had limited success, but some programs, such as *Language for Learning* (Englemann & Osborn, 1999), have shown promise in establishing important skills in learners who may have missed inferred critical language learning periods (Benner et al., 2002). The crux of the matter is that typical teaching strategies (those that are common in mainstream instruction) are unlikely to create much benefit for children who lack pivotal early experiences. What is required is an entirely different approach that encompasses the complexity of language, provides special instructional sequences specifically designed for rapid learning, and provides environments that extend and expand upon what is learned.

An example of such a program is a vocabulary teaching sequence developed some years ago at Headsprout®, which was incorporated into the Headsprout Reading Comprehension product. The program began with a stimulus equivalence type of interaction that quickly established equivalence between a “child level” definition embedded in a sentence, a word (such as distant), and a picture (e.g., of a distant object). This interaction took place while establishing two other vocabulary relations. A fourth relation was added by a fast mapping procedure (see Swingley, 2010) based on creating a discrepancy between already established relations and a newly introduced set. This procedure (for a more detailed description see Leon et al., 2011; Sota, Leon, & Layng, 2011) required an average of only about 5 min to establish all four equivalence relations, with about a 96 % accuracy rate maintained throughout, as measured over tens of thousands of children.¹ This outcome illustrates how instruction that respects the behavioral relations underpinning desirable language performances can be effective for children who vary considerably in early language experiences, perhaps rendering the concept of “critical period” obsolete, or at least not entirely predictive of possible future repertoires.

¹ Later, building on the initial equivalence relations, we developed a prototype computer game that was designed to ensure that complete abstract tacts were rapidly established. The idea was to combine the initial equivalence sequence with the prototype to create a standalone vocabulary program (it was never published). The children played an automated version of slapjack, where the first to slap a card showing distant, for example, got the card. A child played against three animated cartoon characters. The game went very fast, and the range of can have features were systematically varied (see Tiemann & Markle, 1990) until, in a very short period of time, both complex interdimensional abstract tacts, distant and near, were established.

Conclusion

With *Thirty Million Words*, Dana Suskind has provided a detailed overview of and argument for the importance of early language learning and the critical role the environment plays in shaping this complex behavior. Her efforts to do something about the “meaningful differences” that exist between children, and her reliance on science to inform and improve her program, is highly commendable. I would urge all those interested in early language and education to read this book. Yet, as my critique of Suskind’s analysis suggests, behavior analysis can (and should) do more than simply become informed about her work. Behavioral analyses do not conduct themselves, and those who were not trained in behavior analysis are unlikely to provide them. It is up to us to demonstrate what a consequential contingency analysis has to offer, to share our discoveries with interested colleagues like Suskind, and to do everything possible to promote the development of effective programs for those not fortunate enough to have the rich language environment children need to reach their full potential.

Compliance with Ethical Standards

Conflict of Interest The author declares that he or she has no conflicts of interest.

References

- Benner, G., Trout, A., Nordness, P., Nelson, J., Epstein, M., Knobel, M., et al. (2002). The effects of the language for learning program on the receptive language skills of kindergarten children. *Journal of Direct Instruction*, 2(2), 67–74.
- Bruner, J., Goodnow, J., & Austin, G. (1956). *A study of thinking*. New Brunswick, NJ: Transaction Publishers.
- Englemann, S., & Osborn, J. (1999). *Language for learning: teacher’s guide*. Columbus: SRA/McGraw-Hill.
- Goldiamond, I. (1966). Perception, language, and conceptualization rules (pp. 183–244). In B. Kleinmuntz (Ed.), *Problem solving*. New York: Wiley.
- Goldiamond, I., & Dyrud, J. E. (1968). Some applications and implications of behavioral analysis for psychotherapy. In J. M. Shlien (Ed.), *Research in psychotherapy* (Vol. 3, pp. 54–89). Washington, DC: American Psychological Association.
- Goldiamond, I., & Thompson, D. (2004). *The blue books: Goldiamond & Thompson’s the functional analysis of behavior*, P. T. Andronis (Ed.). Cambridge, MA: Cambridge Center for Behavioral Studies (original work published 1967).
- Greer, R. D., & Keohane, D. D. (2005). The evolution of verbal behavior in children. *Behavioral Development Bulletin*, 12, 31–47.
- Greer, R. D. (2008). The ontogenetic selection of verbal capabilities: contributions of Skinner’s verbal behavior theory to a more comprehensive understanding of language. *International Journal of Psychology and Psychological Therapy*, 8, 363–386.
- Hart, B., & Risley, T. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Paul H. Brookes.
- Leon, M., Ford, V., Shimizu, H., Stretz, A., Thompson, J., Sota, M., et al. (2011). Comprehension by design: teaching young learners to comprehend what they read. *Performance Improvement Journal*, 50, 40–47.
- Layng, T. V. J., Sota, M., & Leon, M. (2011). Thinking through text comprehension I: foundation and guiding relations. *The Behavior Analyst Today*, 12, 1–10.
- Layng, T. V. J. (2014). Learning science design and development requirements: an update of Hendrix and Tiemann’s “designs for designers.”. *Mexican Journal of Behavior Analysis*, 40, 39–57.
- Moerk, E. L. (1983). *The mother of Eve—as a first language teacher*. Norwood: Ablex.

- Moerk, E. L. (1986). Environmental factors in early language acquisition. *Annals of Child Development*, 3, 191–235.
- Moerk, E. L. (1990). Three-term contingency patterns in mother-child verbal interactions during first-language acquisition. *Journal of the Experimental Analysis of Behavior*, 84, 293–305.
- Moerk, E. L. (1992). *First language: taught and learned*. Baltimore, MD: Brookes.
- Moerk, E. L. (2000). *The guided acquisition of first language skills*. Stamford: Ablex.
- Rosales-Ruiz, J., & Baer, D. (1997). Behavioral cusps: a developmental and pragmatic concept for behavior analysis. *Journal of Applied Behavior Analysis*, 30, 533–544.
- Salzinger, K. (1994). The lad was a lady, or the mother of all language learning: a review of Moerk's first language: taught and learned. *Journal of the Experimental Analysis of Behavior*, 62, 323–329.
- Skinner, B. F. (1957). *Verbal behavior*. New York: Free Press.
- Sota, M., Leon, M., & Layng, T. V. J. (2011). Thinking through text comprehension iii: analysis of verbal and investigative repertoires. *The Behavior Analyst Today*, 12, 11–20.
- Swingley, D. (2010). Fast mapping and slow mapping in children's word learning. *Language Learning and Development*, 6, 179–183.
- Tiemann, P. W., & Markle, S. M. (1990). *Analyzing instructional content: a guide to instruction and evaluation*. Seattle: Morningside Press.