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Evaluating the Relationship Between Derived Relational Responding, Verbal Operant Development, and Linguistic Structure: Correlating the PEAK-E-PA, the ABLLS-R, and the TOLD-I:4

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EVALUATING THE RELATIONSHIP BETWEEN DERIVED RELATIONAL
RESPONDING, VERBAL OPERANT DEVELOPMENT, AND LINGUISTIC
STRUCTURE: CORRELATING THE PEAK-E-PA, THE ABLLS-R, AND THE TOLD-I:4

by

Bridget E. Munoz

B.S., Southern Illinois University, 2014

A Thesis

Submitted in Partial Fulfillment of the Requirements for the
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Bridget E. Munoz, for the Masters of Science degree in Behavior Analysis & Therapy, presented on July 8, 2016 at Southern Illinois University Carbondale

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MAJOR PROFESSOR: Dr. Mark R. Dixon

The increasing prevalence of Autism Spectrum Disorder has produced a longstanding relevance for continued progressive measures towards a systematic approach to the treatment of deficient language repertoires. Current behavior analytic assessments, such as the *Assessment of Basic Language and Learning Skills-Revised* (ABLLS-R), have demonstrated utility in providing relative measures of the functional characteristics of an individual's language and learner repertoire, as consistent with a traditional Skinnerian approach. Further assessments have been created under other existing theoretical frameworks, such as the *Test of Language Development* (TOLD), and the *Promoting the Emergence of Advanced Knowledge Relational Training System* (PEAK). Each assessment was run with 17 children with Autism. A Spearman's rank order correlation was then conducted to examine the relationships between the ABLLS-R, the TOLD-I:4, and PEAK-E-PA. Therefore, the purpose of the present investigation was to examine any existing relationships between these assessments in order to evaluate their treatment utility, produced measures, and overall implications towards an understanding of language development in children with Autism.

Keywords: autism spectrum disorder, PEAK, complex verbal behavior, language

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CHAPTER 1

INTRODUCTION

As Behavior Analysts we strive to implement the best practices of Applied Behavior Analysis (ABA) in order to achieve an empirically based assessment and treatment for the populations that we serve. Without such empiricism, our field fails to reach a level of systematic conceptualization that is essential in achieving a precisely technological application of treatment for an overall distinguishable, objective procedural basis. Therefore, there is great utility in an examination of the applied technologies that represent this science and the theories that drive them in order to ensure that such integrity and precision is upheld. This utility is further matched by a prevalence rate and wide array of impact that results from developmental disabilities.

One particular developmental disability that has demonstrated much growth in terms of pervasiveness, progress and pursuit of ABA services is Autism Spectrum Disorder (ASD). There are several applied behavior analytic treatments that have transpired to meet the growing need for services and to address the disabling symptoms experienced by those with Autism (Interagency Autism Coordinating Committee & US Department of Health and Human Services, 2012). Such treatments serve as an empirically supported, non-medical platform for facilitating skill development and supporting the acquisition of functional abilities, both of which are crucial for a diagnosed individual's success and overall autonomy (Dixon et al., 2014; Interagency Autism Coordinating Committee & US Department of Health and Human Services [IACC], 2012). The deficits present in a diagnosed individual's repertoire can vary greatly in terms of severity, specific skill domain, and rate of acquisition for a particular

impairment. While the array of the encompassed deficiencies can be extensive, language deficits are a particular characteristic commonly associated with this disorder, and often perceived as the most profoundly detrimental. Furthermore, a relationship between language acquisition and improved outcomes for children with autism has been identified (Gutierrez & Petscher, 2011). Improving an individual's language repertoire has, therefore, become a principal focus of current treatments, as well as an area that has subsequently generated a need for the examination of existing accounts of language.

In order to achieve the most effective treatment that addresses such identifiable deficits, an assessment guide of equal effectiveness must first render results that indicate an individual's skill repertoire and current functioning levels, while maintaining consistency with the prevailing accounts on language and skill development. It is absolutely essential that these assessments appropriately identify which aspects of language are diminished. Highlighting such strengths and deficits across various domains informs the subsequent development of individualized treatment plans and goals that intends to meet the needs identified through the assessment process (Behavior Analysis Certification Board [BACB], 2014). Just as there is a multitude of available treatments for use in practice there are, likewise, various assessment protocols available for use (Dixon, Stanley, Belisle, Rowsey, 2016;). There has been much documented support for the need for continuous investigation of ABA treatments in use for the populations we serve, as well as identification of its high priority status in the growing body of research on Autism (Foxy, 2008; IACC, 2012; McKeel, Rowsey, Dixon, & Daar, 2015;). This topics' prominence in the literature has allowed for our field

to accomplish a conceptually systematic structure of service that is rooted in empiricism. As assessments serve such a vital role and necessary step in the implementation of evidence-based treatment and language development they should, therefore, be held to the same standard in their presence and contribution to existing literature (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010). The assessments that clinicians, professionals, and parents have available to them warrant the same level of scrutiny as treatments do as they are an imperative component in the identification of the cause of language development. Furthermore, it is our duty as members of an empirically based science to ensure that not only the treatments we deliver are validated and effective in practice, but also that the assessments used to guide such treatments are equally validated and empirically supported. Because multiple assessments exist under varying theoretical frameworks, it is further necessary to compare those that are in use to more closely examine their correlational values and identify the strengths and applications of each approach. The significance of this need is further emphasized by the recognition of “consistent, ongoing, objective assessment and data analysis to inform clinical decision-making” as a core characteristic of applied behavior analysis (BACB, 2014).

Diagnostic Criteria and Prevalence of Autism

Autism is a neurodevelopmental disorder characterized by a continuum of symptoms with varying severity. The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) includes two primary core factors as part of their diagnosing criteria: persistent social communication and interaction deficits, and restricted interests and repetitive behavioral patterns (American Psychiatric Association, 2013). Further specifications of manifestations under these criteria include social-

emotional reciprocity, nonverbal communicative social interaction behaviors, the development, understanding, and maintenance of relationships, stereotypical or repetitive motor movements or speech, inflexibility and ritualized patterns, restricted interests with abnormal intensity, and an exacerbated response to sensory aspects in the environment (American Psychiatric Association, 2013). Preliminary signs and symptoms of this disability characteristically emerge early on in a child's development (IACC, 2012). As a child with autism grows older, additional deficits may be recognized when certain developmental milestones are not met.

According to the Autism and Developmental Disabilities Monitoring Network (ADDM), a collaborative Centers for Disease Control and Prevention (CDC) network designed to track the rate and characteristics of children with ASD in the United States, the prevalence of autism has increased 20-30 times that of the estimated prevalence in the late 1960s on a global level (Baio, 2014). This worldwide increase occurred over more than a 30-year span. Astonishingly, the same increase of 30% has occurred in just 7 years in the United States. More specifically, the ADDM reported in their summaries that combined data from 11 different sites yielded an estimation of 1 in 68 children having being identified with ASD (Baio, 2014). These results emphasize that the increasing proportion of individuals with an ASD diagnosis is prevalent on both a global and national level.

Language Deficits

A discussion of notable skill deficits that are common to the experiences of those with Autism is warranted. Moving beyond the criteria outlined by the DSM, behavior analysts and other related fields often place emphasis on language development as a

skill domain (Gutierrez & Petscher, 2011; McKeel, et al., 2015). Deficient language repertoires can include impairments such as inhibited speech either partially, or completely, or can foster maladaptive speech such as echolalia, with the most severe form including the absence of any functional communication at all (Schlinger, 2008; McCoy & Buckhalt, 1990). These deficiencies are commonly expressed in terms of ineffective communication and can encompass one's ability to make requests, label, discuss, comment, and converse (Guess, 1969). Without such skills, individuals with Autism may be unable to request access to preferred items, inquire for necessary information, reciprocate conversation, and label stimuli, all of which would ultimately allow them to better come in contact with their world (Albert et al., 2012). An impaired communicative repertoire can additionally result in developmental barriers, and has been associated with problem behavior (Gutierrez & Petscher, 2011). Acquiring such a repertoire would further facilitate the development of adaptive skills and appropriate behavior in individuals with autism. As previously mentioned, these delays in language have been described as identifying characteristics of individuals with an ASD diagnosis, and are often a pronounced concentration in the treatment of deficits outlined in the above diagnostic criteria (Gutierrez & Petcher, 2011; Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996; Schlinger, 2008). It has been suggested that language acquisition is an underlying component of learning and is indicative of an individual's overall success and social development (Sundberg & Michael, 2001; Lovaas, 1996; Carr & Kologinsky, 1983). The goal, therefore, of many existing clinical interventions is to work towards the acquisition of language by placing an emphasis on increasing forms of communication and, ultimately, addressing deficient language repertoires (Schlinger,

2008; Gutierrez & Petscher, 2011). This practice in the field of Applied Behavior Analysis has been shaped and largely influenced by the extensive experimental and conceptual work of B.F. Skinner, as well as by other existing theories and accounts of language development in other related fields. Traditional behavioral accounts of language and linguistic accounts of language appear to be two of the most commonly referenced theoretical frameworks that serve as a fundamental element in guiding the treatment of language delays. A more contemporary approach further exists as a progressive movement in the understanding of human language and cognition.

Traditional Behavior Analytic Approaches to Language Development

In 1957 Skinner put forth a groundbreaking philosophic foundation of language that represented a departure from that of more traditional theories (e.g., Chomsky, 1965; Pinker, 1994). He began this exodus by contending that language is learned behavior that is under the explicit, functional control of the contingencies within an organism's environment. Skinner, therefore, intended the use of the concept of language to mean "... a verbal environment, which shapes and maintains verbal behavior," with verbal behavior not ascribing to any one specific "form, mode, or medium," thereby encompassing "Any movement capable of affecting another organism," as verbal (Skinner, 1957). He went on to define verbal behavior as any behavior that results in reinforcement mediated by a listener who has been trained to mediate such consequences by the verbal community. He further specifies the mediation by the listener as conditioned responding intended to reinforce the speaker's behavior (Skinner, 1957, p. 225), thereby contending that language is learned behavior. From this he distinguished the relationship between a speaker and a listener, where the

role of the listener did not surpass that of its consequating effects on the behavior of a speaker, and the speaker stood as the integral component in the analysis of verbal behavior. He further contended the emphasis of the function of verbal behavior, rather than its topography or linguistic structure. These contentions ultimately rid the need for a distinction between the principles applied to verbal and nonverbal behavior, a distinction that, up until this point, had been largely supported. In other words, no new principles were required; rather, new terms were proposed. Thus, an inaugural divergence was revealed in the pursuit of achieving an understanding of human language.

Skinner's account of verbal behavior (1957) offered an interpretation of language that has had much influence in today's research and practical application (Schlinger, 2008). This influence can be found in the true value behind the elucidation of Skinner's (1957) *Verbal Behavior*, which is often perceived as an interpretation and proposed methodology that has allowed behavioral practitioners a means of reliable application that conforms to scientific principles (Schlinger, 2008). Skinner described his account as "... an interpretation of the behavior of the *speaker*, given the contingencies of reinforcement maintained by the community." (Skinner, 1987; Skinner, 1957). With this notion established, and an emphasis placed on the variables underlying the function of verbal behavior, Skinner discussed the measure of language in terms of the verbal operant, which serves as a unit of analysis. He subsequently outlined a range of verbal operants that assist in the classification of language (Skinner, 1957). He first proposed the elementary verbal operants, which included the mand, tact, intraverbal, and echoic (Skinner, 1957). Therein he identified separate sources of antecedent control for the

mand, tact, and intraverbal, and further described the notion of functional independence for all the elementary verbal operants by which each represents its own outcome of the controlling variables in the environment, diverging from the “simple environment-based ‘operant’ behavior” (Bailey & Wallander, 1999; Skinner, 1957; Sautter & LeBlanc, 2006). For example, a mand allows for an individual to access specific reinforcers through the response specifying the reinforcer (i.e., the speaker says, “I want ice cream,” and then receives ice cream from the listener) as controlled by the applicable establishing operation, while the tact occurs under the functional control of a discriminative stimulus as maintained by generalized conditioned reinforcers, rather than a state of deprivation (i.e., “that’s ice cream,” in the presence of the visual stimulus; Skinner, 1957). A verbal stimulus with point-to-point correspondence between the stimulus and the response serves as the function for the echoic, while the intraverbal represents a response with no formal point-to-point correspondence with the evoking verbal stimulus (Skinner, 1957). Later on in his analysis came the description of more complex verbal operants by which Skinner sought to address the intricacies of the human thought process as related to language and account for the generalization of responses (Skinner, 1957, p. 91). For example, he described several types of “extended tacts.” These particular verbal extensions included generic extension, metaphorical extension, metonymical extensions, and solistic extension (Skinner, 1957).

Skinner’s analysis of verbal behavior produced a methodology from which research on language and subsequent produced treatment could result. The traditional behavior analytic approach attempts to address delays in language by applying his conceptualization into subsequent applications that emphasizes the acquisition of

functional and appropriate communication. There are a number of reviews that seek to expose the true extent of empirical application since Skinner's (1957) publication (Schlinger, 2008; Dixon et al., 2007; Sautter & LeBlanc, 2006; Dymond & Alvarez, 2010; Dawson, Vicars, & Miguel, 2009). Examining what has resulted with such a critical eye is useful in its production of valuable information regarding the empirical nature of such a longstanding account that has guided and influenced so many. It is additionally useful in informing current investigators of future research directions to aid in closing the gap between conceptual and applied research, a gap in which reviews of Skinner's (1957) *Verbal Behavior* have underscored (Dawson et al., 2009). It appears that many of the initial examinations discuss the overall limited volume of empirical investigations (McPherson, Bonem, Green, & Osborne, 1984; Suatter & LeBlanc, 2006; Oah & Dickinson, 1989). One such example of this comes from a report by McPherson and colleagues (1984) in which their results exposed the non-empirical nature of the current quantity of literature resulting from Skinner's (1957) *Verbal Behavior*. Since then, there has been a cited increase in publication trends as indicated by frequency (Sautter & LeBlanc, 2006). One particular review published by Sautter and LeBlanc (2006) noted that, although a growing professional interest in the area of verbal behavior exists, there still appears to be a discrepancy in the resulting impact amongst the existing experimental literature. Their review encompassed 20 years of publications (1986-2006) and resulted in the identification of 60 empirical studies from which they concluded the aforementioned increase in empirical support. They subsequently predicted an increase in the volume of research on Skinner's (1957) conceptualization, and made suggestions to expand the range of publication outlets and operants examined (Sautter & LeBlanc,

2006). There also appears to be an increase in the number of applied studies that have resulted from Skinner's analysis. Dawson and colleagues (2009) revealed that the field studies they examined exceeded that of the number of laboratory studies in the year 2007. They considered these field studies to be applied in nature, as they held the purpose of examining techniques to teaching verbal skills to individuals with deficient language repertoires (Dawson et al., 2009). They too emphasized the importance of these applied studies in expanding upon the empirical support for training methodologies rooted in Skinner's analysis (1957), and called for a continued examination of the impact of the resulting literature (Dawson et al., 2009). Quite possibly more representative of the field's current trajectory was their suggestion to investigate research programs and how they might influence future behavioral approaches to language acquisition.

Although there is an abundance of reviews that speak to publication trends in terms of frequency, Dixon and colleagues (2007) called upon the limited nature of such examinations, as additional variables are not often considered. This article also shed an important light on the fact that, although an increase in publications in this specific research area has occurred, there is an overwhelming emphasis on only two of Skinner's verbal operants: the *mand* and the *tact*. This pronounced focus identifies a more broad gap in the literature as it questions the true extent of Skinner's (1957) analysis insofar as a complete inclusion of his contentions (Dixon et al., 2007). In other words, although there has been a remarkable increase in the published accounts of Skinner's (1957) conceptualization, it appears that these reviewed articles have largely limited their research questions to mands and tacts, and haven't fully demonstrated the

complexities of language as described by Skinner (1957). More specifically, they discuss a disparity that exists in factors such as complex language and populations of focus (Dixon et al., 2007). Their citation analysis served as an extension of the citation analysis published by Dymond and colleagues (2006) with the goal of providing a more extensive analysis of the impact of Skinner's conceptualization. What they concluded was an established importance of the current publications that have resulted, and a need for additional publications that expand upon current research questions into areas that represent more advance forms of language. They contend that this pursuit will allow for a continued vivacity and influence of Skinner's *Verbal Behavior* (Dixon et al., 2007). Although the aforementioned reviews vary in nature of examination, their purpose is the same, as are their suggestions for research directions towards a more thorough, complex analysis of Skinner's conceptualization (Sautter & LeBlanc, 2006; Dixon et al., 2007; Dawson et al., 2009).

Linguistic Approach to Language Development

Skinner's (1957) conceptualization was groundbreaking and revolutionary, and has provided much support in the development of assessment and training methodologies. He offered the scientific world a reliable means of analyzing complex human behavior that was unlike any suggested paradigm at its time of conception. Despite its almighty nature and potential for greatness, it was not without heavy criticism (Chomsky, 1959; Hayes, Barnes-Holmes, & Roche, 2001). It has been suggested that Skinner's interpretation of human language came at a time in which consumers, scientists, practitioners, and behaviorists alike were not yet ready to receive his ideologies (Bailey & Wallander, 1999). Since then, advances have been made in our

understanding and implementation of Skinner's analysis, yet criticism still exists amongst our past and future work under verbal behavior (Hayes, Barnes-Holmes, & Roche, 2001; Dymond & Alonso-Alvarez, 2010).

Monumental in its critique of Skinner's analysis, Noam Chomsky, a well-known linguist, published a review (1959) in the journal *Language* only two short years following the release of Skinner's (1957) *Verbal Behavior*. His review would become known by many as a piece that questionably changed the face of behaviorism (Schlinger, 2008). His harsh dejections of Skinner's arguments largely encompassed the basic analytic nature from which Skinner drew much of his analysis, and the actual application of the offered conceptualization (Chomsky, 1959; MacQuorodale, 1970). In his review, Chomsky (1959) refers to Skinner's interpretation as creating the "illusion" that it ascribes to scientific theory and casts subsequent doubt on drawing these conclusions from his experimental results obtained with non-human subjects. He criticized the exclusion of linguistic behavior and evaluated the technical language of the analysis, referring to its "metaphoric" and "analogic" classification that he felt was merely a paraphrase for existing terms (Chomsky, 1959). Chomsky accused Skinner of inappropriately packaging traditional linguistic mentalisms into technical terms. Chomsky continued his critique by narrowing in on these terms that Skinner used throughout his analysis, such as *the stimulus*, *reinforcement*, *deprivation*, and *probability* (Chomsky, 1959; MacQuorodale, 1970). He labeled these expressions as nonequivalent to traditional linguistic terms and subsequently attacked the behavioristic vocabulary for blurring the traditional concepts that he ascribes to (Chomsky, 1959; MacQuorodale, 1970). His next major criticism focused again on what he felt was too

simple of an explanation, this time in regards to Skinner's details on the function of behavior (Chomsky, 1959). What Chomsky contends is that language is far too complex of a domain to be covered in such a simple manner as identifying a single function. Chomsky does not support what he perceives as a reductionist approach to an account of language. Rather, he describes a necessity in considering an organism's internal structure, one in which can be found in the brain (Chomsky, 1959). Expanding upon this, his linguistic approach ascribes to a genetic predetermination from which he claims is a key component in analyzing the causation of behavior, and subsequently explaining an organism's behavior (Chomsky, 1959). From his stated examples, his approach also appears to encompass an individual's ability to demonstrate a type of theory construction, a theory that he suggests accounts for grammatical behavior (Chomsky, 1959, pg. 57). MacQuorodale (1970) described Chomsky's supposition as grammar preexisting outside of verbal behavior, acting as a causal influence, thereby completely refuting Skinner's emphasis of grammar occurring as a secondary process that emerges rather than a pre-existence (Skinner, 1957; Chomsky, 1959). The conclusion of Chomsky's (1959) review briefly addressed the application of Skinner's (1957) theoretical framework. He essentially undermined the concepts of stimulus, response, and reinforcement as notions that were not meant to exceed "vague and arbitrary" (Chomsky, 1959, pg. 44). Chomsky's review, although pugnacious, represents an important discrepancy between these two predominant theoretical frameworks that attempt to account for language.

Beyond such a critical lens, a value can be found within a measurement of language as proposed by a linguistic account. This theoretical framework's approach

encompasses broad, and often overlapping perspectives from a biological, cognitive, and environmental perspective. What this largely exemplifies is a focus on the symbolic nature of words, response forms, topography, and structure of language, as represented by cognitive processes such as phonemes, morphemes, lexicon, syntax, grammar, and semantics (Calinescu, 2012; Skinner, 1957; Chomsky, 1965; Pinker, 1994; Clark & Clark, 1977). In a relatively recent examination of the literature, Cromer (1981) revealed many of these subscriptions within the prevailing areas of research found in the linguistic framework. More current linguistic approaches carry forth this interest in cognitive processes, semantics, and pragmatics of communication, and acknowledge the true complexity of language acquisition (Cromer, 1981). While each prevailing measure interacts with one another, there lies an importance in examining each separately as to emphasize their importance and highlight their relevance to specific language-disorders. For example, the cognitive paradigm has been described as containing two main focuses that seek to contribute to an understanding of language acquisition (Cromer, 1981). One explanation looks towards an account of the basic cognitive mechanisms that underlie the structure of language, while the other considers the development of a conceptual foundation and its influence of the growth of syntax and semantics within a language repertoire. Thus, the existing argument emphasizes the control of language as being governed by internal cognitive processes that are intended to classify and store verbal information (Brown, 1973; Piaget, 1926). Cognitive psychologists describe these mechanisms as controlling communicative behavior in the form of receptive and expressive language. Cromer (1981) further discussed how the notion of conceptual knowledge directly ties into the acquisition of language as

described through the understanding of semantics. For example, Cromer (1968) proclaimed the relationship between conceptual knowledge and a semantic aspect of language, with its effect being larger on semantics as opposed to language structure. Still, there exists a profound distinction between these two concepts, and an even greater discrepancy in understanding the extent of their relationship (Cromer, 1968). Additional components in the overarching linguistic paradigm include pragmatics, phonology and syntax. Pragmatics focuses on the way sentences function in communication, the intention of speech (i.e., evaluations, commands, requests, statements, etc.), relating new information, and the influence of contextual factors and expectations (Cromer, 1968). Some research related to pragmatics has identified the role of the speaker and the listener, and a child with Autism's inability to switch between the two (Baltaxe, 1977). Research along the same lines has also identified rules that govern linguistic exchanges and how deficits in these rules affect the appropriateness of speech. Ultimately, in regards to pragmatics, it has been claimed that individuals with Autism are not yet "competent" in their use of this particular language system, and its development may result in pertinent language behavior produced from an underlying cognitive deficit (Baltaxe, 1977; Cromer, 1968). The phonological system of language as a measure has been described as encompassing abstract representations and rules that might be critical to language-disorders in some groups of children (Cromer, 1968). It has been hypothesized that delayed development may result in a constrained phonological output, however, various diagnoses that display deficient language repertoires may differ in this component of language (Cromer, 1968). Other cases of language disorders may be better represented in terms of syntactic abilities, something

that has been described as a possibly innate characteristic in humans, as contended by Chomsky's (1965) biolinguistic account of language. A syntax approach ties directly with that of cognitive processes and perceptual mechanisms with impairments affecting the comprehension and production of language (Cromer, 1968).

The traditional linguistic approach to human language offers an analysis that seeks to identify how and why an individual expresses words. This ultimately encompasses a classification system that attempts to organize words, sentences, and phrases through an appeal to cognitive explanations in identifying the cause of language behavior (Skinner, 1957). This receptive-expressive framework is representative of the current assessments and treatment protocols that are used to intervene on language deficits as experienced by children with autism. This approach demonstrates consistency with its adherence to current descriptions of language disorders. According to The American Speech-Language Hearing Association (1993), a language disorder represents an impaired "comprehension and/or use of spoken, written, and/or other symbol systems," potentially including "the form of language (phonology, morphology, and syntax), the content of language (semantics), and/or the function of definition." These complexities described within the linguistic mechanisms appear to reveal somewhat of a bearing for existing theoretical frameworks on language and its development, although there does exist an incongruity between the directions of a behavioral and linguistic approach. For example, much of the produced knowledge thus far has yielded a distinguishable emphasis on the non-function based properties of language structure (Esch, LaLonde, & Esch, 2010) and the cognitive mechanisms that underlie language, both representing an exodus that is quite distinct from that of

Skinner's (1957) *Verbal Behavior*. Yet, as distinct as it may be, the information that this methodology has produced regarding language, its acquisition, and its overall structure serves to represent the true complexity that underlies language; a complexity that still conceals a greater understanding that is essential to obtain if we are to identify the cause of language development.

Contemporary Behavior Analytic Approaches to Language Development

While the subject of considerable criticism, B.F. Skinner's (1957) analysis remains ever prevalent in its influence of the treatment of language (Schlinger, 2008; Sundberg & Michael, 2001), thereby representing the strength of its content. His conceptualization opened the door for investigators to approach language and cognition in a way that fit well in the existing contingency driven dogma (Hayes, 2004). What's been identified from the aforementioned reviews and citation analyses (eg., Dixon et al., 2007; McPherson et al., 1984; Oah & Dickinson, 1989; Sautter & LeBlanc, 2008) is that, although this door may have been opened, it does not appear that full advantage has been taken of his theorem. The focus has been narrow and, as such, the produced outcomes, while still invaluable, may reach a point in which new formulations are necessary to expand upon its resilience. Additionally, the deductions found within a linguistic methodology are representative of a direction in the understanding of language by which we must account for all of its complexities. Their competing theoretical framework places emphasis on the fact that such a distinction does exist at all: a fact that may denote the need for those additional formulations to serve as an integrating element. Thus, a third wave of behavior analysis (Hayes, 2004) has

emerged as a comprehensive approach to the understanding of language; a feat both the traditional and linguistic frameworks seek to address.

The aggregate investigations that have been accomplished in order to address the components of Skinner's (1957) treatment of language development have been further interpreted and extended upon beneath the scope of stimulus equivalence (e.g., see Sidman, 1971) and, by in large, Relational Frame Theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001). This contemporary contribution provides a functional-analytic approach to human language and cognition in terms of derived relational responding and the establishment of a generalized operant response class (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Roche, Barnes-Holmes, Barnes-Holmes, Stewart, & O'Hora, 2002). RFT, therefore, contends that verbal behavior involves "a history of reinforcement for responding in accordance with a range of contextually controlled, arbitrarily applicable relations known as relational frames" (Barnes-Holmes et al., 2000 pg. 70). This contemporary account on language and cognition propose the necessity for a speaker to also behave as a listener by which verbal behavior develops through an "experiential" acquisition of skills needed to learn new relations and, ultimately, advance their verbal development (Barnes-Holmes et al., 2000; Greer & Speckman, 2009). The concepts as described in RFT (e.g., see Hayes et al., 2001) not only expand upon the current breadth of literature on verbal behavior, but also expand upon Skinner's (1957) preliminary descriptions of the generative nature of human language (Barnes-Holmes et al., 2000). Skinner did, in fact, allude to derived relations in a rather maiden sense. One example of this can be found in a passage in which he described that individuals might learn a person's name after simply seeing that person respond appropriately to the said

name (Skinner, 1957, pg. 359-360). Barnes-Holmes and colleagues (2000) discuss this as an invitation to use the empirical research and conceptual formulations that we now have available to speculate further on what Skinner indicated. These authors call for a possible synthesis of Skinner's account of verbal behavior with the contemporary account that RFT offers, as this may provide a valuable research agenda in the study of human language and cognition (Barnes-Holmes et al., 2000).

What this provides current investigators with is a platform from which the development of complex human verbal behavior is possible (Greer & Speckman, 2009). Such a platform might direct the two prevailing theoretical frameworks towards a collective and comprehensive approach to the understanding of language, one that begins with Skinner's proposed elementary verbal operants and proceeds beyond into a framework that is inclusive and representative of the complexities that underlie human language and cognition. This begins with the notion of stimulus equivalence, the operant analysis of this empirical phenomena, and what has resulted to influence the development of language beyond the direct training of individual responses (Sidman & Taliby, 1982; Barnes-Holmes et al., 2001). Stimulus equivalence emphasizes relationships of equality and the resulting transfer of stimulus functions. For example, when a verbally able human is trained to match A (e.g., the vocal utterance "dog"), to B (e.g., a picture of a dog) and B (e.g., a picture of a dog) to C (e.g., the written word "dog"), this individual will then be likely to match C (e.g., the written word "dog") to A (e.g., the vocal utterance "dog"), and A (e.g., the vocal utterance "dog") to C (the written word "dog"), without any direct training of that relation. What results from this is a derived stimulus relation, which can be defined as a relation between two or more

stimuli that was not directly taught, and that was not exclusively based on the stimuli's physical properties. The conditional discriminations that result from equivalence responding are often readily observed in language-able humans (Luciano, Becerra, & Valverde, 2007), and include relations of reflexivity, symmetry, and transitivity (Sidman & Taliby, 1982). The reflexivity relation is demonstrated when a novel stimulus is matched to itself (e.g., A1 to A1), while a symmetrical relation is demonstrated when the relation is reversed (e.g., if A1-B1, then B1-A1). The transitivity relation involves the inclusion of at least three stimuli (e.g., A1, B1, C1), by which an untrained relation between two of the stimuli emerges (e.g., A1-C1) following training on the other two relations (e.g., A1-B1 & B1-C1) (Sidman & Taliby, 1982). The behavioral account of equivalence has been demonstrated in humans as early as infancy (Lipkens, Hayes, & Hayes, 1993; Luciano et al., 2007). In a study that sought to examine the effects of multiple-exemplar instruction (MEI), investigators were able to demonstrate equivalence responding in a 19-month-old infant (Luciano et al., 2007). These results represent the earliest demonstration of equivalence responding and lend support for the continued investigation of the development of such derived relations. What's additionally noteworthy about this demonstration was that this repertoire was established in the absence of a naming repertoire and a speaker component, thereby further indicating the vast potential for establishing such responding (Luciano et al., 2007).

What is important to distinguish is that children with Autism and other developmental disabilities do not necessarily learn or acquire the response patterns as demonstrated above in a typically developing population (Lipkens et al., 1993; Luciano et al., 2007; Devany, Hayes, & Nelson, 1986). A clear demonstration of this differing

ability came from a study in which language-abled and language-disabled children served as participants (Devany et al., 1986). The children were taught a series of four related discriminations, and then tested to observe the emergence of any equivalent stimuli. Results indicated that all of the typically developing, language-abled participants were able to demonstrate equivalence, while this was not demonstrated in any of the language-disabled participants. What they found, though, was that the children with no language were able to respond consistently with many more trials and prompts necessary in order to achieve the set mastery criteria (Devany et al., 1986). These results revealed a key relationship between the ability to form equivalence classes and language. This relationship is one was suggested as having the ability to set the stage for the development of training techniques that can be applied to the treatment of deficient language repertoires. Since then, a number of examinations of derived stimulus relations and relational framing have divulged much support for applying a RFT framework to the development of a verbal repertoire in children with Autism (e.g., Murphy, Barnes-Holmes, & Barnes-Holmes, 2005; O'Connor, Rafferty, Barnes-Holmes & Barnes-Holmes, 2009; Rehfeldt & Barnes-Holmes, 2009). The implications of this in practice are immeasurable and very meaningful in the development of language, as this relating ability serves as a response class that can occur with a boundless array of stimuli topographies (Roche, et al., 2002). The resulting influence of relational behavior, therefore, further necessitates a transition from solely relying on the direct-acting contingencies, as proposed by Skinner (1957; Gross & Fox, 2009), towards a technology that fully accounts for the complexities of human language and cognition

Resulting Assessments of Language

What has resulted from the prevailing theoretical accounts of language are various assessments used to identify language deficits and, subsequently, allow for treatment decisions to be made based off of the identified repertoires. Many of the existing assessments encompass various components of language development, as described by their corresponding theoretical accounts. One particular comprehensive assessment that has resulted from Skinner's *Verbal Behavior* (1957) is the *Assessment of Basic Language and Learning Skills- Revised* (ABLLS-R; Partington, 2006). This assessment, as well as others of a similar nature, such as the *Verbal Behavior Milestones Assessment and Placement Program* (VB-MAPP; Sundberg, 2008), the *PEAK Direct Training Assessment* (PEAK-DTA; Dixon, 2014a), and the *PEAK Generalization Assessment* (PEAK-GA; Dixon, 2014b), are largely rooted in a Skinnerian account of language as they assess the functional characteristics of language and encompass many of the elementary verbal operants (Skinner, 1957). The ABLLS-R, originally developed in 1998 and revised in 2006 (Partington, 2010), offers an assessment, curriculum guide, and skills tracking system that can be used by parents and professionals in creating specific Individualized Educational Plan (IEP), and subsequent programs used in ABA instruction (Partington, 2010). This assessment comprehensively reviews 25 different skill areas through which individualized goals and objectives can be specified. Language and functional skills are measured across these skill domains through a criterion-referenced platform (Partington, 2010). The ABLLS-R was intended to cover an array of language skills as prescribed by Skinner's account of verbal behavior (i.e., vocal imitation, requests, labeling, intraverbals, spontaneous vocalizations, and syntax and grammar) as well as consider one's motivation to

respond, their ability to attend and respond to the environmental stimuli, their ability to engage in leisure activities, socially interact, follow group instructions and respond in social situations, and engage in a variety of academic skills (i.e, reading, math, spelling), self-help skills, as well as gross and fine motor skills (Partington, 2010). There is preliminary research that has begun to assess and measure the extent of this assessment's validity and reliability. Results of one examination of this (Ursy, 2015) revealed that the assessment has good content validity for identifying specific language delays to the extent of skills that it sets out to measure, however, there were still over 200 items that did not meet the examination's critical value cutoff (.800) and, therefore, were determined as poorly measured constructs. This review also included preliminary results for the inter-rater reliability of the ABLLS-R. An analysis demonstrated strong agreement between raters across the items assessed (Ursy, 2015). The ABLLS-R is intended for use with a variety of age and functioning levels (Partington, 2010).

The *Test of Language Development- Intermediate: Fourth Edition* (TOLD-I:4) represents an assessment of language and its structure consistent with a linguistic account of human language. This assessment was intended to incorporate a variety of linguistic theoretical perspectives that review the features and systems of language (Hamill & Newcomer, 1997; Hayward, Stewart, Phillips, Norris, & Lovell, 2008). These features include semantics and grammar skills (i.e., syntax and morphology), while the systems include listening abilities (i.e., receptive skills), organizing abilities, and speaking abilities (i.e, expressive skills). These areas are assessed across six subtests that are intended to represent overall spoken language. This assessment seeks to measure a child's language skills and document their progress across the various tasks

included. For example, the subtests assess an individual's ability to form compound or complex sentences, point to pictures that represent two-word stimuli, form complete sentences from random word combinations, liken words together, distinguish between correct and incorrect grammar, and identify many meanings for specific words. This assessment claims to be reliable and research-based, however, the existing literature that has examined the extent of this is limited. The TOLD-I:4 is intended for intermediate learners ranging in age from 8 years to 17 years.

The *Promoting the Emergence of Advanced Knowledge Equivalence Pre-Assessment* (PEAK-E-PA; Dixon, 2015) represents a more contemporary approach to the assessment and treatment of human language. The goals of this assessment include objectives towards achieving a complex level of learning, language, and cognition that goes beyond the formal similarity of generalization towards more flexible relational responding (Dixon, 2015). This criterion-referenced assessment and subsequent treatment protocol places emphasis on inferences, abstraction, and symbols through the practices of stimulus equivalence. Some of the skills covered in this guide include common core targets, intelligence test targets, short and long term memory development, creative behavior, merging sensory modalities across stimuli, complex conversation skills, understanding emotions, and perspective taking (Dixon, 2015). This technology includes a pre-assessment by which reflexive, symmetrical, transitivity, and equivalence relations are assessed over a variety of sensory modalities (i.e., visual, auditory, tactile, gustatory, and olfactory) and difficulty levels that seek to assess an individual's ability to learn to relate concepts (Dixon, 2015). The purpose of this initial pre-assessment is to estimate the extent of an individual's pre-existing

relational repertoire in order to assist in determining the skills that should be directly or indirectly assessed on the full PEAK Equivalence Assessment (Dixon, 2015). This is achieved by using a standardized set of novel, arbitrary stimuli (i.e., symbols and made up words) across two tests per relation. Each skill identified in the pre-assessment, and subsequent assessment corresponds directly with 184 skills that the PEAK-E curriculum targets from which relational training can then occur.

Purpose of the Present Investigation

The assessment of individuals with Autism is a necessary and crucial step in programming for skill acquisition and language development. Identifying the produced scores of these assessments across a variety of learners will yield insight on the assessment's ability to determine one's language repertoire. Autism presents those that it affects with a wide array of delays and skill deficits. Therefore, the extent to which an assessment can produce reliable measures related to the identification of these deficits is a critical variable in producing individualized treatment plans that seek to ameliorate impaired language and other diminished skill domains, as identified through assessment. As the field of Behavior Analysis largely functions on the basis of empirical support and systematic conceptualization, establishing a measure of one's deficits and abilities can further serve as an important point of reference for determining training modalities, as well as offer a basis for comparison once a learner begins to acquire some of the identified deficits (Petursdottir & Carr, 2011). With a variety of assessments used in practice under an array of theoretical frameworks, a comparison of some of the available technologies may yield important information regarding the extent to which language is accounted for within each assessment, and which is most appropriate for

identifying deficits in a learner's repertoire. The ABLLS-R represents a traditional behavioral approach to human language, one that is rooted in Skinner's (1957) verbal operants and embodies a functional account of language. The TOLD-I:4 represents a linguistic approach to human language, one that doesn't necessarily ascribe to its function, but offers a thorough account of the complexities observed in human language through examining its structure. Finally, the PEAK-E-PA represents a contemporary approach to human language and cognition that intends to bridge the gap between the traditional behavior analytic approach and a linguistic approach in its assessment of an individual's ability to derive relations. Therefore, a comparison of these resulting technologies may inform fundamental distinctions towards the extent of skills measured by each assessment within their prescribed theoretical account. What can additionally result from evaluating the relationships that exist amongst these technologies is the ability for professionals and consumers to determine what the commonalities that exist amongst the available assessments, as well as how their measures differ, ultimately allowing for any assessment-specific effects to be viewed under a more empirical light (Virtues-Ortega, 2010). Finally, a comparison of existing assessments may allow us to determine whether or not they are sensitive to differences based on functioning levels as determined by the other assessments (Rehfeldt et al., 2009, pg. 41). In other words, comparing the technologies that have been produced in an attempt to account for language will allow us to examine their sensitivity and predictability in identifying language deficits for individuals with Autism, a goal that each assessment encompasses within their mechanisms (Rehfeldt et al., 2009, pg. 42). Therefore, the purpose of the present investigation was to examine the correlational relationship

between the ABLLS-R, the PEAK-E-PA, and the TOLD-I:4 in order to evaluate their treatment utility and more closely examine the theoretical accounts of language that have produced such technologies.

CHAPTER 2

METHODS

Participants

A total of 17 participants (14 males, 3 females) were involved in the present study. Demographic information is summarized in Table 1. All of the participants either had a diagnosis of Autism, or had both a diagnosis of Autism and an additional diagnosis. All participants were clients served at a Mid-Western in-home provider that delivers customized ABA therapy to individuals with Autism. Clients most commonly seek out services by this provider, or are made referrals by their schools, or members of their community. After the initial in-take process occurs, clients receive a customized team that includes a Board Certified Behavior Analyst and skilled Care Team Members that will deliver the services. It is up to the clinical discretion of the acting BCBA on whether or not they will conduct an assessment, and which assessment they will use. Each child receives an individualized care plan that documents goals and programs that will be put into place using the Catalyst data collection platform.

The participant's ages ranged from 3 to 14 years ($M = 7.52$, $SD = 4.19$). 13 of the participants had a sole diagnosis of Autism, while four participants had a dual diagnosis. Specifically, in addition to an Autism diagnosis, one participant had a comorbid diagnosis of Phelan-McDermid Syndrome, one had a diagnosis of Bardet Biedl Syndrome (BBS4), one had a diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD), and one had a Disorder of Central Nervous System diagnosis. Of the 17 participants, zero had existing ABLLS-R, PEAK-E-PA, or TOLD-I:4 scores on file, four

had existing PEAK-DTA scores on file, one had an existing PEAK-G score on file, and two had other assessment scores on file (VB-MAPP).

Settings and Materials

Assessments took place in the participant's home. The rooms in which the assessments were conducted varied, but were kept to the usual location of ABA therapy. All of the rooms included a table in which part of the assessment was conducted, and previously existing stimuli and reinforcers. The primary investigator brought any necessary stimuli specific to each assessment, as described below. Assessments were scheduled with parents/guardians prior to the start of data collection. Assessments were held Monday-Sunday, and usually lasted between one and three hours per session. Additional days were scheduled if needed, however, the number of visits per client did not exceed two. The ABLLS-R assessments were conducted indirectly initially by the child's BCBA and completed directly by the trained graduate student. An indirect assessment involved the child's BCBA going through each item in this assessment and scoring the items that they were certain of based off of existing mastered abilities within a participant's repertoire. The direct assessment of the remaining skills involved the investigator assessing in a one on one, in person format with each participant. There was one participant in which the direct assessment was conducted by both the BCBA and the graduate student. There was also two participants whose parent assisted in completing part of the ABLLS-R indirectly. The primary investigator brought an Apple MacBook Pro to each assessment in order to efficiently record scores for the ABLLS-R assessment. Hard copies were brought of the PEAK-E-PA and TOLD-I:4, with scores recorded by hand, then transferred to a Microsoft Excel

sheet where the raw data was stored. The assessments used in the current study included the *PEAK Equivalence Pre- Assessment* (PEAK-E-PA), the *Assessment of Basic Language and Learning Skills – Revised* (ABLLS-R), and the *Test of Language Development – Intermediate 4 Assessment* (TOLD-I:4).

The PEAK-E-PA assessment contains 48 items with the purpose of assessing an individual's ability to derive reflexive, symmetrical, transitive, and equivalence relations. The assessment contains a total of 12 items per relation with varying degrees of complexity (i.e., basic, intermediate, and advanced). For each relation there is a subsequent score of either "0," "1," or "2," that is marked under each corresponding skill difficulty throughout the assessment. This arrangement yields a score that ranges from 0-12 for each of the four relations, thus resulting in a possible total pre-assessment relational score of 48. The long-form arrangement of this pre-assessment was implemented in this investigation. This involved examining each of the six skills twice with differing stimulus arrangements. Specific materials included a 75-page flip book from which arbitrary visual stimuli were produced and used during the assessment (See Appendix A). Tangible items were also gathered as visual stimuli as specified in the assessment (e.g., highlighter, coin, etc.). Additional stimuli included auditory, tactile, gustatory, and olfactory stimuli used to assess cross-modal derived relations, from which arbitrary vocal words and sounds were used, as well as stimuli that the researcher collected based off availability to satisfy the materials for the tactile and olfactory portion of the assessment, as listed on the corresponding program page.

The ABLLS-R reviews 544 skills from 25 different skill areas. Some of these skill areas include language, social interaction, self-help, essential abilities, academic, and

motor skills. This assessment includes a wide range of skills, varying from simpler to more complex tasks with the goal of refining the level of examination of an individual's skill set with language and learning. Picture stimuli and common objects were used as materials for this assessment. The primary investigator was responsible for collecting all materials to satisfy the assessment of skills that required the use of stimuli. Picture stimuli were collected from existing materials, downloaded from Google, or obtained from the Appendix listed on page 94 of the ABLLS-R Protocol Manual. Various puzzles, form boxes, and block design picture cards were retrieved from local stores, and common objects were collected from the researcher's home, as well as from local stores. If any stimuli from a participant's house demonstrated relevance for a particular task, they were also used during the assessment. Examples of this include blocks and common objects.

The TOLD-I:4 is an assessment that is most commonly used by speech-language pathologists in diagnosing language disorders through the identification of deficits in oral language proficiency. It is intended for ages 8-17, however, it was used with children under the age of eight in this study. This assessment includes six subtests that measure semantics and grammar skills in an attempt to determine an individual's specific oral language strengths and weaknesses. The broad measures that are included are listening abilities, organizing abilities, and speaking abilities, all of which are intended to represent an individual's overall spoken language. The specific subtests within these areas include sentence combining, picture vocabulary, word ordering, relational vocabulary, morphological comprehension, and multiple meanings. Materials

included nine pages of picture stimuli used for the picture vocabulary section of the assessment

Data Analysis

A nonparametric analysis was conducted to examine any existing monotonic relationships between the ranked scores of the paired assessments. The specific nonparametric procedure employed was the Spearman's rank order correlation (i.e., Spearman's rho). Rank values were automatically determined using IBM SPSS Statistics. This particular measure is robust to outliers. Visual analysis of the scatterplots reveals that an outlier exists in this data set (see Figures 1-3). As this procedure is less sensitive to outliers, results will be presented for an analysis that includes the outlier, and an analysis that does not include the outlier. This will be done in order to examine any influence the outlier may have on the implications.

Analysis of PEAK-E-PA and the ABLLS-R

An initial analysis was conducted to evaluate the relationship between total scores on the PEAK-E-PA and the ABLLS-R. The maximum score for the PEAK-E-PA was 48, while the maximum composite score for the ABLLS-R was 1,488. Since such a profound difference exists between the total scores for each assessment, the scores were converted into a percentage. This was accomplished by dividing each participant's score by the maximum score possible. This number was then multiplied by 100 to produce a percentage. Once these percentages were calculated, a Spearman's rho was run for each measure to determine if a statistically significant monotonic relationship exists between these two particular assessments. The effect size was subsequently determined by squaring the produced correlation coefficient. Visual analysis of the data

presented in the form of a scatterplot created using Microsoft Excel occurred in addition to the results of the analyses (Figure 1).

Analysis of PEAK-E-PA and the TOLD-I:4

A second analysis was conducted to evaluate the relationship between total scores on the PEAK-E-PA and the TOLD-I:4. The maximum score for the PEAK-E-PA was the same as indicated above, while total raw score for the TOLD-I:4 was 361. As mentioned above, the scores of both assessments were converted into a percentage. This was accomplished by dividing each participant's score by the maximum score possible. This number was then multiplied by 100 to produce a percentage. Once these percentages were calculated, a Spearman's rho was run for each measure to determine if a statistically significant monotonic relationship exists between these two particular assessments. The effect size was subsequently determined by squaring the produced correlation coefficient. Visual analysis of the data presented in the form of a scatterplot created using Microsoft Excel occurred in addition to the results of the analyses (Figure 2).

Analysis of the ABLLS-R and the TOLD-I:4

A third and final analysis was conducted to evaluate the relationship between total scores on the ABLLS-R and the TOLD-I:4. The maximum composite score for the ABLLS-R was 1,488, while the maximum raw score for the TOLD-I:4 was 361. Similar to the other two comparisons, the assessment scores were converted into a percentage. This was accomplished by dividing each participant's score by the maximum score possible. This number was then multiplied by 100 to produce a percentage. Once these percentages were calculated, a Spearman's rho was run for each measure to determine

if a statistically significant monotonic relationship exists between these two particular assessments. The effect size was subsequently determined by squaring the produced correlation coefficient. Visual analysis of the data presented in the form of a scatterplot created using Microsoft Excel occurred in addition to the results of the analyses (Figure 3).

Procedure

All of the assessments (PEAK-E-PA, ABLLS-R, and TOLD-I:4) were completed by the author of this study in the Southern Illinois University Carbondale Applied Behavior Analysis program. In order to initiate the assessments, the client's BCBA first initiated contact with a parent/guardian to determine whether or not they would be interested in having their child participate in the study. If they indicated interest, a research solicitation letter and consent form was sent to them via e-mail, or delivered in person by the BCBA or primary investigator. Then, the primary investigator extended contact with the parent/guardian in order to schedule a time for the researcher to come and begin the assessments. All assessments were completed in the participant's home to minimize distractions. Participants were delivered intermittent reinforcement throughout the duration of the assessment, non-contingent upon correct responses. Reinforcement was delivered in the form of attention, a short break, or access to a particular predetermined reinforcer. The assessor provided the necessary stimuli for conducting each assessment as indicated above.

Promoting the Emergence of Advanced Knowledge- Equivalence Pre-Assessment

Each PEAK-E-PA assessment was conducted directly by the primary investigator. For each program the corresponding instructions were followed exactly as

written. For all relations, a match to sample format was implemented for some of the included programs. This involved the presentation of a sample stimulus (e.g., A1) and two comparison stimuli (e.g., B1 and B2), while reciting the provided instructions out loud. For example, to assess a basic program using this particular arrangement, the investigator presented three arbitrary stimuli (e.g., A1, B1, and B2), two of which were formally identical, and directed the participant's attention to the sample stimulus (e.g., A1), while saying "This is the same as this," then directed the participant's attention to the corresponding comparison stimulus (e.g., B1 or B2). This comparison stimulus was then presented as a sample stimulus with two comparison stimuli (e.g., A1 and A2) below. The investigator then delivered the instruction "Find the same", while directing the participant's attention to the sample stimulus (e.g., B1). In order for a response to be considered correct, the participant must have selected the correct corresponding comparison stimulus. This was then repeated with a differing stimuli arrangement to determine a score of 0, 1, or 2. Other arrangements involved the presentation of the stimuli in a sequential manner with the delivery of vocal stimuli that corresponded with the sample and comparison stimuli presented (e.g., "those were the same"). Some involved the delivery of arbitrary words, such as "diz" and "vug", with correct responses requiring the participant to indicate 'yes' or 'no' in whichever way they were able to (i.e., verbally, through signs, head shakes, or with a communication device.) Other response types included the participant stating a previously dictated arbitrary word (e.g., learner says "feks"), the participant copying an arbitrary word on a piece of paper or typing it on a keyboard, the participant stating an arbitrary word in place of another, and the participant drawing arbitrary symbols. Stimuli used to test symmetrical, transitive, and

equivalent relations were not formally identical, thus being arbitrarily related.

Participants had 45-seconds to respond and complete the task for each item.

The Assessment of Basic Language and Learning Skills-Revised

Each ABLLS-R assessment was first assessed indirectly by the participant's acting BCBA in conjunction with the primary investigator by using the ABLLS-R Protocol Manual. Skills that have been observed or previously mastered, as indicated by the BCBA, were marked as present in the participant repertoire. A score was determined based off the extent to which the participant met each skill's criteria. If there was a skill that the BCBA was uncertain of, it was directly assessed by the primary investigator. The specific skill areas that were examined in this portion of the investigation included Basic Learner Skills Assessment, Academic Skills Assessment, Self-Help Skills Assessment, and Motor Skills Assessment. Specific skill areas within these domains included: Cooperation and Reinforcer Effectiveness, Visual Performance, Receptive Language, Motor Imitation, Vocal Imitation, Requests, Labeling, Intraverbals, Spontaneous Vocalizations, Syntax and Grammar, Play and Leisure, Social Interaction, Group Instruction, Classroom Routines, Generalized Responding, Reading, Math, Writing, Spelling, Dressing, Eating, Grooming, Toileting, Gross Motor, and Fine Motor. Each skill domain area included a different number of tasks that varied from 6-57. Each task under its corresponding skill domain included a task identifier, a scoring box, the task name, the task objective, the relevant question, examples of the objective, and criteria for scoring. Before the start of each assessment, reinforcers and problem behaviors were clearly identified by gathering information from the BCBA and the

participant's parent. The assessment was conducted in a one-on-one format that was familiar to each participant.

The Test of Language Development-Intermediate: Fourth Edition

Each TOLD-I:4 assessment was conducted directly by the primary investigator. The investigator began with the first subtest, and moved sequentially through the subtests until the assessment was complete. Instructions were delivered word for word straight from the assessment manual for each subtest. Items were run in succession until completed, or until the specified discontinuation criteria was met. Discontinuation criteria was listed at the bottom of the instructions for each subtest.

CHAPTER 3

RESULTS

Analysis of PEAK-E-PA and the ABLLS-R

Following the calculation of all three-assessment scores for each participant, a Spearman's rho test was run to evaluate the relationship between PEAK-E-PA and the ABLLS-R using SPSS both with and without the observed outlier. A correlation matrix is summarized in Table 2 and Table 3. A two-tailed test of significance revealed a significant relationship between PEAK-E-PA and the ABLLS-R ranked assessment scores both with and without the outlier ($r_s(17) = .774, p < .01$; $r_s(16) = .728, p < .01$). The two correlation coefficients produced indicate a high positive correlation. A graph summarizing this relationship is displayed in Figures 1 and 4 from which visual analysis of the data is provided. The results of the squared correlation coefficient suggest that 59.9% of the variance in the ABLLS-R scores can be accounted for by the PEAK-E-PA scores with the outlier included. 53% of the variance can be accounted for without the outlier included. Results indicate that 0% of participants received a maximum score on the ABLLS-R. There were no participants that received the lowest possible score of zero on the ABLLS-R. 100% of participants scored to some extent on the reflexivity portion of the PEAK-E-PA assessment. Eight participants (47%) scored on both the reflexivity and symmetry portions of the assessment, while two participants (11%) of participants scored on the reflexivity, symmetry, and transitivity portions of the pre-assessment, and only one (5%) scored on all four relations included in the PEAK-E-PA. Similar to the ABLLS-R, there were no participants that scored a zero on the PEAK-E-PA.

Analysis of PEAK-E-PA and the TOLD-I:4

A Spearman's rho test was run to evaluate the relationship between PEAK-E-PA and the TOLD-I:4 using the same software as described above. Similar to the first analysis, a Spearman correlation matrix is summarized in Table 2 and Table 3. The results of the two-tailed test of significance indicate a high positive correlation between these two assessments, while also demonstrating significance both with and without the outlier ($r_s(17) = .822, p < .01$; $r_s(16) = .785, p < .01$). Squaring the correlation coefficients indicate that 67.6% of the variance in the TOLD-I:4 scores can be accounted for by the PEAK-E-PA scores with the outlier, and 61.6% of variance in those scores can be accounted for without the outlier. A graph summarizing this relationship is displayed in Figures 2 and 5 where visual analysis of the data is provided. Results showed that six participants (35%) achieved the lowest possible score of 0 on the TOLD-I:4, while no participants received the lowest possible score of 0 on the PEAK-E-PA. Results additionally demonstrated that 0% of participants received a maximum score on both the TOLD- I:4 and the PEAK-E-PA.

Analysis of the ABLLS-R and the TOLD-I:4

A Spearman's rho was run to evaluate the relationship between the ABLLS-R and the TOLD I:4 using SPSS, with a Spearman correlation matrix summarized in Table 2 and Table 3. This analysis revealed a statistically significant relationship between PEAK-E-PA and the ABLLS-R ranked assessment scores with, and without the outlier included ($r_s(17) = .921, p < .01$; $r_s(16) = .904, p < .01$). These correlation coefficients indicate a very high positive correlation across both analyses. A graph summarizing this relationship is displayed in Figures 3 and 6, where visual analysis of the data is also

provided. Squaring the correlation coefficients suggest that 84.8% of the variance in the ABLLS-R scores can be accounted for by the TOLD-I:4 scores with the outlier included in the data, and 81.7% can be accounted for without the outlier included in the data.

Again, results revealed that 0% of participants received a maximum score on the ABLLS-R. 11 participants (65%) received a score of 0.55% or above on the TOLD-I:4, with the highest score not exceeding 43%.

CHAPTER 4

DICUSSION

The results of the present investigation yield important implications towards a greater understanding of human language through the relationships that resulted from the non-parametric statistical procedures employed. Specifically, Spearman's rank-order correlation analyses were computed to assess and determine whether or not a monotonic relationship exists between ranked assessment scores on the PEAK-E-PA and the ABLLS-R, the PEAK-E-PA and the TOLD-I:4, and the ABLLS-R and the TOLD-I:4. Identifying the degree of monotonicity between these assessments will allow for an initial look at the direction of scores of one variable as scores from the comparison variable increase. Such a relationship may lend support towards the suggestive identification of which theoretical framework has produced the most appropriate assessment for the present sample. The results of these comparisons yielded statistically significant, positive monotonic relationships between all three comparisons both with and without the inclusion of the outlier. Results minimally varied for data that included and excluded the univariate outlier, thus implying similar inferences for both analyses (see Figures 1-6). High positive correlations were produced for the PEAK-E-PA and ABLLS-R comparison (see Figures 1 and 4), as well as for the PEAK-E-PA and TOLD-I:4 comparison (see Figures 2 and 5). A very high positive correlation was produced for the ABLLS-R and TOLD-I:4 correlation (see Figures 3 and 6). These produced relationships, as indicated by the correlation coefficients, provide evidence towards convergent validity for these assessments. The squared correlation coefficients suggest that the percent of variance explained by each comparison was supportive in

establishing a level of certainty that one can relate an individual's ranked scores on one assessment to another's across all three analyses. The percent of variance ranged from 53%-85% across data that included and excluded the outlier. The strongest variance accounted for, as well as the strongest produced relationship was observed in the comparison between the ABLLS-R and the TOLD-I:4 ($rs(17) = .921, p < .01$; $rs(16) = .904, p < .01$). The weakest relationship was observed between the PEAK-E-PA and the ABLLS-R ($rs(17) = .774, p < .01$; $rs(16) = .728, p < .01$). Although the weakest relationship out of the three, the correlation coefficient still indicates a high positive correlation.

While these results are correlational in nature, there are important summaries that can be made from the raw data (see Figures 1-6) as well as from the relationships that exist between the variables. As such, the particular sample included in this examination must first be considered. The present sample appears to represent a lower functioning population, as many of the participants displayed diminished skill repertoires, as indicated through their assessment scores, consistent with that of a low level learner. The produced scatterplots revealed that no participant received a maximum score on each of the assessments, thereby supporting their sufficiency in identifying deficits in a learner's skill repertoire. However, these results also reveal a high proportion of individuals who received the lowest possible score of zero on the TOLD-I:4 as compared to the ABLLS-R and PEAK-E-PA. This may suggest that, although the TOLD-I:4 assessment was highly correlated to both the PEAK-E-PA and ABLLS-R, it might not serve as the most appropriate assessment for identifying deficits that are necessarily relevant to a lower functioning individual. This is further exemplified

by the data revealing that no participant received a score of zero on the ABLLS-R, nor the PEAK-E-PA, and that no participant scored over 43% correct on the TOLD-I:4. In further examining the relationship between the PEAK-E-PA and TOLD-I:4, results elude to the complexities accounted for in both assessments. Again, though, as there was a higher proportion of participants who scored zero on the TOLD-I:4, and no participants who scored zero on the PEAK-E-PA, the PEAK pre-assessment may serve as a better tool for identifying deficits in lower functioning individuals than the TOLD-I:4. Along these same lines, it appears that the ABLLS-R most sufficiently identified deficits amongst participants. This can be seen through the very high positive monotonic relationship observed between the ABLLS-R and the TOLD-I:4, as well as the high positive monotonic relationship observed between the PEAK-E-PA and the ABLLS-R. These results may, therefore, suggest that the traditional Skinnerian account of human language may serve as an adequate representation of a learner's repertoire for lower functioning individuals, and that both a linguistic approach and contemporary approach to language are accounted for to some extent through the skills represented in the ABLLS-R. Without additional higher functioning participants included in the sample, though, it cannot be said to what extent linguistic structure or derived relational responding is truly accounted for through a traditional behavior analytic approach to language.

As previously mentioned, the PEAK-E-PA and the TOLD-I:4 appear to represent more advanced repertoires that encompasses greater complexity in a learner's language. While it appears that these assessments may not have been ideal for identifying deficits that are necessarily relevant to a lower functioning individual, it is

important to emphasize their ability to identify some level of deficit in the present sample. This ability suggests that such complexities still exist in this particular group of individuals with Autism, which is an important finding. What this might ultimately imply is that, as a learner increases their skill set under an assessment of a more traditional nature, assessments that account for higher levels of complexity will be necessary when an individual reaches a certain point in their assessment score that was appropriate for lower level learners. For example, the ABLLS-R may not be a sufficient representation of a learner's skill deficits if that learner is displaying more complexities in their repertoire, whereas the PEAK-E-PA and the TOLD-I:4 may offer a better means of identifying deficits that represent such complexities. This was well captured with the data set that included the outlier (see figures 4, 5, and 6). This outlier represented a higher functioning individual who displayed such described language complexities. What these findings may, therefore, support is the contention that Skinner's (1957) analysis of language did not fully account for the true extent of complexities that exist within a learner's language repertoire (Chomsky, 1959). While both the PEAK-E-PA and TOLD-I:4 serve to identify deficits in a learner's repertoire, albeit their advanced nature, that correspond, to some extent, with an individual's score on the ABLLS-R, we can further establish the possibility that a greater depth of complexity in the assessment of language exists beyond that of what is covered by the ABLLS-R. The strength of the observed relationship between these two may also imply noteworthy findings. This high positive correlation may allude to the structure of language, as described by a linguistic approach, being accounted for by a demonstration of derived relational responding; something that has been suggested in a more contemporary approach to language

(Barnes-Holmes et al., 2000; Greer & Speckman, 2009). What this relationship may ultimately suggest is that what was prescribed through a linguistic framework of language in terms of the structure of language, the symbolic nature of words, syntax, semantics, and other related mechanisms (Calinescu, 2012; Chomsky, 1959; Chomsky, 1965; Pinker, 1994) may be accounted for by one's ability to derive relations. These results, although correlational, further support the results of Devany and colleagues (1986) from which they demonstrated the close relation between one's ability to form equivalence classes and language as accounted for by a more traditional linguistic approach. Support of these results can also be found in Cromer's (1981) discussion of more current linguistic approaches needing to acknowledge the true complexity of language acquisition. The greater correspondence between these two assessments may then support the need for a contemporary approach to human language and cognition to bridge the gap between the functions of language identified through a traditional behavior analytic assessment, and the structural complexities identified through a linguistic assessment. This contemporary approach may encompass such a speech-language account that was suggested by Esch and colleagues (2010), as both the PEAK-E-PA and TOLD-I:4 were not only sufficient in identifying related deficits in the learners' repertoires, but were also sufficient in establishing a correspondence between language structure and derived relational responding (see Figures 2 and 5).

In further considering the nature of the assessment represented by a linguistic theoretical framework as compared to the nature of the assessment represented by a more traditional behavior analytic account (see Figures 3 and 6), these results may further lend support to contentions made regarding the omission of function from

consideration with assessments rooted in a linguistic nature, such as the TOLD-I:4 (Esch et al., 2010). In other words, the emphasis on non-function based properties, such as word structure and word modality (i.e., expressive/receptive), is consistent with the corresponding definition of language disorders (ASHA, 1993), but might not necessarily demonstrate adequacy in the application of subsequent language technologies, such as those rooted in Skinner's (1957) *Analysis of Verbal Behavior* (Esch et al., 2010), which appears to be sufficient for lower functioning individuals. What can therefore be concluded is that a linguistic approach to assessing language may fail to identify functional relations through which deficits can be identified, and a traditional behavior analytic approach to assessing language may fail to adequately represent the structure of language, as it does not provide an assessment that extends far beyond the verbal operants (Skinner, 1957). This may account for the lower scores on the TOLD-I:4 when examining its correspondence with the ABLLS-R (see Figures 3 and 6). This notion may further support the suggestion made by Esch and colleagues (2010) that, in order to achieve a complete speech-language account, the form of a speaker's response, as well as the function of interactions between a speaker and a listener must be identified in order to adequately assess existing deficits and provide a comprehensive treatment program.

The results of the present investigation, specifically the scores obtained on the PEAK-E-PA, lends support to the notion that most humans are capable of deriving arbitrary relations without direct training (Gross & Fox, 2009). This is apparent in the fact that each participant yielded some score on the PEAK-E-PA, despite their scores on the ABLLS-R (see Figures 1 and 4). This demonstrates that even early learners

encompass the ability to derive relations among arbitrary stimuli, a finding that remains consistent with the literature (Lipkens et al., 1993; Luciano et al., 2007), and provides implications towards an application of a RFT framework to the development of a verbal repertoire in children with Autism (Murphy et al., 2004; O'Connor et al., 2009; Rehfeldt & Barnes-Holmes, 2009). The traditional linguistic approach that the TOLD-I:4 represented seeks to identify the cause to the expression of words by humans through an evaluation of topographies (Cromer, 1968; Esch et al., 2010). This linguistic framework emphasizes the acknowledgement of the true complexity of language and its development under biological, cognitive, and environmental perspectives (Calinescu, 2012; Skinner, 1957). As previously mentioned, criticisms have resulted from those that ascribe to such methodologies in terms of the simplistic nature of a Skinnerian account of language (Chomsky, 1959). Somewhat in line with these criticisms has been the examination of the extent to which Skinner's theoretical framework has divulged in empirical investigations (e.g., McPherson et al., 1984; Oah & Dickinson, 1989; Sautter & LeBlanc, 2006; Dixon et al., 2007; Dymond et al., 2006). What has largely been revealed in these examinations is the limited nature to which Skinner's analysis of verbal behavior has been investigated, and the need for an expansion that is representative of more advance forms of language (Dixon et al., 2007). Results of the present investigation lend support to these criticisms, as the ABLLS-R, an assessment rooted in the analysis of language as prescribed by Skinner (1957), appears to only assess and identify a certain extent of deficits within an individual's language repertoire.

The three examined assessments share a common central purpose of identifying deficits in a learner's language repertoire. They seek to measure critical components of

one's verbal abilities to prescribe appropriate treatment directions that will attempt to ameliorate the identified deficits. Therefore, the extent to which they are capable of identifying such deficits may allude to the extent to which our technologies account for human language. As aforementioned, these results provide support for each assessment's ability to identify deficits in a learner's repertoire, and establishes that each offers an assessment of language. No participant obtained a maximum score on any of the assessments, thereby indicating their ability to identify deficits related to what is covered in each assessment. The difference that exists between each of these assessments, though, is the content in which each encompasses. The ABLLS-R emphasizes the basic verbal operants through its assessment of language skills. It does not, however, account for the structure of language as does the TOLD-I:4 assessment. The TOLD-I:4 covers complex linguistic structure, such as grammar, syntax, semantics, and pragmatics. It does not, however, account for the functional characteristics of language that the ABLLS-R accounts for. PEAK-E-PA appears to account for both the functional characteristics of language and the structure accounted for by a linguistic approach, therefore demonstrating that it accounts for more structural variance of language. The strong monotonic relationship observed between the ranked scores on the PEAK-E-PA and the ranked scores on the TOLD-I:4 seems to provide more support for the position that derived relational responding has more implications in terms of structure of human language than the Skinnerian account of language (Devany et al., 1986). Further along these lines, this relationship suggests that the structure accounted for by the linguistic approach to language development, as represented through TOLD-I:4, may be accounted for by derived relational responding, as represented by PEAK-E-

PA. In other words, the TOLD-I:4 seemed to provide a much more complex assessment of language, as represented by the fact that the average score obtained was 4.5% and many received the lowest possible score of 0% (see Figure 2). Yet we can say with confidence that derived relational responding and language structure are related to some extent, which might therefore indicate that a relational repertoire that accounts for the function of the structure is necessary to achieve the linguistic structure accounted for in the TOLD-I:4. This is, once again, supported by the degree to which the PEAK-E-PA accounts for variance in the TOLD-I:4. Thus, there is a great need to continue to investigate the extent to which derived relational responding influences the development of a language repertoire, a need that has been additionally emphasized in much of the literature (Barnes-Holmes et al., 2000; Dixon et al., 2014; Dymond & Alvarez, 2010; Rehfeldt et al., 2009).

These implications are not to be confused as an argument against the use of any of these assessments. Each assessment thrives under the assumption that they are a valid and reliable means of identifying language deficits under their existing theoretical frameworks (Dixon et al., 2014; Newcomer & Hamill, 1996; Usry, 2015). What this means is that ABLLS-R is a reliable assessment of verbal operant behavior, one that appears sufficient for lower functioning individuals, while TOLD-I:4 is a reliable assessment of linguistic structure, and PEAK-E-PA is a reliable assessment of derived relational ability, both which appear to be more sufficient for higher functioning learners than lower functioning learners. Therefore, they are each worthwhile to the extent that their content is assessable in a learner's repertoire. For example, the ABLLS-R is absolutely valuable in assessing an individual's language and learner repertoire,

however, the parameters of the individuals that it is conducted with must be considered. We must question whether or not it would identify any deficits in a more advanced learner's repertoire, for example. The extent to which it is a sufficient assessment for those who demonstrate complex language structure and relating abilities must be examined. If a learner is to receive a significantly high score on this particular assessment, we must now question how well this assessment is really identifying deficits that remain in their language repertoire. As previously mentioned, the results of the present investigation lend support towards the fact that there is a lot more to be accounted for in terms of language that goes beyond the verbal operants and common reliance on direct-acting contingencies (Gross & Fox, 2009). The PEAK-E-PA and TOLD-I:4 appear to represent an entirely new set of skills within a developing language repertoire, a set of skills that are simply not accounted for in assessments rooted in a traditional Skinnerian account. Once a learner exceeds the parameters assessed in the ABLLS-R, it then appears that an assessment that accounts for more structural variance is needed. These complexities are better represented in a more contemporary approach.

The implications and procedural foundation of the current investigation are not without limitation. To start, the TOLD-I:4 and ABLLS-R represent widely used and disseminated assessments, however, the extent to which their validity and reliability have been examined is limited, although preliminary investigations do exist (e.g., Newcomer & Hamill, 1993; Ursy, 2015). An additional limitation related to the assessments in this study comes from the intended age range for the TOLD-I:4. The current study employed the intermediate version of this assessment, which is intended

for children from 8-17 years of age. As there were many participants who fell below this intended range, and quite possibly below the functioning level of such age range, the ability of its assessment of their linguistic structure repertoire may have been limited. Future research may seek to examine the additional existing versions of the Test of Language Development battery of assessments to investigate the true extent to which it can be applied with children with autism. A third limitation is additionally related to the TOLD-I:4. The primary investigator who conducted this assessment did not have previous experience with its implementation before this study. Additionally, a limitation may be found in the discontinuity of assessment. As a result of the nature of the Midwest Company that provided the participants, assessments were often completed at different times, rather than in one sitting. Therefore, there may exist extraneous variables that could have influenced a participant's performance on the assessments. Carrying forward with the participants, an additional limitation can be found in the size of the present sample, as well as the limited range of functioning levels exhibited in the participants. These points may limit the external application of these results, as the sample does intend to represent the population of children with autism. The small sample size presented may reduce the external validity of the results. However, despite the size of the sample, the results produced demonstrated statistical significance, which can be less likely with a smaller sample, thereby emphasizing the significance of the present study's results. There are also limitations that can be found within the type of statistical analysis that was conducted. There is rarely a perfect correlation that results from these analyses in a behavioral science. Therefore, these analyses are inherently subject to some form of interference that may influence the proposed significance of the

results. In using a Spearman's rank correlation, these data were subjected to limited variation in readings as a result of the ranked nature of the analysis. Also, correlation does not indicate causation, and the correlational data produced cannot be used to establish such cause. Along similar lines is the issue of directionality in correlational analyses. This poses a rather distinct limitation, as it cannot be concluded which variable was responsible for the presented results. Correlational studies may also be influenced by a third, unidentified variable. This is something that must be considered when reviewing the results of this examination. An additional limitation was the absence of a measure of Inter Observer Agreement. While the investigator was well versed with two of the three assessments, and while these assessments do contain some extent of psychometric properties that speak to the reliability of their implementation, the accuracy of administration cannot be accounted for in the present investigation. Finally, the inclusion of the outlier as a means of comparison may be viewed as a limitation. However, it's crucial to note that, under the nonparametric analysis conducted, the difference in the produced relationships with and without the outlier were minimal. Although there were slight changes observed in the results, there still exists a notable positive, direct relationship between all three comparisons, with each still demonstrating statistical significance.

Despite the described limitations, there are still numerous ways in which the presented results can be expanded upon in future research beyond what has already been suggested. For example, future research may want to account for current functioning levels of their participants to better examine the extent to which these assessments identify skill deficits. This may be further examined by limiting the age

range of participants, and including information regarding the duration in which they have been receiving services. In addition to this, future studies may seek to emphasize higher functioning participants to offer a more robust examination of how these relationships are affected when participants who display more complex forms of language are included. This study implied a strong correspondence between the structure of language and derived relational responding. Therefore, there is a utility in future research examining the extent to which one's ability to derive relations influences one's linguistic skills. Finally, because there may have been influence of a third variable in the comparison of these relationships, an examination of what that variable may be (i.e., other measures of language) is an avenue for future research.

Skinner's proposed theorems that resulted from *Verbal Behavior* (1957) can be viewed as representing a rather significant shift in paradigms (Greer & Speckman, 2009). This perception results from his emphasis on the independence of speaker and listener abilities in an individual's developing language repertoire (Skinner, 1957). This distinction is mirrored, to some extent, by the linguistic subscription to receptive and expressive language (Crystal, 2006). Beyond this parallel, the linguistic account of language has been cited as providing structural analyses that are useful in the pursuit of achieving a more complete treatment of language (Crystal, 2006; Greer & Speckman, 2009), thereby indicating the utility of an examination of its produced measures. Much of the existing verbal behavior therapies have been influenced by traditional behavior analytic and linguistic frameworks, yet the described differences in both accounts still represent a rather incomplete account of human language (Barnes-Holmes et al., 2000; Esch et al., 2010; Hayes et al., 2001). For example, a traditional linguistic approach

emphasizes the symbolic nature of language that attempts to capture its complexities, but does not account for the function of that structure, while a traditional behavioral account of language does place emphasis on the function of language through the role of verbal operants, but does not account for the structure or symbolic nature of communication and has subsequently produced arguments against its accountability for the complexities of language (Chomsky, 1959; Devany et al., 1986). Relational Frame Theory has attempted to account for these discrepancies by offering an approach to language rooted in a human's ability to derive relations (Barnes-Holmes et al., 2000; Hayes et al., 2001). This contemporary methodology attempts to account for both the function of language, as prescribed by a traditional behavior analytic approach, as well as the structure of language and its associated complexities, as prescribed by a linguistic approach. This investigation, therefore, sought to examine the relationship between verbal operant development, linguistic structure, and derived relational responding as represented through produced correlations of the existing assessment applications. The produced outcomes support the utility of each assessment in identifying deficits in a learner's repertoire, as well as suggest each one's effectiveness in assessing lower functioning individuals. They further support the need for a contemporary approach to language and human cognition, as well as provide important implications for the appropriateness of each assessment technology that has resulted from the existing theoretical frameworks of language. The results of this study support the notion that there exists a great complexity that underlies human language and cognition, one that researchers must continue to examine under a contemporary approach, such as one employed by the PEAK relational training system, if we are to

provide an account of language that encompasses such identified complexities, and adequately treat the resulting deficits.

Table 1

Participant Demographic Information

Characteristics	N	%
Age		
3-5	8	47%
6-8	3	18%
9-11	2	12%
12-14	4	24%
Gender		
M	14	82%
F	3	18%
Diagnosis		
Autism	13	76%
Dual-Diagnosis	4	24%

Table 2

Spearman's Correlation Matrix

	PEAK-E-PA Ranked scores	TOLD-I:4 Ranked scores	ABLRS-R Ranked scores
PEAK-EP-A Ranked scores	1.000		
TOLD-I:4 Ranked scores	.822*	1.000	
ABLRS-R Ranked scores	.774*	.921*	1.000

Note: * Correlation is significant at the .01 level

Table 3

Spearman's Correlation Matrix Without the Outlier

	PEAK-E-PA Ranked scores	TOLD-I:4 Ranked scores	ABLLS-R Ranked scores
PEAK-EP-A Ranked scores	1.000		
TOLD-I:4 Ranked scores	.785*	1.000	
ABLLS-R Ranked scores	.728*	.904*	1.000

Note: * Correlation is significant at the .01 level

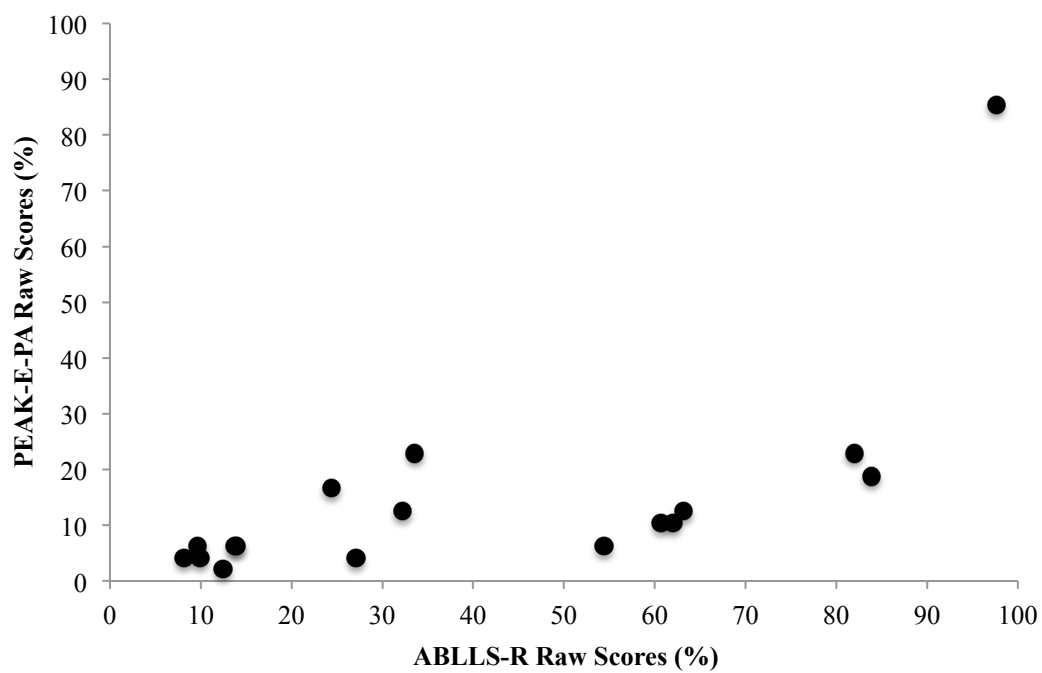


Figure 1. Relationship between PEAK-E-PA Raw Scores (%) and ABLIS-R Raw Scores (%).

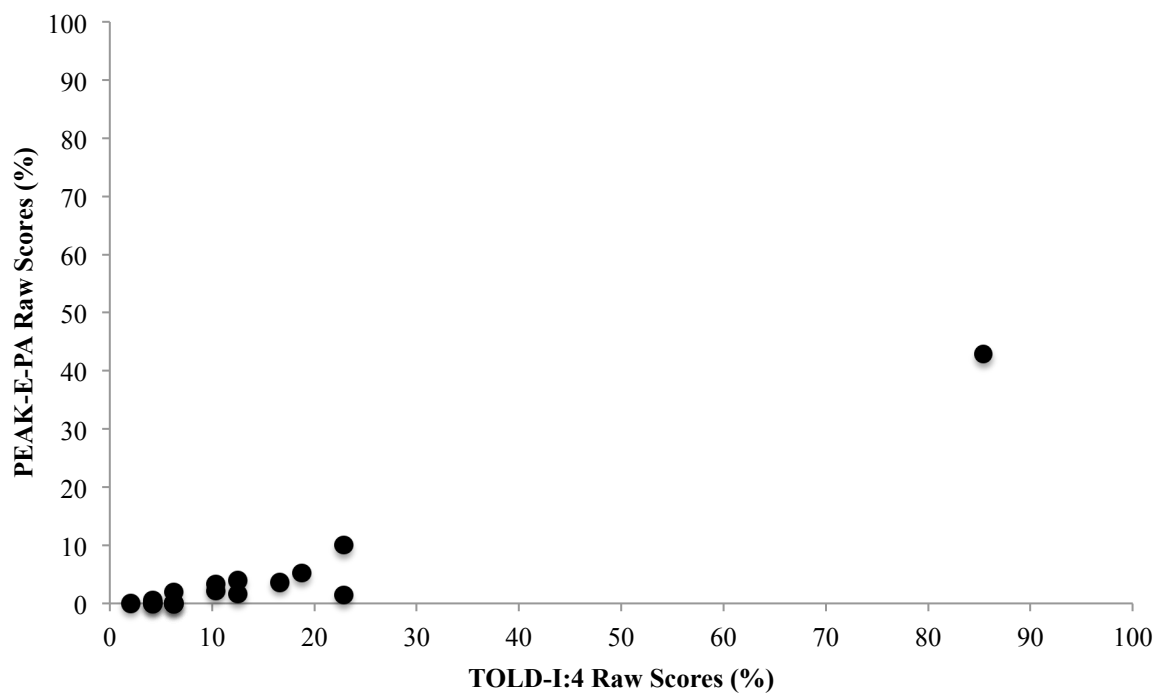


Figure 2. Relationship between PEAK-E-PA Raw Scores (%) and TOLD-I:4 Raw Scores (%).

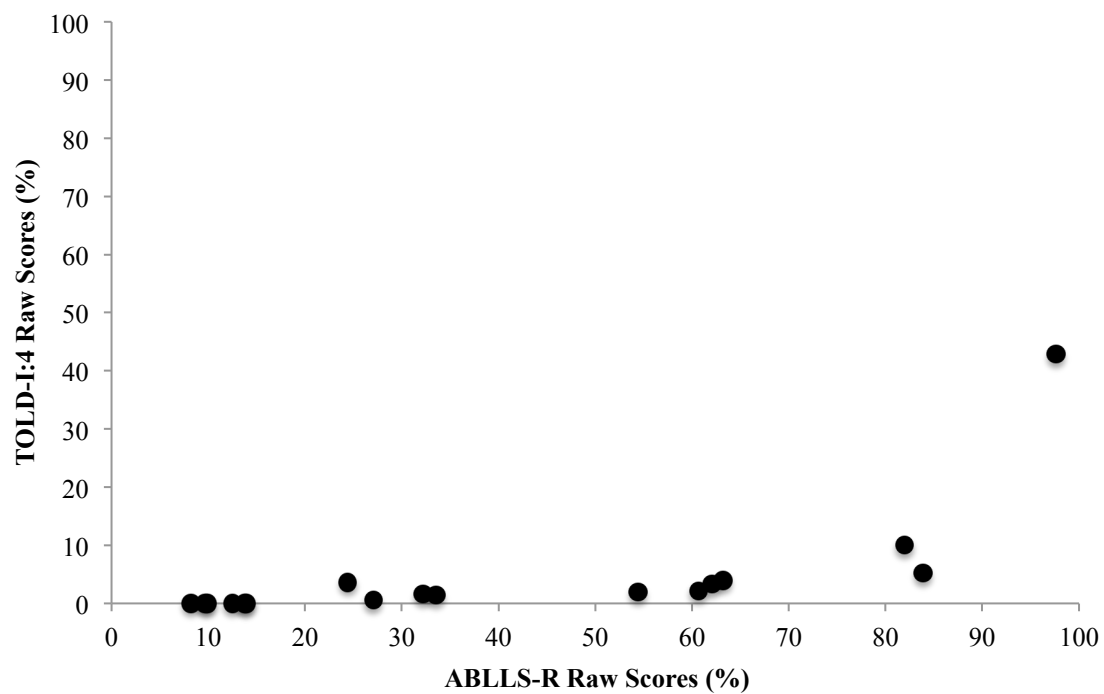


Figure 3. Relationship between TOLD-I:4 Raw Scores (%) and ABLLS-R Raw Scores (%).

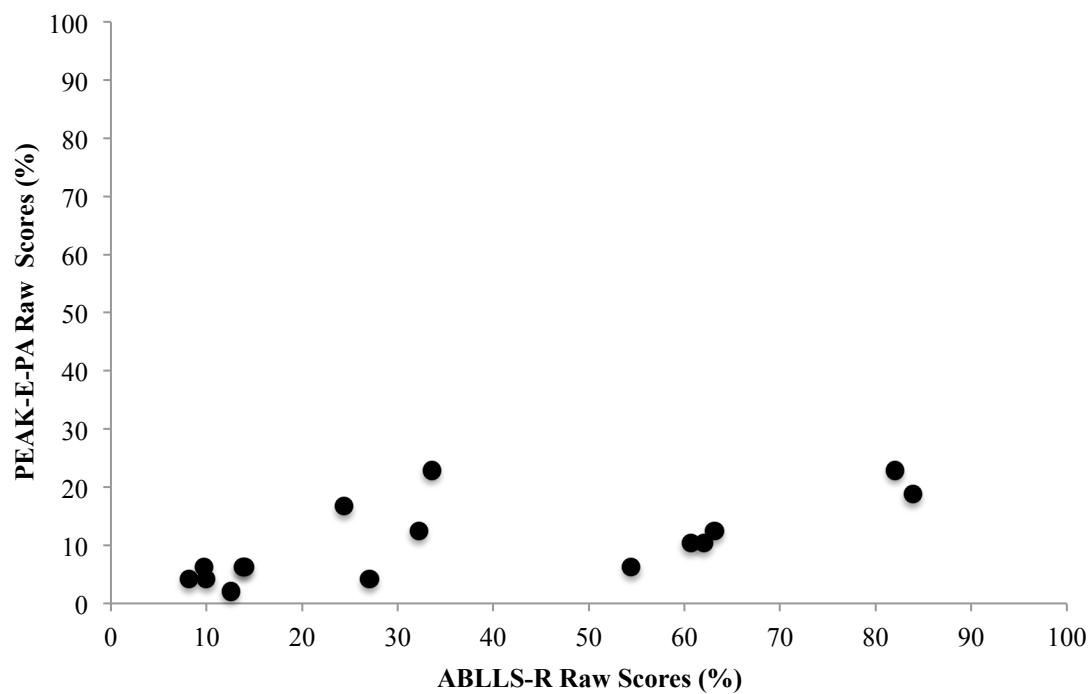


Figure 4. Relationship between PEAK-E-PA Raw Scores (%) and ABLLS-R Raw Scores (%) with the outlier removed.

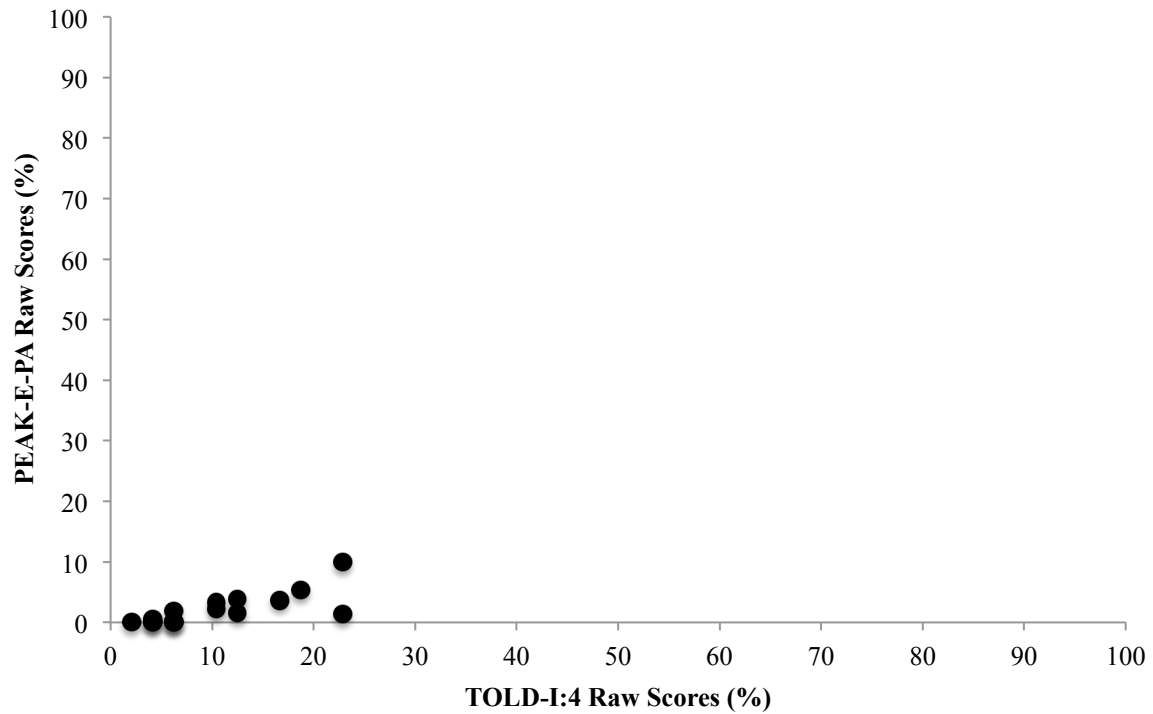


Figure 5. Relationship between PEAK-E-PA Raw Scores (%) and TOLD-I:4 Raw Scores (%) with the outlier removed.

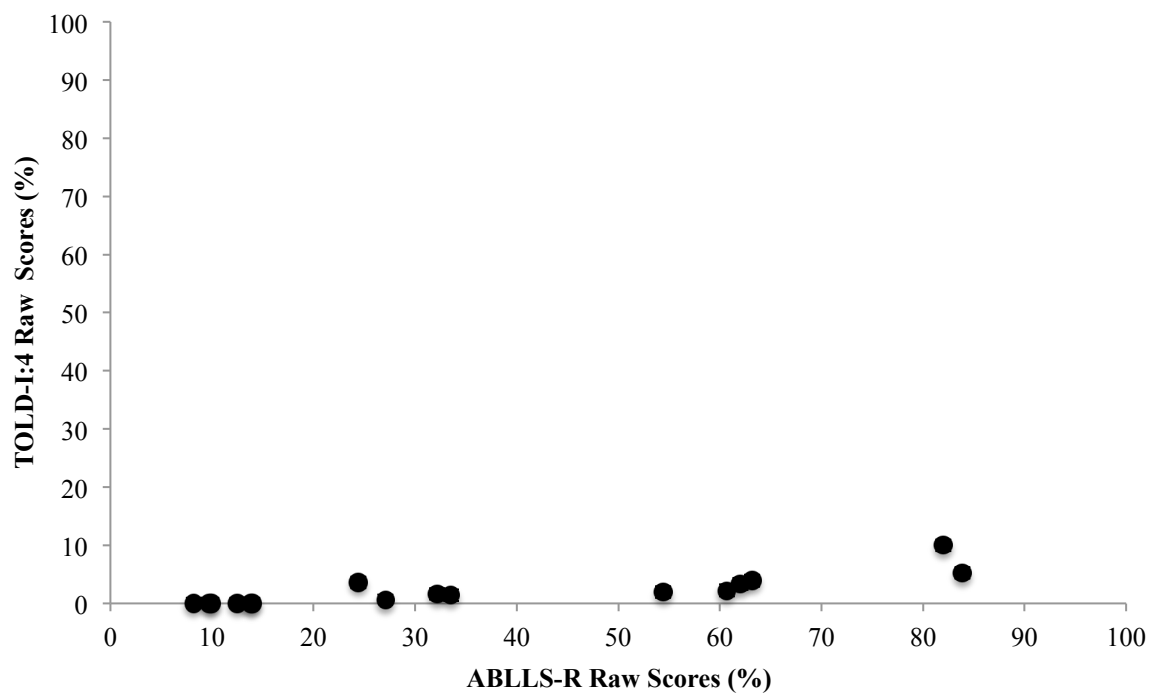


Figure 6. Relationship between TOLD-I:4 Raw Scores (%) and ABLLS-R Raw Scores (%) with the outlier removed.

References

- Albert, K. M., Carbone, V. J., Murray, D. D., Hagerty, M., & Sweeney-Kerwin, E. J. (2012). Increasing the mand repertoire of children with autism through the use of an interrupted chain procedure. *Behavior Analysis in Practice*, 5(2), 65-76.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- American Speech-Language Hearing Association (1993). Definitions of communication disorders and variations [Relevant Paper]. Retrieved from www.asha.org/policy
- Bailey, J. S., & Wallander, R. J. (1999). Verbal Behavior. In B. A. Thyer (Ed.), *The philosophical legacy of behaviorism* (pp. 117-152). Great Britain: Kluwer Academic Publishers.
- Baio, J. (2014). Prevalence of autism spectrum disorder among children aged 8 years – Autism developmental disabilities monitoring network, 11 sites, united states, 2010. *Surveillance Summaries*, 63(SS02), 1-21. Retrieved from <http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6302a1.htm>
- Baltaxe, C. (1977). Pragmatic deficits in the language of autistic adolescents. *Journal of Pediatric Psychology*, 2, 176-180.
- Barnes-Holmes, D., Barnes-Holmes, Y., & Cullinan, V. (2000). Relational frame theory and Skinner's *Verbal Behavior*: A possible Synthesis. *The Behavior Analyst*, 23(1), 69-84
- Behavior Analysis Certification Board. (2014). Applied behavior analysis treatment of autism spectrum disorder: Practice guidelines for healthcare funders and

- managers. Retrieved from http://bacb.com/wp-content/uploads/2015/07/ABA_Guidelines_for_ASD.pdf
- Brown, R (1973). *A first language*. Cambridge: Harvard University Press.
- Calinescu, M. (2012). Chomsky's biolinguistic approach to mind and language. *Linguistic and Philosophical Investigations*, 11, 91-96
- Carr, E. G., & Kologinsky, E. (1983). Acquisition of sign language by autistic children II: Spontaneity and generalization effects. *Journal of Applied Behavior Analysis*, 5, 55-65. doi: 10.1901/jaba.1983.16-297
- Chomsky, N. (1959). Review of Skinner's *Verbal Behavior*. *Language*, 35, 26-58
- Chomsky, N. (1965) *Aspects of the theory of syntax*. Cambridge: M.I.T. Press
- Clark, H. H., & Clark, E. V. (1977). Psychology and language: An introduction to psycholinguistics. *Language*, 55(2), 436-439. doi: 10.2307/412600
- Cromer, R. F. (1981). Developmental language disorders: Cognitive processes, semantics, pragmatics, phonology, and syntax. *Journal of Autism and Developmental Disorders*, 11(1), 57-74. <http://dx.doi.org/10.1007/bf01531341>
- Dawson, A., Vicars, S. M., & Miguel, C. F. (2009). Publication trends in The Analysis of Verbal Behavior: 1999-2008. *The Analysis of Verbal Behavior*, 25, 123-132.
- Devany, J. M., Hayes, S. C., & Nelson, R. O. (1986). Equivalence class formation in language-able and language-disabled children. *Journal of the Experimental Analysis of Behavior*, 46(3), 243-257. <http://dx.doi.org/10.1901/jeab.1986.46-243>
- Dixon, M. R. (2014). *The PEAK relational training system module 1: direct training*. Carbondale, IL: Shawnee Scientific Press.

- Dixon, M. R. (2015). PEAK Relational Training System: Equivalence Module. Carbondale, IL: Shawnee Scientific Press.
- Dixon, M. R., Belisle, J., Stanley, C., Rowsey, K., Daar, J. H., & Szekely, S. (2014). Toward a behavior analysis of complex language for children with autism: Evaluating the relationship between PEAK and the VB-MAPP. *Journal of Developmental and Physical Disabilities, 27*(2), 223-233.
doi: 10.1007/s10882-014-9410-4
- Dixon, M. R., Stanley, C. R., Belisle, J., & Rowsey, K. E. (2016). The test-retest and interrater reliability of the promoting the emergence of advanced knowledge-direct training assessment for use with individuals with autism and related disabilities. *Behavior Analysis: Research and Practice, 16*(1), 34-40.
<http://dx.doi.org/10.1037/bar0000027>
- Dixon, M. R., Small, S. L., & Rosales, R. (2007). Extended analysis of empirical citations with Skinner's *Verbal Behavior*: 1984-2004. *The Behavior Analyst, 30*(2), 197-209. Retrieved from
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2203633/>
- Dymond, S., & Alvarez, B. (2010). The selective impact of skinner's *Verbal Behavior* on empirical research: A reply to Schlinger (2008). *The Psychological Record, 60*, 355-360. <http://dx.doi.org/10.1080/01608060903529772>
- Dymond, S., O'Hora, D., Whelan, R., & O'Donovan, A. (2006). Citation analysis of Skinner's *Verbal Behavior*: 1984-2004. *The Behavior Analyst, 29*, 75-88

- Esch, B. E., LaLonde, K. B., & Esch, J. W. (2010). Speech and language assessment: A verbal behavior analysis. *The Journal of Speech and Language Pathology-Applied Behavior Analysis*, 5(2), 166-191. <http://dx.doi.org/10.1037/h0100270>
- Foxx, R. M. (2008). Applied behavior analysis treatment of autism: The state of the art. *Child and Adolescent Psychiatric Clinics of America*, 17(4), 821-834.
- Greer, R. D., & Speckman, J. (2009). The integration of speaker and listener responses: A theory of verbal development. *The Psychological Record*, 59(3), 449-488.
- Gross, A. C., & Fox, E. J. (2009). Relational frame theory: An overview of the controversy. *Analysis of Verbal Behavior*, 25(1), 87-98
- Guess, D. (1969). A functional analysis of receptive language and productive speech: Acquisition of the plural morpheme. *Journal of Applied Behavior Analysis*, 2, 55-64.
- Gutierrez, A., & Petscher, E. S. (2011). A behavior analytic approach to teaching language. *Journal of Communications Research*, 3(1), 39-53. Retrieved from <http://connection.ebscohost.com/c/articles/93708189/behavior-analytic-approach-teaching-language>
- Hamill, D. D., & Newcomer, P. L. (1997). *Test of language development-intermediate 4*. Pro-Ed.
- Hamilton, S. A. (1988). Behavioral formations of verbal behavior in psychotherapy. *Clinical Psychology Review*, 8(2), 181-193. doi:10.1016/0272-7358(88)90058-X
- Hayes, S. C. (2004). Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies. *Behavior Therapy*, 35, 639-665. [http://dx.doi.org/10.1016/s0005-7894\(04\)80013-3](http://dx.doi.org/10.1016/s0005-7894(04)80013-3)

- Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational Frame Theory: A post Skinnerian account of human language and cognition*. New York: Plenum.
- Hayward, D. V., Setwart, G. E., Phillips, L. M., Norris, S. P., & Lovell, M. A. (2008). *Language, phonological awareness, and reading test directory*. London, ON: Canadian Centre for Research on Literacy and Canadian Language and Literacy Research Network.
- Interagency Autism Coordinating Committee, US Department of Health & Human Services. (2012). IACC/OARC autism spectrum disorder publications analysis: the global landscape of autism research. Retrieved from <http://iacc.hhs.gov/publicationanalysis/july2012/index.shtml>
- Lipkens, G., Hayes, S. C., & Hayes, L. J. (1993). Longitudinal study of derived stimulus relations in an infant. *Journal of Experimental Child Psychology*, 56, 201-239. <http://dx.doi.org/10.1006/jecp.1993.1032>
- Lovaas, I. (1996). A program for the establishment of speech in psychotic children. In J. K. Wing (Ed.), *Early childhood autism. Clinical, educational and social aspects*. New York: Pergamon Press.
- Luciano, C., Becerra, G. I., & Valverde, M. R. (2007). The role of multiple-exemplar training and naming in establishing derived equivalence in an infant. *Journal of the Experimental Analysis of Behavior*, 83(3), 349-365. <http://dx.doi.org/10.1902/jeab.2007.08-06>
- MacQuorodale, K. (1970). On Chomsky's review of Skinner's *Verbal Behavior*. *Journal of the Experimental Analysis of Behavior*, 13, 83-39.

- Matson, J. L., Benavidez, D. A., Compton, L. S., Paclawskyj, T., & Baglio, C. (1996). Behavioral treatment of autistic persons: A review of research from 1980 to the present. *Research in Developmental Disabilities, 17*(6), 433-465. doi: 10.1016/S0891-4222(96)00030-3
- McCoy, J. F., & Buckhalt, J. A. (1990). Language acquisition. In J. L. Matson (Ed.), *Handbook of behavior modification with the mentally retarded*. New York: Plenum Press.
- McKeel, A., Rowsey, K., Dixon, M. R., & Daar, J. H. (2015). Correlation between PEAK relational training system and one-word picture vocabulary tests. *Research in Autism Spectrum Disorders, 12*, 34-39. doi: 10.1016/j.rasd.2014.12.007
- McPherson, A., Bonem, M., Green G., & Osborned, J. G. (1984). A citation analysis of the influence on research of Skinner's *Verbal Behavior*. *The Behavior Analyst, 7*(2), 157-167
- Murphy, C., Barnes-Holmes, D., & Barnes-Holmes, Y. (2005). Derived manding in children with autism: Synthesizing Skinner's verbal behavior with relational frame theory. *Journal of Applied Behavior Analysis, 38*(4), 445-462. <http://dx.doi.org/10.1901/jaba.2005.97-04>
- Oah, S., & Dickinson, A. M. (1989). A review of empirical studies of verbal behavior. *The Analysis of Verbal Behavior, 7*, 53-68
- O'Connor, J., Rafferty, A., Barnes-Holmes, D., & Barnes-Holmes, Y. (2009). The role of verbal behavior, stimulus nameability and familiarity on the equivalence performances of autistic and normally developing children. *Psychological Record, 59*(10), 53-74.

- Odom, S. L., Collet-Klingenberg, L., Rogers, S. J., & Hatton, D. D. (2010). Evidence-based practice in interventions for children and youth with autism spectrum disorders. *Preventing School Failure*, 54(4), 275-282. doi: 10.1080/10459881003785506
- Partington, J. W. (2006). *ABLLS-R: The assessment of basic language and learning skills- revised*. Walnut Creek: Behavior Analysts, Inc.
- Partington, J. W. (2010). *The assessment of basic language and learner skills-revised (ABLLS-R)*. Pleasant Hill, CA: Behavior Analysts, Inc.
- Petursdottir, A., & Carr, J. E. (2011). A review of recommendations for sequencing receptive and expressive language instruction. *Journal of Applied Behavior Analysis*, 44(4), 859-876. doi: 10.1901/jaba.2011.44-859
- Piaget, J., & Inhelder, B. (1969) The gaps in empiricism. In A. Koestler & J. R. Smythies (Eds.), *Beyond reductionism*. London: Hutchinson, 118-160.
- Pinker, S. (1994). *The Language Instinct*. New York, NY: Harper Perennial Modern Classics.
- Rehfeldt, R. A., Barnes-Holmes, Y., & Hayes, S. C. (2009). *Derived relational responding applications for learners with autism and other developmental disabilities. A progressive guide to change*. California: New Harbinger Publications, Inc.
- Roche, B., Barnes-Holmes, Y., Barnes-Holmes, D., Stewart, I., & O'Hara, D. (2002). Relational frame theory: A new paradigm for the analysis of social behavior. *The Behavior Analyst*, 25(1), 75-91.

- Sautter, R. A., & LeBlanc, L. (2006). Empirical applications of Skinner's analysis of verbal behavior with humans. *The Analysis of Verbal Behavior*, 22, 35-48.
- Schlinger, H. D. (2008). The long good-bye: Why B.F. Skinner's *Verbal Behavior* is alive and well on the 50th anniversary of its publication. *The Psychological Record*, 58, 329-337. Retrieved from:
http://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?article=1069&context=tpr_is_Alive_and_Well_on_the_50th_Anniversary_of_its_Publication
- Sidman, M. (1971). Reading and auditory-visual equivalences. *Journal of Speech Language and Hearing Research*, 14, 5-13.
- Sidman, M., & Taliby, W. (1982). Conditional discrimination versus matching-to-sample: An expansion of the testing paradigm. *Journal of the Experimental Analysis of Behavior*, 37, 5-22.
- Skinner, B. F. (1957). *Verbal behavior*. Englewood Cliffs: Prentice Hall.
- Skinner, B. F. (1987) Controversy? In S. Modgil & C. Modgil (Eds.), *B. F. Skinner: Consensus and controversy* (pp. 11-12). New York: Falmer.
- Sundberg, M. L. (2008). *VB-MAPP: Verbal behavior milestones assessment and placement program*. Concord: AVB Press.
- Sundberg, M. L., & Michael, J. (2001). The benefits of Skinner's analysis of verbal behavior for children with autism. *Behavior Modification*, 25, 698-724. doi: 10.1177/0145445501255003
- Ursy, J. N. (2015). *Validation of the assessment of basic language and learning skills-revised for students with autism spectrum disorder using an expert review panel*.








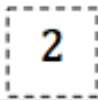





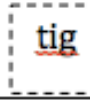






(Doctoral dissertation). Retrieved from:

<http://digitalcommons.liberty.edu/doctoral/1056/>

Virtues-Ortega, J. (2010). Applied behavior analytic intervention for autism in early childhood: meta-analysis, meta-regression, and dose-response meta analysis of multiple outcomes. *Clinical Psychological Review*, 30(4), 387-399. doi: 10.1016/j.cpr.2010.01.008

Appendices

Appendix A

Reflexivity	Train		Test		
		=	 	= 	
Symmetry	Train		Test		
		=	 	= 	
Transitivity	Train		Train	Test	
		=	 	=  	= 
Equivalence	Train		Train	Test	
		=	 	=  	= 

Exemplars of stimuli presented to participants in the PEAK-E-PA across each included relation. The stimuli in the dashed lines represent visual stimuli, and the stimuli in quotations represent auditory stimuli.

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Major Professor: Dr. Mark Dixon