
Theses and Dissertations

2009

Using concurrent operants to evaluate perseverative conversation in children and adolescents diagnosed with Asperger's disorder

Matthew J. O'Brien
University of Iowa

Copyright 2009 Matthew J O'Brien

This dissertation is available at Iowa Research Online: <http://ir.uiowa.edu/etd/415>

Recommended Citation

O'Brien, Matthew J.. "Using concurrent operants to evaluate perseverative conversation in children and adolescents diagnosed with Asperger's disorder." PhD (Doctor of Philosophy) thesis, University of Iowa, 2009.
<http://ir.uiowa.edu/etd/415>.

Follow this and additional works at: <http://ir.uiowa.edu/etd>



Part of the [Educational Psychology Commons](#)

USING CONCURRENT OPERANTS TO EVALUATE PERSEVERATIVE
CONVERSATION IN CHILDREN AND ADOLESCENTS DIAGNOSED WITH
ASPERGER'S DISORDER

by

Matthew J. O'Brien

An Abstract

Of a thesis submitted in partial fulfillment of the requirements
for the Doctor of Philosophy degree in
Psychological and Quantitative Foundations (School Psychology)
in the Graduate College of The University of Iowa

December 2009

Thesis Supervisors: Professor David P. Wacker
Professor Stewart W. Ehly

ABSTRACT

Perseverative conversation is a problem vocal behavior that is unique to individuals with Asperger's disorder. It is characterized by long-winded monologues revolving around circumscribed interests. The current research literature suggests that perseverative conversation may exacerbate already poor social relations, impede productivity at work and home, and lead to disruptive behavior when it is restricted. Despite the negative repercussions there is a lack of research related to the assessment and treatment of this behavior. In the field of applied behavior analysis, concurrent operants assessments have been used effectively to identify relative preference for concurrently available reinforcers. In the current study, choice assessments using concurrent operants arrangements were used to evaluate the reinforcing properties of perseverative conversation in children and adolescents with Asperger's disorder. Five participants, all with Asperger's disorder and reported difficulties with perseverative conversation, were assessed in three phases: A preference assessment for conversation topics; an assessment of preference for reinforcer dimensions; and an assessment of preference for competing dimensions. In the first phase a two-stage preference assessment separated high-preferred from less-preferred conversation topics and in the second and third phases participants were asked to make choices regarding their preference for conversation content, conversational style, and conversation duration. Phase II results suggested that participants preferred conversing about their respective circumscribed interests over neutral topics, actively conversing rather than listening, and conversing for longer duration rather than shorter duration. Phase III, which assessed relative preference for the three reinforcer dimensions, resulted in a hierarchy of preference for all but one participant. Two participants demonstrated the strongest preference for conversation content and two participants demonstrated the strongest preference for conversational style. Conversation duration was least preferred by four of the five participants. Perseverative conversation occurred at a relatively high rate across

all assessment phases. The results are discussed in terms of current theoretical explanations for perseverative thinking and behavior, implications for treatment, and future research of this problem vocal behavior.

Abstract Approved: _____

Thesis Supervisor

Title and Department

Date

Thesis Supervisor

Title and Department

Date

USING CONCURRENT OPERANTS TO EVALUATE PERSEVERATIVE
CONVERSATION IN CHILDREN AND ADOLESCENTS DIAGNOSED WITH
ASPERGER'S DISORDER

by

Matthew J. O'Brien

A thesis submitted in partial fulfillment of the requirements
for the Doctor of Philosophy degree in Psychological and
Quantitative Foundations (School Psychology) in the
Graduate College of The University of Iowa

December 2009

Thesis Supervisors: Professor David P. Wacker
Professor Stewart W. Ehly

Graduate College
The University of Iowa
Iowa City, Iowa

CERTIFICATE OF APPROVAL

PH.D. THESIS

This is to certify that the Ph.D. thesis of

Matthew J. O'Brien

has been approved by the Examining Committee for the thesis requirement for the Doctor of Philosophy degree in Psychological and Quantitative Foundations (School Psychology) at the December 2009 graduation.

Thesis Committee:

David P. Wacker, Thesis Supervisor

Stewart W. Ehly, Thesis Supervisor

Linda J. Cooper-Brown

Scott D. Lindgren

John A. Northup

ACKNOWLEDGMENTS

Throughout the dissertation process there has been nothing more rewarding than sitting down to generate my acknowledgements to those who have helped me through what has been both a great challenge and an immense educational experience. Although my gratitude in words cannot match the contributions that many of my family, friends, peers, colleagues, teachers, and mentors have provided to the completion of this project and to my development as a person and professional, I hope that one day I can do for others what these people have done for me.

To the children and adolescents who participated in this study and the families who played an integral part – I thank you for donating your time and energy to this project. Your efforts have been invaluable to the understanding of a truly unique behavior and fascinating disorder.

To Melanie Bachmeyer, Kelly Schieltz, Patrick Romani, Kelly Vinqvist, Jeffrey Luke, Yaniz Padilla, Anu Dutt, and Maliha Zaman – thank you for assisting in the development of this study, collecting data, offering critical feedback, and providing support. All of you will someday have the chance to be challenged with this task and I am confident that you will all succeed. I hold you all in high regard and know you will continue the Iowa Tradition.

To Todd Kopelman, Brenda Engebretson, Joel Ringdahl, and Wendy Berg – I express my appreciation for the opportunity to learn from you. More often than not I learned as much from your actions as I did from your words. You are consummate professionals and I am fortunate to have models like you to emulate. I especially thank

Brenda for her patience and willingness to take the time to teach, encourage, and inspire a junior student who had little more to offer than a willingness to learn.

To Agnes DeRaad – thank you for your editorial expertise and gentle nudges that kept me on track to finish this project. You have an amazing gift and I have sympathy for future students who some day will not be afforded your wonderful services.

To John Lee – I now understand why you are referred to as the “graph guru”. Your skill and knowledge with all things graphical contributed greatly to this finished product and I am grateful for that.

To my dissertation committee – John Northup, Stewart Ehly, Scott Lindgren, Linda-Cooper Brown, and Dave Wacker – I cannot imagine that a more distinguished team of individuals could work together so harmoniously. To John – I appreciate your insight and valuable recommendations. I have learned greatly from your teaching. To Stewart – I am grateful for your support throughout the dissertation process and your willingness to “go to bat” for me throughout my graduate school experience. To Scott – the tremendous respect I have for you as a professional can only be matched by my respect for you as a person. Thank you for teaching me the power of empathy for the children and families we serve. To Linda – thank you for devoting so much time to supervising me and showing me that there is a time and place for smiling while at work. You have been instrumental in my development as a student and as a professional.

To Dave Wacker – I will forever be indebted to you for the passion you have instilled in me and the opportunities you have provided me. My “second life” began the day that I began your course on behavioral assessment as you opened my eyes to a field and a philosophy that fascinated me. You took me under your wing, pushed me to excel,

and provided me with the reinforcement that has kept me motivated to succeed, all while exemplifying the motto “give, expecting nothing thereof”. As I continue my “second life” I hope you will continue to see me as worthy of your time and effort as I will always consider you my mentor. Thank you.

To Rachel, Kate, Andrew, and Michael – I express my gratitude to all of you for your unconditional love and support. I consider you my closest friends. Older or younger, I have always seen each of you as a role model and I could not be prouder to be your brother.

To my mother and my late father – the education that you have afforded me as your son cannot be matched by the greatest educational institution. Mom, you have never failed at being my biggest supporter. You are my hero.

To Kieran – through all of the joyous times and all of the difficult times your smile has always reminded me of what is important in life.

To my beloved wife, Paula – my journey to this point has not been easy, but I thank you for joining me along the way. Your love and support has never waived and because of that I attribute to you much of my success. I apologize for making you a “dissertation widow”, but know that our future will be much brighter because your sacrifices allowed me to accomplish my goals.

TABLE OF CONTENTS

LIST OF TABLES	ix
LIST OF FIGURES	x
CHAPTER	
I. INTRODUCTION	1
The Paradox of Asperger’s Disorder.....	1
Circumscribed Interests: Benefit or Burden?	2
Perseverative Conversation in Asperger’s Disorder	3
Perseverative Conversation as a Problem Vocal Behavior	3
Intense Interests	4
Conversation Style	4
Extended Conversation	5
Explaining Perseverative Conversation	6
Perseverative Conversation Explained from a Behavioral Perspective	8
The Current Study	9
Underlying Assumptions and Need for the Current Study	9
Purpose of the Current Study	9
II. REVIEW OF THE LITERATURE.....	11
An Overview	11
Defining Asperger’s Disorder	12
Differentiating Asperger’s Disorder from High-Functioning Autism	14
DSM-IV-TR Diagnostic Criteria	15
Language and Communication	17
Social Functioning	19
Behavioral Functioning.....	20
Circumscribed Interests in Asperger’s Disorder.....	21
Defining Circumscribed Interests	23
Themes and Types of Circumscribed Interests.....	24
Development and Expression of Circumscribed Interests	25
Explaining Circumscribed Interests	27
Differentiating Asperger’s Disorder and Obsessive Compulsive Disorder	28
Perseverative Thinking and Behavior in Asperger’s Disorder	30
The Definition and Types of Perseveration	30
Perseveration in Asperger’s Disorder	32
Perseveration and Circumscribed Interests in Conversation	34
Problems Emanating from Perseverative Conversation	38
The Study of Behavior via the Analysis of Function.....	41
Assessment and Treatment of Aberrant Behavior Using a Functional Perspective	41
Reinforcement-Based Treatments.....	42
Developing Hypotheses of Aberrant Behavior.....	43
The Development of Functional Analysis Procedures	43
Innovations and Modifications to Functional Analysis Procedures	45
Problem Vocal Behavior Studied from a Functional Perspective	46
Early studies of problem vocal behavior: Treatment without functional analysis methodology	47

Initial application of functional analysis methodology to problem vocal behavior.....	48
Extending the functional analysis literature on vocal problem behavior:	
Problem vocal behavior topographies.....	49
Populations studied.....	50
Functions identified via functional analysis methods.....	50
Treatments based on functional analysis results.....	51
Studies exploring the antecedent relationships of problem vocal behavior.....	53
Concurrent Operants as an Assessment Tool.....	54
Choice and Concurrent Operants Arrangements.....	54
Assessing Reinforcer Quality Using Concurrent Operants Arrangements.....	55
Assessing Dimensions of Reinforcement Using Concurrent Operants Arrangements.....	56
The Current Study.....	58
The Basis for the Current Study.....	58
Research on Asperger’s Disorder.....	58
Research on Problem Vocal Behavior from a Functional Perspective.....	60
Blending the Research.....	61
A Proposed Study.....	62
Hypotheses.....	63
Conclusion.....	63
III. METHODOLOGY.....	65
Setting.....	65
Therapy Rooms and Materials.....	65
Participants.....	65
Response Definitions.....	69
Data Collection and Interobserver Agreement.....	70
Experimental Design and Procedures.....	71
General Procedures.....	72
Caregiver Interview.....	72
Phase I: Preference Assessment.....	72
Phase II: Assessment of Reinforcer Dimensions of Perseverative Conversation Using a Concurrent Operants Arrangement.....	74
Test for social function.....	76
Test of reinforcer quality related to conversation content.....	76
Test of reinforcer quality related to conversation style.....	77
Test of reinforcer magnitude in terms of conversation duration.....	77
Phase III: Assessment of Competing Reinforcer Dimensions Using a Concurrent Operants Arrangement.....	78
Conversation content versus conversation style.....	79
Conversation style versus conversation duration.....	80
Conversation duration versus conversation content.....	81
IV. RESULTS.....	82
Summary of Tables and Figures.....	82
Phase I: Preference Assessment.....	82
Phase II: Assessment of Reinforcer Dimensions.....	82
Phase III: Assessment of Competing Reinforcer Dimensions.....	82
Individual Results.....	83
Andrew.....	83

Phase I: Preference Assessment	83
Phase II: Assessment of Reinforcer Dimensions	84
Phase III: Assessment of Competing Reinforcer Dimensions	85
Conversation content versus conversation style.....	85
Conversation duration versus conversation style.....	85
Conversation content versus conversation duration.....	86
Summary of Results.....	86
Clint.....	87
Phase I: Preference Assessment	87
Phase II: Assessment of Reinforcer Dimensions	88
Phase III: Assessment of Competing Reinforcer Dimensions	89
Conversation content versus conversation style.....	89
Conversation duration versus conversation style.....	89
Conversation content versus conversation duration.....	90
Summary of Results.....	90
Juan.....	91
Phase I: Preference Assessment	91
Phase II: Assessment of Reinforcer Dimensions	91
Phase III: Assessment of Competing Reinforcer Dimensions	92
Conversation content versus conversation style.....	92
Conversation duration versus conversation style.....	93
Conversation content versus conversation duration.....	93
Summary of Results.....	94
Michael.....	95
Phase I: Preference Assessment	95
Phase II: Assessment of Reinforcer Dimensions	95
Phase III: Assessment of Competing Reinforcer Dimensions	96
Conversation content versus conversation style.....	96
Conversation duration versus conversation style.....	97
Conversation content versus conversation duration.....	98
Summary of Results.....	98
Oscar.....	99
Phase I: Preference Assessment	99
Phase II: Assessment of Reinforcer Dimensions	100
Phase III: Assessment of Competing Reinforcer Dimensions	100
Conversation content versus conversation style.....	100
Conversation duration versus conversation style.....	101
Conversation content versus conversation duration.....	101
Summary of Results.....	102
V. DISCUSSION	103
Summary of Overall Results	103
Phase I.....	103
Phase II.....	104
Phase III.....	106
General Discussion.....	108
Study Implications.....	110
Limitations	111
Future Directions.....	113
Summary	116
APPENDIX A. TABLES AND FIGURES	118

APPENDIX B. DSM-IV-TR CRITERIA FOR ASPERGER’S DISORDER	151
APPENDIX C. CAREGIVER INTERVIEW FORM.....	153
APPENDIX D. PREFERENCE ASSESSMENT RECORD FORM.....	160
APPENDIX E. SIX-SECOND INTERVAL DATA COLLECTION FORM	162
REFERENCES	164

LIST OF TABLES

Table

A1. Participant Descriptions	119
A2. Preference Assessment Stage One Results	122
A3. Summary of Phase II Results	123
A4. Summary of Phase III Results.....	124
A5. Hierarchy of Reinforcer Dimensions Based upon Phase III Results	125

LIST OF FIGURES

Figure

A1. Phase II: Test Conditions for Assessment of Reinforcer Dimensions	120
A2. Phase III: Test Conditions for Assessment of Competing Reinforcer Dimensions ..	121
A3. Phase I: Forced-Choice Preference Assessments Results for Andrew	126
A4. Phase I: Forced-Choice Preference Assessments Results for Clint	127
A5. Phase I: Forced-Choice Preference Assessments Results for Juan.....	128
A6. Phase I: Forced-Choice Preference Assessments Results for Michael.....	129
A7. Phase I: Forced-Choice Preference Assessments Results for Oscar.....	130
A8. Phase II: Assessment of Reinforcer Dimensions Results for Andrew.....	131
A9. Phase II: Assessment of Reinforcer Dimensions Results for Clint.....	132
A10. Phase II: Assessment of Reinforcer Dimensions Results for Juan	133
A11. Phase II: Assessment of Reinforcer Dimensions Results for Michael.....	134
A12. Phase II: Assessment of Reinforcer Dimensions Results for Oscar	135
A13. Phase III: Content vs. Style Results for Andrew	136
A14. Phase III: Duration vs. Style Results for Andrew	137
A15. Phase III: Content vs. Duration Results for Andrew	138
A16. Phase III: Content vs. Style Results for Clint	139
A17. Phase III: Duration vs. Style Results for Clint.....	140
A18. Phase III: Content vs. Duration Results for Clint	141
A19. Phase III: Content vs. Style Results for Juan.....	142
A20. Phase III: Duration vs. Style Results for Juan	143
A21. Phase III: Content vs. Duration Results for Juan.....	144
A22. Phase III: Content vs. Style Results for Michael	145
A23. Phase III: Duration vs. Style Results for Michael.....	146
A24. Phase III: Content vs. Duration Results for Michael	147
A25. Phase III: Content vs. Style Results for Oscar	148

A26. Phase III: Duration vs. Style Results for Oscar	149
A27. Phase III: Content vs. Duration Results for Oscar	150

CHAPTER I

INTRODUCTION

Asperger's disorder is an autism spectrum disorder (ASD) that affects an estimated 2.5 of every 10,000 children (Fombonne, 2007). Although the etiology is unknown, like other ASDs, it is believed to be the result of a neurological disorder and there is convincing evidence that a genetic basis exists (Woodbury-Smith & Volkmar, 2009). Unlike autistic disorder, Asperger's disorder is characterized by stronger nonverbal reasoning abilities and intact language from an early age, often leading to later diagnosis (Ghaziuddin & Mountain-Kimchi, 2004). Despite significant impairments in social, communicative, and behavioral functioning, individuals with Asperger's disorder remain an understudied and underserved population (Kasari & Rotheram-Fuller, 2005). This study evaluated a behavioral problem, perseverative conversation, which is unique to and common for individuals with Asperger's disorder.

The Paradox of Asperger's Disorder

Asperger's disorder may best be described as a paradox of strengths and weaknesses. Numerous studies suggest individuals with Asperger's disorder possess average to above average cognitive profiles (e.g., Ehlers, Nyden, Gillberg, et al., 1997; Ozonoff, South, & Miller, 2000; Szatmari, Tuff, Finlayson, Bartolucci, 1990), some have splinter skills consistent with savant syndrome (Treffert, 2000), and there is a subset of individuals with Asperger's disorder who exhibit high intellectual precocity (Foley-Nicpon & O'Brien, 2007).

Despite superior skills, individuals with Asperger's disorder often exhibit significant dysfunction across multiple areas of their lives. The diagnosis of Asperger's disorder necessitates marked impairment in social interaction (e.g., lack of social reciprocity, poor eye gaze, failure to develop peer relationships) and the presence of repetitive and stereotyped patterns of behavior, interests, and activities (American Psychiatric Association, 2000). Clinical presentation often includes additional behavioral

excesses (e.g., hyperactivity, extreme verbosity, hyponasal speech) and deficits (e.g., motor incoordination, lack of speech prosody). Nearly 40% of individuals with Asperger's disorder suffer from psychiatric symptoms other than those identified in the DSM-IV diagnostic criteria for Asperger's disorder (Raja & Azzoni, 2001). Comorbid diagnoses, such as attention-deficit/hyperactivity disorder (AD/HD), mood disorders (including major depression, dysthymia, and bipolar disorder), and tic disorders are common for individuals with Asperger's disorder. Research has suggested that individuals with Asperger's disorder are more likely to experience suicidal ideation, depression, temper tantrums, and defiance than typically-developing peers (Green, Gilchrist, Burton, and Cox, 2000; Shtayermman, 2008) and they may be predisposed to aggression due to being constantly bullied and teased, struggling with impairments in reading others' social cues, and experiencing executive dysfunction (Tantam, 2003).

Circumscribed Interests: Benefit or Burden?

Circumscribed interests are a common characteristic of individuals with Asperger's disorder (Bashe & Kirby, 2001) and have been presented as both a benefit and impairment by researchers. Circumscribed interests are narrow but intense interests that often pervade the thoughts and actions of individuals with Asperger's disorder. For some children and adolescents with Asperger's disorder, circumscribed interests provide a topic of conversation that motivates social interaction among otherwise withdrawn or fearful individuals (Winters-Messiers, 2007). Individuals with Asperger's disorder often exhibit executive dysfunction, including disorganization and lack of goal-setting; however, when it comes to their special interests they demonstrate highly complex filing systems and develop intricate long-term goals (Attwood, 2003). Winters-Messiers (2007) noted that circumscribed interests are "entwined with their self-images" (p. 144), and when involved in activities related to their interests "they felt more positive about themselves" (p. 144). Circumscribed interests can be adapted to future career endeavors, providing individuals with Asperger's disorder highly-satisfying work opportunities.

Despite the benefits that circumscribed interests may serve, the burden that such interests place on the individual with Asperger's disorder can be severe. This is often due to the topic or theme of interest and/or the way in which the individual expresses his interest. The interests are often eccentric or socially odd (e.g., photocopiers) and may be perceived as boring to peers (e.g., Attwood, 1998). Individuals with Asperger's disorder express their interests by engaging in conversation about them. Children and adolescents may be eager to ask numerous questions about their interests or instruct others about the minute details associated with their interests. They are likely to persevere on the topic of interest, leading to a host of social, academic, and behavioral problems. This form of discourse is referred to as perseverative conversation.

Perseverative Conversation in Asperger's Disorder

Perseverative conversation is a well-documented but understudied problem behavior in individuals with Asperger's disorder. It is a complex phenomenon without a consensus definition in the research literature. In general, it refers to excessive, repetitive speech about a circumscribed topic of interest. This differs from other forms of perseverative speech, echolalia, and vocal stereotypies in many ways, including both the quantity and quality of discourse. Perseverative conversation involves more complete and grammatically correct responses and it almost always occurs in the presence of other individuals.

Perseverative Conversation as a Problem Vocal Behavior

Conversation skills, such as the ability to flexibly discuss multiple topics in a to-and-fro manner with others are important skills that most children and adolescents learn to exercise within social interactions. Such skills are often learned through social contingencies, such as attention. Individuals with Asperger's disorder do not seem to be as responsive to the social contingencies as most people, particularly with regards to the development of appropriate conversation skills. Common dimensions of perseverative conversation are asocial in nature. Specifically, individuals with Asperger's disorder

who engage in perseverative conversation typically (a) only talk about their own specialized interests; (b) dominate the conversation, without allowing others an opportunity to offer information or provide a response; and (c) engage in long-winded conversation that may go on for long periods of time without attending to either subtle or overt social cues of other individuals.

Intense Interests

Although the diagnostic criteria for autistic disorder and Asperger's disorder are the same when it comes to restricted and repetitive interests, there is a significant difference in the way in which these two populations express their interests. While individuals with autistic disorder tend to actively engage or manipulate objects related to their interests, individuals with Asperger's disorder amass vast amounts of factual information regarding their interests through reading and questioning other people (Volkmar & Klin, 2000). These facts about their narrow interests often find their way into conversations with others, but usually in an irrelevant manner that breaks social or cultural codes (Attwood, 1998). Although most people are able to converse flexibly about a range of topics, individuals with Asperger's disorder are more likely to fixate on their topic of interest to the exclusion of all other topics. Thus, they appear egocentric in their interactions. Most children and adolescents with Asperger's disorder have difficulties reading the social cues of others (e.g., facial expressions, eye gaze) and struggle with theory of mind tasks (i.e., difficulty responding to thoughts and feelings of others). This lack of social awareness prevents individuals with Asperger's disorder from taking into account the ideas and interests of others in conversation and allows them focus solely on their own.

Conversation Style

Successful oral discourse involves communicative exchange between two or more people. Individuals with Asperger's disorder do not understand or fail to heed the conventional rules of social discourse. Instead, conversation involving an individual with

Asperger's disorder is more likely to sound like a one-sided monologue (Attwood, 2003) or a professor lecturing to his students. Children and adolescents with Asperger's disorder have a difficult time with turn-taking in conversation and seem to lack appreciation for others' perspectives and priorities (Eisenmajer, et al., 1996). They struggle with social pragmatics and cannot decipher the social cues that signal when they can start talking (e.g., momentary pause, eye contact). Thus, when another individual tries to play an active role in the conversation the individual with Asperger's disorder is likely to talk over that person. Even when another person tries to interrupt or provide their perspective the individual with Asperger's disorder is unrelenting in their control of the conversation.

Extended Conversation

For most people there is a point in conversation where a topic or theme has been exhausted and the conversants terminate the discussion or change topics. However, for many individuals with Asperger's disorder there seems to be no point of satiation when talking about their special interests. The speaking style of individuals with Asperger's disorder tends to be quite lengthy and conveys too much information (e.g., Bishop & Adams, 1986; Wing, 1981). Several studies on the language and communication skills of individuals with Asperger's disorder have found their speaking style to be pedantic and long-winded (e.g., Eisenmajer, et al., 1996; Ghaziuddin & Gerstein, 1996). They tend to have "bookend" difficulties (Bashe & Kirby, 2001), whereby beginning a conversation is difficult, but once it has begun the individual with Asperger's disorder cannot seem to end it at an appropriate time, often talking until all relevant information has been fully explained. Because of the vast knowledge they have acquired about their interests, quite often the conversation must include unnecessary elaboration of the finest details related to the topic of interest, as well as frequent reiteration of the individual's important points. It has been suggested that individuals with Asperger's disorder make overt attempts to

display their high level of intelligence by talking at great length about their interests providing encyclopedic-like scripts for vast amounts of time (Attwood, 1998).

Explaining Perseverative Conversation

Although research has not identified a specific cause of perseverative conversation, several explanations of perseverative thinking and behavior in autism and Asperger's disorder have been offered. These explanations range from neurobiological perspectives to behavioral accounts. Neurological studies of human and animal brains have identified neuronal systems implicated in repetitive behaviors and thinking. Stereotypies have been induced in animals and humans when dopamine agonists are applied and when dopamine uptake inhibitors are administered (Lewis & Baumeister, 1982), implicating dopamine pathway involvement. Severe social deprivation, which also has an effect on dopamine pathways via reduction of dopaminergic neurons, has been found to result in stereotypies in primates (Martin, Spicer, Lewis, Gluck, & Cork, 1991). The importance of serotonin uptake has also been studied and researchers have found a loss of central serotonin exacerbates, but does not cause, already existing stereotypies (McDougle, et al., 1996). This finding is not surprising given research that has shown selective serotonin reuptake inhibitors (SSRIs) are often effective in decreasing repetitive behaviors.

Turner (1999) described the development of repetitive behaviors in autism spectrum disorders as a "homeostatic mechanism" (p. 841). She theorized that individuals with autism experience a great deal of unwanted stress and over arousal in everyday life (e.g., the presence of novel situations, objects, and people) and engagement in repetitive behaviors and thinking provides a sense of relief from these situations. A few studies have shown support for this notion. For example, Charlop (1986) examined rates of echolalia in children with autism when they were presented with novel tasks and familiar tasks, revealing the highest rates of echolalia during the novel tasks. However, problems have been noted with design and interpretation in the studies supporting this

notion (e.g., in the Charlop study, echolalia may have served as an attempt to gain help with the novel task rather than to express over arousal), which has failed to secure popular acceptance of this hypothesis.

A similar theory has been offered by Baron-Cohen (1989) and expanded by Carruthers (1996). This idea proposes that repetitive behaviors are developed as a coping strategy for a confusing and unpredictable social world. In this theory, different repetitive behaviors may be developed for different reasons. For example, insistence on sameness develops as a way to exert control over the individual's world, while circumscribed interests provide a largely nonsocial form of pleasure that, due to social impairments, cannot be found in the social world. Like the "homeostatic mechanism" theory, this proposal presupposes that novel situations, especially those involving social demands, will result in the highest level of repetitive behavior.

Wahlberg (2001) suggested a developmental neurological perspective called control theory to explain perseverative thinking and behavior in individuals on the autism spectrum. Control theory suggests that while typical neurological development is geared towards incorporating complex forms of unpredictability in order to accept change and learn from experience, individuals with an autism spectrum disorder exhibit neurological development that is focused on increasing the predictability of the world. By making their environment predictable, individuals with an autism spectrum disorder expend less energy and experience less stress and anxiety trying to adapt new or incomprehensible information. Thus, for individuals with Asperger's disorder, perseverative conversation allows them to interact about a concrete and predictable theme and avoid novel subjects that may require higher-order processing and lead to stress, anxiety and mental exhaustion.

The executive dysfunction theory (Hughes, Russell, & Robbins, 1993; Turner, 1997), offered as an explanation for the development of circumscribed interests, has been applied to the acquisition of repetitive behaviors as well. According to this theory,

perseveration represents a subtype of executive dysfunction (Liss et al., 2001), whereby the child with autism cannot appropriately regulate his or her behavior. Thus, the individual becomes locked into a particular mode of thought and/or behavior and cannot generate novel behavior (Turner, 1997). An analogous theory has been studied in individuals with schizophrenia who display repetitive behaviors. These studies found an association between results on tests of executive functioning and restricted and repetitive behaviors (e.g., Frith & Done, 1990).

*Perseverative Conversation Explained from
a Behavioral Perspective*

An operant perspective assumes that all behavior is purposeful and influenced by the environmental events that precede and follow it. This functional perspective emphasizes social consequences (e.g., social attention, escape from demands, tangible reinforcement), as well as automatic reinforcement. According to this perspective, repetitive behaviors, including perseverative conversation, are learned or maintained via automatic (e.g., sensory) or social reinforcement. For example, Lovaas, Newsom, and Hickman (1987) suggested that sensory consequences often serve to reinforce stereotypies when engagement in such repetitive behaviors (e.g., hand-flapping, rocking, echolalia) provide auditory and/or tactile stimulation that makes recurrence more likely. Studies have shown that positive social reinforcement in the form of attention, and negative reinforcement, in the form of escape from aversive situations, may also serve as maintaining consequences for repetitive behaviors (e.g., Durand & Carr, 1987). Studies of verbal problem behavior (e.g., bizarre vocalizations, echolalia, perseverative speech) have identified positive social reinforcement (i.e., attention; e.g., Rehfeldt & Chambers, 2003), negative reinforcement (i.e., escape from demands; e.g., Pace, Iwata, Cowdrey, Andree, & McIntyre, 1993), access to tangible items (e.g., Ewing, Magee, & Ellis, 2002); and nonsocial functions (i.e., automatic reinforcement; e.g., Ahearn, Clark, MacDonald, & Chung, 2007) as maintaining them. Studies have also shown that repetitive behavior

displayed by individuals with autism can be used to reinforce alternative low-rate behaviors (Charlop, Kurtz, & Casey, 1990; Hung, 1978; Sugai & White, 1986; Wolery, Kirk, & Gast, 1985) suggesting that such behavior can be potent reinforcers.

The Current Study

Underlying Assumptions and Need for the Current Study

Research has provided several assumptions that form the basis for the current study. First, perseverative conversation is a problem behavior that is unique to individuals with Asperger's disorder and it is unlike other repetitive behaviors described in the literature, including many forms of repetitive speech. Second, perseverative conversation (a) revolves around narrow interests; (b) is expressed in a controlling or monologue manner; and (c) is long-winded, often extending into the finest minutia regarding the narrow interests. Third, this behavior is a source of many problems for children and adolescents with Asperger's disorder as it provides a barrier to social development and peer acceptance, interferes with productivity at work and school, and is likely to result in additional problem behaviors when it is restricted. Finally, despite the problems that perseverative conversation produces, there is little empirical research aimed at better understanding why it occurs. Although there are a few theories to explain why it occurs and how it initially develops, there is no strong evidence to suggest that any one theory is correct. Given this lack of understanding as well as the lack of effective treatment options for this distinctive problem behavior, further study to understand the reinforcing properties of perseverative conversation in Asperger's disorder is warranted.

Purpose of the Current Study

The purpose of the current study was to conduct an assessment in the clinic setting to determine the reinforcing properties of perseverative conversation in children and adolescents with Asperger's disorder using a concurrent operants arrangement. The primary goal of this study was to better understand the preference of children and adolescents with Asperger's disorder for three particular dimensions of perseverative

conversation: (a) conversation content; (b) conversation style; and (c) conversation duration, as well as the relative preference between these dimensions. Assessing preference for these three dimensions may be helpful in developing treatments aimed at decreasing this problem behavior by developing more conversational flexibility.

CHAPTER II

REVIEW OF THE LITERATURE

An Overview

This review of the literature provides the reader with a basic understanding of Asperger's disorder, highlights the problem of perseverative conversation, and discusses how the use of behavior analytic research may be useful for increasing our understanding of this problem behavior. The first section of this review outlines the history of Asperger's disorder, its diagnostic definition, and research on various repetitive behaviors displayed by individuals with Asperger's disorder. The unique characteristics associated with this disorder as well as the variety of impairments in social and communicative functioning are highlighted. Within the review of literature on repetitive behaviors associated with Asperger's disorder is a description of perseverative conversation, a common, but highly problematic behavior exhibited by many with Asperger's disorder.

In the second section, behavior analytic research regarding assessment and treatment of problem behavior is described. This section concentrates on how the analysis of function has led to successful reinforcement-based treatments for aberrant behaviors. Additionally, I discuss the application of such treatments to problem vocal behavior.

In the final section of this literature review a description of the current study is provided. This section blends our understanding of Asperger's disorder and perseverative conversation with the functional models in behavior analytic research to develop hypotheses regarding the relative preference each participant may have for various dimensions of reinforcement implicated in perseverative conversation. Finally, a description of the mechanisms hypothesized to be underlying perseverative speech is offered.

Defining Asperger's Disorder

The term *autism* comes from the Greek word *autos*, meaning *self*. This was the term coined by Leo Kanner, a child psychiatrist at Johns Hopkins University, to describe, in his landmark 1943 paper, 11 children with a distinct neurological condition (Kanner, 1943). This condition was characterized by a lack of interest in other people, communication deficits, behavioral rigidity, and unusual body movements, such as hand-flapping. Kanner's paper was widely read and sparked great interest in the investigation of children with this disorder.

Without knowledge of Kanner's work, one year later in 1944, an Austrian pediatrician named Hans Asperger authored a dissertation study describing a similar population of children (Asperger, 1944/1991). In this paper he provided an account of four boys, aged 6 to 11 years, who had severe impairments in social communication (e.g., difficulty understanding social cues, overly formal speech) and motor skills, and displayed highly unusual interests and behaviors. However, unlike most of the children described by Kanner, these four boys, whom he identified as having a personality disorder he termed "autistic psychopathology", all had intact cognitive abilities. Given that Asperger's paper was published in the German language and during World War II, it was not widely read (Ozonoff, Dawson, & McPartland, 2002) and did not receive the same level of attention.

Asperger's work was largely ignored until a 1981 article in *Psychological Medicine* by Lorna Wing that reviewed Asperger's study and described the characteristics of 34 individuals she had examined and who demonstrated a similar profile to those originally described by Asperger (Wing, 1981). It was in this paper that the term *Asperger's syndrome* (the term *Asperger's syndrome*, or "AS" for short continues to be used by some researchers, but the formal diagnostic label is *Asperger's disorder*) was used for the first time in the scientific literature and her account included additional details of the disorder that further extended the description offered by

Asperger. Although some researchers initially saw Asperger's syndrome as the same thing as high-functioning autism and argued against it as a separate disorder (e.g., Schopler, 1985; Schopler, 1998), it was finally validated as a disorder when it was included in the 1993 International Classification of Diseases and Disorders – Tenth Edition (ICD-10; World Health Organization, 1992) and the 1994 publication of the *Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition, Text Revision* (DSM-IV-TR; APA, 2000;). Thus, as an official disorder, Asperger's disorder is relatively new.

Hans Asperger's original description of the four boys with social and communicative deficits detailed some unique characteristics that are not highlighted by today's diagnostic systems. In fact, his depiction is somewhat divergent with today's popular definitions of his namesake disorder. Although the core deficits in communication and social functioning are clear in Asperger's writings, he also emphasized motor skill impediments, oppositionality, odd speech (e.g., pedanticism), social withdrawal, and a strong heritability of the disorder tied only to males (Asperger, 1944/1991).

Defining Asperger's disorder has not proven to be an easy task. In addition to the ICD-10 and DSM-IV-TR criteria, no fewer than five prominent definitions have been widely-circulated and are used for both clinical diagnostic decisions and research purposes (Ghaziuddin, Tsai, & Ghaziuddin, 1992; Leckam, Libby, Wing, Gould, & Gillberg, 2000; Klin & Volkmar, 1997; Wing, 1981; Szatmari, Bryson, Boyle, Streiner, & Doku, 2003; Tsai, 1992). The biggest difference among the various definitions is the exclusion criteria for Asperger's disorder as both ICD-10 and DSM-IV-TR definitions do not allow for the diagnosis to be given to individuals who meet the criteria for autistic disorder or for individuals with an early language delay.

*Differentiating Asperger's Disorder from
High-Functioning Autism*

Despite efforts to develop an accurate description and a set of valid criteria for Asperger's disorder, some researchers have taken a step back to explore whether it is a distinct disorder from other autism spectrum disorders, or whether it is the same thing as a high-functioning form of autistic disorder (high-functioning autism or HFA). Among the most common research findings is the presence of higher IQs, especially pertaining to verbal reasoning, in the Asperger's disorder population (Ehlers et al., 1997; Lincoln, Allen, & Kilman, 1995; Lincoln, Courchesne, Allen, Hanson, & Ene, 1998; Manjiviona & Prior, 1999) and greater language deficits in individuals with HFA than those with Asperger's disorder (Howlin, 2003; Sciotto & Cantwell, 2005; Ozonoff, South, & Miller, 2000). Studies have also shown differences between these two disorders that are not otherwise accounted for by the differences found in their diagnostic criteria (i.e., early language delays and/or delays in cognition).

In terms of social functioning, most studies have found that individuals with Asperger's disorder have less severe social deficits than those with HFA (Macintosh & Dissanayake, 2006). Research by Ozonoff et al. (2000) suggests that those with Asperger's disorder have greater social competence between the ages of 4 and 5, although such differences may not hold in later ages. With regards to social relationships, Koyama, Tachimori, Osada, Takeda, and Kurita (2007) found participants with Asperger's disorder scored much lower on measures of relationships with people than participants with HFA; however, Eisenmajer et al. (1996), Gillberg (1989), and Kugler (1998) identified individuals with Asperger's disorder as having a stronger desire to interact with others, and to make and sustain friendships than individuals with HFA. Macintosh and Dissanayake (2006) found children with Asperger's disorder engaged in conversation more often and initiated interaction more frequently. The quality of social interactions also seems to differ between these two groups, with individuals diagnosed

with Asperger's disorder engaging in a primarily "active but odd" interaction style that is more domineering and aggressive, while those with HFA are more "aloof and passive" in their social interactions (Ghaziuddin, 2008).

Although individuals with Asperger's disorder and those with HFA both typically possess specialized interests, persons with Asperger's disorder have a greater quantity of circumscribed interests (Ozonoff et al., 2000). Differences also seem to exist concerning the way these two groups express their special interests. Individuals with Asperger's disorder are more likely to gather great amounts of information regarding their circumscribed interests and individuals with HFA prefer to actively engage or manipulate objects related to their interests (Volkmar & Klin, 2000).

Outcome studies have provided a clue as to how long-term effects may be differentiated based upon diagnosis. In comparison with children diagnosed with Asperger's disorder, children with HFA have been shown to have a greater need for special education services (Gilchrist, Green, Cox, Burton, Rutter, & LeCouteur, 2001; Ozonoff et al., 2000) and individuals with Asperger's disorder are more likely to advance to post-secondary studies (Cederlund, Hagberg, Billstedt, Gillberg, & Gillberg, 2008). Cederlund et al. (2008) studied 140 males, 70 with HFA and 70 with Asperger's disorder, 5 years after their original diagnoses. They found that individuals with Asperger's disorder were more likely to hold jobs, live independently, and had higher scores in terms of the Global Assessment of Functioning scale. The Asperger's disorder group in this study also exhibited a significantly higher rate of illegal activities.

DSM-IV-TR Diagnostic Criteria

The definition for Asperger's disorder in the DSM has not changed from its initial 1994 entry in the APA's guidebook of mental disorders as one of five pervasive developmental disorder (PDD) subtypes. The definition, as outlined in the DSM-IV-TR, suggests core deficits in two areas – social interaction and restricted and repetitive

behaviors and interests – as well as impairments in daily functioning, and exclusionary criteria related to language and cognition.

For a diagnosis of Asperger's disorder, the DSM-IV-TR requires that an individual have "qualitative impairments" (APA, 2000, p. 84) in two or more components of social interaction. Among the areas likely to be impaired are use of nonverbal behaviors to regulate social interaction (e.g., eye-to eye gaze, facial expression, body postures, and gestures), development of appropriate peer relationships (i.e., relationships that correspond to the individual's developmental level), spontaneous seeking to share enjoyment, interests, or achievements with others (e.g., showing others objects or interests) and adequate social or emotional reciprocity. These are the same social interaction criteria that must be met for a diagnosis of autistic disorder.

Also similar to the criteria for autistic disorder, a diagnosis of Asperger's disorder requires the presence of "restricted repetitive and stereotyped patterns of behavior, interests and activities" (APA, 2000, p. 84). At least one of four criteria listed must be present. Impairments may be demonstrated by intense "preoccupations with stereotyped and restricted patterns of interest" (APA, 2000, p. 84), a rigid engagement in nonfunctional routines, stereotyped mannerisms (e.g., hand flapping, rocking, spinning), and/or interest in parts of objects rather than the objects themselves (e.g., preoccupation with the wheels of a toy car rather than the car itself).

Although the criteria previously described for the social and behavioral clusters are exactly the same for Asperger's disorder and autistic disorder, it is the exclusionary criteria in the definition of Asperger's disorder that differentiates the two. For a diagnosis of Asperger's disorder, an individual must not have had early language delays (i.e., single words were spoken by age 2 years and simple phrases used by age 3 years), a precondition for autistic disorder diagnosis. Individuals with Asperger's disorder must also have had normal cognitive development and adaptive behavior. Delays in cognition

and adaptive behavior, while not a requirement for autistic disorder, are common in an estimated 70% of individuals with autism (Fombonne, 1999).

The DSM-IV-TR criteria for Asperger's disorder, although widely popular, are not without criticism. Volkmar and Klin (2000) provided a critique of these criteria and suggested that they may be inadequate for clinical diagnostic practice. Their greatest criticism of the DSM-IV-TR criteria is that they lack adequate description and detail. Descriptors, such as "marked impairment", "qualitative impairment", and "clinically significant impairment" are highly subjective and are not accompanied by any guidance as to their meaning. Another criticism is that there are no inclusion of criteria regarding impairments in language and communication, despite evidence that such impairments are common, albeit not as severe as those demonstrated by individuals with autistic disorder (Landa, 2000). Finally, the exclusionary criterion related to language is one of the few differences between Asperger's disorder and autistic disorder, yet studies suggest that the developmental boundaries within this definition (i.e., first words by 2 year of age and word strings by age 3 years) may be arbitrary and lack discriminate validity (Volkmar & Klin, 2000).

Language and Communication

The DSM-IV-TR definition for Asperger's disorder may not allow for early language delays, but research makes clear that this disorder carries a number of impairments in speech, language, and communication, even from an early age. In Hans Asperger's initial description of this disorder (1944/1991), among the important features of the four boys he described were the atypical characteristics of their communication and language usage. He labeled their speaking styles as pedantic, meaning they exhibited a bookish quality that sounded more mature than their ages and involved the use of obscure words. All four boys also demonstrated significant impairments in nonverbal communication, including impaired eye contact and limited facial expressions.

Individuals with Asperger's disorder are commonly found to have an unorthodox speaking style with regards to prosody (i.e., grammatical, pragmatic, and affective use of language) and vocal quality. Eisenmajer et al. (1996) studied speech in individuals with Asperger's disorder and noted that participants tended to have an unusual "nasal" tone of voice that was flat and monotone. Shriberg, Paul, McSweeney, Klin, Cohen, and Volkmar (2001) also noticed speech and articulation problems in individuals with Asperger's disorder, including grammatical and pragmatic abnormalities in two-thirds of their AS participants. In addition to expressive speech difficulties, much has been written on the failure of individuals with Asperger's disorder to accurately interpret the pragmatic and affective cues of others (e.g., Attwood, 1998; Landa, 2000). For example, in one study participants with Asperger's disorder demonstrated significant impairments in the ability to interpret others' speech prosody to determine their emotions (Koning & Magill-Evans, 2001).

As mentioned previously, pedantic speech is common in individuals with Asperger's disorder. Some experts have nominated it as a hallmark feature of Asperger's disorder (Burgoine & Wing, 1983) and others have gone so far as to suggest it should be a formal criterion for the disorder (Gillberg & Gillberg, 1989). Ghaziuddin and Gerstein (1996) defined pedantic speech as "the type of speech in which the speaker conveys more information than the topic and goals of the conversation demand, violating expectations of relevancy and quantity; sentence structure may have the formality, and vocabulary display the erudition expected of written language" (p.589). Seventy-six percent of the AS participants in their study demonstrated pedantic speech as opposed to only 31 percent of those diagnosed with high-functioning autism. However, this may be an underrepresentation of pedantic speech in Asperger's disorder as the authors measured speech using audio tapes with rather short duration times and, as they suggested, face-to-face interviews with greater conversation lengths would provide a better sample.

Conversational difficulties are also common among people with Asperger's disorder. Not only do they struggle to understand idioms (Kerbel & Grunwell, 1998), humor (Ozonoff & Miller, 1996), metaphors, and irony (Happe, 1995), making reciprocation difficult, when they do reciprocate conversation what they say and how they communicate reflect poor skills in social discourse. Individuals with Asperger's disorder make more unclear references during conversation than typically developing peers (Fine, Bartolucci, Szatmari, & Ginsberg, 1994), and often are more verbose on topics of interest (Adams, Green, Gilchrist, & Cox, 2002). Possibly the biggest hindrance to appropriate social discourse, and one of the more studied aspects of language in individuals with Asperger's disorder, is the difficulty in turn-taking within conversation. Ghaziuddin and Gerstein (1996) described the verbosity and lack of turn-taking as "monologue speech" (p. 589). Ramberg, Ehlers, Nyden, Johansson, and Gillberg (1996) studied language and pragmatic functions in children with Asperger's disorder and found substantial impairment in turn-taking within dyadic conversation.

Social Functioning

Much of what is known about the social functioning of individuals with Asperger's disorder is the result of clinical experience rather than experimental study (Attwood, 1998). It seems apparent that those with Asperger's disorder have significant impairments in social functioning compared to neurotypical peers (Gillberg, 1989; Ozonoff et al., 2000; Szatmari, Archer, Fisman, Streiner, & Wilson, 1995). In a literature review conducted by Lee and Park (2007), all studies reviewed except for one found adaptive behavior scores for children and adolescents with Asperger's disorder to be lowest in the area of socialization. In addition to social skill deficits, there is evidence suggesting children and adolescents with Asperger's disorder possess greater social anxiety than typically developing peers (Kuusikko, et al., 2008). Children with Asperger's disorder also experience more rejection from their peers (Mrug & Hodgens, 2008), likely because of their combination of social and communication deficits. Among

the characteristics serving as barriers to social success are difficulties with physical boundaries, low frustration tolerance, self-centeredness, poor understanding of social cues, and weak motor skills (Myles & Simpson, 2002; Perry, 2004; Wing, 1981). This has led to the misconception that individuals with Asperger's disorder do not desire to make and maintain friends (Myles & Simpson, 2002).

Behavioral Functioning

The DSM-IV-TR definition for Asperger's disorder includes criteria related to "restricted repetitive and stereotyped patterns of behavior, interests and activities" (APA, 2000, p. 84), a common feature of this disorder; however, other areas of behavioral functioning have been studied in individuals with Asperger's disorder with significant findings. Within both the popular media and the scientific literature a somewhat controversial, but well-studied facet of Asperger's disorder is the association with aggression and crime. A number of case studies have described incidents of physical aggression (Baron-Cohen, 1988; Mawson, Grounds, & Tantam, 1985), theft (Chen, Chen, Yang, Yeh, Chen, & Lo, 2003; Chesterman & Rutter, 1993), sexual offenses (Chen et al., 2003; Kohn, Fahum, Ratzoni, & Apter, 1998; Milton, Duggan, Latham, & Tantam, 2002) and even murder (Schwartz-Watts, 2005) in individuals with Asperger's disorder. Moreover, prevalence studies in the United Kingdom have indicated that offenders in mental health hospital populations have a higher rate of AS (1.5%) than the general public (0.36%; Scragg & Shah, 1994). However, a study conducted by Ghaziuddin, Weidmer-Mikhail, and Ghaziuddin (1998) refuted the idea that individuals with Asperger's disorder are any more prone to aggression and crime than the general public. Newman and Ghaziuddin (2008) studied 37 cases of violence involving individuals with Asperger's disorder, finding that nearly 85 percent of these individuals "probably" or "definitely" had an underlying comorbid psychiatric diagnosis that may have better accounted for their behavior. Although neither denying nor agreeing with the Asperger's disorder-violence connection, Tantam (2003) suggested that individuals with Asperger's

disorder may be predisposed to aggression due to being constantly bullied and teased, struggling with impairments in reading others' social cues, and experiencing executive dysfunction.

In a study of 20 male adolescents with Asperger's disorder, Green, Gilchrist, Burton, and Cox (2000) found that they were more likely to experience suicidal ideation, depression, temper tantrums, and defiance than typically-developing peers. In fact, these symptoms are so impairing that adolescents with Asperger's disorder are sometimes misdiagnosed with conduct disorder. Many, however, receive a secondary diagnosis of a behavior disorder during the middle school years (Church, Alisanki, & Amanullah, 2000). Several studies (e.g., Perry, 2004; Wing, 1981) have described low frustration tolerance, another common symptom of conduct disorder, as a customary characteristic found in children with Asperger's disorder. Tantam (2003) discussed "catastrophic reactions" (p.150) – extreme emotional and/or behavioral responses to environmental stimuli – as a common symptom in AS. The screaming, shouting, destruction of property and physical aggression towards self and others associated with catastrophic reactions are frequently the result of sensory overload (e.g., noisy environments). Finally, studies of adaptive behavior in children and adolescents with Asperger's disorder suggest that maladaptive and externalizing behaviors are prevalent (Macintosh & Dissanayake, 2006; Myles, et al., 2007). In these studies maladaptive and externalizing behaviors refer to problem behaviors, such as arguing and hyperactivity, as well as deficits in cooperation, self-control, and responsibility.

Circumscribed Interests in Asperger's Disorder

Asperger's original description (1944/1991) of the disorder provided the following detailed description of circumscribed interests in his subjects (as reported in Attwood, 2003):

We know an autistic child who has a particular interest in the natural sciences. His observations show an unusual eye for the essential. He orders his facts into a

system and forms his own theories even if they are occasionally abstruse. Hardly any of this he heard or read, and he always refers to his own experience. There is also a child who is a “chemist”. He uses all his money for experiments which often horrify his family and even steals to fund them. Some children have even more specialized interests, for instance, only experiments which create noise and smells. Another autistic boy was obsessed with poisons. He had a most unusual knowledge in this area and possessed a large collection of poisons, some quite naively concocted by himself. He came to us because he had stolen a substantial quantity of cyanide from the locked chemistry store at his school. Another, again, was preoccupied by numbers. Complex calculations were naturally easy for him without being taught. Another autistic child had specialized technological interest and knew an incredible amount about complex machinery. He acquired this knowledge through constant questioning, which was impossible to fend off, and also to a great degree through his own observations. He came to be preoccupied with fantastic inventions, such as spaceships and the like, and one observes how remote from reality autistic interests are. (Asperger, 1944/1991, p. 72).

Although circumscribed interests have been a prominent feature in this disorder since Asperger’s own description, it has not gained the focus of today’s researchers like other aspects of the disorder (Happe, 1991; Winter-Messiers, 2007). Studies have shown that 90% or more adults and children with Asperger’s disorder have at least one circumscribed interest (Bashe & Kirby, 2001; Tantam, 1991), while over 40% have three or more (Bashe & Kirby, 2001), indicating much higher rates than other spectrum diagnoses (Ozonoff et al., 2000). Another indicator of the prominence of circumscribed interests is their inclusion in current diagnostic practice. Among the five well-known Asperger’s disorder diagnostic systems (i.e., Gillberg & Gillberg, 1989; Tantam, 1988; Szatmari, Brenner, & Nagy, 1989; APA, 2000; WHO, 1992), all but one (Szatmari et al., 1989) specifically implicate the presence of circumscribed interests as a major diagnostic component. To meet criteria for Asperger’s disorder, the DSM-IV-TR requires some form of “restricted repetitive and stereotyped patterns of behavior, interests, and activities” (APA, 2000, p. 84), which can be satisfied by an “encompassing preoccupation with one or more stereotyped and restricted patterns of interests that is either abnormal in intensity or focus” (APA, 2000, p. 84) or by a “persistent preoccupation with parts of objects” (APA, 2000, p. 84).

Defining Circumscribed Interests

Drawing a line between what is “abnormal” and what is normal in terms of circumscribed interests, is not an easy task as it often comes down to the timing, intensity, and nature of the interest (Perry, 2004). That is, the earlier, the more intense, and the more unusual the preoccupation, the more likely it fits the pattern associated with Asperger’s disorder. Attwood (1998) described circumscribed interests as “a special interest that dominates the person’s time and conversation and the imposition of routines that must be completed” (p. 89) and Winter-Messiers (2007), in a study on the development of circumscribed interests, defined them as “those passions that capture the mind, heart, time, and attention of individuals with Asperger’s disorder, providing the lens through which they view the world” (p. 142). Notwithstanding the need for a precise definition, discussions of circumscribed interests in research have provided descriptive terms that have helped to capture what such interests are. For example, circumscribed interests have been labeled all-absorbing (e.g., Klin, Carter, & Sparrow, 1997; South, Klin, & Volkmar, 1997), narrow (e.g., Baron-Cohen, 1989), unusual (Perry, 2004), and single-minded (e.g., Ghaziuddin, 2002).

Although circumscribed interests are common in other autism spectrum disorders, albeit to a lesser degree than in Asperger’s disorder (Ozonoff et al., 2000), they tend to be expressed via object manipulation, visual-spatial tasks, and music, whereas individuals with Asperger’s disorder are more likely to gather great amounts of information regarding their circumscribed interests (Volkmar & Klin, 2000). Often, those with Asperger’s disorder develop elaborate and unique classification systems for their interests. For example, Slater-Walker and Slater-Walker (2002) described in their book how after getting married, the groom, whom was diagnosed with Asperger’s disorder, took on the job of combining the couple’s record collections of classical music. He developed a cataloguing system which he used to organize them, in order, by the composer’s date of birth rather than by alphabetical order.

There seems to be a mastery component to the interests of persons with Asperger's disorder that leads them to devote vast amounts of time and energy into developing an encyclopedia-like knowledge of the topic or theme, often to the detriment of other activities and responsibilities. This knowledge is ordinarily composed of very fine detail, while the grand picture surrounding the topic of interest is less understood. This usually becomes evident in social interactions when an individual with Asperger's disorder will engage in monologue speech surrounding his or her interests (Mesibov, Adams, & Klinger, 1997). Such interactions are more likely to emulate a teacher – student lecture on the finer points of the interests of individuals with Asperger's disorder, rather than a fluid conversation between two people.

Themes and Types of Circumscribed Interests

The most common types of interest can be ascertained through case study reports and surveys of individuals with Asperger's disorder and their families. In general, as Baron-Cohen and Wheelwright (1999) have noted, their interests are more likely to be about how *things* work rather than how *people* work. This focus on nonsocial topics makes sense given their difficulties navigating the social world. However, due to the unusual quality and sometimes asocial nature of their interests (as well as their odd style of communicating such interests), children and adolescents with Asperger's disorder tend to be more isolated from neurotypical peers. A wide range of topics of interest found in individuals with Asperger's disorder has been documented in the research literature, including such unusual topics as deep-fat fryers, waist measurements (Klin, Volkmar, & Sparrow, 2000), toilet brushes (Attwood, 1998), paper bags (Gillberg, 1991), and globes and maps (Myles & Simpson, 2003).

Some topics of interest seem to be more common in individuals with Asperger's disorder than others. In an attempt to better understand the development and nature of circumscribed interests, Winter-Messiers (2007) categorized the interests and themes of 24 children and adolescents with Asperger's disorder. She identified the general themes

as transportation (e.g., airplanes, trains), music (e.g., composing, saxophone), animals (e.g., goats, frogs), video games (e.g., role-playing games), motion pictures (e.g., *Star Wars*, Disney movies) and art (e.g., anime, manga). Another study sought to identify the most common interests of individuals with Asperger's disorder through the use of parent surveys (Bashe and Kirby, 2001) and found among the top interests video and computer games, works of art, movies, fictional books, television programs, and computers. Both of these studies suggest that the interest themes that individuals with Asperger's disorder embrace are socially appropriate; however, while the themes may be appropriate, the results do not speak to the intensity of the interest nor to the particulars of their interests, which are likely to make them less socially acceptable (i.e., an interest in computers may be socially appropriate, but an all-absorbing interest in types of computer keyboards is less acceptable). In the Winter-Messiers investigation, for example, parents expressed concerns about the intensity of their interests and lack of interest in other topics. Possibly the most notable interest in persons with Asperger's disorder is Thomas the Tank Engine. Given a large amount of anecdotal evidence suggesting a connection between interests in Thomas the Tank Engine and autism, a study was conducted in 2001 by the United Kingdom's National Autistic Society to better understand the nature of this relationship (National Autistic Society [NAS], 2002). Findings suggested that nearly 60% of children with an autism spectrum diagnosis had a strong interest in Thomas. Moreover, about a third of children with autism had an "obsessive" relationship with the train character. They also found that such an interest in Thomas did not go away quickly as they remained interested in the character for two years beyond that of typically developing peers.

Development and Expression of Circumscribed Interests

Circumscribed interests are a stable trait in Asperger's disorder (Piven, Harper, Palmer, & Arndt, 1996). That is, development of narrow interests and the intensity by which they pursue them does not go away with time. In fact, despite improvements with

age in the social and communicative domains (Fecteau, Mottron, Berhiaume, & Burack, 2003), as well as with such behaviors as repetitive motor movements and routine rigidity, impairment related to circumscribed interests increases markedly across development (South, Ozonoff, & McMahon, 2005). There is some evidence that the number of interests increases with age. Children and adolescents typically have more than one circumscribed interest, but by adulthood, nearly 20% have developed six or more interests (Bashe and Kirby, 2001).

In addition to increases in the number of circumscribed interests over time, the themes or topics of interest in childhood change with age as well (Attwood, 2003). For most individuals with Asperger's disorder, circumscribed interests develop as early as 2 to 3 years (Bashe & Kirby, 2001). Perry (2004) describes an 18-month old child preoccupied by vacuum cleaners and a 15-month old more interested in acorns on the playground than the other children playing on the playground. Most children with Asperger's disorder begin with a simple interest in the parts of objects, such as the wheels on toy cars. This eventually expands into categories of objects (e.g., types of refrigerators), for which the child amasses large amounts of information. Most of this information is done through active discovery, by asking questions and reading (Attwood, 2003). As those with Asperger's disorder become teens, the interests generally advance to higher-level topics such as electronics, computers (including computer programming and computer gaming) and science fiction. By this age the individual with Asperger's disorder is typically an avid researcher, but continues to seek additional information through social means (e.g., asking questions, conversations with experts).

Studies have shown that individuals with Asperger's disorder express their interests in specific ways. South et al. (2005) found that the most likely form of expression was through repetitive talking about the interests. Bashe and Kirby (2001) corroborated this result, finding that the number one way children with Asperger's disorder pursue their interests was through talking. Reading about circumscribed

interests may become the most preferred form of expressing their interests as they get older.

Explaining Circumscribed Interests

The reason circumscribed interests develop and what function they may serve has been debated with no clear answer prevailing. Several explanations and theories have been posited with overlapping components. The greatest amount of attention has been paid to theories regarding the way individuals with Asperger's disorder process information. Frith and Happe (1994) suggested that those with Asperger's disorder spend most of their time centering on the minutia of the world (e.g., the components of refrigerators) and cannot ascertain the gestalt (e.g., the idea that refrigerators are beneficial to the health and diet of humans). Despite their difficulty processing the "bigger picture", their success in developing taxonomies of the minutia (e.g., cataloguing the parts and types of refrigerators) provides them with a predictable way of organizing the world.

Another information processing theory explains the single-minded pursuit of circumscribed interests as a result of executive dysfunction (Hughes, Russell, & Robbins, 1993; Turner, 1997). This theory suggests that impaired executive functioning results in perseverative thinking and behavior regarding topics and objects and does not allow for other themes to be explored. Thus, the individual with Asperger's disorder is "stuck-in-set" and acquires great amounts of knowledge about a relatively few topics. Frith, (2003) commented that the executive dysfunction in individuals with autism, resulting from frontal lobe impairment, does not mean that they have poor attention, just "peculiar attention" (p. 171) that makes it difficult to attend to more than just the minute details of a select few topics.

Tantam (2000) explained the development of circumscribed interests in individuals with Asperger's disorder as a function of pleasure, while Pyles (2000) explained such a development in her son, who has Asperger's disorder, as a function of

fear. Relative to pleasure, when a certain stimulus is paired with enjoyment, the child attempts to return to that feeling over and over by becoming engrossed in the stimulus. Thus, an exciting game played on a computer may lead a child to become obsessed with computers or some aspect of them. On the flip side, as Pyles suggests, a negative experience or initial fear of a stimulus may motivate a child to understand every aspect of that stimulus in order to control or reduce the fear it occasions. For example, Pyles' son became captivated by witches after developing an initial fear of them. Similar explanations for the occurrence of repetitive behaviors have been posited in the behavioral psychology literature, explaining that repetitive behaviors are negatively reinforced as they reduce physiological stress (Lewis, Baumeister, & Mailman, 1987).

Finally, several researchers have postulated a connection between an "insistence on sameness" (i.e., the need to maintain organization and consistency in everyday life, which is common among individuals with autism) and the development of circumscribed interests (Carruthers, 1996; Szatmari, Brenner, & Nagy, 1989). In this explanation, circumscribed interests provided predictability and allow the child with Asperger's disorder to gain control over his or her environment. Because the social world is unpredictable, and therefore frightening, interests about how things work, rather than how people work, are preferred.

Differentiating Asperger's Disorder and Obsessive Compulsive Disorder

The presence of obsessions in individuals with Asperger's disorder leads many to question whether some individuals with Asperger's disorder also have obsessive compulsive disorder (OCD). Few studies have looked at the comorbidity of Asperger's disorder and OCD. Bejerot, Nylander, and Lindstrom (2001) studied 64 individuals diagnosed with OCD and found that 20% also had autistic traits, while Szatmari, Bartolucci, Bremner, Bond, and Rich (1989) found that 29% of individuals with high-functioning autism showed obsessive symptoms. In neither study was there any mention

of the actual comorbidity of these two diagnoses. This may be due to the difficulty in defining obsessions versus circumscribed interests. As mentioned previously, a precise definition for what constitutes a circumscribed interest is lacking; however, there does not appear to be much disagreement over the definition of “obsessions”. Lewis and Bodfish (1998) defined various terms related to repetitive behaviors in autism, including the following definition of an obsession: “Repetitive, persistent thoughts, impulses, or images that are experienced as intrusive and inappropriate and that cause marked anxiety or distress” (p. 82). Although individuals with Asperger’s disorder can be described as “obsessed” with regards to their respective interests, Lewis and Bodfish’s definition differs substantially from what we know about the circumscribed interests of those with Asperger’s disorder. The rituals and circumscribed interests identified in individuals with Asperger’s disorder is usually comforting and pleasurable, rather than anxiety provoking as it is in OCD (Martin, Patzer, & Volkmar, 2000; Tantam, 2000). As Attwood (1998) stated regarding individuals with Asperger’s disorder with circumscribed interests, “the person really enjoys their interest and does not try to resist it” (p. 93). A study by Bashe and Kirby (2001) supported such a view of circumscribed interests when they surveyed individuals with Asperger’s disorder to find out how their interests affected their lives. The most common response to this inquiry was that circumscribed interests provided genuine enjoyment, security, comfort and relaxation, and facilitated the avoidance of aversive social situations. Thus, the main difference between the obsessions experienced in OCD and the circumscribed interests found in many individuals with Asperger’s disorder is that the AS interests provide pleasure to the individual and are subsequently sought out, while the obsessions that persons with OCD experience are ego-dystonic and anxiety-provoking.

A thorough comparison of the obsessions experienced by individuals with OCD and the circumscribed interests of individuals with autism was conducted by McDougle et al. (1995). In this investigation, the circumscribed interests of 50 participants

diagnosed with autism and the obsessions and compulsions of 50 participants diagnosed with OCD were compared in terms of content and behavior. The authors were able to discriminate the two diagnoses based upon the content of thoughts and behavior. More specifically, the participants with autism were much less likely to have recurrent thoughts or interests with aggressive, sexual, religious, symmetry, and somatic content. OCD participants were more likely to engage in behaviors involving cleaning, checking, and counting than AS participants.

Perseverative Thinking and Behavior in Asperger's Disorder

The Definition and Types of Perseveration

Perseveration often refers to the repetition of non-aberrant thoughts and behaviors beyond what is typical to accomplish a goal (Ridley, 1994). There are many different types of perseverative behavior exhibited in autism spectrum disorders, including stereotypies, compulsions, tics, and echolalia, which are often very similar except for the way the repetitive behaviors or thoughts are manifested. Turner (1997) developed a taxonomy of repetitive behaviors that also included insistence on sameness of environment, rigid routines and rituals, and abnormal attachments to objects and preoccupations. Factor analytic studies of perseverative behaviors and thoughts in individuals with autism suggested between two and three factors that would encompass these behaviors (Bodfish, Lam, & Lewis, 2006; Shao, et al., 2002). Shao et al. (2003) suggested a two-factor model with one composed of lower-level behaviors and thoughts called "Repetitive Sensory and Motor Behaviours and Interests", and the second factor including higher-level behaviors and thoughts, labeled "Insistence on Sameness". Lower-level behaviors would likely include repetitive movements, such as tics, stereotypies, and self-injurious behaviors, while higher-level behaviors would include insistence on sameness, repetitive language, and circumscribed interests.

In autism spectrum disorders, which include Asperger's disorder, the most common perseverative behaviors are stereotypies, echolalia, self-injury, and insistence on

sameness. Stereotypies and stereotypic behavior refers to repetitive, rigid, and invariant behaviors that tend to be socially inappropriate (Turner, 1999). It is a heterogeneous class of behaviors that can be verbal or nonverbal, fine or gross motor oriented, and simple or complex (Cunningham & Schreibman, 2008). The most common types of stereotypy in individuals with autism are repetitive movements of the lower extremities (28% of all individuals) and object stereotypy (25%; Campbell et al., 1990). Although stereotypies are typically found to be maintained by automatic (sensory) reinforcement (e.g., Lovaas, Newman, & Hickman, 1987; Piazza, Adelinas, Hanley, Goh, & Delia, 2000), a large number of studies have identified social contingencies, including attention and escape from work as maintaining such behaviors (e.g., Ahearn, Clark, Gardener, Chung, & Dube, 2003; Kennedy, Meyer, Knowles, & Shukla, 2000). Even though the terms “stereotypy” and “perseveration” are sometimes used interchangeably, Ridley (1994) suggested distinguishing these forms of repetitive behavior by the degree of repetitive behavior. That is, stereotypies are behaviors repeated at a high rate, while perseveration connotes recurrent behavior at a normal rate.

Echolalia refers to repetitive speech, particularly words or short phrases. Although it is usually deemed to be intrinsically reinforced (i.e., it occurs as an automatic consequence of the behavior itself), there has been some research suggesting it can serve a function (e.g., Prizant & Duchan, 1981). Echolalia can take many forms, including immediate repetition, delayed repetition, parroting (i.e., repeating what one hears), and spontaneous phrase repetition (i.e., repeating a novel word or phrase). An estimated 75% of individuals with autism display some form of echolalia (Charlop, 1992).

Self-injurious behavior (SIB), which is sometimes grouped in with other stereotypies, refers to any behavior that is directed towards oneself and causes tissue damage (Tate & Baroff, 1966). Although the most frequent topographies are self-hitting/banging of the head and self-biting, a wide range of topographies have been documented (Iwata et al., 1994). Empirical studies of SIB suggest that it is most often

maintained by escape from tasks and aversive situations, but can also be reinforced via gaining access to attention, food, and other tangible objects, and by producing sensory reinforcement (Iwata et al., 1994). Given the insidious nature of such behavior it has been a focus of a large amount of research, particularly from a behavior analytic perspective (Horner, Carr, Strain, Todd, & Reed, 2002).

Insistence on sameness is a phrase unique to the study of behavior in autism (Lewis & Bodfish, 1998). It refers to the tendency to maintain rigid routines and avoid changes to the immediate environment. For example, some individuals with autism insist that items in their physical environment, such as furniture or food at dinner, be placed in the same place daily. Other trivial changes such as making an unannounced extra stop on the daily bus route may leave an AS individual upset or confused. Prior and MacMillan (1973) studied sameness behavior in children with autism and childhood schizophrenia. Every one of the 10 children with autism in their study exhibited multiple sameness behaviors, such as lining things up in rows, rigid bedtime, eating, and dressing routines, and insistence on furniture and other object placements. Szatmari, Bartolucci, and Bremner (1989) compared “insistence on sameness” between patients with high-functioning autism and Asperger’s disorder against participants with other psychiatric diagnoses. Results suggested that participants with HFA and Asperger’s disorder engaged in significantly more behaviors related to “insistence on sameness” (p. 713) than controls. Szatmari, et al. (2006) further distinguished “insistence on sameness” (p. 583) between participants with Asperger’s disorder and those with autism, with individuals with Asperger’s disorder demonstrating significantly more of these behaviors than those with autism.

Perseveration in Asperger’s Disorder

Even though perseverative thinking and behavior have been well studied in autistic populations, research specific to Asperger’s disorder is lacking. In 1990, prior to the acceptance of Asperger’s disorder as a formal diagnostic label, Kerbeshian, Burd, and

Fisher studied the characteristics of individuals with an AS profile. In comparison to neurotypical peers and individuals with autism, a significantly greater number of children with Asperger's disorder demonstrated repetitive behaviors. In fact, 85% of participants with Asperger's disorder demonstrated perseverative speech and engagement in repetitive activities, and 92% had circumscribed interests. These three areas, in addition to impaired nonverbal communication, peculiar social interaction, and clumsy motor movements, constituted the most common characteristics observed in AS participants.

An examination of the repetitive behavior profile of individuals with HFA and Asperger's disorder was conducted by South et al. (2005). The parents of 61 children and adolescents with HFA, Asperger's disorder, and typical development were interviewed regarding repetitive behavior symptoms of their children. Both the HFA and Asperger's disorder groups exhibited significantly more symptoms in repetitive behavior categories (i.e., Object Use, Motor Movements, Rigid Routines, and Circumscribed Interests) than typically developing peers by parent report. The differences between the HFA and Asperger's disorder groups in terms of the number of symptoms reported in each category were insignificant, with the exception of the Object Use category, for which the parents of the HFA participants reported more symptoms (e.g., lining things up, spinning/banging objects). In the AS group, the repetitive behavior endorsed most often was "repetitive talk about one topic" (p. 151). Nearly 80% of all respondents indicated their child or adolescent engaged in this behavior, whereas only 14% of typically developing peers do so. Another study on repetitive behaviors in autism and Asperger's disorder indicated that younger children tended to engage more in repetitive motor and sensory behaviors, while older children and adolescents were more likely to engage in repetitive complex behaviors (Militermi, Bravaccio, Falco, Fico, & Palermo, 2002). This pattern has also been found in studies exploring the level of functioning on repetitive behaviors, with lower-functioning individuals with an autism spectrum disorder engaging in more repetitive motor and sensory behaviors and higher-functioning

individuals with Asperger's disorder engaging in complex behaviors (Manjiviona & Prior, 1999).

Nearly every description of repetitive behaviors in individuals with Asperger's disorder makes specific reference to perseverative conversations about circumscribed interests, whereas virtually none mention repetitive motor movements. Even early descriptions, such as those by Asperger (1944/1991) and Wing (1981) characterized the conversation styles of individuals with Asperger's disorder as repetitive, using overly formal language, and most often about their own narrow interests. Kerbeshian, Burd, and Fisher (1990), in a study on the characteristics of 13 individuals with Asperger's disorder, described their speech and conversation as "lengthy and repetitive, often being focused on one area of interest...They often attempt to channel all conversation into their areas of interest." (p. 721). Personal accounts describing experiences with Asperger's disorder children have labeled such repetitive conversation as monologue speech and suggested that it usually involves their specialized interests (Attwood, 1998; Attwood, 2003; Perry, 2004). Frith (2003), in describing her experiences with children and adolescents with Asperger's disorder and HFA, reported that it was difficult to interrupt a child engaged in activities, such as talking, that revolved around circumscribed interests. Toth and King (2008) suggested that DSM-IV criteria may be misleading people regarding language (i.e., the requirement that no early language delay should be present), as pedantic and repetitive language are common impairments in the early development of individuals with Asperger's disorder.

Perseveration and Circumscribed Interests in Conversation

Perseverative thinking and behavior are hallmark characteristics of Asperger's disorder. One particular topography of perseverative behavior that has been described often in the literature, but rarely studied, is *perseverative conversation* (i.e., repetitive talk or conversation) (South, Ozonoff, & McMahon, 2005). Although perseverative conversation in individuals with Asperger's disorder is common (Mesibov, Adams, &

Klinger, 1997), it is rarely, if ever, mentioned outside of the context of circumscribed interests.

Despite the frequent mention of perseverative conversation in the literature regarding Asperger's disorder, it has not been adequately defined. In the development of an assessment tool for evaluating conversational impairments in individuals with autism, de Villiers, Fine, Ginsberg, Vaccarella, and Szatmari (2007) defined perseverative conversation as "excessive persistence on a chosen topic without turning attention to new topics or situations" (p. 1377). Perseverative conversation can also be understood via description of the common features used to identify it. By definition, perseverative conversation is repetitive. The repetition is nearly always concerning the narrow interest(s) of the individual with Asperger's disorder. Rather than a conceptual or abstract discussion, perseverative conversation can appear to be a listing of the detail-oriented and sometimes irrelevant facts surrounding the conversation topic (Volkmar and Klin, 2000). Finally, while the term conversation is usually thought of as an exchange of ideas between two or more people, it can also connote the verbal communication of ideas from one person to another. This latter understanding of the expression applies to perseverative conversation, as individuals with Asperger's disorder frequently communicate in a domineering manner that lacks turn-taking and general conversational flexibility.

Perseverative conversation, as it is used in the proposed study and as described in the literature on Asperger's disorder must be differentiated from the concepts *vocal stereotypy*, *echolalia* and *verbal perseveration*. Vocal stereotypy is a general term that refers to "patterned repetitive vocalizations" (Turkington & Anan, 2007, p. #152) that often are not observed as serving a social function (Graybiel, 2008). Vocal stereotypies can be in the form of single words (e.g., Falcomata, Roane, Hovanetz, Kettering, & Keeney, 2004), simple phrases (e.g., Ahearn, Clark, MacDonald, & Chung, 2007), meaningless sounds (e.g., Taylor, Hoch, & Weissman, 2005), or a combination of all

three (e.g., Athens, Vollmer, Sloman, & Pipkin, 2008). Echolalia is a term sometimes used interchangeably with vocal stereotypy or, more often, perceived as a distinct type of vocal stereotypy. It refers to a mechanical repetition of words or phrases spoken by another person, usually with the same intonation. Sometimes the repetition will feature just an echoed word, whereas at other times it will mimic whole sentences or even conversations. Although the repeated word or phrase may make sense, it is frequently used out of context. Echolalia can occur in immediate and/or delayed contexts. Vocal stereotypy and echolalia are seen frequently in the literature concerning individuals diagnosed with autistic disorder, but seldom in studies and reports on individuals with HFA or Asperger's disorder.

The definition for *verbal perseveration*, sometimes referred to as *perseverative speech*, parallels the definition set forth for perseverative behavior. It refers to persistent repetition of a word or phrase when a new adapted verbal response is expected (Cohen & Dehaene, 1998). However, this definition is applied differently by various disciplines. In the field of cognitive psychology, as well as speech and language pathology, verbal perseveration, and perseveration in general, has been conceptualized as having a three-tiered taxonomy based upon the complexity of the perseveration (Sandson & Albert, 1984). At the most basic level is continuous perseveration, which involves prolongation of responses without pause or discontinuance. That is, repeating a word or phrase over and over, regardless of whether the initial iteration of the word or phrase was contextually appropriate. For example, when an individual is asked if he likes hamburgers, a response of this type might be "I like hamburgers, hamburgers, hamburgers..." over and over. One step higher in complexity is recurrent perseveration, which is the inappropriate recurrence of a response previously expressed. For example, after previously answering "I like hamburgers" to a question about food, repeating this same response when talking about favorite books is recurrent perseveration. Finally, the most complex form of perseveration is called stuck-in-set. This type of perseveration

involves reverting to previous topics or categories of response. For example, after discussing sports for ten minutes, a conversation may evolve to the topic of favorite books; however, despite this evolution in conversation, an individual demonstrating “stuck-in-set” perseveration provides similar responses in the discussion of books as he/she did about sports.

Within behavioral psychology, use of the term *verbal perseveration* has been associated with several meanings. For example, it has been used to mean verbal utterances sharing 50% of the “lexical items” as previous utterances (Reichle, Brubakken, & Tetreault, 1976), high-rate contextually inappropriate verbalizations, including repetitive requests for items and activities (Ewing et al., 2002), and single words or phrases about a narrow topic (Kostinas, Scandlen, & Luiselli, 2001). Other studies (e.g., Dixon, Benedict, & Larson, 2001; Wilder, Masuda, O'Connor, & Baham, 2001) have described target behaviors similar to one or more of the above examples, but termed them something else (e.g., inappropriate verbal behavior, bizarre vocalizations).

Like vocal stereotypy, echolalia, and verbal perseveration, perseverative conversation involves repetitive speech. However, unlike these other terms, it involves more extensive speech than single words or simple phrases. Individuals with Asperger’s disorder who engage in perseverative conversation commonly engage in long-winded monologues (Ghaziuddin & Gerstein, 1996) composed of grammatically correct sentences, that are usually logical and articulate, but with obscure words rather than simple vocabulary. Although perseverative conversation tends to involve highly factual, detailed, concrete statements, it generally does not parrot speech from others. Finally, even though perseverative conversation possesses similar features to the stuck-in-set subtype of verbal perseveration, as well as some descriptions of perseverative verbalization in the behavioral literature (e.g., Kostinas, Scandlen, & Luiselli, 2001), it usually involves more spontaneous and somewhat novel verbalizations surrounding a particularly favored topic.

Problems Emanating from Perseverative Conversation

Circumscribed interests and perseverative conversation may have some positive effects for persons with Asperger's disorder. Asperger's initial description (1944/1991) included the observation that "a special interest enables them to achieve quite extraordinary levels of performance in a certain area" (p. 45). Winter-Messiers (2007) suggested that fine motor skills could be improved by incorporating the special interests into tasks that require cutting, drawing, writing, building and other fine motor manipulations. She also advocated for the infusion of these interests into the academic arena to motivate students with Asperger's disorder to achieve and encourage their active participation in the classroom. Attwood (1998) identified four ways in which living could be enhanced using circumscribed interests: (a) to increase motivation and learning; (b) to foster employment in the areas of the interests (e.g., an individual highly interested in elevators might be able to design or install elevators as a profession); (c) as a cognitive restructuring component in cognitive-behavioral therapy; and (d) to assist in making friends with others possessing the same interests. In the behavioral literature, a study by Charlop, Kurtz, and Casey (1990) suggested that using perseverative speech as a reinforcer may result in improved on-task behavior and task accuracy, although the population in the study was largely lower-functioning individuals.

Despite the potential benefits of circumscribed interests, perseverative conversation associated with circumscribed interests is ordinarily considered a severe impairment for many children with Asperger's disorder. Although parents and teachers view perseverative conversation regarding circumscribed interests as annoying and disruptive, the individual with Asperger's disorder may be oblivious to the problems that result. Frith (1991) commented that it "may appear excessive, abstruse and sterile to others, but not the Asperger person" (p. 14). Among the most common and potentially devastating problems that emanate from perseverative conversation about circumscribed interests are disruptive behaviors including physical aggression, prevention of and

impairment in social relationships, and prevention and impairment of learning new skills and in productivity at school, home, and work.

Disruptive behaviors ranging from tantrumming (Reese, Richman, Zarcone, & Zarcone, 2003) to violence and criminal acts (Allen et al., 2008; Ghaziuddin, 2002) have been described as consequences resulting from the restriction of perseverative conversation and behavior regarding circumscribed interests. Asperger (1944/1991) observed that his participants were inclined to act out when others interfered with their perseverative thoughts or actions, and more recently, Myles and Southwick (1999) suggested that the obsessive and single-minded pursuits of special interests was one of the greatest causes of behavioral difficulties. Even when discussion turns to those special interests, tantrumming is likely to result if the individual with Asperger's disorder cannot control the discussion and the direction of the conversation (Myles & Simpson, 2003; Myles & Southwick, 1999). Tantam (2003) reported that catastrophic reactions occasionally result when a seemingly innocuous interruption, such as a parent posing an unrelated question, occurs during perseverative conversation. Although modest in quantity, research to date reveals restricted access to perseverative conversation as a significant problem for individuals with Asperger's disorder. For example, in a study using a functional assessment interview with 100 children with autism, Reese et al. (2003) sought to explore the relationship between restriction from perseverative thinking and behavior and disruptive behavior. The results suggested that gaining access to perseverative thinking and behavior and escaping demands while engaged in perseverative thinking and behavior frequently led to disruptive behaviors, including hitting, biting, yelling, and falling to the floor, among others.

Much has been written about the impact social skill deficits have on developing social relationships in children and adolescents with Asperger's disorder (e.g., Church et al., 2000; Ozonoff et al., 2000; Shaked & Yirmiya, 2003). In addition to such deficits, frequent engagement in perseverative conversation severely inhibits social success. The

topics that dominate the perseverative conversations, while sometimes appropriate, have a tendency to be odd, eccentric, or immature for the age of individual with Asperger's disorder (Attwood, 2006; Winter-Messiers, 2007). Such topics and the vast knowledge accumulated can be endearing in the minds of adults (Church et al., 2000), but they often result in teasing and bullying among peers. Although their topics of interest may be uninteresting to others, another reason perseverative conversation interferes with social development is the manner, or conversation style, in which the child with Asperger's disorder discusses his or her interests. Myles and Simpson (2002) described the conversation type as "awkward, inflexible, self-centered" (p. 20) and devoid of social cues, while others (e.g., Church et al., 2000; Frith, 1991; Klin & Volkmar, 1997; Tonge, Brereton, Gray, & Einfeld, 1999) have suggested a domineering, aggressive, in-your-face style of interaction, typical in individuals with Asperger's disorder, is particularly detrimental to making and maintaining friends. Moreover, even though some people with Asperger's disorder merely regurgitate accumulated facts regarding their interests, others attempt to force their interests on others (Perry, 2004) or intensely try to persuade their listeners of a particular point of view regarding their interests while ignoring their opinions (Attwood, 1997). Initially, conversations may begin with a neutral topic, but the conversation may be quickly channeled to the individual with Asperger's disorder's area of interest (Kereshian et al., 1990), while failing to relinquish control of the conversation or allow for turn-taking (Ramberg et al., 1996). Thus, children and adolescents with Asperger's disorder regularly gravitate to younger children who tend to be more tolerant (Perry, 2004). Even when there are common special interests between an AS individual and a peer, the inability of the AS individual to appropriately regulate the length of the conversation leaves the peer bored and/or annoyed. Such conversations involve pedantic commentary on the minutest details, ultimately overwhelming their listeners (Tager-Flusberg & Anderson, 1994; Volkmar & Klin, 2000). In a study of 40 children and adolescents with Asperger's disorder, Church et al., (2000) found that in

addition to the lengthy perseveration on a specific interest it was the repetition day after day of the same material that put off others. When involved in perseverative conversation most individuals with Asperger's disorder are oblivious to the listener's interests and affective state (Colle, Baron-Cohen, Wheelwright, & van der Lely, 2008). Myles and Southwick (1999) offered this summary of how perseverative conversation leads to difficulties in social interaction and making friends:

To many persons with Asperger's Syndrome, conversation exists primarily as a means of talking about a topic that is fascinating to them, regardless of audience input or interest. Without the ability to monitor others' thoughts or value the input of others, extensive monologues on a restricted topic often occur. They do not understand that when a person rolls her eyes, crosses her arms, or backs away she is signaling a lack of interest in what is being said. (p. 15).

The Study of Behavior via the Analysis of Function

Human behavior can be studied from one of two perspectives. Using a structural perspective, behavior is studied in terms of its form. That is, studies of behavioral structure are concerned with what a behavior looks like or its topographical qualities. This type of study uses behavior to draw inferences about hypothetical internal cognitive abilities and states (Pierce & Cheney, 2004). A functional perspective, however, is more concerned with the environmental events that set the occasion and maintain a response. Thus, when two individuals display the same behavioral topography (e.g., hand biting), a structural study may see topographically indistinguishable behavior, but a functional study may perceive them as entirely different if they serve different purposes (e.g., one is emitted to gain attention, but the other is emitted to escape a work task). Applied behavior analysis focuses on the functional perspective.

Assessment and Treatment of Aberrant Behavior

Using a Functional Perspective

Within behavior analytic research, a continuum from basic to applied studies exists (e.g., Fisher & Mazur, 1997; Hake, 1982; Wacker, 1996). At the far ends of the

continuum are two types of research, basic and applied, which are connected via bridge studies. Although basic and applied studies both take a functional approach to the study of behavior, among the differences that divide these ends of the continuum is applied research's focus on the examination and application of variables that improve a specific behavior being studied (Baer, Wolf, & Risley, 1968). Thus, applied research is often focused on the assessment and treatment of skill acquisition and the assessment and treatment of aberrant or problem behaviors.

Behavior analytic research on aberrant behavior (e.g., physical aggression, self-injury, destruction) has placed the greatest focus on the identification of the operant function of the behavior in an attempt to match it with an appropriate treatment. Early studies provided hypotheses for such behaviors, but without the benefit of experimental operant methodology to test the functional relationship between the environment and problem behavior. Consequently, treatments were often unsuccessful due to a mismatch of behavior function and treatment selection, and those that were deemed successful attributed the favorable outcomes to powerful reinforcers and punishers that were likely to work regardless of their match to the function of the aberrant behavior being treated (Mace, 1994). Punishment-based techniques, such as overcorrection, time-out, response-cost, and contingent stimulation were a popular choice for problem behaviors until recent history (Pelios et al., 1999). Although punishment-based procedures for treatment and elimination of aberrant behavior have been found to be superior with regards to short-term efficacy when compared to reinforcement-based procedures (National Institutes of Health, 1989), increased attention to legal and ethical considerations of such intrusive procedures, as well as concerns over negative long-term outcomes have led to a decrease in punishment-based treatments and a subsequent increase in reinforcement-based treatments (Matson & Taras, 1989; Pelios et al., 1999).

Reinforcement-Based Treatments

The increased focus on reinforcement-based treatments for decreasing aberrant behavior has been evident in the literature (Northup, Vollmer, & Serrett, 1993; Pelios et al., 1999). Among the most common treatments are interventions based on differential reinforcement (Alberto & Troutman, 2006). Studies of differential reinforcement have demonstrated success in decreasing problem behavior by differentially reinforcing low rates of problem behavior (DRL; Deitz & Repp, 1973; Lennox, Miltenberger, & Donnelly, 1987; Wright & Vollmer, 2002), other behaviors (DRO; Deitz & Repp, 1983; Haring & Kennedy, 1990; Lindberg, Iwata, Kahng, & DeLeon, 1999; Ringdahl, Vollmer, Marcus & Roane, 1997; Vollmer & Iwata, 1992), more appropriate or alternative behaviors (DRA; Allen & Stokes, 1987; Durand, Crimmins, Caufield, & Taylor, 1989; Stokes & Kennedy, 1980), incompatible behaviors (DRI; Ayllon & Roberts, 1974; Friman, 1990; Lewis & Sugai, 1996; Symons, McDonald, & Wehby, 1998), and communication (DRC; Carr & Durand, 1985; Durand & Carr, 1987; Durrand & Carr, 1991).

Developing Hypotheses of Aberrant Behavior

The hypotheses commonly employed in research on aberrant behavior were first categorized by Carr (1977) and Johnson and Baumeister (1978). Carr, in a review on studies of self-injurious behavior (SIB), described SIB as a learned operant with hypotheses of function typified into three categories. First, it could be maintained by positive social reinforcement, such as access to attention or other socially-mediated stimuli (e.g., toys, activities). Second, SIB could be maintained by negative reinforcement. In this case, the escape or avoidance of an aversive stimulus, such as work tasks, increased the likelihood of future self-injury. Third, it could be maintained by self-stimulation. That is, SIB provides needed sensory stimulation for individuals who experience a deficit in areas such as tactile, vestibular, and kinesthetic modalities of sensory stimulation.

The Development of Functional Analysis Procedures

Based largely on the reinforcement categories described by Carr (1977), Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) developed a comprehensive experimental procedure for precise identification of variables that maintain problem behavior. Iwata and colleagues incorporated three distinct test conditions and a control condition in a multielement design aimed at identifying the response-reinforcer relationships of self-injurious behavior in nine individuals with a developmental disability. The test conditions included an examination of the effects of social disapproval (i.e., attention via verbal reprimand), escape from academic demands, and the absence of attention and play materials on SIB. The control condition involved noncontingent access to attention and tangible items. This procedure successfully demonstrated differentiation of function both within individuals and across the participants. The development of this procedure by Iwata et al. offered a significant advantage over previous assessment methodologies (e.g., the A-B-C assessment described by Bijou, Peterson, & Ault, 1968). It allowed for the systematic manipulation of environmental variables leading to causal, rather than correlational inferences. Thus, treatments could be matched to empirically derived functions of the target behavior. Research has demonstrated that considerable differences in treatment selection and results emanating from behavioral assessments are likely when no experimental manipulation of variables is made (Hall, 2005; Lerman & Iwata, 1993; Mace & Lalli, 1991; Piazza et al., 2003; St. Peter et al., 2005, Thompson & Iwata, 2007), substantiating the importance of identifying the response-reinforcer relationship in treating problem behaviors. Moreover, such treatments are reinforcement-based, resulting in the exclusion of less acceptable, punishment-based techniques (Neef & Iwata, 1994). In fact, in a review of treatment studies for SIB and aggression, Pelios et al. (1999) found that selection of reinforcer-based treatments has sky-rocketed since the introduction of Iwata et al.'s (1982/1994) functional analysis methodology, while punishment-based treatments have lagged behind.

Innovations and Modifications to Functional Analysis Procedures

Since the seminal study by Iwata et al. (1982/1994) a number of changes have been applied to the functional analysis procedures in order to increase its practicality and to tailor it to a variety of settings and behaviors, while maintaining experimental control. Although the extended multi-element design employed by Iwata et al. still dominates the functional analysis literature (Hanley, Iwata, & McCord, 2003), studies have employed different designs and evaluated different combinations of variables. For example, with antecedent variables, functional analysis procedures have been conducted with varying degrees of attention (e.g., Taylor & Romanczyk), task difficulty (e.g., DePaepe, Shores, Jack, & Denny, 1996), various aversive stimuli (e.g., Smith, Iwata, Goh, & Shore, 1995), toys (e.g., Van Camp et al., 2000), the incorporation of demands, such as academic tasks, into other conditions (e.g., Romaniuk et al., 2002), and conditions with and without choice (e.g., Vaughn & Horner, 1997). In essence, the list of possible antecedent variations is endless, given the idiosyncratic variables shown to evoke problem behavior documented in the literature (Hanley et al., 2003). Other studies have used different degrees of consequence quality or type, such as different sources of attention (e.g., Broussard & Northup, 1997), reprimands versus irrelevant statements (Fisher, Ninness, Piazza, & Owen-DeSchryer, 1996), physical versus verbal attention modes of attention (e.g., Kodak, Northup, & Kelley, 2007), different consequence magnitudes, such as the duration of access to attention and tangibles (e.g., Volkert, Lerman, and Vorndran, 2005), and different consequence schedules involving intermittent, rather than continuous, application of consequences (e.g., Lalli & Casey, 1996).

Some of the aforementioned changes to antecedent and consequence variables have been conducted in the context of what has been called a *brief* functional analysis, as opposed to an extended functional analysis. The brief experimental analysis was originally developed for use in 90 min outpatient clinic evaluations where an extended functional analysis would not be practical (see Wacker, Berg, Harding, & Cooper-Brown,

2004 for a historical reference). The procedure was first described by Cooper, Wacker, Sasso, Reimers, and Donn (1990) using an antecedent-based analysis and later refined by Northup et al. (1991) exploring response-reinforcer relationships. Several differences between the extended and brief versions exist. The brief version involves sessions of reduced length, often between 5 and 10 min each, and it allows for as few as one or two probes of test conditions (Wacker et al., 2004). A procedural distinction between the extended and brief functional analyses is demonstrated in the use of “mini-reversals”, which involves the replication of a test condition in which target behavior occurs, separated by a control condition. Thus, when an increase in the target behavior occurs in a test condition, is followed by a decrease in behavior in a control condition, and again increases in the replication of the test condition, a function has been identified. Multiple studies (e.g., Brown et al., 2000, Kahng & Iwata, 1999; Tincani, Castrogiovanni, & Axlerod, 1999; Wallace & Iwata, 1999) have compared the brief experimental analysis to extended analyses and found it to be a comparable tool in situations where an extended analysis cannot be conducted (e.g., schools, outpatient clinics).

Problem Vocal Behavior Studied from a

Functional Perspective

Studies incorporating functional analysis methodologies have examined the functional relationship of a wide range of problem behaviors. Hanley, Iwata, and McCord (2003) conducted a review of the functional analysis literature through the year 2000 regarding problem behavior and identified a number of topographical categories commonly studied. Among the most common topographical categories were self-injurious behavior, aggression, and disruptive behavior. Among those behaviors less often studied were mouthing (Goh et al., 1995), breath holding (Kern, Mauk, Marder, & Mace, 1995), pica (Piazza, Hanley, & Fisher, 1996), drug ingestion (Chapman, Fisher, Piazza, & Kurtz, 1993), elopement (Piazza, Hanley, Bowman, Ruyter, Lindauer, & Saiontz, 1997), and finger sucking (Ellingson et al., 2000).

Early studies of problem vocal behavior: Treatment without functional analysis methodology. Within the operant literature, one type of problem behavior that has been studied sparsely is problem vocal behavior. As a general topographical category, in the context of this review, problem vocal behavior includes such topographies as bizarre speech, psychotic speech, stuttering, vocal stereotypies, and perseverative speech. Early studies of problem vocal behavior paralleled those of other problem behavior in that they lacked the benefit of functional analysis methodology and consequently focused more on the development of treatments through trial-and-error procedures than on the assessment of reinforcement contingencies maintaining problem behavior. Early applied behavior analysis studies concerned with vocal problem behavior often employed punishment-based procedures alone or in combination with reinforcement-based procedures. For example, in three early studies on a variety of problem vocal behaviors (i.e., loud vocalizations, perseverative speech, and inappropriate verbalizations) participants were successfully treated with a combination of timeout procedures and differential reinforcement (Barton, 1970; Bostow & Bailey, 1969; Reichle, Brubakken, and Tetreault, 1976). Other punishment-based procedures have used a variety of aversive stimuli to decrease problem vocal behavior, including electric shock (Daly & Frick, 1970), window washing (Fischer & Nehs, 1978), and the viewing of video replays of problem verbal behaviors (O'Brien & Raynes, 1973). Even without the aid of functional analysis methodology, other successful treatment procedures have employed extinction (Ayllon & Michael, 1959; Laws, Brown, Epstein, & Hocking, 1971; Liberman, Teigen, Patterson, & Baker, 1973), shaping (Risley & Wolf, 1967), differential reinforcement using tangibles (Ayllon & Haughton, 1964; Patterson & Teigen, 1973), differential reinforcement using attention (Ayllon & Haughton, 1964; Rickard, Dignam, & Horner, 1960; Nydegger, 1972; Varni, Russo, & Cataldo, 1978) habit reversal (Wagaman, Miltenberger, & Arndorfer, 1993), token economies (Ingham & Andrews, 1973; Wincze, Leitenberg, &

Agras, 1972), response cost (Doleys & Slapion, 1975; Kazdin, 1973), and noncontingent reinforcement (Wong, Terranova, Bowen, Zarate, Massell, and Liberman, 1987).

Initial application of functional analysis methodology to problem vocal behavior.

Nearly five years after the introduction of functional analysis methodology by Iwata et al (1982/1994), similar procedures were used for the first time to assess the functional relationship associated with problem vocal behavior. Mace, Webb, Sharkey, Matson, and Rosen (1988) conducted a functional analysis of bizarre speech (i.e., irrelevant statements, statements of a sexual nature, and maladaptive statements) in a 29-year-old woman diagnosed with mild mental retardation and schizophrenia. Among the test conditions in the analysis was a *demand* condition (i.e., stuffing quilts), a *group interaction* condition (using a FR1:FR1 schedule for appropriate and inappropriate speech), and a *one-to-one interaction* condition that involved differential reinforcement (i.e., attention) of alternative behavior (i.e., appropriate verbalizations). Results of the analysis suggested that bizarre vocalizations were maintained via escape from demands and attention. A treatment consisting of differential reinforcement of alternative behavior and guided compliance for work tasks was successful in decreasing bizarre vocalizations.

In a subsequent study on the maintaining variables of problem vocal behavior, Mace and Lalli (1991) used four analogue conditions to test hypotheses developed during descriptive analyses regarding a 46-year old man's delusional and hallucinatory speech. Descriptive analyses provided escape and attention hypotheses, which were tested in an experimental analysis. The results indicated that attention was the only maintaining consequence and treatments using noncontingent attention and teaching the appropriate recruitment of attention were successful in decreasing vocal problem behavior to near zero levels. In addition to adding to the operant research literature on problem vocal behavior, this study showed the usefulness of descriptive analyses in the design of functional analysis methodology and demonstrated the successful application of functional analysis results to multiple treatment approaches. Despite this study's results,

Mace and Lalli lamented that in the face of functional analysis methodology, little research on the reinforcing variables of problem vocal behavior had been conducted.

Extending the functional analysis literature on vocal problem behavior: Problem vocal behavior topographies. Fewer than fifteen -studies using functional analysis methodology to examine the response-reinforcer relationship for problem vocal behavior have been conducted in the 20 years since the initial study by Mace et al. (1988); however, within this select literature a number of extensions to the literature have occurred. One extension is the expansion of functional analysis to other topographies of problem vocal behavior. Although bizarre or psychotic speech has been the primary topography studied from a functional perspective (DeLeon, Arnold, Rodriguez-Catter, & Uy, 2003; Ewing et al., 2002; Dixon et al., 2001, Lancaster et al., 2004; Wilder et al., 2001; Wilder, White, & Yu, 2003), the use of functional analysis methodology has also been applied to general inappropriate vocalizations (Falcomata et al., 2004; Pace, Ivancic, & Jeferson, 1994), sexually inappropriate remarks (Dixon et al., 2001), disruptive vocalizations (i.e., loud statements; Buchanan & Fisher, 2002), verbal noncompliance (Peyton, Lindauer, & Richman, 2005), perseverative speech (Ewing et al., 2002; Frea & Hughes, 1997; Rehfeldt & Chambers, 2003; Ross, 2002), and vocal stereotypy (Ahearn et al., 2007; Athens, Vollmer, Sloman, & St. Peter Pipkin, 2008; Carr & Britton, 1999; Taylor et al., 2005). Many of the studies included one or more topography of problem vocal behavior. In one study (Dixon et al., 2004), the problem vocal behaviors of four participants included utterances that were depressive, aggressive, suicidal, profane, and/or sexually inappropriate. Thus, multiple studies have identified various vocal topographies besides bizarre and psychotic speech as serving an operant function. Given that problem verbal responses are included in the criteria for a number of mental health disorders (e.g., autism, schizophrenia, speech disorders; APA, 2000), the expansion into various topographies is a welcome progression.

Populations studied. Another extension of research has occurred with regard to the populations studied. Many clinical populations have been represented in recent functional analysis studies of problem verbal behavior. The vast majority of these studies have been on individuals with development disabilities, including autism (Ahearn et al., 2007; Athens et al., 2008; Ewing et al., 2002; Falcomata et al., 2004; Peyton et al., 2005; Ross, 2002; Taylor et al., 2005), Down syndrome (Athens et al., 2008), and mental retardation (Carr & Britton, 1999; DeLeon et al., 2003; Dixon et al., 2001; Frea & Hughes, 1997; Kostinas et al., 2001). However, other populations involving such diagnoses as Asperger's disorder (Rehfeldt & Chambers, 2003), schizophrenia (Wilder et al., 2001; Wilder et al., 2003), dementia and/or Alzheimer's disease (Buchanan & Fisher, 2002) and brain-injury (Dixon, et al., 2004; Pace et al., 1994) have been published. Only one study (i.e., Ewing et al., 2002) included a typically developing individual as a participant. Ewing and colleagues included two individuals who were distinct from each other (i.e., Danny was a 13-year old academic honors student and Alice was a 15-year old with moderate mental retardation and autism), but who each displayed problem behaviors maintained by the same operant functions.

Functions identified via functional analysis methods. In all published studies on problem vocal behavior using functional analysis methodology one or more operant functions have been successfully identified. In concordance with the early studies by Mace and colleagues (1988, 1991), most of the studies reviewed have identified access to attention as a function for one or more study participants (Athens et al., 2008; Buchanan & Fisher, 2002; Carr & Britton, 1999; DeLeon et al., 2003; Dixon et al., 2001; Dixon et al., 2004; Ewing et al., 2002; Frea & Hughes, 1997; Lancaster et al., 2004; Rehfeldt & Chambers, 2003; Ross, 2002; Wilder et al., 2001; Wilder et al., 2003). DeLeon et al. further explored the relationship of different types of attention to bizarre speech, finding that attention involving statements about the bizarre speech exhibited by the subject was more reinforcing than attention involving statements unrelated to the bizarre speech.

Other studies have implicated a wide range of functions, including negative reinforcement (i.e., escape from demands; Dixon et al., 2004; Pace et al., 1993; Peyton et al., 2005), access to tangible items (i.e., food; Ewing et al., 2002); and nonsocial functions (i.e., automatic reinforcement; Ahearn et al., 2007; Athens et al., 2008; Buchanan & Fisher, 2002; Falcomata et al., 2004; Lancaster et al., 2004; Taylor et al., 2005). The hypothesized reinforcing property or properties of those deemed to be automatically reinforced was often a component of the auditory stimulation produced by the vocal behavior (e.g., the volume, physical sensation of noise vibration). In fact, Taylor et al. (2005) found the rate of vocal stereotypy in a 6-year old girl with autism to be correlated with the auditory stimulation provided by toys, such that the less noise produced by the toy the more vocal stereotypy and vice-versa. Based upon the majority of these findings pointing to attention as an operant function, it should not be a surprise that many of the pre-functional analysis studies on problem vocal behavior found success with treatment selections directed at attention (i.e., extinction via ignoring, differential reinforcement using attention, and noncontingent attention).

Treatments based on functional analysis results. Three general categories of treatment, antecedent-based, consequence-based, and combined treatments (i.e., those involving both antecedent-based and consequence-based components) have been shown to be effective in decreasing problem vocal behavior and, in some cases, increasing appropriate verbalizations. Among those studies incorporating a consequence-based treatment, the most common treatment implemented involved the combination of differential reinforcement and extinction. Dixon et al. (2001), Dixon et al. (2004), Frea and Hughes (1997), Rehfeldt and Chambers, (2003), and Wilder et al. (2001), all used DRA procedures for appropriate vocal behavior and extinction for inappropriate vocal behavior, based on the identified function (i.e., attention or escape). DeLeon et al. (2003) also used DRA procedures, but incorporated verbal redirection to more appropriate topics when bizarre speech occurred, and Wilder et al. (2003) used a combination treatment

approach that involved DRA and extinction, as well as a simplified habit reversal procedure (i.e., awareness training and competing response training) to successfully decrease bizarre vocalizations. Taylor et al. (2005) showed that DRO (i.e. access to auditory toys for the absence of vocal stereotypy for up to 5 minutes) could be an effective treatment for automatically reinforced vocal stereotypy.

The majority of antecedent-based treatments have involved noncontingent reinforcement (NCR). Three of those studies (Buchanan & Fisher, 2002; Carr & Britton, 1999; Lancaster et al., 2004) successfully reduced problem behavior with NCR (i.e., attention and/or access to music). Falcomata et al. (2004) and Athens et al. (2008) added a response cost component to NCR to treat automatically-reinforced vocal problem behavior. In two studies of escape-maintained vocal problem behavior (Pace et al., 1994; Peyton et al., 2005), treatments involved the manipulation of demands in order to decrease the target behavior. More specifically, Pace et al. used a demand fading procedure to increase compliance and decrease obscene language, while Peyton et al. demonstrated that nondirective prompts were effective in reducing vocal noncompliance to near zero levels. Ross (2002) incorporated functional communication training (FCT) and a response-cost procedure to substantially diminish the perseverative utterances of three children with autism. Ahearn et al. (2007) were able to use response interruption and redirection (RIRD) to reduce vocal stereotypy by effectively “blocking” the behavior by neutrally asking questions during the occurrence of the stereotypy. RIRD, like other forms of response blocking, may be considered an aversive event and could be categorized as a punishment procedure (Lerman & Iwata, 1996). Thus, if RIRD is considered a punishment-based procedure, out of the existing studies on vocal problem behavior using functional analysis methods, only four (Ahearn et al; Athens et al., 2008; Falcomata et al., 2004; Ross, 2002) employed punishment-based treatments and none used punishment alone.

Studies exploring the antecedent relationships of problem vocal behavior.

Examinations of the antecedents of problem vocal behavior have been studied using methods similar to those described by Carr and Durand (1985). Durand and Crimmins (1987) evaluated psychotic speech (i.e., nonsensical and irrelevant statements) in a 9-year-old boy with autism. Three experiments were conducted in this study, involving antecedent manipulations, consequence manipulation, and treatment, across the three experiments, respectively. In the first experiment an antecedent analysis was conducted using demand test conditions varying in terms of task difficulty and a diverted attention condition. The results of this analysis indicated that tasks of greater difficulty resulted in a higher degree of psychotic speech, while the application of diverted attention did not result in responding differentiated from baseline conditions. In the second experiment a manipulation of the consequences for psychotic speech (i.e., time-out) during work tasks resulted in increased problem vocal behavior, further implicating the role of escape in maintaining psychotic speech. Finally, Durand and Crimmins taught the participant a more appropriate communicative alternative (i.e., "Help me") to replace the psychotic speech in order to receive a break from work. Using a reversal design, a dramatic decrease in psychotic speech occurred when a functionally equivalent vocal response was available.

Few other studies have attempted to explore the antecedent-response relationship of problem vocal behavior. Taylor et al. (2005) followed a functional analysis that identified an automatic function for vocal stereotypy with an antecedent analysis that tested the relationship of problem vocal behavior with the presence of auditory and non-auditory toys. The antecedent analysis demonstrated a clear increase in vocal stereotypy in the presence of non-auditory toys. Peyton et al. (2005) manipulated types of demands while holding all other variables constant in order to identify the demand context under which noncompliant vocal behavior was most likely to occur. The results suggested that

noncompliant vocal behavior was more likely to occur when task prompts were nondirective than when they were directive.

Concurrent Operants as an Assessment Tool

Functional analysis methodology has proven to be a popular means for accurate identification of operant functions of problem behavior (Hanley et al., 2003). However, research suggests that functional analyses sometimes fail to identify a clear function (e.g., Derby et al., 1992; Vollmer, Marcus, Ringdahl, & Roane, 1995). In such cases, other assessment procedures may be utilized. Concurrent operants arrangements have been used as an assessment tool for the identification of operant functions in cases in which the results of a functional analysis were unclear (e.g., Fisher et al., 1994; Piazza, Fisher, Hanley, Remick, Contrucci, & Aitken, 1997). As an assessment of operant function, concurrent operants arrangements are constructed so that two or more forms of reinforcement (e.g., parent attention, access to toys, escape from work) are in direct competition with response allocation occurring according to an individual's value for the available types of reinforcement (Fisher & Mazur, 1997). Concurrent operants arrangements have also been used in cases in which the operant function maintaining a particular problem behavior is already known in order to better understand the relative preference for alternative reinforcers and reinforcer dimensions.

Choice and Concurrent Operants Arrangements

Within the behavior analytic literature, choice pertains to the allocation of operant behavior among alternative sources or dimensions of reinforcement (Pierce & Cheney, 2004). It is governed by the relativistic properties of response alternatives. Thus, by pairing alternatives together and allowing allocation of time and behavior between the alternatives, also known as a concurrent schedules arrangement, relative preference can be determined. As has been discussed by Fisher and Mazur (1997) in a review on choice responding, this method has been extensively studied in both basic and applied research.

Additionally, choice has been applied to behavior analytic assessment and treatment studies.

Fisher and Mazur (1997) identified two benefits to using concurrent operants arrangements. First, concurrent operants assessments yield information on how a three-term contingency (i.e., antecedent-behavior-consequence) for one response affects the probability of another, concurrently available, response. This more approximates the natural environment in which people typically have multiple response options. Second, concurrent operants arrangements allow for two options to be available at one time, providing a good measure of relative preference, whereas single operant formats (e.g., functional analysis methods) provide options only at different points in time.

Assessing Reinforcer Quality Using

Concurrent Operants Arrangements

Use of concurrent operants assessments to determine the quality of reinforcers relative to other, concurrently available reinforcers has been well documented in the literature. Whereas some assessments have looked at various forms of reinforcers (e.g., caregiver preference; Rapp, 2005) most assessments of reinforcer quality have involved the use of tangible items (e.g., toys, edibles, money). In one of the earlier studies using a concurrent operants paradigm, Fisher et al. (1992), noting the difficulty in identifying reinforcers for individuals with severe and profound mental retardation, compared a forced-choice assessment (i.e., two choices are offered concurrently, with the first one approached suggesting relative preference over the alternative) with a free-operant preference assessment (i.e., preference was denoted by which stimuli were approached by the participant). The results suggested that the forced-choice method provided greater differentiation among the available stimuli. Other studies (e.g., DeLeon & Iwata, 1996; Roane, Vollmer, Ringdahl, & Marcus, 1998) have compared the forced-choice method with other preference assessment methods (e.g., multiple stimulus without replacement,

free operant) and generally found support for its accuracy in identifying powerful reinforcers.

Concurrent operants assessments have been used to compare preference for different categories of reinforcement (i.e., social attention, tangibles, escape from demands). For instance, one component of a study by Harding, Wacker, Berg, Barretto, and Rankin (2002) compared allocation of time between concurrently available parental attention and preferred toys in children with severe behavior problems. The results suggested that toys were more highly preferred than parental attention. In another study by Harding and colleagues (1999) the preference for positive and negative reinforcement was compared in a concurrent operants assessment with two preschool-aged children with severe problem behaviors. The participants allocated responding towards parental attention when no demands were presented; however, when parental attention options incorporated demands, the children's allocation was differentiated based upon the presence or absence of preferred toys. Falcomata et al. (2004) conducted a choice study with an 18-year old male with autism. The subject was allowed to allocate time between a room with a radio and a room where he was allowed to sing. The individual chose the "radio room" on three consecutive choice presentations.

Assessing Dimensions of Reinforcement

Using Concurrent Operants Arrangements

Besides reinforcer quality, concurrent schedules have incorporated several dimensions of reinforcement in stand-alone comparisons (e.g., high reinforcer magnitude versus low reinforcer magnitude) as well as combinatorial comparisons (e.g., high magnitude and short duration versus low magnitude and long duration). Among the dimensions that have been assessed more extensively are reinforcer rate, delay to reinforcement, response effort, and reinforcer magnitude (i.e., quantity, duration, or intensity).

Studies on reinforcer rate in concurrent operants assessment formats often involve other dimensions of reinforcement. For example, Neef, Shade, and Miller (1994) conducted a study that evaluated reinforcer rate in combination with reinforcer quality, delay to access of reinforcement, and response effort. Bowman, Piazza, Fisher, Hagopian, and Kogan (1997) used a concurrent operants assessment to evaluate reinforcer rate with a range of preferred stimuli with seven children who displayed destructive behavior. Constant access to one high-preferred reinforcer was matched with a cycle of presentations of various less-preferred reinforcers. Over half of the participants showed a preference for the varied presentation conditions.

Concurrent operants assessments have provided researchers with a method to assess impulsivity via delays in reinforcement. These studies often paired delayed access to larger reinforcers with immediate access to smaller reinforcers, with more impulsive individuals often choosing the latter option. For example, Neef, Mace, and Shade (1993) conducted a concurrent operants assessment with two teen girls and allowed them to earn nickels for completion of math problems. When the delays to reinforcement were equal in both conditions, both girls allocated time proportionate to the schedules of reinforcement inherent in the choices (i.e., they chose the condition that would result in more nickels). When the delay to reinforcement was unequal between the choice conditions, both girls allocated more time to the more immediate reinforcement, suggesting impulsive responding. A second experiment in this study incorporated reinforcer quality to determine the possibility of an interaction effect. One participant showed a preference for quality and chose the condition with the higher preferred reinforcer, even when it meant a delay to access that reinforcer; however, the other participant continued to allocate more time to the more immediate reinforcer, regardless of reinforcer quality.

Reinforcer magnitude encapsulates the quantity, intensity, or duration of a reinforcer (Hoch, McComas, Johnson, Faranda, & Guenther, 2002). There have been

many basic studies on reinforcer magnitude in concurrent operants arrangements (e.g., Reed, 1991). Several applied studies have also assessed reinforcer magnitude in concurrent operants arrangements, but they are primarily treatment studies (e.g., Vollmer, Borrero, Lalli, & Daniel, 1999). An exception is a study conducted by Trosclair-Lasserre, Lerman, Call, Addison, and Kodak (2008). In this study reinforcer duration (i.e., length of presentation of toys and/or attention that had previously served to maintain problem behavior) was assessed with four young children exhibiting problem behaviors. Results suggested that clear differences in preference for magnitude existed, with all but one child choosing the greater reinforcer magnitude.

Response effort is another variable that has been integrated into the concurrent schedules arrangement. In a study similar to the one conducted by Neef et al. (1993) using math problems, Mace, Neef, Shade, and Mauro (1996) manipulated the difficulty of math problems, the schedule of reinforcement, and the quality of reinforcers to assess choice using the same participants as their 1993 study. The results suggested that the participants were more likely to choose the easier math problems, even when it involved a leaner schedule of reinforcement than the difficult problems. Quality of reinforcer provided an additive effect to this pairing and swayed choice allocation when stacked against a dense schedule with more difficult problems.

The Current Study

The Basis for the Current Study

The literature reviewed to this point has explored two broad strands of research. The first strand delved into the research on individuals diagnosed with Asperger's disorder and the second strand examined the analysis of problem behavior from a functional perspective. Each strand established the basis for the current study.

Research on Asperger's Disorder

The research literature has made it clear that Asperger's disorder is a complex disorder marked by social, communicative, and behavioral deficits. However, there are

several criticisms aimed at the literature on Asperger's disorder. For example, much of what is written about Asperger's has been generalized from research on individuals with autism. This is risky given research findings that have suggested that these two disorders are related, but equivocal (e.g., Eisenmajer et al., 1996; Howlin, 2003; Scituito & Cantwell, 2005). Too frequently the studies are anecdotal (Attwood, 1998) and there is a need for experimental research pertaining to individuals with Asperger's disorder.

Among the experimental research on Asperger's disorder, few of the many problem behaviors demonstrated by individuals with Asperger's disorder have been studied from an applied behavior analysis perspective. In fact, in the *Journal of Applied Behavior Analysis* (JABA), fewer than five such studies were located. Despite the shortage of behavioral studies with individuals with Asperger's disorder, those that have been conducted demonstrate the success of behavior analytic assessment and treatment strategies with this population. For example, Delano (2007) implemented a multi-component video modeling intervention to help improve written language skills, a common deficit for individuals with Asperger's disorder, in three teens with Asperger's disorder. Slow responding, another common problem of this disorder, was successfully treated in a teen with Asperger's disorder by Tiger, Bouxsein, and Fisher (2007) using differential reinforcement procedures. Those same authors assessed compliance to specific versus general instructions in an older teen with Asperger's disorder, finding that specific instructions occasioned higher levels of compliance (Bouxsein, Tiger, & Fisher, 2008). Ducharme, Sanjuan, and Drain (2007) also addressed noncompliance in three young children with Asperger's disorder using compliance training to successfully increase compliance to tasks that previously resulted in noncompliance.

Although considered a hallmark characteristic of the disorder, research on the perseverative speech regarding circumscribed interests in individuals with Asperger's disorder is severely lacking (South et al., 2005; Winters-Messiers et al., 2007). This is surprising given the fact that as many as 95% of individuals with Asperger's disorder

have circumscribed interests (e.g., Kerbeshian et al., 1990) and nearly 80% of children and adolescents with Asperger's disorder engage in repetitive speech about a narrow topic of interest (South, Ozonoff & McMahon, 2005). Episodes of violence, social difficulties, and poor productivity and learning are all negative repercussions emanating from this behavior. Given the prevalence of perseverative speech and its subsequent disruption more research seems warranted.

*Research on Problem Vocal Behavior from
a Functional Perspective*

The ability to identify the environmental determinants of behavior through experimental analysis procedures, such as those first described by Iwata et al. (1982/1994) and Carr and Durand (1985), has been one of the most significant advancements in the field of applied behavior analysis (Iwata & Worsdell, 2005). This technological development has been particularly important to the assessment and treatment of aberrant behavior (Mace, Lalli, & Lalli, 1991), leading to a decrease in punishment-based treatments (Pelios et al., 1999). Experimental analysis procedures have rarely been applied to vocal problem behaviors; however, when they have been utilized they have led to the development of successful, reinforcement-based treatments for a wide range of vocal problem behaviors (e.g., DeLeon et al., 2003; Dixon et al., 2001).

Perseverative speech is a distinct topography of vocal problem behavior that has been studied minimally from a functional perspective (Ewing et al., 2002; Frea & Hughes, 1997; Rehfeldt & Chambers, 2003; Ross, 2002). Although operational definitions of perseverative speech have differed slightly among the studies, they all shared the same functional operant, as identified via functional analyses. In every one of these studies attention was the sole social reinforcer. This resulted in successful reinforcement-based treatments, most commonly differential reinforcement of alternative responses and extinction of perseverative speech (Frea & Hughes, 1997; Rehfeldt &

Chambers, 2003). Even studies prior to functional analysis methodology and those not employing functional analysis methodology utilized treatments aimed at restricting attention contingent upon perseverative behavior (e.g., Facon, Beghin, & Riviere, 2007; Kostinas et al., 2004; Reichle et al., 1976). Thus, research has established attention as the most likely reinforcer in perseverative vocal behavior.

Blending the Research

Within the research on Asperger's disorder perseverative conversation is a problem behavior that has been well described. Additionally, there has been much written, albeit largely anecdotal, on the problems perseverative speech can cause. Applied behavior analysis literature has contributed to the understanding of perseverative speech by suggesting that in many individuals perseverative speech is maintained by attention, which has resulted in successful reinforcement-based treatments. Yet, virtually no research has satisfactorily answered the question of why perseverative speech occurs in the manner that has been described within the Asperger's disorder literature (i.e., spontaneous, dominant, long-winded monologues related to circumscribed interests, that are usually logical and articulate, but with obscure words rather than simple vocabulary). Moreover, studies on perseverative speech have been restricted to individuals with autism (e.g., Rehfeldt & Chambers, 2003) and/or mental retardation (Ewing et al., 2002), failing to focus on individuals with Asperger's disorder. Even if it can be assumed that the perseverative speech exhibited by individuals with Asperger's disorder is maintained by social positive reinforcement (i.e., attention) there are still unanswered questions about the reinforcing properties of this behavior.

Researchers have suggested that perseverative speech revolves around circumscribed interests (e.g., Wing, 1981); however, there is no experimental research to confirm that individuals with Asperger's disorder are any more likely to choose to discuss a specific topic of interest over other topics. Literature on this disorder has also indicated that the perseverative speech of individuals with Asperger's disorder is usually

long-winded (e.g., Kerbeshian et al., 1990); however, no studies have examined individual preference for conversation duration. Finally, most descriptions of individuals with Asperger's disorder have portrayed them as domineering (Myles & Simpson, 2003), ignoring the comments of others and resulting in problem behavior when interrupted; however, no experimental studies have shown an individual preference for controlling a conversation. Thus, additional research is needed to further our understanding of the reinforcing value of several components of perseverative speech in individuals with Asperger's disorder.

As an assessment tool, concurrent operants arrangements can be helpful in establishing individual preferences for various reinforcer dimensions (Fisher & Mazur, 1997). Research has shown that concurrent operants arrangements can successfully identify individual preference with regards to reinforcer quality (e.g., Falcomata et al., 2004) and reinforcer magnitude (e.g., Trosclair-Lasserre et al., 2008). In the case of perseverative conversation, such an approach may be successful in further evaluating the relative preference of conversation content and style, two forms of reinforcer quality, as well as conversation length, which is a form of reinforcer magnitude.

A Proposed Study

In order to better understand perseverative conversation in individuals with Asperger's disorder, the proposed study will evaluate three distinct dimensions of reinforcement associated with this problem vocal behavior: conversation content (i.e. reinforcer quality), conversation style (i.e., reinforcer quality), and conversation duration (i.e., reinforcer magnitude). Based upon the success of previous research in evaluating reinforcement dimensions, a concurrent operants arrangement will be used.

This study represents the first attempt to better understand the reinforcing aspects of perseverative conversation in individuals with Asperger's disorder from a behavioral perspective. Additionally, this study is the first to study the reinforcing properties of problem vocal behavior using a concurrent operants arrangement.

Hypotheses

Research on perseverative conversation in individuals with Asperger's disorder resulted in the following hypotheses for this study:

1. Given a choice between sitting alone or talking about a preferred topic with another person, children and adolescents with Asperger's disorder will choose to talk about a preferred topic with another person.
2. Given a choice between talking about a circumscribed interest and talking about a neutral topic, children and adolescents with Asperger's disorder will choose to converse on the topic associated with their circumscribed interest(s).
3. Given a choice between taking a dominate position in a conversation (i.e., actively talking or teaching someone else about a topic) about a preferred topic and taking a subordinate position in a conversation (i.e., passively listening to someone else talk) about a preferred topic, children and adolescents with Asperger's disorder will choose to hold the dominate position in the conversation.
4. Given a choice between talking about a preferred topic for a short duration and talking about a preferred topic of a longer duration, children and adolescents with Asperger's disorder will choose to engage in conversation for a longer duration of time.
5. In an examination of the competition of the content, style, and duration of perseverative conversation, children and adolescents will demonstrate a relative preference for a specific dimension of reinforcement.

Conclusion

Perseverative conversation in individuals with Asperger's disorder represents an interesting paradox. Despite the problems that result from the rigid manner in which these individuals converse about their circumscribed interests, this problem vocal behavior is prevalent in the Asperger's population and it occurs frequently. Thus, there is something highly reinforcing about this problem behavior that we do not fully

understand. Just as the goal of applied research is to improve the human condition, this attempt to better understand the perseverative conversation has the ultimate goal of improving the lives individuals with Asperger's disorder through the development of treatments to assist in increasing conversational flexibility.

CHAPTER III

METHODOLOGY

Setting

This study was conducted in the Pediatric Behavior Outpatient Clinics at the University of Iowa Hospital and Clinics. These clinics are tertiary-level outpatient clinics that serve children and adolescents with a wide range of behavior concerns. The specific clinics used for this study were the Pediatric Autism Clinic, the Behavioral Pediatrics Clinic (BPC), the Pediatric Neurobehavioral Clinic (NBC), and the Pediatric Psychology Clinic. All clinics were staffed by a Ph.D.-level behavioral psychologist and graduate-level practicum students in psychology and special education.

Therapy Rooms and Materials

All study procedures were conducted in the therapy rooms located in the behavioral suite that serves the clinics. Each therapy room consisted of a table, chairs, and a foam mat for play activities. The rooms were equipped with a ceiling-mounted video camera and microphone for observation on closed-circuit television in an adjacent room. Prior to each assessment, a strip of blue painter's tape was placed across the floor and across the middle of the table dividing the room in equal halves. During the initial phase of the assessment, 76 mm by 120 mm index cards with writing or a picture were present in the room, while age-appropriate toys and activities were placed on the mat in the room for all phases.

Participants

The participants were 5 children and adolescents who were referred to one of the behavioral clinics due to behavioral concerns. See Table 1 for a description of each participant. Participation in the current study commenced at the initial visit or a return visit for each participant. Each participant met all of the following inclusion criteria:

1. The participant was a child or adolescent between the ages of 5 years, 0 months and 17 years, 11 months at the time of participation.

2. The participant was diagnosed with Asperger's disorder by a medical professional (e.g., pediatrician, pediatric neurologist, child psychiatrist), licensed psychologist, or other qualified professional trained in the diagnosis of autism spectrum disorders.

3. The participant had one or more circumscribed interest that was discussed in a perseverative manner, resulting in impaired functioning in one or more area of daily living (e.g., social development, academic learning) by parent report.

Andrew was an 8 years, 1 month old boy in the 2nd grade who was also diagnosed with obsessive compulsive disorder (OCD). Andrew was initially referred to the Neurobehavioral Clinic due to “obsessions” with clocks, elevators, butterflies, helicopters, and bugs. His parents reported that he talked about these topics 15 to 20 times each day for up to 1 hour and 30 minutes if not interrupted. Andrew would become upset if his perseverative conversation was interrupted and he would then interrupt the individual who interrupted him. The “obsessions” had caused problems in multiple areas of functioning. Andrew was “rejected” by peers and would seek out adults to talk about his interests. The perseverative conversation also disrupted his work production at school as he frequently got off topic and was hard to redirect. Pharmacological and behavioral treatments had been tried with little success in decreasing the problem behavior.

Clint was 11 years, 5 months old and in 5th grade. He was also diagnosed with attention deficit/hyperactivity disorder (AD/HD) and disruptive behavior disorder, not otherwise specified. Clint was initially referred to the Neurobehavioral Clinic due to “meltdowns”, including tantrumming and physical aggression; however, his parents also reported that he frequently engaged in perseverative conversation about hunting, trapping, hiking, and a television show called *NCIS*. Clint’s perseverative conversation included talking about and teaching others about his interests as well as pleading with his parents to buy him hunting and trapping supplies, such as guns and bows. Clint’s parents reported that he talked about his interests at least 15 times per day, every day. Although

the duration of such conversations varied, Clint's parents estimated that they typically lasted about 10 minutes each time. Redirection often worked to stop Clint's perseverative speech; however, occasionally he would become angry when restricted from talking about his interests. Clint's parents noticed that other children were less likely to interact with him when he began talking about his interests, and they attributed his lack of close friends to his "bossy" style of interaction. Despite not interfering with productivity at home or school, Clint regularly incorporated his interests into school work (e.g., writing about hunting) and often negotiated for items related to his interests as rewards for completing work at home. A behavioral treatment (i.e., differential reinforcement of alternative behavior and extinction), had been tried at home with little success.

Juan was 10 years, 4 months old and in 4th grade. He was also diagnosed with disruptive behavior disorder, not otherwise specified and cognitive disorder, not otherwise specified. The latter diagnosis was made due to below average processing speed despite above average cognitive abilities. Juan was initially referred to the Pediatric Psychology Clinic due to concerns of noncompliance and rigid and repetitive thinking and behavior. He talked about a number of interests in a perseverative manner, including Pokémon, geography (maps and populations), and video games, with video games dominating most discussions. Juan's father estimated that he talked about these interests between 10 and 50 times per day, with most discussions lasting up to 15 minutes. Juan usually chose to talk with younger children and adults about his interests and his father reported that his "eccentricities" had prevented him from having any common age friends. Juan reported that he had just one friend who was 7 years old. Juan's favorite video games were first-person shooting games that involved a substantial degree of violence and he had gotten into trouble at school on several occasions for mimicking the actions and the scripts from his games. At home, Juan was noncompliant with daily work (e.g., cleaning up, getting ready for bed) and would tantrum when he was

restricted from his video games. At school he often blurted out information about his interests during class instruction and individual work. No assessment or treatment had been conducted at the time of the research study.

Michael was 9 years, 9 months old and in 4th grade. He was initially referred to the Autism Clinic due to perseverative speech and disruptive behavior related to his “obsessions”. Michael had been diagnosed with major depressive disorder, OCD, and nonverbal learning disorder. Michael’s parents reported that he exhibited obsessions with Webkinz (a virtual pet on the internet) and computer hardware (e.g., computer specifications, random access memory, processor types). They estimated that he would spontaneously bring up Webkinz or computers 100 or more times per day, but also would steer conversations to these topics whenever he could. Michael’s discussions of his interests ranged in duration from 10 s to 30 min. He talked about Webkinz and computers with anyone, and on several occasions his parents observed him approach strangers to discuss these topics. Michael’s parents reported that he would continue to talk about his interests even if the person he was talking to asked him to stop. Despite superior verbal abilities he was educated part time in the special education room at school due to his inability to refrain from talking out in class and his difficulty focusing on school work. Michael would occasionally engage in tantrumming and make provocative statements (e.g., “I’m going to kill myself.”) when others would not attend to him. On one occasion Michael refused to complete any work at school for nearly four hours until he could tell another student about his new Webkinz. Michael began taking paroxetine and risperdal three months prior to this study and his parents reported decreases in disruptive behavior but no change in his perseverative conversation.

Oscar was 13 years, 0 months old and in 7th grade. He was initially referred to the Biobehavioral Service Clinic due to noncompliance, physical aggression, and school refusal. Oscar had no other diagnoses and he was not taking any medications. He engaged in perseverative conversation about several interests, with the most prominent

being military history and video games. In addition to talking about military history, Oscar watched the Military Channel for multiple hours every day. He talked about his interests, on average, 30 or more times per day, with each conversation lasting a few minutes or longer if another person provided continuous attention. Oscar's mother reported that with the exception of video games Oscar's interests were "odd for his age" and the way in which he talked about them repelled other children. Oscar frequently "shut down" at school when required to do work, but would interact if another person engaged him in conversation about his interests. This caused significant stress on Oscar's mother as she was called to his school to pick him up when he "shut down". Oscar had never been assessed or treated for the perseverative conversation.

Response Definitions

Five dependent measures were evaluated in three phases: preference assessment (Phase I), concurrent operants assessment of reinforcer dimensions (Phase II), and concurrent operants assessment of competing reinforcer dimensions (Phase III). During Phase I, *topic selection response* was recorded when a participant made physical contact with a topic card or when the participant verbally indicated a preference for an available topic. If more than one topic was selected, the first one contacted or verbally indicated was identified as the topic selection response.

During Phases II and III of this study, data were collected within a 6-s partial interval observation system. *Time allocation* was defined as percentage of intervals present in one of two concurrently available conditions. *Perseverative conversation* was operationally defined as intelligible verbal utterances which contained a phrase (i.e., a string of 2 or more words) or sentences directly related to one or more of the participant's circumscribed interests. Such utterances included declarative statements, as well as questions and soliloquies. All other verbal behavior (i.e., words, phrases, sentences) was considered *nonperseverative*. During conditions in which the participant was expected to listen to the investigator talk, data were collected on participant *interruptions*, which were

defined as instances of participant utterances consisting of phrases and was reported in terms of the percentage of time (i.e., percentage of intervals) engaged in interruptions within a particular condition.

Data Collection and Interobserver Agreement

Data were collected by the investigator in Phases I, II, and III via in-vivo observations in an adjacent room using closed-circuit television with a camera feed inside the therapy room. A recording sheet was developed for data collection during the preference assessment (see Appendix C for a copy of preference assessment recording sheet) and a 6-s partial interval data sheet was customized for recording data in Phases II and III (see Appendix D for a copy of data recording sheet used). Interobserver agreement (IOA) data were collected simultaneously and independently by trained graduate students, with some IOA data taken at a later date via audio recordings.

During Phase I, an agreement on topic selection response data was defined as both observers having recorded the same selection response or no selection response for each trial. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus the number of disagreements and multiplying by 100%. Interobserver agreement was collected for 50% of the preference assessment trials for all participants, with observers agreeing on all trials throughout the study, yielding an interobserver agreement score of 100%.

For Phases II and III, agreement percentages were calculated by comparing observers' records on an interval-by-interval basis. Agreement occurred when both observers marked the presence or absence of the same behavioral response in the same interval and disagreement occurred when one observer marked the presence of a particular behavior and the other observer did not. Interobserver agreement was then calculated by dividing the number of agreements by the sum of the agreements and disagreements.

In Phase II, IOA data were collected for 36% of all sessions. Interobserver agreement for time allocation in this phase averaged 98% (range, 95% to 100%). Interobserver agreement for perseverative conversation averaged 90% (range, 72% to 100%) and agreement for nonperseverative speech averaged 96% (range, 91% to 100%). Finally, interobserver agreement for interruptions averaged 94% (range, 93% to 100%).

IOA were collected for 32% of all sessions in Phase III. The average agreement for time allocation in this phase was 98% (range, 92% to 100%). For perseverative conversation, interobserver agreement averaged 89% (range, 67% to 100%), while agreement for nonperseverative speech averaged 94% (range, 82% to 100%). Interobserver agreement for interruptions averaged 95% (range, 88% to 100%).

Experimental Design and Procedures

During Phase I, a multiple-stimulus-without-replacement (MSWO) preference assessment for conversation topics was conducted in a similar fashion to that described by DeLeon and Iwata (1996; i.e., presentation of multiple stimuli with the option to choose only one), but without multiple trials and without actual access to the selected topics. This was followed by a forced-choice assessment conducted within a concurrent schedules design, as described by Fisher et al. (1992), using the most and least preferred conversation topics from the MSWO. Results of the latter preference assessment generated a preferential hierarchy that was used in the following two phases of the study.

The second phase of this study consisted of an assessment of reinforcer dimensions of perseverative conversation within a concurrent schedules design as described by Fisher et al. (1992). The dimensions studied included two aspects of reinforcer quality (i.e., conversation content and conversation style) and one aspect of reinforcer magnitude (i.e., duration access). Phase III evaluated the competition of these three variables in a concurrent schedules design. Each test condition was followed by a combined condition, in which both dimensions were freely available, and then reversed back to the test condition to form a brief A-B-A (A-B-A-B-A on an occasion for two

participants) reversal design (e.g., Wacker et al., 2004) to further analyze the dimensions of reinforcement and their competition within Phase III.

General Procedures

Caregiver Interview

The pre-assessment interview, which typically lasted no more than 45 minutes, occurred by telephone or in person and was focused on participant demographics, diagnostic history, description of the perseverative speech, circumscribed interests, impairments in functioning related to perseverative speech, and assessment and/or treatment history related to the perseverative speech. The purpose of the interview was to assess the participant's eligibility for this study and to gather information about the participant's circumscribed interests.

Phase I: Preference Assessment

A preference assessment was conducted to identify relative preference among a range of conversation topics. This was done in two stages. During the first stage, a multiple stimulus without replacement (MSWO) preference assessment, between six and eight index cards (76 mm by 120 mm), each with a different topic written in text or depicted by a picture (based upon the participant's ability to read), were randomly placed in a line on a table in the middle of the room approximately 10 cm apart. The topics for each participant were those identified during the caregiver interview as preferred and related to the participant's circumscribed interests and those nominated by the investigator as age-appropriate topics. The participant was asked to sit approximately 0.3 m from the table, directly in the center of the line of cards, and the investigator either read the text or described the picture on each of the topic cards to the participant. The participant then read or described the topics back to the investigator to make sure they were understood. Once all of the topics were accurately identified by the participant, the investigator instructed the participant to choose the most preferred topic to talk about (i.e., "Which of these topics do you like to talk about the most? Pick just one."). Verbal

selection (i.e., reading the text from the card or stating the topic aloud) and physical selection (i.e., touching or picking up the topic card) were both acceptable selection responses. Once a topic was selected it was removed from the table and the remaining topic cards were rotated such that the topic card at the left end of the line was moved to the far right end and all topics were shifted leftward. If more than two topics were selected, the first one indicated was recorded as the topic selection response. If no topic was chosen within 30 s from the investigator's instruction, another verbal prompt to choose a topic was provided. If after an additional 30 s still no topic was chosen, this stage was discontinued. The stage was completed after all but one topic card was selected.

The second stage of the preference assessment (i.e., forced-choice method) incorporated the two most preferred topics and the two least preferred topics identified during the first stage. During this stage each of the four topics was paired with every other topic once, in a randomized order, for a total of six stimulus-pair presentations. For each stimulus-pair presentation one topic card was placed approximately 0.2 m to the right of the center line of the table and the other topic card was placed approximately 0.2 m to the left of the center line on the table. Once again, the participant was asked to sit roughly 0.3 m from the table, equidistant to both topic cards, while the investigator read the text or described the picture of the two topic cards to the participant. The participant was then instructed to pick one of the topics to converse about for 60 s (i.e., "Choose one of these two topics that you would like to talk about for one minute."). As in stage one, verbal and physical selections were both acceptable selection responses. If both topics were selected then the first one chosen was determined to be the selection response. If no selection was made within 5 s the participant was allowed to sample each topic for 10 s and then directed again to choose a topic for conversation. If, after the instructions were presented for a second time, still no choice was made the topic cards were removed and the next trial commenced. Once a topic was selected, the cards were then removed from

the table and the participant was instructed by the investigator as follows, “Now you can either tell me about [selected topic] or teach me about [selected topic] for 60 s.” During the 60 s of conversation, the investigator only replied using one of three neutral responses, “hmm”, “really”, “oh”, or, in response to a question by the participant the investigator responded in no more than one brief sentence lasting fewer than 5 s. No attempts were made by the investigator to keep the participant on the topic selected. Once the 60 s ended the participant was allowed to engage in free play with toys and activities alone on a play mat at the back of the therapy room for 60 s before the next stimulus-pair was presented. The forced-choice preference assessment was completed once all stimulus-pair combinations had been presented.

Phase II: Assessment of Reinforcer Dimensions of Perseverative Conversation Using a Concurrent Operants Arrangement

Phase II consisted of a concurrent operants assessment of reinforcer dimensions related to perseverative conversation. This phase of the study was conducted to evaluate each participant’s relative preference for dimensions related to reinforcer quality and reinforcer magnitude. Prior to beginning this phase, toys and activities from Phase I were removed and the therapy room was divided in half using blue painter’s tape. This physical division extended the length of the room and included the table, which was also divided into two equal halves. Two chairs were placed on either side of the table. This phase consisted of four test conditions requiring the participant to allocate time between two choice areas, each associated with either the presence or the absence of a particular reinforcer dimension. During any condition, if the participant’s time allocation did not exceed 60% for either choice option the condition was repeated until one choice option did. During the repeated condition the rules respective to each side were switched such that the rules from the left side were now applied to the right side and vice-versa. This

was done in order to rule out idiosyncratic factors (e.g., preference for one side of the room).

During this phase, the investigator began each condition by explaining the rules associated with each side of the room. The participant was aided by the use of index cards that were placed on each side of the room and described the rules associated with the respective side. Rules were outlined in text for readers and in pictures for poor readers or nonreaders. With the exception of one condition (i.e., assessment of reinforcer magnitude), the participant was informed that he could freely allocate time to either side of the room, but that the rules of the particular condition he was in had to be followed. Once the rules were described, the participant was asked to stand on the line of blue tape in the center of the room. The investigator then instructed the participant to choose a side. The session began as soon as the child moved to one side of the room. If the participant failed to make a choice after 5 s, the investigator presented the rules associated with each side again and prompted the participant to make a selection. If the participant still did not make a selection after another 5 s, then the session began and the child was ignored by the investigator. Each of the four conditions except for the final condition (i.e., assessment of reinforcer magnitude) lasted 60 s. If at any time during a condition the participant did not follow the rules associated with the particular side of the room he was in, the investigator provided a verbal prompt (e.g., “On this side of the room you are not allowed to discuss [a particular topic].”). If the prompt failed, the investigator ignored the participant until he was abiding by the rules. For any choice that consisted of the participant controlling discussion on a topic, the investigator replied using one of three neutral responses, “hmm”, “really”, “oh”, or, in response to a question by the participant the investigator responded in no more than one brief sentence lasting fewer than 5 s.

The four conditions were as follows: (a) test for social function; (b) test of reinforcer quality related to conversation content; (c) test of reinforcer quality related to

conversation style; and (d) test of reinforcer magnitude in terms of conversation duration. The test for social function was presented first for each participant to make sure his choice was motivated by social variables (i.e., attention). All participants showed a preference for social variables and thus the assessment continued. The three subsequent conditions were randomly sequenced for each participant with any repeat conditions occurring back-to-back.

Test for social function. The participant could choose to talk or teach the investigator about his preferred topic of interest on one side of the room or the participant could sit alone without any activities on the other side of the room. If the participant chose the latter option at any time the investigator turned away from the participant and did not respond to any verbal statements or questions. However, the participant was not restricted from talking in any other way. No attempts were made by the investigator to keep the participant on a specified topic.

Test of reinforcer quality related to conversation content. During this condition the participant's preference for conversation topic was assessed. He was asked to choose between talking to or teaching the investigator about a preferred conversation topic or talking to or teaching the investigator about a neutral or less preferred topic. Thus, conversation style and the duration of the conversation were held constant. The preferred conversation topic and the neutral or less preferred conversation topic were selected using the results of the preference assessment in Phase I. The investigator followed the participant to whichever side he chose. If at any time the participant allocated time to the neutral/less preferred topic, but began conversing about another topic the investigator prompted the participant to follow the rules (e.g., "Remember, we can only talk about [less preferred topic] when we are on this side of the room."). If the participant continued to converse about another topic the investigator ignored the participant by turning his back until the participant began to abide by the rules. When time was allocated to the

preferred conversation topic option the investigator made no attempt to keep the participant on one specific topic.

Test of reinforcer quality related to conversation style. In this condition both the topic of conversation and the duration of the conversation were held constant. The participant was allowed to choose between talking or teaching about a preferred conversation topic (i.e., a dominant position) or allowing the investigator to talk about the preferred conversation topic (i.e., a subordinate position). If the participant allocated time to the conversation style option the investigator followed the protocol for the previous two conditions (i.e., neutral responses and simple answers to questions with no attempts to restrict the topic). If the participant allocated time to the other side the investigator engaged in a monologue on the previously identified preferred conversation topic. The monologue consisted of declarative statements and opinions regarding the preferred topic with no more than 5 s between any two statements. Attempts by the participant to interrupt the investigator were ignored or talked over and no questions by the participant were answered by the investigator.

Test of reinforcer magnitude in terms of conversation duration. During this condition the participant was allowed to choose between conversation lasting 30 s or 3 min. Unlike the other conditions, for this condition the participant was told that he could not freely allocate between the two conditions. Thus, time allocation was recorded as 100% for the first selection made. For either choice the participant was allowed to control the conversation and was allowed to converse about a previously identified preferred conversation topic. The investigator followed the same protocol used during previous conditions when the participant was allowed to talk or teach about a preferred conversation topic (i.e., neutral responses and simple answers to questions with no attempts to restrict the topic).

Phase III: Assessment of Competing Reinforcer Dimensions

Using a Concurrent Operants Arrangement

Phase III evaluated competition between the reinforcer dimensions. During this phase, a concurrent operants arrangement similar to the one employed in Phase II was used. The physical setting of the room remained the same as in Phase II, with the room and table divided into two equal areas. This phase consisted of three test conditions requiring the participant to allocate time between two choice areas, each associated with a specific set of rules related to the reinforcer dimensions being studied. Each condition was presented either two or three times depending upon whether a reversal was initially achieved. The rules of each choice in the condition were switched for subsequent reversals, such that those rules applied to the left side were now associated with the right side and vice-versa, in order to rule out idiosyncratic responding due to extraneous variables.

The general procedures for this phase were similar to those for Phase II. The investigator began each condition by explaining the rules associated with each side of the room. The participant was aided by the use of index cards that were placed on each side of the room and described the rules associated with the respective side. Rules were outlined in text for readers and in pictures for poor readers or nonreaders. The participant was also informed that he could freely allocate time to either side of the room, but that the rules of the particular condition he was in had to be followed. Once the rules were described, the participant was asked to stand on the line of blue tape in the center of the room. The investigator then instructed the participant to choose a side. The session began as soon as the child moved to one side of the room. If the participant failed to make a choice after 5 s, the investigator presented the rules associated with each side again and prompted the participant to make a selection. If the participant still did not make a selection after another 5 s, then the session began and the child was ignored by the investigator. One of the three test conditions (i.e., test of the relevant preference

between conversation content and conversation style) lasted for 60 s, while the other two test conditions lasted between 30 s and 3 min depending upon which choice selection was made. The same time limits were set for the combined conditions, with the combined dimensions condition corresponding to the “conversation style versus conversation content” condition lasting 60 s and the other two combined dimensions conditions lasting between 30 s and 3 min.

If at any time during a test or combined condition the participant did not follow the rules associated with the particular side of the room he was in, the investigator provided a verbal prompt (e.g., “On this side of the room I am the one who gets to talk about [specified topic].”). If the prompt failed, the investigator ignored the participant until he was abiding by the rules. For any choice that consisted of the participant talking to or teaching the investigator about a topic, the investigator was only allowed to reply using one of three neutral responses, “hmm”, “really”, “oh”, or, in response to a question by the participant the investigator was allowed to respond in no more than one brief sentence lasting fewer than 5 s.

During each of the three test conditions, and their respective combined conditions, one variable was held constant. For example, when conversation style (i.e., reinforcer quality) was paired against conversation duration (i.e., reinforcer magnitude), conversation content (i.e., reinforcer quality) was held constant, but with the preferred topic rather than a less preferred or neutral topic. The three test conditions included (a) test of relative preference between conversation content and conversation style; (b) test of relative preference between conversation style and conversation duration; and (c) test of relative preference between conversation duration and conversation content.

Conversation content versus conversation style. This condition assessed the participant’s relative preference between two dimensions of reinforcer quality: topic of conversation and control of conversation. The participant was asked to choose between the investigator talking or teaching about a preferred topic of conversation and

controlling the conversation about a less-preferred or neutral topic. Conversation duration was held constant at 60 s during this condition. Rules similar to those for the assessment of reinforcer quality in Phase II (i.e., test of conversation content and test of conversation style) were used in this condition. The investigator followed the participant to whichever side he chose. If at any time the participant allocated time to the neutral/less preferred topic (i.e., the “conversation style” side), but began conversing about another topic the investigator prompted the participant to follow the rules (e.g., “Remember, you can only talk about [less preferred topic] when we are on this side of the room.”). If the participant allocated time to the “conversation content” side the investigator engaged in a monologue on the preferred conversation topic (i.e., declarative statements and opinions regarding the preferred topic, ignoring participant attempts to interrupt).

The combined dimensions condition associated with this test condition allowed the participant to choose between controlling the conversation about a preferred topic (i.e., presence of active style, preferred content, and longer duration) and taking a subordinate position (i.e., investigator controls the conversation) involving conversation on a less preferred or neutral topic. Conversation duration was held constant at 60 s.

Conversation style versus conversation duration. In this condition the relative preference between conversation style and reinforcer magnitude (i.e., conversation duration) was assessed, while holding the conversation content constant. The participant was presented with a choice between controlling the conversation on a preferred topic for 30 s (i.e., relatively small time duration) or the investigator controlling the conversation about a preferred topic for 3 min (i.e., longer duration of time). If the participant chose to control the conversation for a smaller duration of time, once the 30 s ended the participant was not allowed to then switch over to the paired option. However, if the participant chose to allocate time to the option with a longer conversation duration, so long as a balance of time remained the participant was allowed to allocate back to the

option with the shorter duration. If the participant allocated time to the conversation style choice option the investigator followed the same protocol used during previous conditions when the participant was allowed to control a preferred conversation topic (i.e., neutral responses and simple answers to questions with no attempts to restrict the topic).

The respective combined dimensions condition presented the participant with the option of controlling the conversation for a longer duration of time (i.e., 3 min) or allowing the investigator to control the conversation for a shorter time length (i.e., 30 s). The conversation topic was held constant using a preferred topic.

Conversation duration versus conversation content. This condition assessed the participant's relative preference between reinforcer magnitude (i.e., conversation duration) and conversation content. The participant could choose to allocate time between a longer conversation about a less preferred or neutral topic and a shorter conversation about a preferred topic. Both options allowed the participant to control the conversation. Once again, the longer conversation lasted 3 min, while the shorter conversation lasted 30s. The same rules regarding allocation during the previous condition (i.e., no allocation to the longer period was allowed if time allocation expired during the shorter period) and investigator responses during the participant's conversation (i.e., neutral short responses) were applied to this condition.

The combined dimensions condition corresponding to this test condition involved the option of talking or teaching the investigator about a preferred topic for 3 min or talking or teaching about a less preferred or neutral topic for 30 s. The participant was always allowed to control the conversation in this condition.

CHAPTER IV

RESULTS

Summary of Tables and Figures

Phase I: Preference Assessment

Results of the first stage of the preference assessment (MSWO) are shown in Table 2. For each participant there is an inclusive list of the topics used for this stage. The two most preferred topics are listed in the shaded section at the top of the table and the two least preferred topics are listed in the shaded section at the bottom of the table. Topics identified as circumscribed interests by caregiver report are in italics and all other topics were generated by the investigator.

The results of the second stage of the preference assessment (forced-choice method) are shown for each participant in Figures 3, 4, 5, 6, and 7. The bar graphs depict the percentage of trials each topic was chosen in this format. The four topics included in this stage are presented in the order of preference, with the topic chosen most often presented first and the topic chosen least often or not at all presented last.

Phase II: Assessment of Reinforcer Dimensions

Figures 8, 9, 10, 11, and 12 depict the results for each participant of the concurrent operants assessment of reinforcer dimensions conducted in Phase II of this study. The bars represent time allocation between two choice options for each of the four conditions tested. For three of the participants more than one trial was conducted for a particular test. Additionally, open circles for each test represent percentage of intervals engaged in perseverative conversation. Perseverative conversation could not be recorded during one test (i.e., Test of Conversation style) for one participant (Michael) because the participant's choice only allowed the investigator to talk during that test.

Phase III: Assessment of Competing Reinforcer Dimensions

The results for each participant for each condition of the concurrent operants assessment of competing reinforcer dimensions, conducted in Phase III, are depicted in

Figures 13 through 27. The bars for these figures represent the time allocated to each choice option of a particular condition. Three bars are associated with each test condition in an A-B-A fashion depicting the time allocated for the initial test of competition between the reinforcer dimensions, a combined dimensions condition, and a return to the test of competition. Perseverative conversation, interruptions, and nonperseverative speech are plotted on the graph using an open circle, an open diamond, and an open box, respectively. Data on these variables were only included when applicable to the test conditions.

Individual Results

Andrew

Phase I: Preference Assessment

As depicted in Table 2, with all topics available, Andrew chose clocks as the most preferred topic to discuss. Once clocks was removed from the available topics he chose elevators as the most preferred topic. Both of these topics had been identified previously during the caregiver interview as circumscribed interests. The final two topics chosen were bugs and baseball, with baseball chosen last. Bugs had been identified previously as a circumscribed interest, while baseball was a topic generated by the investigator.

The top two topics chosen, clocks and elevators, and the final two topics chosen, bugs and baseball, were included in the second stage of the preference assessment, the forced-choice assessment. Andrew's results for this stage are depicted in Figure 3. After all possible pairs of the four topics had been presented to Andrew the topic chosen most often was elevators, which he selected in 100% of the trials. Clocks was selected second most at 66.67%. Bugs was next in terms of trials selected at 33.33%, while baseball was never chosen. Andrew's two most preferred topics, according to the first stage, were also the two most preferred topics in the second stage; however, the order of preference was reversed in the second stage, suggesting that there may have been a difference in topic preference depending upon how many topics were available. The least preferred topics in

the first stage were also the least preferred topics in the second stage and fell in the same order of preference for both stages.

Phase II: Assessment of Reinforcer Dimensions

Andrew demonstrated preference on the first trial in three of the four test conditions, as depicted in Figure 8. In the test for social function he allocated 100% of the time to the choice option that included active conversation and high-preferred content, suggesting Andrew was sensitive to social reinforcement (i.e., attention). In this choice option he perseverated on the preferred topic, elevators, for 90% of the session intervals and talked about other topics for 10% of session intervals.

In the test of reinforcer quality related to conversation content Andrew allocated 100% of the time to the high-preferred topic choice option, suggesting a preference for elevators as a conversation topic over baseball. This matches the caregiver interview and Phase I results, which indicated a preference for elevators as a conversation topic. Andrew engaged in perseverative conversation for 100% of all intervals during this test.

The test of reinforcer quality related to conversation style was repeated one time in order to identify a clear preference as Andrew allocated an equal amount of time to both choice options on the first trial. The second trial of this condition resulted in 100% time allocation to the active choice option, suggesting Andrew preferred to actively discuss the preferred topic. During the first trial of this condition Andrew engaged in perseverative conversation for 80% of all intervals in the active conversation option (40% of intervals for the entire condition) and nonperseverative conversation for 20% of intervals in the active conversation condition (10% of intervals for the entire condition). He also interrupted the investigator's conversation in 50% of all intervals in the passive conversation option (25% of intervals for the entire condition). In the second trial Andrew displayed perseverative conversation in 80% of the intervals and did not engage in any nonperseverative speech.

Contrary to one of this study's hypotheses, Andrew did not demonstrate a preference for greater conversation duration in the test of reinforcer magnitude, allocating 100% of the time to the 30-s choice option. During this condition he displayed perseverative conversation in 90% of all intervals and engaged in nonperseverative speech in 10% of all intervals.

Phase III: Assessment of Competing Reinforcer Dimensions

Conversation content versus conversation style. The results of this condition, as depicted in Figure 13, suggested a relative preference for conversation content over conversation style. In the first test session Andrew allocated 100% of the time to the conversation content choice option (i.e., investigator discusses high-preferred topic for 1 min), while in the second test session he allocated 80% of the time to the conversation content option. In each test session Andrew engaged in interruptive behavior. This occurred in 40% of all intervals during the first test session and 25% of all applicable intervals during the second test session (10% of total intervals for test session). In the second test session Andrew did not demonstrate perseverative conversation, but did converse nonperseveratively in 100% of the applicable intervals (20% of total intervals for the second test session).

In the combined dimensions condition associated with the content versus style condition, Andrew allocated 100% of his time to the choice option that allowed him to actively converse about a preferred topic over the condition that would have allowed the investigator to converse about a less-preferred topic for 1 min. In this choice option he engaged in perseverative conversation for 70% of all intervals and engaged in nonperseverative conversation for 30%.

Conversation duration versus conversation style. Andrew allocated 100% of the time to the conversation style choice option (i.e., participant discusses high-preferred topic for 30 s) in both test sessions of this condition (see Figure 14), suggesting a relative

preference for conversation style over conversation duration. Perseverative conversation occurred in 100% of all intervals for both test sessions.

The combined dimensions condition matched to the duration versus style condition allowed Andrew to choose between actively conversing about a high-preferred topic for 3 min and the investigator conversing about a high-preferred topic for 30 s. Andrew allocated 100% of the time to the latter condition and interrupted the investigator in 20% of the intervals.

Conversation content versus conversation duration. In this condition, which offered the choice of talking about a high-preferred topic for 30 s and talking about a less-preferred topic for 3 min, Andrew chose to allocate 100% of the time to the option with the high-preferred topic for both sessions (see Figure 15). This indicated a relative preference for conversation content over conversation duration. Perseverative conversation occurred in 100% of all intervals for both trials.

In the combined dimensions condition Andrew allocated 100% of the time to the choice option that allowed him to converse about a high-preferred topic for 3 min versus conversing about a less-preferred topic for 30 s. Perseverative conversation occurred in 60% of all intervals, nonperseverative conversation in 10%, and no conversation in 30%.

Summary of Results

Preference assessment results from the second stage indicated that elevators was the most preferred topic for Andrew, followed by clocks, reversing the order of these two from the results of the first stage. Baseball was chosen last in the first stage of the preference assessment and not chosen at all in the second stage.

Phase II results showed that Andrew had a preference for conversation involving his circumscribed interest and active conversation. However, he failed to show a preference for greater conversation duration. Perseverative conversation was 80% or above in all conditions and nonperseverative speech only occurred in 20% of the intervals

in one condition. Interruptions occurred in half of all intervals where the investigator was an active conversant.

Based upon Andrew's responses in Phase III a hierarchy of relative preference for the reinforcer dimensions, as depicted in Table 5, suggested conversation content was the most preferred of the three tested dimensions. This was followed by conversation style, while conversation duration was the least preferred of those tested. These results are consistent with those in Phase II, which failed to demonstrate a preference for conversation duration. Perseverative conversation remained high throughout this phase with over half of the sessions where perseverative conversation was available resulting in 100% engagement. Andrew was more likely to engage in a high degree of perseverative conversation during short conversation durations (i.e., 30-s sessions) than long durations. Interruptions occurred in all applicable sessions, with a slight downward trend across the assessment.

Clint

Phase I: Preference Assessment

In the first stage of the preference assessment Clint chose guns as the most preferred topic to discuss. He chose *NCIS* when guns was removed from the available options. His final two choices were Bakugan and swimming, with swimming serving as the last choice. The two most preferred topics in this stage had been identified as circumscribed interests and the two least preferred topics were generated by the investigator.

As depicted in the results in Figure 4, when all possible pair combinations had been presented to Clint the topic chosen in the most trials (100%) was *NCIS*. Guns was chosen in the next greatest number of trials (66.67%). Clint chose Bakugan in 33.33% of all trials and swimming was never chosen over another topic. Although the two least preferred topics from the first stage fell in the same order in the second stage, *NCIS*,

which had been the second most preferred topic in the first stage, was the most preferred topic in the second stage, trading places with guns.

Phase II: Assessment of Reinforcer Dimensions

In all four test conditions of Phase II, Clint demonstrated a preference, as shown in Figure 9. In the first test, an assessment of social function, he allocated 100% of the time to the condition with active conversation and high-preferred content. This suggested sensitivity to social reinforcement. Clint engaged in perseverative conversation for 100% of all session intervals.

During the test of reinforcer quality related to conversation content, Clint allocated 100% of the time to the high-preferred topic choice option and talked perseveratively about the *NCIS* television show (high-preferred topic) in 90% of all intervals and 10% of the time talked non-perseveratively. This indicated a preference for *NCIS* over swimming as a topic of conversation.

In the test of reinforcer quality related to conversation style, Clint allocated 80% of the time to the choice option that allowed him active conversation about a preferred topic versus 20% of the time to the passive conversation choice option. This suggested a preference for active conversation style. During the time allocated to the active conversation option, Clint demonstrated perseverative conversation for 100% of all intervals (80% of intervals for the entire condition) and during the time allocated to the passive conversation option he interrupted 100% of the intervals (20% of intervals for the entire session).

Clint allocated 100% of the time to the 3-min choice option in the test of reinforcer magnitude, indicating a preference for greater conversation duration. He engaged in the perseverative conversation in 73.33% of all intervals and talked nonperseveratively for 10% of all intervals. No conversation occurred in 16.67% of all intervals.

Phase III: Assessment of Competing Reinforcer Dimensions

Conversation content versus conversation style. Clint's results for this condition of Phase III, which are depicted in Figure 16, indicated a relative preference for conversation content over conversation style. In both test sessions he allocated 100% of the time to the choice option that allowed the investigator to converse about a high-preferred topic over actively conversing about a less-preferred topic. In the first test session Clint did not interrupt the investigator's conversation, but in the second session he did so in 20% of the intervals.

In the combined dimensions condition Clint chose to converse about a high-preferred topic over the investigator conversing about a less-preferred topic. He engaged in perseverative conversation for 90% of the intervals in the combined dimensions session and no conversation occurred in 10%.

Conversation duration versus conversation style. In the initial test session for this condition Clint allocated 100% of the time to the choice option that allowed the investigator to converse about a high-preferred topic for 3 min over actively talking about the high-preferred topic for 30 s (see Figure 17). He also interrupted the investigator's conversation during 30% of all intervals. During the second session Clint allocated 100% of the time to the conversation style choice option, necessitating a third test session. In the third test session he again allocated 100% of the time to the conversation style session, indicating a relative preference for conversation style over conversation duration. Perseverative conversation occurred in 80% and 50% of the intervals during the second and third trials, respectively. Nonperseverative conversation occurred in 10% of the intervals for session two and 50% of the intervals for session three.

The combined dimensions condition associated with this test condition provided Clint with the option of conversing about a high-preferred topic for 3 min or allowing the investigator to converse about a high-preferred topic for 30 s. He allocated time to both of these conditions, with 64.29% of the time allocated to the former condition and

35.71% of the time allocated to the latter. During the first option (i.e., active conversation about high-preferred topic for 3 min) Clint conversed perseveratively in 88.89% of the intervals and nonperseveratively in the remaining intervals (11.11%). While allocating time in the second condition he interrupted conversation in 83.33% of the intervals.

Conversation content versus conversation duration. In this test condition Clint demonstrated a relative preference for conversation content over conversation duration as he allocated 100% of the time in both test sessions to the choice option that allowed him to converse about a high-preferred topic for 30 s rather than converse about a less-preferred topic for 3 min (see Figure 18). Perseverative conversation occurred in 100% of the intervals in both test sessions.

In the combined dimensions condition Clint chose to discuss the high-preferred topic for 3 min versus talking about a less-preferred topic for 30 s. This resulted in perseverative conversation for 73.33% of all intervals and no conversation for the remaining 26.67% of intervals.

Summary of Results

Results from both stages of the preference assessment identified the same two conversation topics (i.e., *NCIS* and guns) as high-preferred and the same two conversation topics as less-preferred (i.e., Bakugan and swimming); however, the most preferred topics from the first stage were in a reverse order in the second stage, suggesting that relative preference for high-preferred conversation topics may change slightly based upon the number of topics available.

In Phase II Clint demonstrated a preference for conversation about circumscribed interests, active conversation style, and greater conversation duration. His highest rate of perseverative conversation came in the test for social function and the test of reinforcer quality related to conversation style (both 100% of intervals), while his lowest rate of

perseverative conversation occurred in the test of reinforcer magnitude (73.33% of intervals).

Results from Phase III suggested a hierarchy with conversation content as the most preferred reinforcer dimension, followed in terms of preference by conversation style and conversation duration (see Table 5). Perseverative conversation ranged from 50% to 100% of intervals across test sessions. Although the rate of interruption was relatively low during applicable test sessions, a substantial increase (i.e., 83.33%) occurred in one combined dimensions session where the investigator was allowed to converse about a preferred topic for a short duration.

Juan

Phase I: Preference Assessment

When all topics were available to Juan, he chose video games as the most preferred topic. With video games removed from the available topics, Juan chose geography (maps) as the most preferred topic. The final two topics chosen, after all other topics had been chosen, were baseball and Transformers, with Transformers chosen last. The two most preferred topics in this stage had been identified as circumscribed interests and the two least preferred topics identified in this stage were generated by the investigator.

Juan's results for the second stage are depicted in Figure 5. When all possible pair combinations had been presented, the topic chosen the most by Juan was video games, which he chose in 100% of all trials. Geography was the next highest preferred topic, chosen in 66.67% of all trials. Juan chose baseball in 33.33% of all trials and Transformers was never chosen.

Phase II: Assessment of Reinforcer Dimensions

Phase II results for Juan are shown in Figure 10. Juan demonstrated a definite preference in all four of the test conditions. In the test for social function he allocated 100% of the time to the choice option allowing him to engage in conversation with the

investigator, indicating sensitivity to social reinforcement. During this condition Juan engaged in perseverative conversation for 80% of all intervals and nonperseverative conversation for 20% of the intervals.

During the test of reinforcer quality related to conversation content, Juan had the option of conversing about a high-preferred topic (video games), and a less-preferred topic (i.e., baseball). He allocated 100% of the time to the high-preferred topic. Juan talked perseveratively about video games for 100% of the intervals in this condition.

In the test of reinforcer quality related to conversation style, Juan demonstrated a preference for active conversation, allocating 100% of the time to this choice option. He engaged in perseverative conversation for 70% of the intervals, nonperseverative conversation for 20% of the intervals, and no conversation for 10% of all intervals.

Juan did not show a preference for greater conversation duration, as measured in the test of reinforcer magnitude. He allocated 100% of the time to the 30-s condition, which is contrary to one of the study's hypotheses. During the 30-s condition Juan demonstrated perseverative conversation for 100% of the intervals.

Phase III: Assessment of Competing Reinforcer Dimensions

Conversation content versus conversation style. Juan's results for this condition, which are depicted in Figure 19, suggest a relative preference for conversation style over conversation content. In the first test session of this condition Juan allocated 100% of the time to the conversation style choice option, and engaged in perseverative conversation for 40% of the intervals despite the rules prohibiting conversation about the high-preferred topic. Although he allocated to both choice options in the second test session, the majority (i.e., 70%) was allocated to the conversation style choice option. For the time spent in the active conversation option Juan engaged in perseverative conversation for 42.83% of the intervals and engaged in nonperseverative conversation for 57.14% of intervals, despite the rules of the condition precluding conversation about high-preferred

topics. There were no interruptions while he was in the conversation content choice option.

During the combined dimensions condition Juan allocated 100% of the time to the choice option that allowed him to actively converse about a preferred topic rather than allow the investigator to converse about a less-preferred topic. Perseverative conversation occurred in 50% of the intervals in this condition, while nonperseverative conversation occurred in 10% and no conversation occurred in 40%.

Conversation duration versus conversation style. Juan allocated 100% of the intervals in both test sessions to the conversation style choice option that allowed him to converse about a high-preferred topic for 30 s rather than the conversation duration option, which allowed the investigator to converse about a high-preferred topic for 3 min (see Figure 20). These results suggested a relative preference for conversation style over conversation duration. He engaged in perseverative conversation in 60% and 80% of all intervals in the first and second sessions, respectively. Additionally, in the first test session Juan engaged in nonperseverative conversation for 20% of intervals and no conversation in 20% of intervals, while nonperseverative conversation occurred in 20% of intervals for the second test session.

In the combined dimensions condition associated with this test condition Juan allocated 100% of the time to the choice option that allowed the investigator to converse about a high-preferred topic for 30 s instead of the condition that allowed him to actively engage in conversation about a high-preferred topic for 3 min. No interruptions occurred during this condition.

Conversation content versus conversation duration. Juan demonstrated a relative preference for conversation content over conversation duration when these reinforcer dimensions were pitted against each other (see Figure 21). He allocated 100% of the time in both test sessions to the choice option that allowed him to converse about a high-preferred topic for 30 s rather than the choice option that entailed conversation about a

less-preferred topic for 3 min. Perseverative conversation was at 80% and 100% for the first and second sessions, respectively, while nonperseverative conversation occurred in 20% of the intervals for the first test session.

Juan allocated 100% of the time to the choice option that allowed him to converse about a less-preferred topic for 30 s over the alternative option, which would allow him to talk about a high-preferred topic for 3 min. Although this option did not allow him to converse about high-preferred topics, he did engage in perseverative conversation about a high-preferred topic for 20% of the intervals.

Summary of Results

The two conversation topics identified as high-preferred (i.e., video games and geography) and the two conversation topics identified as least-preferred (i.e., baseball and Transformers) in the first stage of the preference assessment were the same and followed the same order in the second stage. Thus, stage two results validated those from the first stage.

Phase II results for Juan indicated preference for conversation about circumscribed interests and active conversation style. However, the results failed to show preference for longer conversation duration. Perseverative conversation was highest during the tests of reinforcer quality related to conversation content and reinforcer magnitude, which were both at 100%, while nonperseverative conversation occurred in 20% of all intervals during the test for social function and the test of reinforcer quality related to conversation style.

Juan's choices during Phase III resulted in a hierarchy of preference with conversation style as the most preferred of the tested reinforcer dimensions (see Table 5). Conversation content came second in terms of preference, while conversation duration was the least preferred of the three dimensions. Perseverative conversation ranged from 40% to 100% with an upward trend across test conditions. The highest rate occurred during the third test condition (i.e., conversation content versus conversation amount),

averaging 90% across the two test sessions. Although nonperseverative conversation was relatively higher during the first test condition, during this condition Clint allocated to a choice option that restricted him to conversation about a less-preferred topic. No interruptions occurred during any session.

Michael

Phase I: Preference Assessment

With all conversation topics available Michael chose Webkinz as his most preferred topic to talk about. The second most preferred topic was computer hardware. The two least preferred topics were dinosaurs and baseball, with baseball chosen last. Both high preferred topics were pre-identified as circumscribed interests and the two least preferred topics had not been identified as circumscribed interests.

Michael's results for the second stage of the preference assessment, the forced-choice method, are depicted in Figure 6. All possible paired combinations of the two most preferred and the two least preferred topics from the first stage were presented to Michael. Three of the four topics (i.e., Webkinz, computer hardware, and dinosaurs) were chosen by Michael in an equal number of trials (66.67%) and the fourth topic, baseball was never chosen.

Phase II: Assessment of Reinforcer Dimensions

Michael demonstrated a preference on the first trial for three out of the four tests conditions (see Figure 11). During the first trial in the test for social function no clear preference was identified as Michael allocated equal time to the choice option involving social reinforcement and the choice option without it. Perseverative conversation occurred in only 20% of the intervals associated with the social reinforcement option (10% of all intervals) and no conversation occurred in 80% (40% of intervals for the entire condition). When this condition was repeated, Michael showed a preference for the choice option involving social reinforcement, allocating 100% of the time to this

option. Perseverative conversation increased to 70% in this trial and nonperseverative conversation occurred in 30% of the intervals.

In the test of reinforcer quality related to conversation content, Michael chose to talk about a high-preferred topic (i.e., Webkinz) rather than a less-preferred topic (i.e., baseball). He allocated 100% of the time to this choice option. Michael talked perseveratively in only 30% of all intervals during this test condition and nonperseveratively during 20% of the intervals. In 50% of the intervals no conversation occurred.

In contrast to one of this study's hypotheses, Michael did not show a preference for active conversation during the test of reinforcer quality related to conversation style. In this test condition he allocated 100% of the time to the passive conversation choice option. However, during this condition Michael interrupted conversation during 50% of all intervals.

Michael demonstrated a clear preference for longer conversation duration during the test of conversation magnitude. He allocated 100% of the time to the 3-min option, but only engaged in perseverative conversation for 60% of the test intervals. Nonperseverative conversation occurred in 13.33% of all intervals, while no conversation occurred in 26.67% of the intervals.

Phase III: Assessment of Competing Reinforcer Dimensions

Conversation content versus conversation style. Figures 22, 23, and 24 show the Phase III results for Michael. Relative preference for the first test condition necessitated three test sessions as Michael allocated 100% of the time to the conversation content choice option (i.e., investigator converses about high-preferred topic) in the first test session and allocated 70% of the time to the conversation style choice option (i.e., participant converses about less-preferred topic) in the second test session. In the final test session Michael allocated 100% of the time to the conversation style choice option, suggesting a relative preference for conversation style. In the second test session Michael

engaged in perseverative conversation in 14.29% of the applicable intervals (10% of all intervals for the test session) despite the rules of the condition precluding it. The same percentage of time was spent in nonperseverative conversation, while no conversation occurred in 71.43% of intervals (50% of all session intervals). Additionally, interruptions occurred in 30% of all intervals during the first session and 66.67% of applicable intervals during the second test session (20% of all intervals in the test session), while no perseverative conversation occurred during the third test session.

In both combined dimensions sessions Michael allocated 100% of the time to the choice option that allowed the investigator to converse about a less-preferred topic over active conversation about a high-preferred topic. Interruptions occurred in both combined dimensions sessions with 70% of intervals in the first combined dimensions session involving interruptions and 20% of all intervals in the second combined dimensions session involving interruptions.

Conversation duration versus conversation style. Michael demonstrated a relative preference for conversation duration during this condition. During the initial test session he allocated 100% of the time to the 3-min choice option that allowed the investigator to converse, rather than the 30-s choice option in which he would have actively conversed. Interruptions occurred in 26.67% of intervals for this test session. Michael allocated time to both choice options in the second test session, but allocated the majority of time to the conversation duration choice option (88.24%) rather than the conversation style option (11.76%). Interruptions occurred in 20% of intervals when applicable (17.65% of intervals for the entire session), while nonperseverative speech occurred in 100% of applicable intervals (11.76% of intervals for the entire session).

In the combined dimensions session Michael allocated 73.68% of the time to a choice option that allowed him to converse actively about a high-preferred topic for 3 min and 26.32% of the time to the choice option that allowed the investigator to converse about a high-preferred topic for 30 s. Michael engaged in perseverative conversation for

64.29% (47.37% of all intervals for the entire session) of intervals and nonperseverative conversation in 14.29% of intervals (10.53% of all intervals for the entire session) during the active conversation choice option. Additionally, he interrupted during 60% of intervals (15.79% of intervals for the entire session) during the alternative option.

Conversation content versus conversation duration. Michael's choices in this condition suggested a relative preference for conversation content over conversation duration. In both test sessions Michael allocated 100% of the time to the choice option that allowed him to converse about a high-preferred topic for 30 s over talking about a less-preferred topic for 3 min. No conversation occurred in the first test session, while perseverative conversation occurred in 40% of intervals and nonperseverative conversation occurred in 20% of intervals during the second test session.

During the combined dimensions condition Michael allocated 100% of the time to a choice option that allowed him to talk about a less-preferred topic for 30 s instead of the choice option that would have allowed him to talk about a high-preferred topic for 3 min. No conversation took place during the combined dimensions condition.

Summary of Results

Michael's choices during the first stage of the preference assessment could not be validated completely during the second stage as he failed to demonstrate differential preference among three conversation topics (i.e., Webkinz, computer hardware, and dinosaurs). This pattern may indicate that Michael's relative preference for topics is likely to change depending upon the number of topics available or his preference changes rather quickly over time. In determining the least preferred conversation topic, the second stage provided similar results to the first stage with baseball being the least preferred for both. Given Michael's preference for Webkinz during the first stage of the preference assessment phase, a decision was made to use Webkinz as the "high-preferred topic" for subsequent phases.

Michael's results in Phase II suggested a preference for conversation about circumscribed interests and conversation of a longer duration. Michael failed to show a preference for active conversation, but demonstrated a high degree of interruptions when not allowed to actively converse about a circumscribed interest. He did not engage in perseverative conversation for greater than 70% of all intervals in any test condition and only did so in 20% of the intervals during the first trial of the test for social function. Nonperseverative conversation and no conversation occurred in all test conditions where applicable.

Michael did not demonstrate a preference hierarchy during Phase III. Conversational style was preferred in the first test condition, conversation duration was preferred during the second test condition, and conversation content was preferred during the final test condition. Thus, each dimension was chosen once by Michael. Perseverative conversation varied across test conditions and sessions, with rates no higher than 40% of session intervals. One test session in each of the three test conditions resulted in zero perseverative conversation; however, nonperseverative conversation occurred in all but one of these sessions. Interruptions occurred in all applicable sessions, with rates between 20% and 70% of session intervals.

Oscar

Phase I: Preference Assessment

Results for this stage are shown in Table 2. When all conversation topics were available, Oscar chose military history as the most preferred topic to discuss. Following the removal of military history from the available topics, he chose video games as his most preferred topic. Both of these topics had been identified as circumscribed interests by Oscar's parents. Music and football were the last two topics chosen with football being the final topic. Both of these topics were generated by the investigator.

When all possible pair combinations had been presented to Oscar, the topic chosen most often was military history, which was chosen in 100% of all trials (see

Figure 7). Video games was the next highest topic at 66.67%. Music was chosen in 33.33% of all trials and football was never chosen as a conversation topic.

Phase II: Assessment of Reinforcer Dimensions

Oscar's Phase II results are depicted in Figure 12. Oscar showed a preference in all four test conditions. In the test for social function he demonstrated sensitivity to social reinforcement as he allocated 100% of time to the choice option allowing perseverative conversation about a circumscribed interest. Oscar conversed perseveratively in 80% of all intervals for this condition, and engaged in nonperseverative conversation in 20% of all conditions.

Oscar demonstrated a preference for conversation about his circumscribed interest, choosing to allocate 100% of the time to conversation about military history over football in the test of reinforcer quality related to conversation content. Perseverative conversation occurred in 90% of all intervals, while nonperseverative conversation occurred in 10%.

During the test of reinforcer quality related to conversation style Oscar showed a preference for active conversation, allocating 100% of the time to the active conversation choice option. Perseverative conversation occurred in 100% of all intervals.

In the test of reinforcer magnitude, Oscar chose to allocate 100% of the time to the 3-min conversation choice option, suggesting a preference for longer conversation duration. During this condition he engaged in perseverative conversation about military history for 86.67% of all intervals, and talked non-perseveratively for 13.33% of intervals.

Phase III: Assessment of Competing Reinforcer Dimensions

Conversation content versus conversation style. Oscar showed a relative preference for conversation style in both test sessions for this condition (see Figure 25). He allocated 100% of time to the choice option involving active conversation about a

less-preferred topic over the choice option that allowed the investigator to converse about a high-preferred topic. Perseverative conversation was at 100% in both test sessions.

During the combined dimensions condition Oscar allocated 100% of the time to the choice option that allowed him to converse about a high-preferred topic instead of the alternative option, which allowed the investigator to discuss a less-preferred topic. Perseverative conversation was at 90% during the combined dimensions condition.

Conversation duration versus conversation style. Oscar allocated 100% of the time to the conversation style choice option that allowed him to converse about a high-preferred topic for 30 s rather than the alternative option, which allowed the investigator to converse about a high-preferred topic for 3 min (see Figure 26). This suggests a relative preference for conversation style over conversation duration. Perseverative conversation occurred in 100% of the intervals for both test sessions.

In the combined dimensions condition associated with this test condition, Oscar allocated 100% of the time to a choice option that involved active conversation about a high-preferred topic for 3 min. He engaged in perseverative conversation for 93.33% of the intervals during this combined dimensions session and no conversation occurred in 6.67% of the intervals. The alternative option which Oscar did not choose would have allowed the investigator to converse for 30 s about a high-preferred topic.

Conversation content versus conversation duration. Conversation content was relatively preferred over conversation duration during this test condition (see Figure 27). In both test sessions, which allowed Oscar to choose between conversing about a high-preferred topic for 30 s and conversing about a less-preferred topic for 3 min, he allocated 100% of time to the former choice option. Perseverative conversation was 80% of intervals for the first session and 100 of intervals for the second session, while nonperseverative conversation occurred in 20% of intervals for the first test session.

During the combined dimensions session, Oscar chose the option that allowed him to converse about a less-preferred topic for 30 s over conversing about a high-

preferred topic for 3 min. Nonperseverative conversation was at 83.33% of all intervals for this session and nonperseverative conversation was at 10%.

Summary of Results

The same two conversation topics (i.e., military history and video games) were chosen as high-preferred in both stages of the preference assessment and the same occurred for the least-preferred topics (i.e., music and football). The order of results for the high- and less-preferred conversation topics matched exactly in both stages, suggesting valid representations of Oscar's relative preference for the available topics.

In Phase II Oscar's results indicated a preference for conversation about a circumscribed interest, active conversation style, and longer conversation duration. In all test conditions Oscar engaged in perseverative conversation for no less than 80% of the intervals and nonperseverative conversation ranged from 10% to 20% across conditions.

Oscar demonstrated the highest preference for conversation style of the reinforcer dimensions tested (see Table 5). Conversation content followed, with conversation duration the least preferred. Perseverative conversation occurred in 100% of intervals in all test sessions except for one, where it occurred in 80% of intervals. Perseverative conversation was slightly less during combined dimensions conditions, but still above 80% in each session. Interruptions were not applicable in any condition as Oscar always allocated toward the choice option that allowed him to actively converse.

CHAPTER V

DISCUSSION

The purpose of this study was to better understand perseverative conversation, a unique, but problematic behavior in children and adolescents with Asperger's disorder, by evaluating its reinforcing properties. Hypotheses related to three dimensions associated with this behavior were studied using a concurrent operants arrangement to determine preference for these dimensions and preference when the dimensions competed against one another. This chapter includes a summary of the assessment results, a general discussion of the study, implications for research and clinic, study limitations, and directions for future research.

Summary of Overall Results

Phase I

Research suggests that circumscribed interests are a customary and stable trait in individuals with Asperger's disorder (e.g., Bashe & Kirby, 2001; Piven et al., 1996; Tantam, 1991) and are most often expressed through repetitive talking about the interests (e.g., Bashe & Kirby, 2001; South et al., 2005). For each of the participants in this study, their respective caregivers identified the interests that were most likely to be the focus of the participants' conversations. To ensure that the conversation topics nominated by the caregivers were preferred, Phase I, which consisted of a two-stage preference assessment, was conducted.

During the first stage of the preference assessment, which employed a MSWO method, more-preferred and less-preferred conversation topics were distinguished for all five participants (see Table 2). For each of the five participants the two most preferred topics matched those nominated by a caregiver prior to the assessment, suggesting accurate caregiver nominations. For all but one subject (i.e., Andrew), neither of the least preferred topics had been a nominated topic by a caregiver. For Andrew, the topic of

bugs had been identified as a preferred topic prior to the assessment but was chosen sixth out of seven topics.

The second stage of the preference assessment, which involved a forced-choice methodology, served as a means to validate the results of the first stage and to further separate the more-preferred and less-preferred conversation topics by allowing the participants the opportunity to sample the topics in conversation and then presenting the topics in pairs rather than in larger groups. For four of the five participants there was no change from the first stage to the second stage in terms of the two most- and the two least-preferred topics, suggesting correspondence across the preference assessment methods. Although Michael's least-preferred conversation topic (i.e., baseball) did not change from the first to the second stage, another less-preferred topic from the first stage, dinosaurs, was chosen just as often as two other high-preferred topics during the second stage. The order of the two most- or least-preferred topics, but not both, changed from stage one to stage two for all but one participant (i.e., Oscar), such that a topic chosen first in the first stage was identified as second-most preferred in the second stage and vice-versa, or a topic chosen as least-preferred during the first stage was identified as second to last in the second stage.

Phase II

The most salient lineament of perseverative conversation within the research literature on Asperger's disorder are related to the content (e.g., Attwood, 1998), style (e.g., Eisenmajer, et al., 1996), and duration (e.g., Ghaziuddin & Gerstein, 1996) of this behavior. This phase of the study was conducted to evaluate each participant's relative preference for dimensions related to reinforcer quality and reinforcer magnitude, thereby testing four of the five study hypotheses.

The first test condition, the test for social function, assessed whether the participant was sensitive to social reinforcement. This condition tested the hypothesis, When given a choice between sitting alone or talking about a preferred topic with another

person, children and adolescents with Asperger's disorder will choose to talk about a preferred topic with another person. All five participants demonstrated sensitivity to social contingencies, confirming this hypothesis. Four of the five participants allocated 100% of the time to the social choice option on the first trial. Michael did so on the second trial after splitting time in each choice option during the first trial. Perseverative conversation was at 70% of intervals or above for all participants.

The test of reinforcer quality related to conversation content tested the following hypothesis: Given a choice between talking about a circumscribed interest and talking about a neutral topic, children and adolescents with Asperger's disorder will choose to converse on the topic associated with their circumscribed interest(s). This hypothesis was confirmed for all five participants who allocated 100% of the time to the option that included conversation about a circumscribed interest. Perseverative conversation was higher during this test condition than all others, with four of the five participants conversing perseveratively for 90%.

The test of reinforcer quality related to conversation style tested the hypothesis that suggested the children and adolescents with Asperger's disorder and perseverative conversation problems would choose to take an active conversation style over a passive one if given the choice. This hypothesis was confirmed for four of the five participants. Only Michael allocated more time to the choice option that allowed the investigator to converse about a high-preferred topic. Andrew spent an equal amount of time in both choice options during the first trial, but then allocated to the conversation style choice option for the second and third trials. With the exception of Michael, who did not spend any time in active conversation, perseverative conversation was at or above 70% of intervals during this test condition. A relatively high level of interruptions occurred when three of the participants (i.e., Michael, Andrew, and Clint) allocated time to the passive conversation choice option. Interruptions ranged from 50% to 100% of the applicable

intervals, suggesting that even when one of the participants chose to allow another person to control the conversation they had difficulty relinquishing control.

The hypothesis that proposed children and adolescents with Asperger's disorder who demonstrate problems with perseverative conversation would choose to converse for a longer rather than a shorter duration was examined in the test of reinforcer magnitude. Of all the hypotheses, less support was found for this one than the all others. Three of the participants allocated time to the option with the longer conversation duration. Perseverative conversation ranged from 60% of intervals to 100% of intervals, with the highest degree occurring in the shorter duration choice option (i.e., average of 73.33% during the 3-min option versus 95% during the 30-s choice option).

Based upon Phase II results, four of this study's hypotheses were confirmed. The greatest amount of support was evident for the social function hypothesis and the conversation content hypothesis, which were unanimously confirmed (see Table 3).

Phase III

The results of Phase II demonstrated that, in general, children and adolescents with Asperger's disorder show preference for conversation involving circumscribed interests, an active conversation style, and longer duration. Phase III assessed the participant's relative preference between these three dimensions. Thus, the final phase of this study tested the hypothesis that children and adolescents with Asperger's disorder who exhibit problems with perseverative conversation will demonstrate relative preference for a specific dimension of reinforcement. This was confirmed for all but one participant (i.e., Michael; see Tables 3 and 4).

When conversation about a circumscribed interest (and a passive conversation style) competed with an active conversation style (and a less-preferred conversation topic), three of the five participants showed a relative preference for the former. With the exception of Michael, the choices were definitive, necessitating only two trials of this condition. However, three of the participants (i.e., Andrew, Juan, and Michael) allocated

time to both choice options during at least one of the trials. For Michael, three trials were administered with agreement occurring for the first and third trials. Perseverative conversation about circumscribed interests was very low for one of the three participants who allocated at least a portion of time to the conversation style condition (i.e., Michael), while a moderate degree of perseverative conversation (i.e., average of 42% of intervals across both trials) was exhibited by another participant (i.e. Juan). Oscar engaged in a relatively high degree of perseverative conversation (i.e., an average of 90% of the intervals across the two trials). However, it should be noted that perseverative conversation about a circumscribed interest was not allowed during this condition, suggesting that Juan and Oscar had trouble inhibiting this behavior. Interruptions ranged from 0% to 66.67% of intervals (average of 30.28%) for the three participants who allocated time to the conversation content choice option, which also suggests at least minor inhibitory control difficulties.

In the test of relative preference between a longer conversation duration (with a passive conversation style) and an active conversation style (for a shorter conversation duration), all but one participant (i.e., Michael) demonstrated a preference for conversation style. Clint was the only participant to require three test trials to determine a preference, with the latter two trials showing agreement. Perseverative conversation was often at or above 80% of intervals when time was allocated to the conversation style choice option. The only exceptions were for a single trial for one participant (i.e., Juan; 60% of intervals), and a brief 12-s allocation to the conversation style option by Michael, which did not include any perseverative conversation. Interruptions occurred during all applicable trials, with a relatively small range of occurrence (i.e., 20% to 30% of intervals).

In the final test condition, conversation about a circumscribed interest (for a shorter conversation duration) competed against a longer conversation duration (about a less-preferred topic). All five of the participants demonstrated a relative preference for

conversation about a circumscribed interest and all five showed this preference in only two trials, with 100% allocation for each. For all participants, except Michael, perseverative conversation averaged 90% or higher across the two trials. This was higher than any other test condition. Michael only averaged 20% across two trials.

For four of the five participants the hierarchical order of reinforcer dimensions (see Table 5) fell into one of two patterns: (a) conversation style as the most preferred and conversation duration as the least preferred (i.e., style-content-duration); or (b) conversation content as the most preferred and conversation duration as the least preferred (i.e., content-style-duration). Juan and Oscar demonstrated the first pattern, while Andrew and Clint displayed the second pattern. For all four of these participants conversation duration was the least preferred of the dimensions, suggesting that conversation duration may be less likely to serve as a reinforcer for perseverative conversation than the content or style of conversation. For Michael, no discernable hierarchy was achieved, suggesting that the three dimensions of reinforcement were equally preferred. A comparison of perseverative conversation across all applicable choice options indicated that those in which the participant was allowed to actively converse about a circumscribed interest, even when it entailed shorter conversation duration, resulted in the highest level of perseverative conversation (i.e., average of 77.37% of all intervals) among all choice options.

General Discussion

Repetitive thinking and behavior (e.g., compulsions, echolalia, stereotypies, tics) is common across a variety of developmental and psychiatric conditions (e.g., obsessive compulsive disorder, Parkinson's disease, schizophrenia, Tourette's syndrome). For autism spectrum disorders it constitutes one of three domains in the diagnostic criteria. However, research on repetitive thinking and behavior in autism is exceedingly overshadowed by studies on the social and communication deficits of this population (Rutter, 1996). Studies have determined that perseverative conversation is a widespread

behavior problem in individuals with Asperger's disorder (e.g., Bashe & Kirby, 2001) and deleterious effects are frequently cited in clinical accounts of Asperger's disorder. For example Allen et al. (2008) and Ghaziuddin (2002) suggested that violence and criminal acts in individuals with Asperger's disorder are commonly indicated as consequences resulting from the restriction of perseverative conversation and behavior regarding circumscribed interests. There are a few theories as to how this behavior develops and is maintained over time (see Turner, 1999 for a brief overview); however, these theories have not been tested and they focus more on a broad range of perseverative behaviors and individuals with lower functioning autism.

There are numerous research studies that have empirically evaluated various forms of perseverative communication, such as bizarre speech, echolalia, and perseverative speech, and a few of these have successfully treated these behaviors (e.g., DeLeon et al., 2003; Wilder et al., 2003). Unfortunately, the type of perseverative conversation exhibited by those with Asperger's disorder is qualitatively different in its form than those behaviors studied previously. For example, it entails more extensive, spontaneous speech with novel verbalizations made up of grammatically correct sentences. Given the frequency of this problem behavior and the potentially severe repercussions associated with it it is surprising that no known empirical research has been conducted to better understand the reinforcing properties it possesses.

This study extended the existing literature as it is the first known empirical examination of the reinforcing dimensions of perseverative conversation in children and adolescents with Asperger's disorder. Although clinical descriptions of this behavior abound and studies have identified this as a prevalent behavior in the Asperger's disorder population, no other study has made an attempt to find out what makes this behavior reinforcing to those who engage in it.

In order to evaluate perseverative conversation, it had to be conceptualized in a way that would separate it from other forms of perseverative communication. This is the

first study to operationally define perseverative conversation, as it is applied to individuals with Asperger's disorder, and the three reinforcer dimensions tested that were hypothesized to maintain it. Although these definitions should be subject to questions of validity and reliability, this represents the first attempt to transmute perseverative conversation from its conceptual definition to an operational definition that is researchable from a behavioral perspective.

Within the field of applied behavior analysis, concurrent operants arrangements have been used to assess problem behaviors such as PICA (Piazza et al., 1996), self-injury (e.g., Shore, Iwata, DeLeon, Kahng, & Smith, 1997) and aggression (e.g., Harding et al., 1999). Problem vocal behavior, including perseverative communication (e.g., echolalia, perseverative speech) has been studied on multiple occasions using functional analysis methodology (e.g., Ewing et al., 2002; Frea & Hughes, 1997). However, to date no known studies have used a concurrent operants arrangement to study problem vocal behaviors. This study extends the current literature on choice and concurrent operants arrangements by examining a behavioral topography previously not studied in this format.

Study Implications

From a group-level perspective the hypotheses examined in this study were accepted. The participants' choices suggested sensitivity to social reinforcers, showed preference for conversation about circumscribed interests, active conversation style, and longer conversation duration. Additionally, the participants demonstrated preference for specific dimensions of reinforcement when they competed against each other. These results suggest that individuals with Asperger's disorder who demonstrate perseverative conversation show individualized preference for different aspects of this behavior. Current literature has indicated that perseverative conversation is more likely to revolve around circumscribed interests than other topics, often involves controlling or active conversation style rather than a passive style, and is more likely to be long-winded than

succinct, and this study provided the evidence to support these descriptions. All five participants showed sensitivity to social reinforcement, as displayed during the test for social function. Although we did not extensively examine the role of social reinforcers (e.g., attention) as motivation for perseverative conversation, the results support the claim (e.g., McPartland & Klin, 2006) that despite an appearance of apathy towards others or disinterest in social interaction, many children with Asperger's disorder may be motivated by social interaction. Moreover, no participant was required to converse during the assessment sessions, yet in 50% of all applicable sessions perseverative conversation was above 90% of session intervals, suggesting regular social interaction.

At the participant level a moderate degree of variability was present and not all hypotheses were accepted for all participants. In Phase II, two of the five participants (i.e., Andrew and Juan) failed to show preference for longer conversation duration and one participant (i.e., Michael) failed to show preference for active conversation style. In Phase III, Michael did not show preference for a particular reinforcer dimension when these dimensions were in competition. The variability among participants provides important implications to the study of perseverative conversation in Asperger's disorder. Although the group results allow us to infer that, in general, children and adolescents with Asperger's disorder who engage in perseverative conversation show preference for conversation about circumscribed interests, active conversation style, and longer conversation duration, the individual results suggest that differences within this population should be expected. In fact, based upon the individual results, with the exception of conversation content, differences are likely.

Limitations

Novel studies are often vulnerable to criticism, misinterpretation, and errors. This study is no exception. Potential limitations, both within and across all three phases exist. Within Phase I participants were never allowed to sample any of the conversation topics prior to the first stage and they were not allowed access to conversation on these topics

until the second stage. There is some research to suggest that this may make a difference in individual's choices (Tessing, Napolitano, McAdam, DiCesare, & Axelrod, 2006). In fact, during the second stage of the preference assessment, in which participants were allowed access to conversation on the competing topics, minor changes in the order of preference (e.g., most preferred became second-most preferred and vice-versa) occurred for all but one participant. However, no major differences were observed across the two stages.

For the sake of efficiency only one trial was conducted for each test condition in Phase II, unless time allocation between the choice options was equal, and either two or three trials were conducted for each test condition in Phase III. This is a limitation in the sense that it did not allow for a pattern of stable responding to occur. With additional trials stable responding would have lead to greater confidence in the results. Moreover, as was the case in Phase III, time allocation may have changed in subsequent trials in Phase II had additional trials been carried out. Ultimately, the limited number of trials may cast doubt on the results.

Another limitation is that in all three phases of this study perseverative conversation occurred in an unnatural context. Prior to the study, caregivers for each participant reported that perseverative conversation occurred in a spontaneous fashion, without prompting or cuing. In typical social interactions the responses they typically receive from others during the perseverative conversation will usually entail social cues (e.g., facial expressions suggesting boredom, verbal responses or requests to stop talking) to suggest disinterest in the conversation and there is often more extensive reciprocal verbal dialogue. Unlike the natural settings, during this assessment participants were cued to talk about a particular topic, allowing the card to prime the conversation and serve as a discriminative stimulus for the opportunity to do so. Additionally, the investigator was restricted from providing the natural social cues that can signal a child to stop conversing. However, in a natural context the individual would be more likely to

initiate perseverative conversation spontaneously without a cue/prompt and social cues would be likely to occur.

Although the proposed research protocol called for up to three sessions over the course of no more than three weeks time in order to complete the assessment, three of the participants completed the entire assessment in one day. Thus, regular access to perseverative conversation for upwards of three consecutive hours raises the possibility of satiation and serves as a limitation in this study. Despite caregivers' reports that the duration of perseverative conversation could last from 10 minutes to 1 hour and 30 minutes and for some participants the level of perseverative conversation was just as high at the end of Phase III as it was in the beginning of Phase II, it would be impossible to determine the effect of satiation on responding over the course of the assessment. Satiation would be more likely for the three participants who completed the assessment in one day, providing an unaccountable variable that may have led to different results between the two groups (i.e., those who completed the assessment in one day versus those who completed it in three separate sessions).

Finally, one assumption underlying this study was that perseverative conversation, like many other problem vocal behaviors, is maintained via social attention. Although we conducted a test for social function, resulting in a strong likelihood that all participants are sensitive to social reinforcement, we did not evaluate further the idea that other forms of social reinforcement, such as escape from tasks or aversive situations, or access to tangibles, could serve as a function or additional functions of this behavior. Using functional analysis methodology prior to this assessment may have enhanced the validity of attention assumption.

Future Directions

As a relatively new mental health diagnosis Asperger's disorder has been the subject of only a fraction of the research conducted on autism spectrum disorders as a whole. Perseverative conversation is a specific characteristic of this disorder that has

much written about it but little research to understand it. Although there are existing theories as to why perseverative thinking and behavior occur in individuals with autism and Asperger's disorder (e.g., see Turner, 1999 for a review), none have been proven and no known research has been conducted to better understand why it may be reinforcing. This study attempted to do that; however, it is only the first step in a long line of much needed research. Much can be done to improve and build upon this study as well as use the information that resulted to develop treatments to address this problem behavior.

In order to make this assessment better suited to outpatient clinics where evaluations typically range from 60 to 120 minutes, future studies should attempt to develop a more abbreviated assessment. Some popular assessment procedures currently being used in outpatient clinics, such as the brief functional analysis (e.g., Cooper et al., 1990) and the brief (free-operant) preference assessment (Roane et al., 1998) were adapted from more extended procedures. Similar extensions may be possible with the procedures in the current study. Given the accuracy of caregiver reports and the strong correspondence between the first and second stages of the preference assessment, eliminating the preference assessment altogether or eliminating the second stage of the preference assessment may ways to reduce the duration of the assessment. Although an interview format would not allow for the observation of perseverative conversation for Phases II and III, but it may serve as an adequate alternative when time constraints exist.

This study focused on reinforcer dimensions that were tied to the literature on perseverative conversation; however, additional reinforcer dimensions and variations on the dimensions used in the current study may also prove important for understanding this behavior. For example, although studies of individuals with Asperger's disorder have suggested that circumscribed interests are most often expressed via conversation, future studies should attempt to corroborate this suggestion by evaluating different classifications of reinforcement whereby access to perseverative conversation about circumscribed interests competes with access to tangibles (e.g., reading materials, toys,

figures) related to the circumscribed interests. Other dimensions of reinforcement, such as delays to reinforcement (e.g., waiting one minute for one minute of perseverative conversation versus waiting five minutes for ten minutes of perseverative conversation), and response effort (e.g., complete ten math problems for one minute of perseverative conversation versus twenty math problems for two minutes of perseverative conversation) would also be beneficial for the prescription of treatment. Variations on the reinforcer dimensions in the current study may lead to different findings in future research. For example, modifying reinforcer magnitude by further differentiating the longer and shorter durations (e.g., increasing 3-min sessions to 10-min sessions and decreasing 30-s sessions to 15-s sessions) may lead to more consistent findings for those participants who see little difference between the current duration times or may lead to behavioral change as those who chose longer session duration become satiated earlier.

The results of this study provide knowledge about an understudied problem vocal behavior; however, just as it is the case with functional analysis methodology, the ultimate goal is not the knowledge that results from the assessment but the development of effective treatments tied to this knowledge. Behavior analytic research has shown that failure to match treatments to assessment results leads to poor outcomes (Mace, 1994). Although the participants in this study did not often allocate to choice options that allowed the investigator to converse, when they did interruptions occurred in 80% of the sessions despite rules prohibiting it and planned ignoring by the investigator. This suggests that setting explicit expectations (i.e., rules) and/or planned ignoring is not enough to discourage perseverative conversation. Treatment may be more successful if particular dimensions of reinforcement are targeted in a systematic way. One example of this type of treatment is a concurrent operants arrangement (e.g., Harding et al., 2002; Peck et al., 1996; Piazza, Fisher, Hanley, Remick, Contrucci, & Aitken, 1997) whereby the most preferred dimension of reinforcement competes with the less-preferred dimensions in a choice format that attempts to develop flexibility by biasing the

individual's choice. For example, if an individual demonstrates a hierarchy that includes conversation content as the most preferred, followed by conversation style and conversation duration, the choice options might be set up so that the individual must choose between listening to the therapist discuss the circumscribed interest for a short period of time and actively conversing about a neutral topic for a long duration. In either choice option the individual is "giving up" a dimension of reinforcement and no longer actively conversing about a circumscribed interest for a long duration. Given that all but one of the participants in this study showed the greatest preference for either conversation content or conversation style these dimensions may be important areas to target for the majority of children and adolescents with this problem behavior.

Finally, as mentioned earlier, a common limitation to research in clinic settings is the inability to reproduce the natural environment, including naturally occurring antecedent and consequence events. Future research should devise assessments of perseverative conversation that allow for exposure to natural contingencies. Common settings, such as home and school, and persons most responsible for social reinforcement, such as family and schoolmates, should be incorporated into such evaluations.

Summary

Perseverative conversation has been described as a significant source of disruption in the lives of individuals with Asperger's disorder, as it exacerbates already deficient social development (Church et al., 2000; Frith, 1991), prevents productivity at home and school, and leads to serious behavior problems (Myles and Southwick, 1999). Five children and adolescents diagnosed with Asperger's disorder served as participants in a study on perseverative conversation. Using concurrent operants arrangements this study sought to identify the reinforcing properties of this problem vocal behavior. Assessment results suggested that the participants were sensitive to social reinforcement, and preferred conversation about their respective circumscribed interests, active conversation style, and longer conversation duration. Additionally, all but one participant

demonstrated a preference for a singular reinforcer dimension over other dimensions of reinforcement. The results provide information that may be incorporated into acceptable treatments for perseverative conversation and stimulate additional research to replicate these results and explore other important dimensions of reinforcement. This study is unprecedented in the sense that no previous studies have explored this specific behavior in an empirical manner, and no studies of similar behaviors have explored the reinforcer dimensions via a concurrent operants arrangement. It represents a first step in what should be a long line of research on perseverative conversation.

APPENDIX A
TABLES AND FIGURES

Table A1. *Participant Descriptions*

Participant	Age (year-month)	Other Diagnoses (in order of most recent)	Topics of Interest (in no particular order)
Andrew	8 – 1	obsessive-compulsive disorder	elevators, butterflies, helicopters, bugs, SpongeBob Square pants television show, clocks
Clint	11 – 5	attention deficit hyperactivity disorder; disruptive behavior disorder, not otherwise specified	hunting, trapping, hiking, animals, <i>NCIS</i> television show
Juan	10 – 4	disruptive behavior disorder, not otherwise specified; cognitive disorder, not otherwise specified	geography, video games, weather, Pokémon
Michael	9 – 9	major depressive disorder; obsessive-compulsive disorder; nonverbal learning disorder	Webkinz, Bionicals, Legos, computer hardware
Oscar	13 – 0	None	military history, video games, natural science

Figure A1. Phase II: Test Conditions for Assessment of Reinforcer Dimensions

CONDITION A	Phase II: Assessment of Reinforcer Dimensions	CONDITION B
Participant talks with the investigator about preferred topic for 1 minute	<i>Test for Social Function</i>	Participant is alone for 1 minute
Participant talks with the investigator about preferred topic for 1 minute	<i>Test of Reinforcer Quality: Conversation Content</i>	Participant talks with investigator about low-preferred topic for 1 minute
Participant talks with the investigator about preferred topic for 1 minute	<i>Test of Reinforcer Quality: Conversation Style</i>	Investigator talks with participant about preferred topic for 1 minute
Participant talks with the investigator about preferred topic for 3 minutes	<i>Test of Reinforcer Magnitude</i>	Participant talks with investigator about preferred topic for 30 seconds

Figure A2. Phase III: Test Conditions for Assessment of Competing Reinforcer Dimensions

Phase III: Assessment of Competing Reinforcer Dimensions

CONDITION A

CONDITION B

Test	Investigator talks about preferred topic for 1 minute	<i>The relative preference between Content (A) and Style (B)</i>	Participant talks about less-preferred topic with investigator for 1 minute	Test
Control	Participant talks about preferred topic with investigator for 1 minute		Investigator talks about less-preferred topic for 1 minute	Control
Test	Investigator talks about preferred topic for 3 minutes	<i>The relative preference between Duration (A) and Style (B)</i>	Participant talks about preferred topic with investigator for 30 seconds	Test
Control	Participant talks about preferred topic with investigator for 3 minutes		Investigator talks about preferred topic for 30 seconds	Control
Test	Participant talks about preferred topic with investigator for 30 seconds	<i>The relative preference between Content (A) and Duration (B)</i>	Participant talks about less-preferred topic with investigator for 3 minutes	Test
Control	Participant talks about preferred topic with investigator for 3 minute		Participant talks about less-preferred topic with investigator for 30 seconds	Control

Table A2. Preference Assessment Stage One Results

	Andrew	Clint	Juan	Michael	Oscar
High Preferred	<i>clocks</i>	<i>guns</i>	<i>video games (Doom)</i>	<i>Webkinz</i>	<i>military history</i>
	<i>elevators</i>	<i>NCIS television show</i>	<i>geography (maps)</i>	<i>computer hardware</i>	<i>video games</i>
	Pokémon	<i>trapping</i>	swimming	<i>Legos</i>	<i>biology</i>
	<i>helicopters</i>	<i>hiking</i>	<i>Pokémon</i>	<i>Bionicals</i>	bicycles
	<i>butterflies</i>	<i>bow shooting</i>			
		baseball			
Low Preferred	<i>bugs</i>	Bakugan	baseball	dinosaurs	music
	baseball	swimming	Transformers	baseball	football

Note. Topics listed in italics were reported as circumscribed interests by caregiver report. All others were generated by the investigator.

Table A3. Summary of Phase II Results

	Test for Social Function¹	Test of Reinforcer Quality Related to Conversation Content²	Test of Reinforcer Quality Related to Conversation Style³	Test of Reinforcer Magnitude⁴
Andrew	Preference for social reinforcement	Preference for conversation about circumscribed interest	Preference for active conversation style	Preference for shorter conversation duration
Clint	Preference for social reinforcement	Preference for conversation about circumscribed interest	Preference for active conversation style	Preference for longer conversation duration
Juan	Preference for social reinforcement	Preference for conversation about circumscribed interest	Preference for active conversation style	Preference for shorter conversation duration
Michael	Preference for social reinforcement	Preference for conversation about circumscribed interest	Preference for passive conversation style	Preference for longer conversation duration
Oscar	Preference for social reinforcement	Preference for conversation about circumscribed interest	Preference for active conversation style	Preference for longer conversation duration

Note. Shaded regions indicate study hypothesis was confirmed for participant. Non-shaded regions indicate study hypothesis not confirmed for participant.

1. Hypothesis tested: Participant will choose to talk about circumscribed interest with another person over nothing.
2. Hypothesis tested: Participant will choose to talk about circumscribed interest over another topic.
3. Hypothesis tested: Participant will choose to actively converse rather than passively converse about circumscribed interest.
4. Hypothesis tested: Participant will choose to converse for a longer duration over a shorter duration about circumscribed interest.

Table A4. *Summary of Phase III Results*

	Conversation Content vs. Conversation Style	Conversation Duration vs. Conversation Style	Conversation Content vs. Conversation Duration
Andrew	Content	Style	Content
Clint	Content	Style	Content
Juan	Style	Style	Content
Michael	Style	Duration	Content
Oscar	Style	Style	Content

Table A5. *Hierarchy of Reinforcer Dimensions Based upon Phase III Results*

Hierarchical Order of Reinforcer Dimensions	
Andrew	1. Conversation Content 2. Conversation Style 3. Conversation Duration
Clint	1. Conversation Content 2. Conversation Style 3. Conversation Duration
Juan	1. Conversation Style 2. Conversation Content 3. Conversation Duration
Michael	1. Conversation Style (tie) Conversation Content (tie) Conversation Duration (tie)
Oscar	1. Conversation Style 2. Conversation Content 3. Conversation Duration

Figure A3. Phase I: Forced-Choice Preference Assessments Results for Andrew

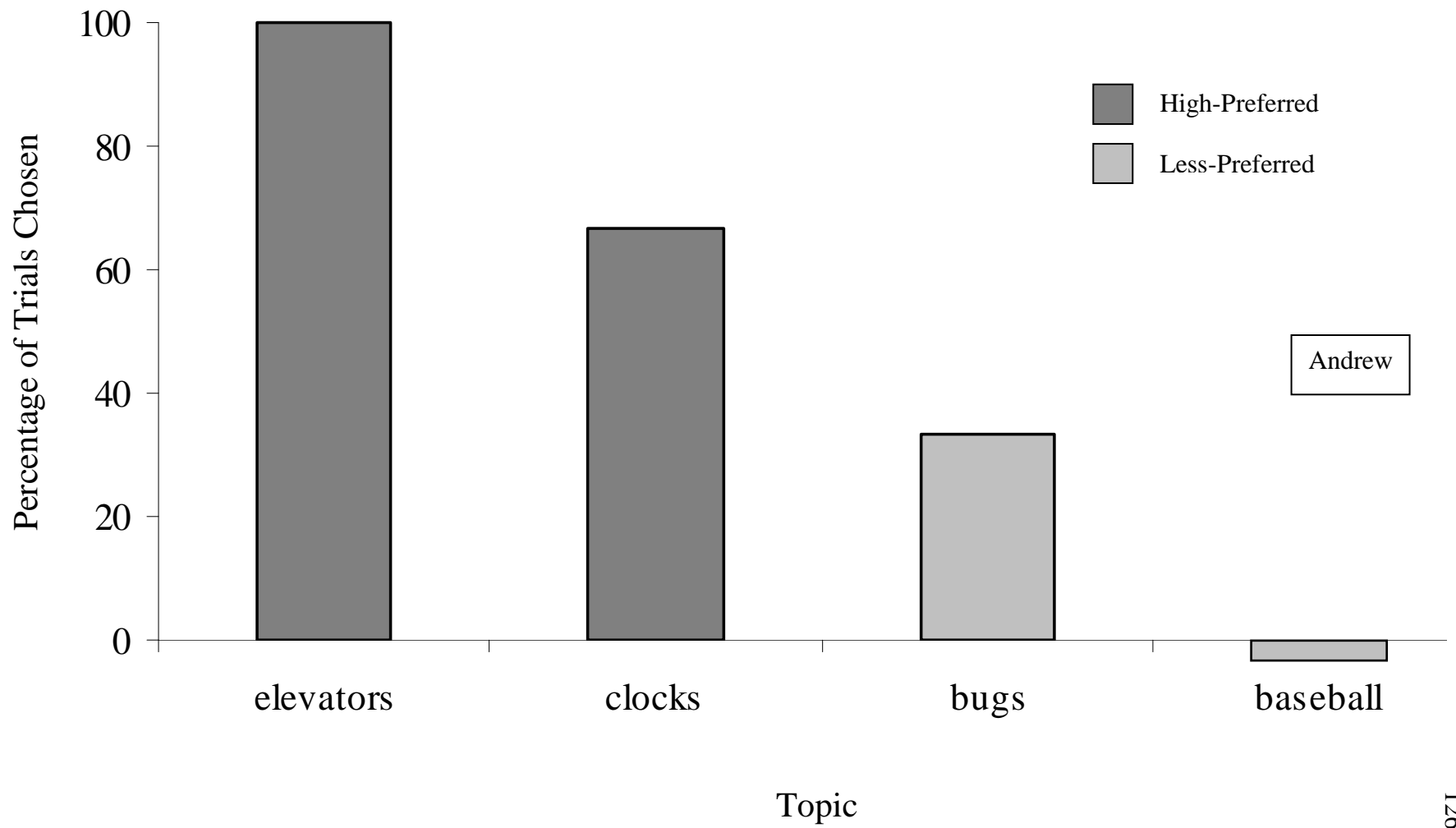


Figure A4. Phase I: Forced-Choice Preference Assessments Results for Clint

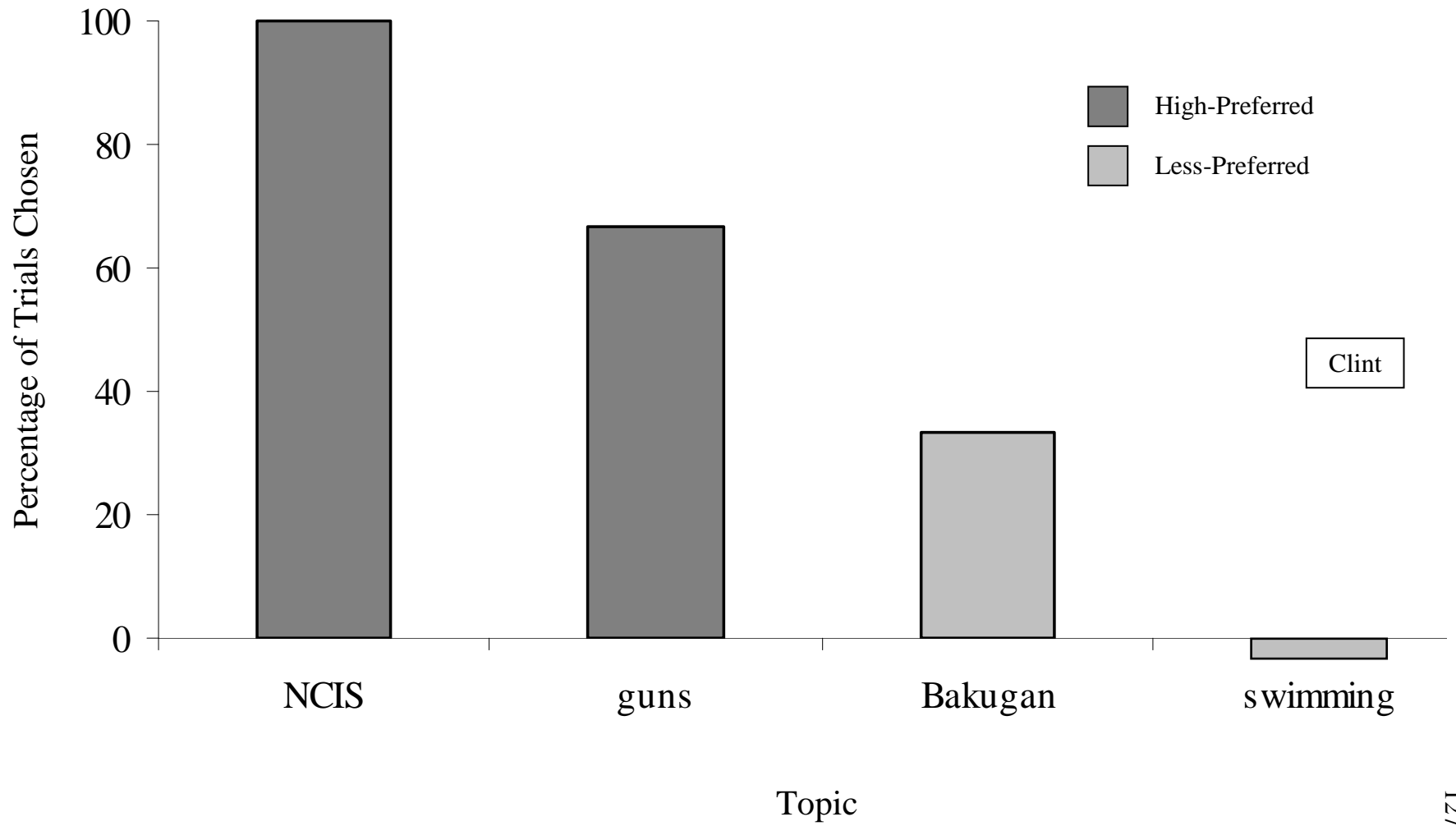


Figure A5. Phase I: Forced-Choice Preference Assessments Results for Juan

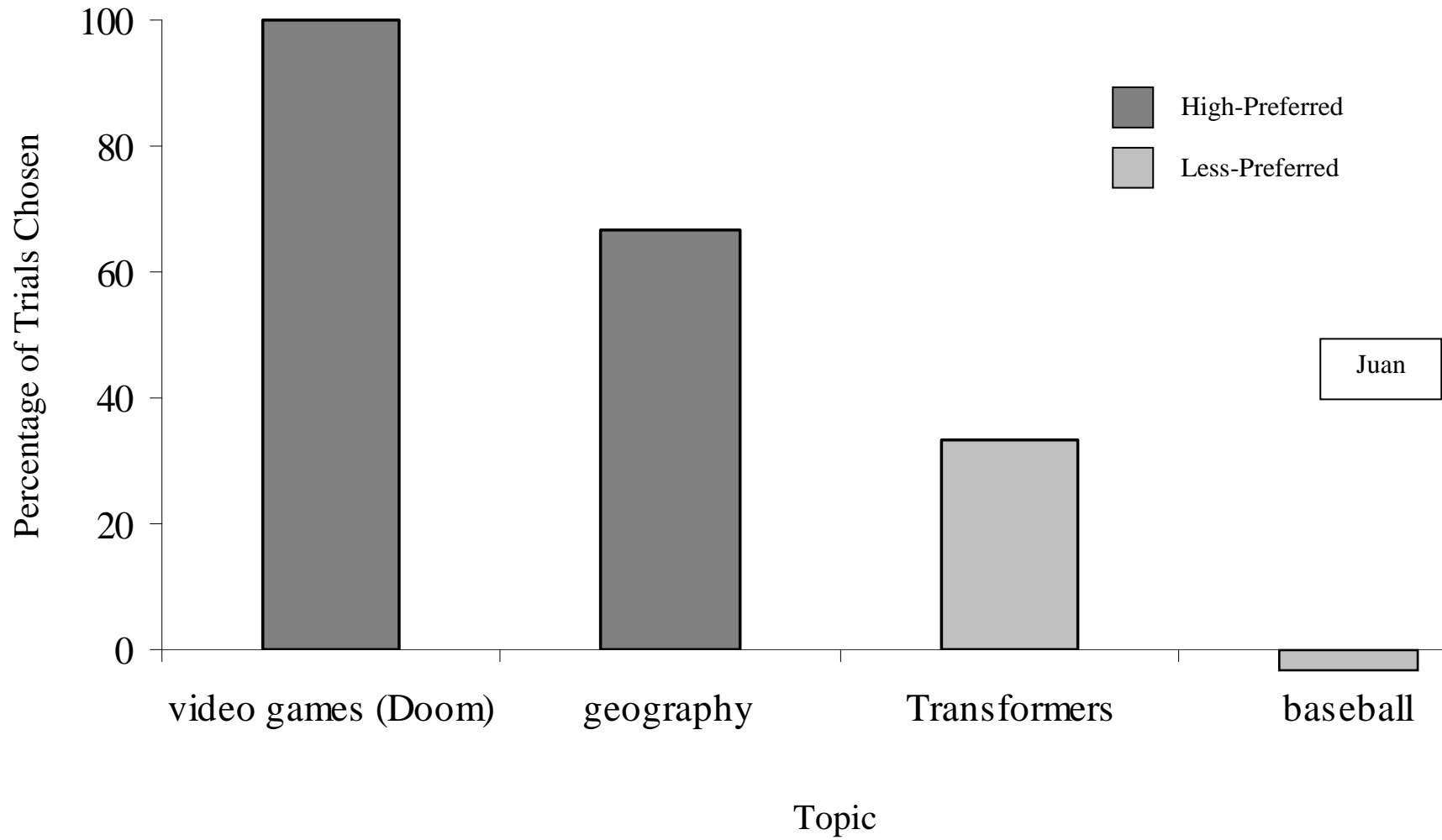


Figure A6. Phase I: Forced-Choice Preference Assessments Results for Michael

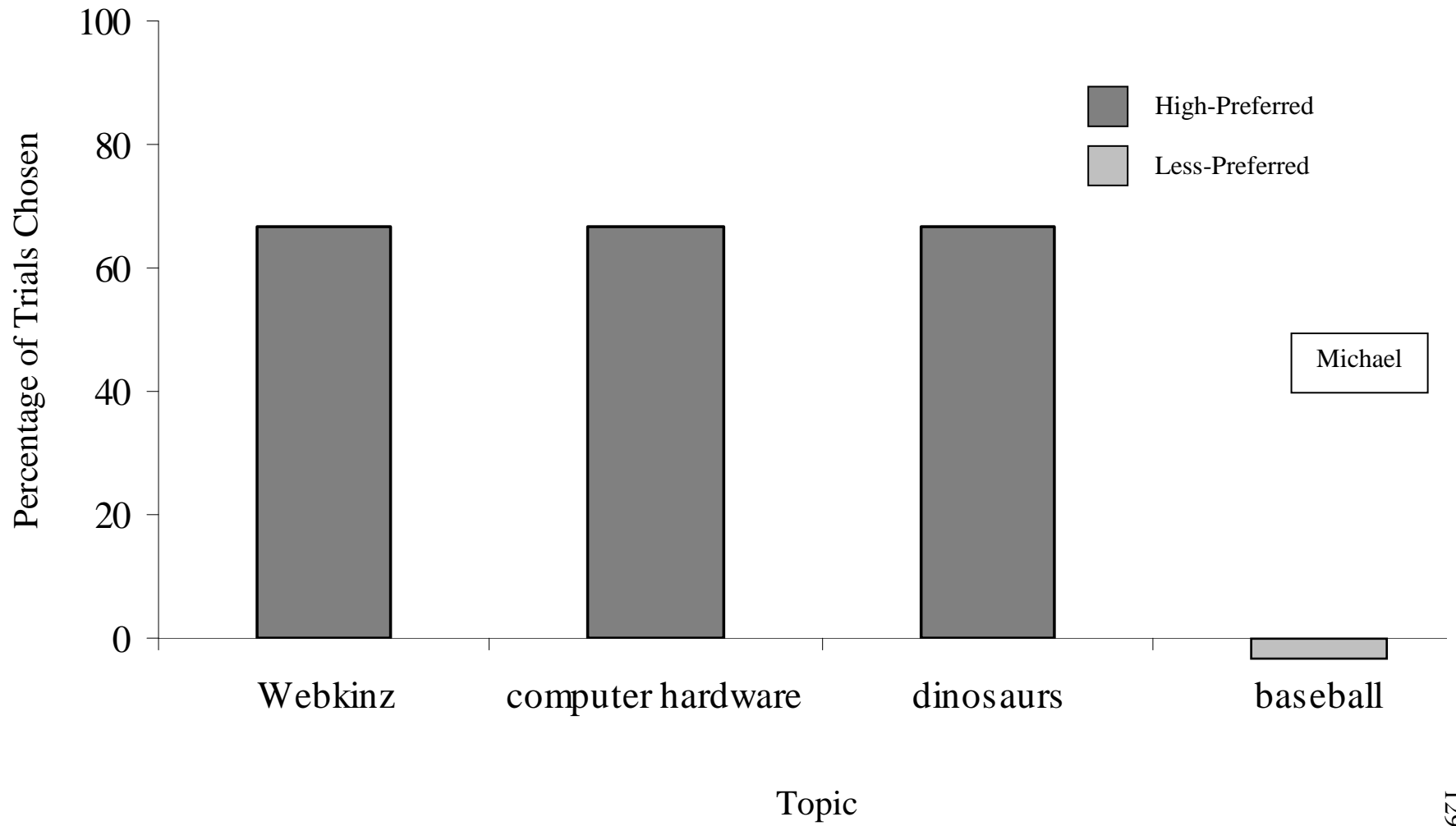


Figure A7. Phase I: Forced-Choice Preference Assessments Results for Oscar

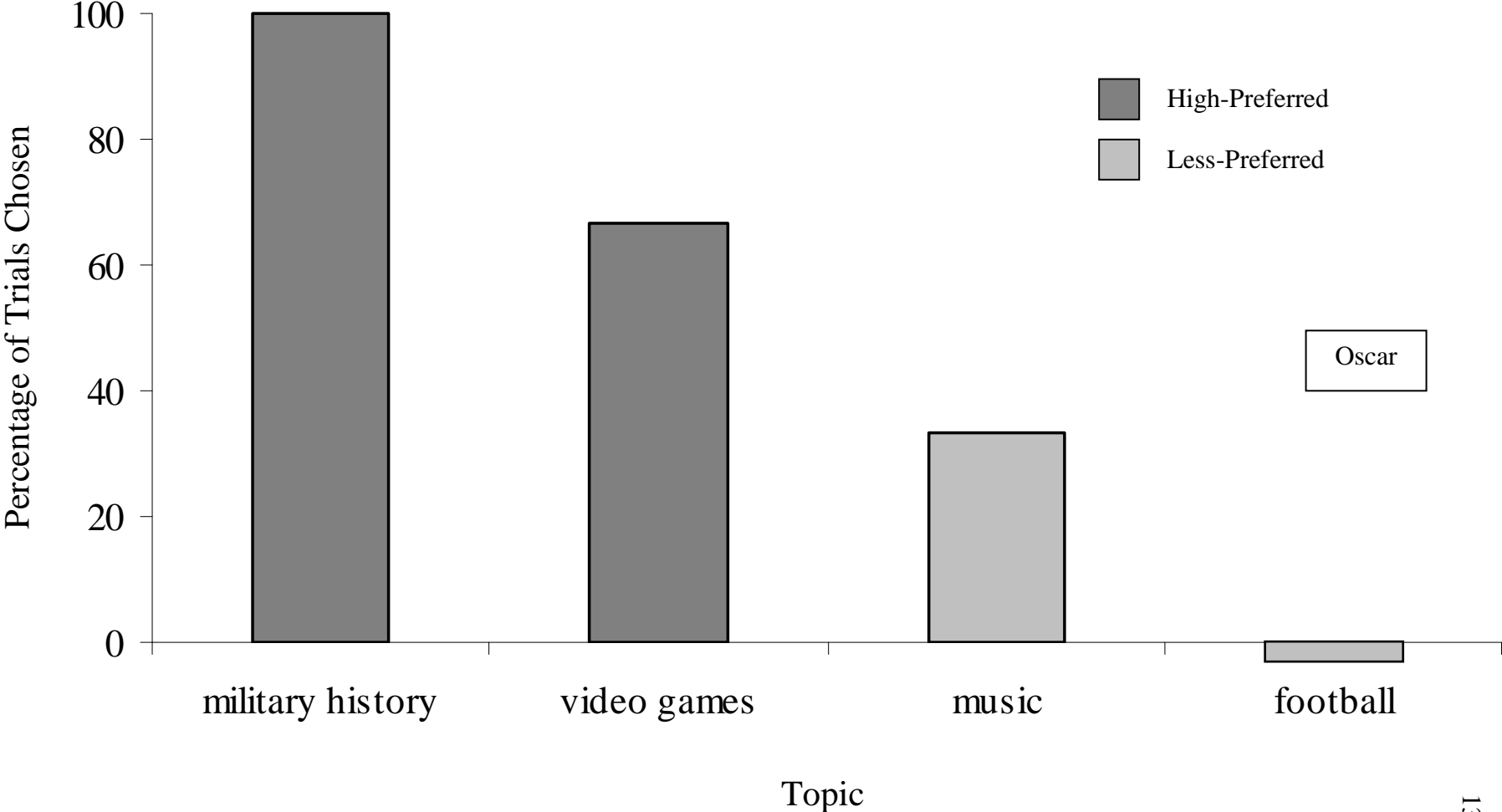


Figure A8. Phase II: Assessment of Reinforcer Dimensions Results for Andrew

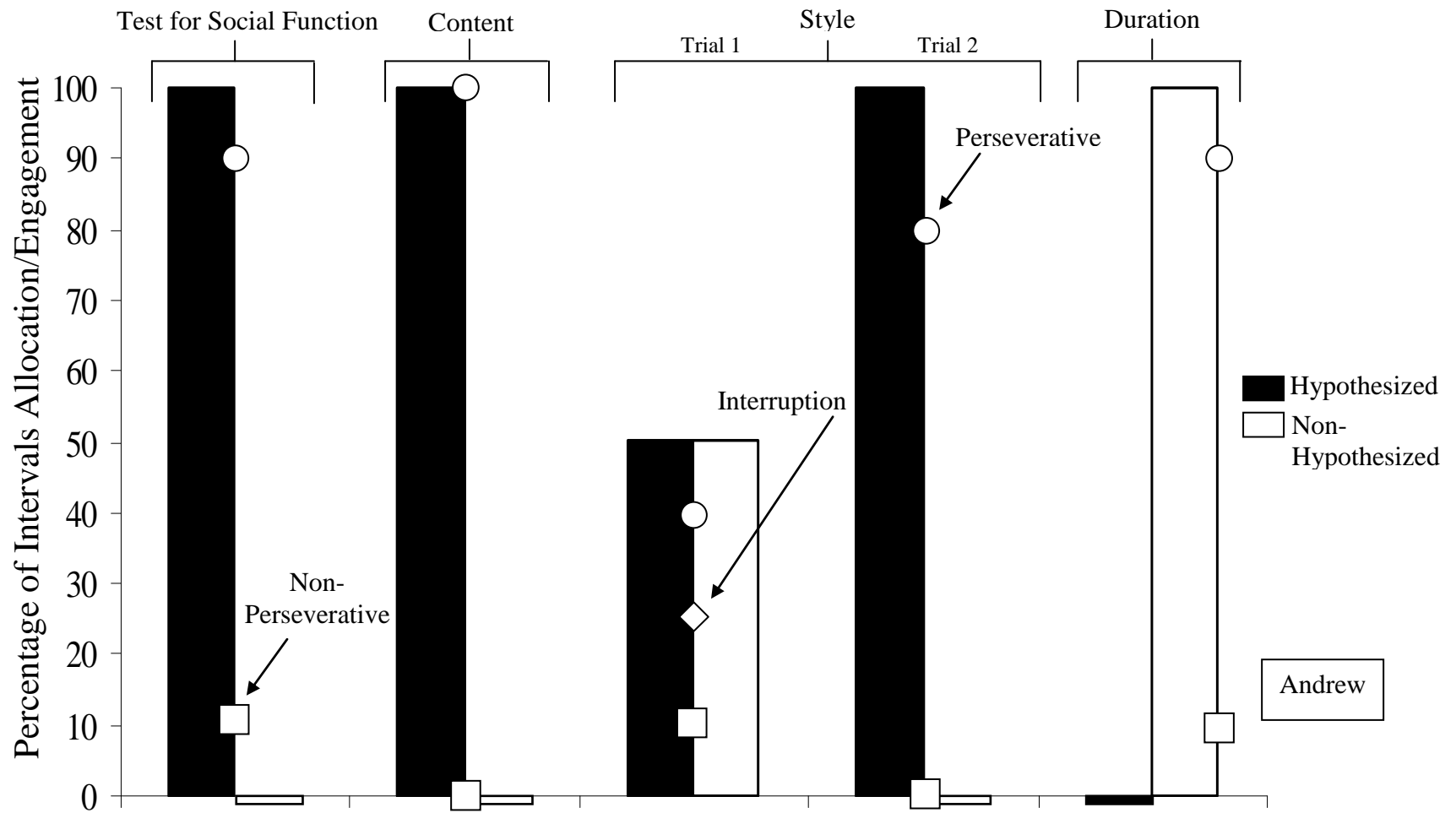


Figure A9. Phase II: Assessment of Reinforcer Dimensions Results for Clint

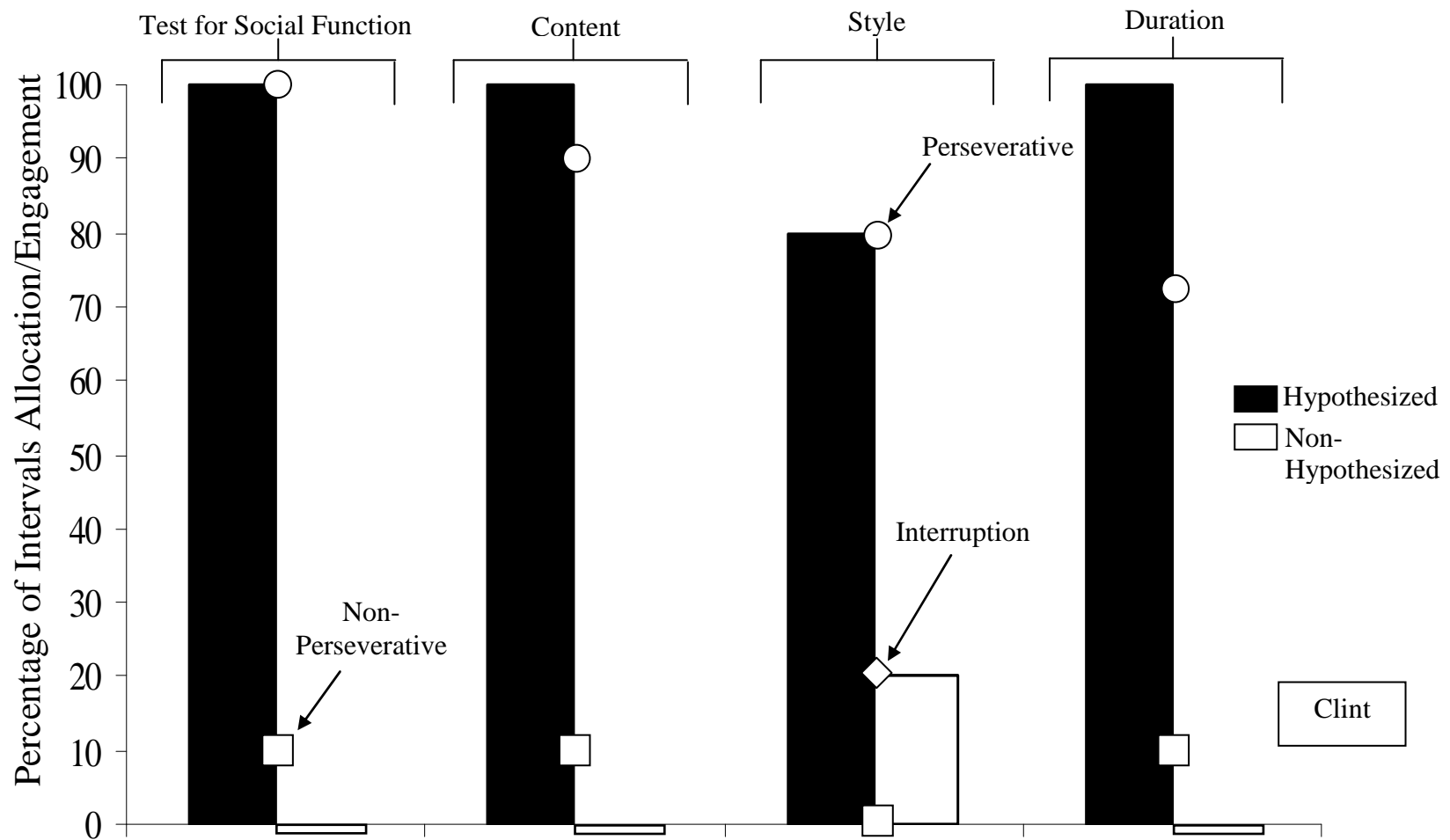


Figure A10. Phase II: Assessment of Reinforcer Dimensions Results for Juan

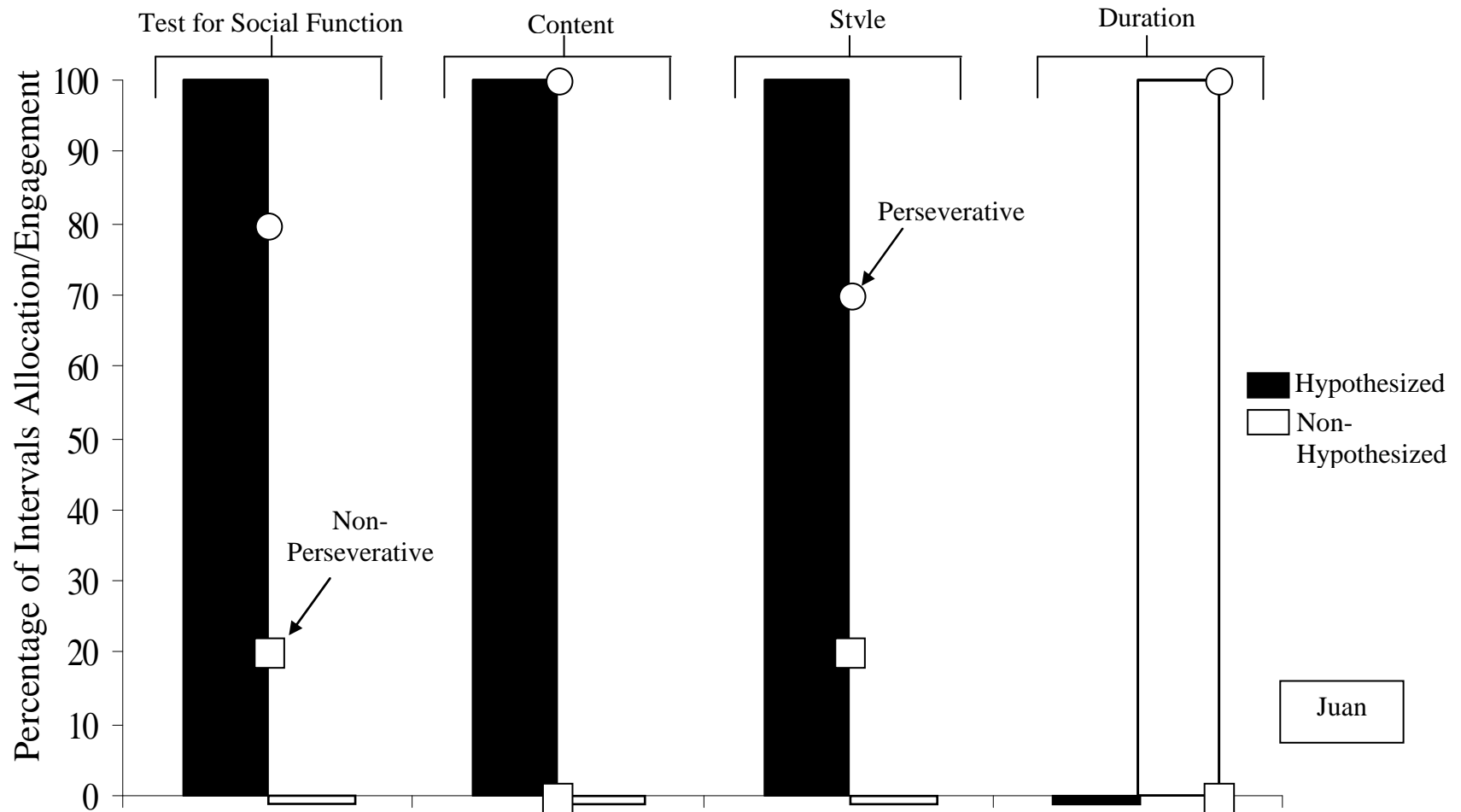


Figure A11. Phase II: Assessment of Reinforcer Dimensions Results for Michael

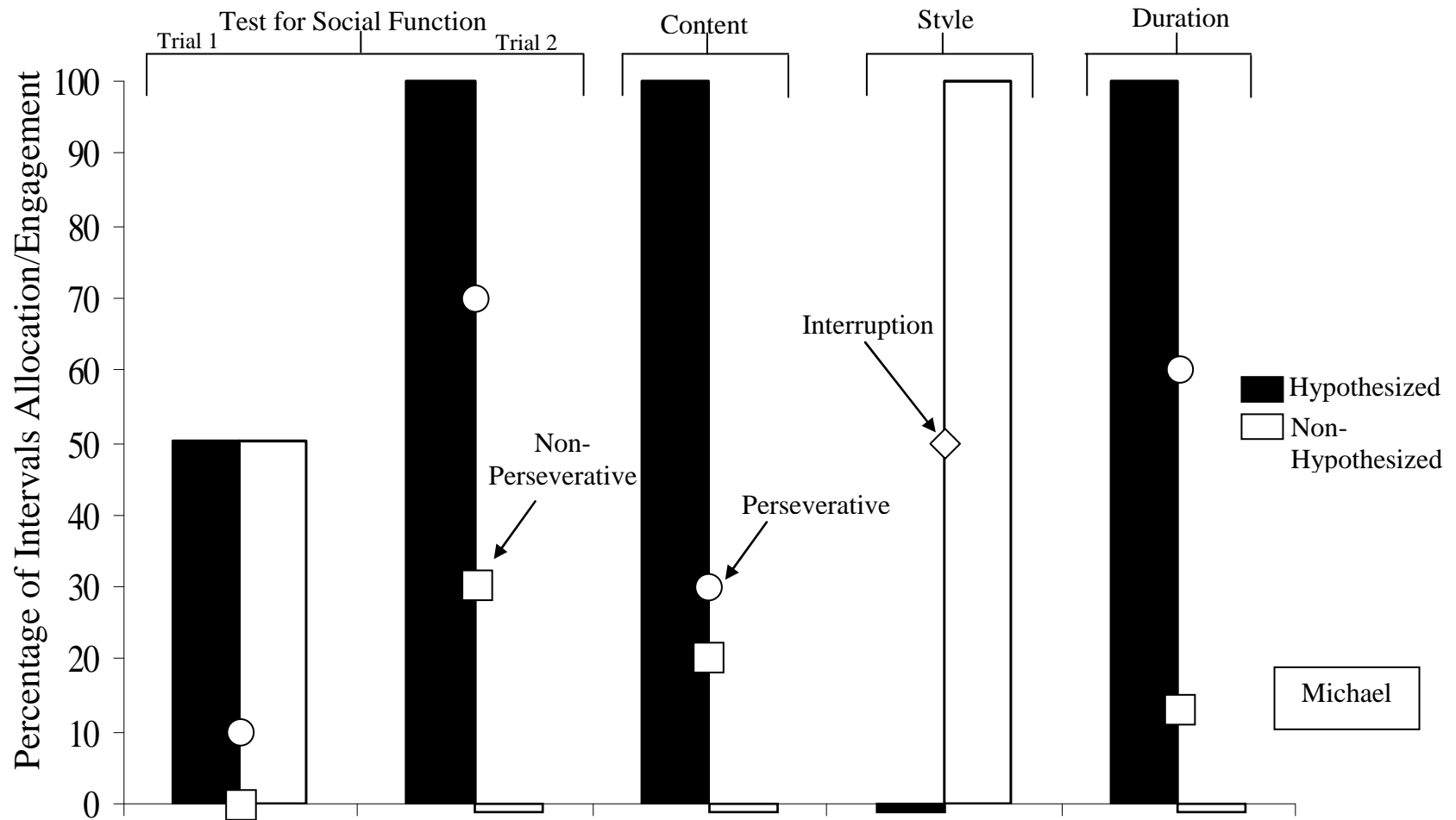


Figure A12. Phase II: Assessment of Reinforcer Dimensions Results for Oscar

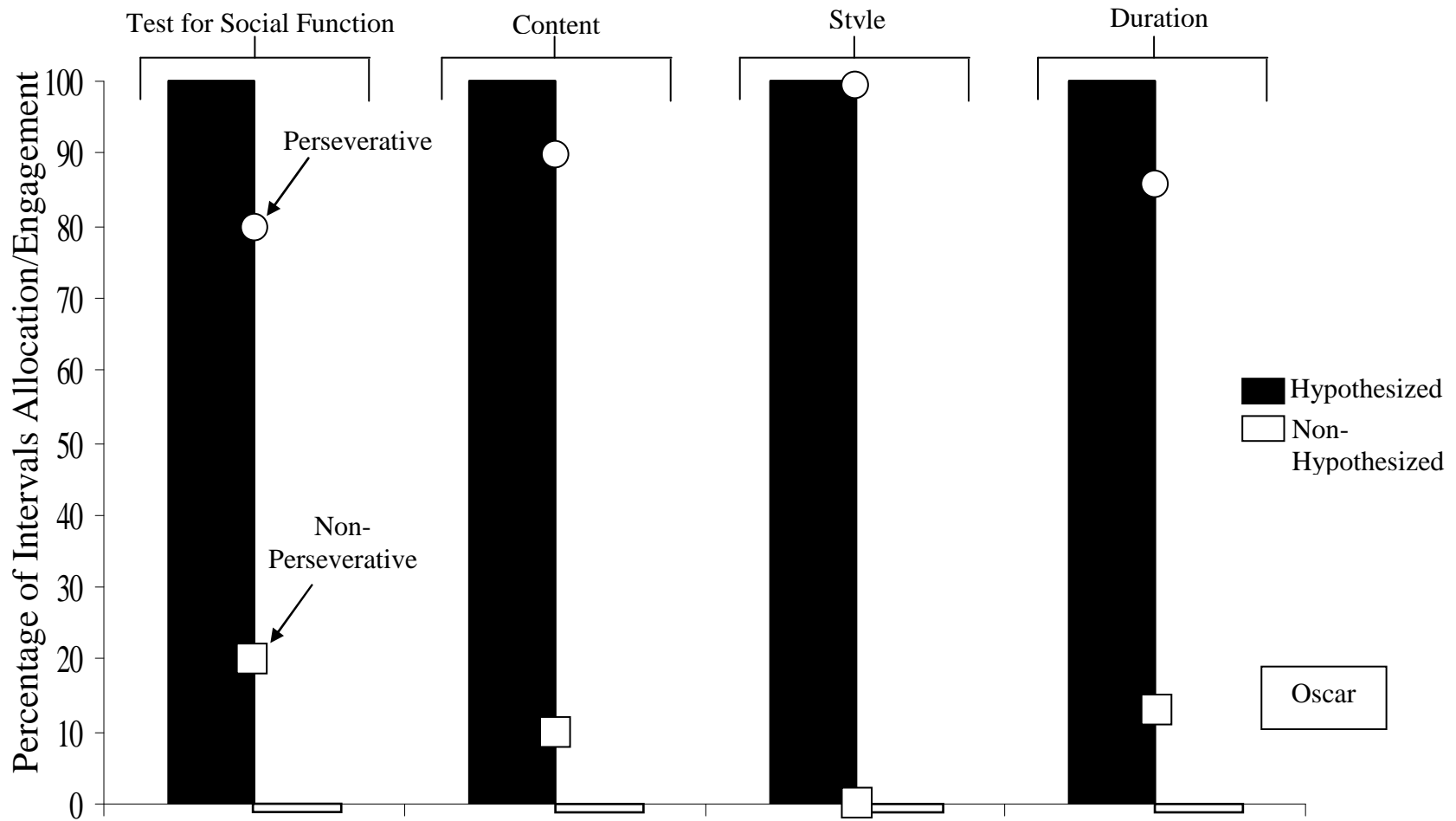


Figure A13. Phase III: Content vs. Style Results for Andrew

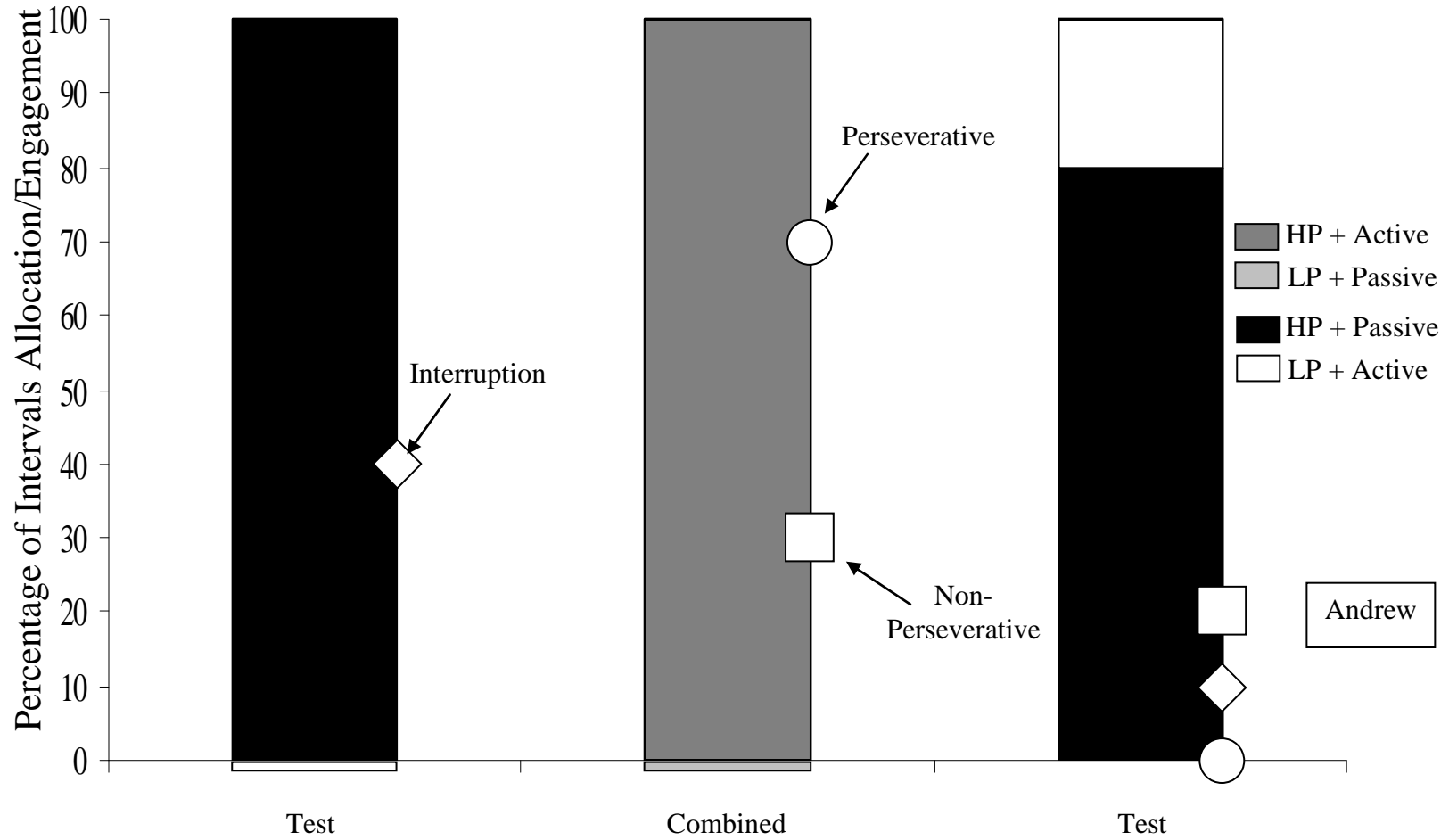


Figure A14. Phase III: Duration vs. Style Results for Andrew

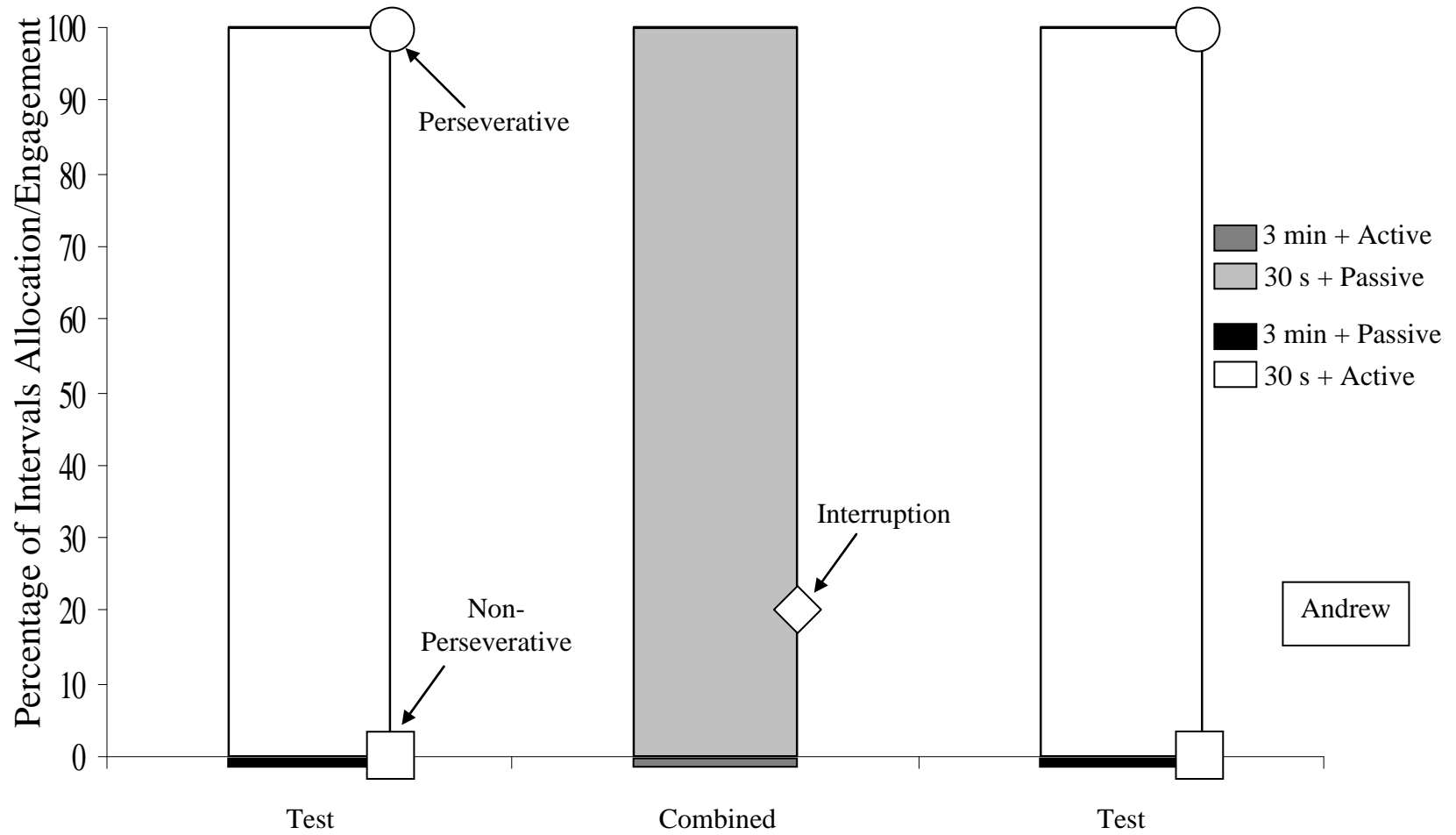


Figure A15. Phase III: Content vs. Duration Results for Andrew

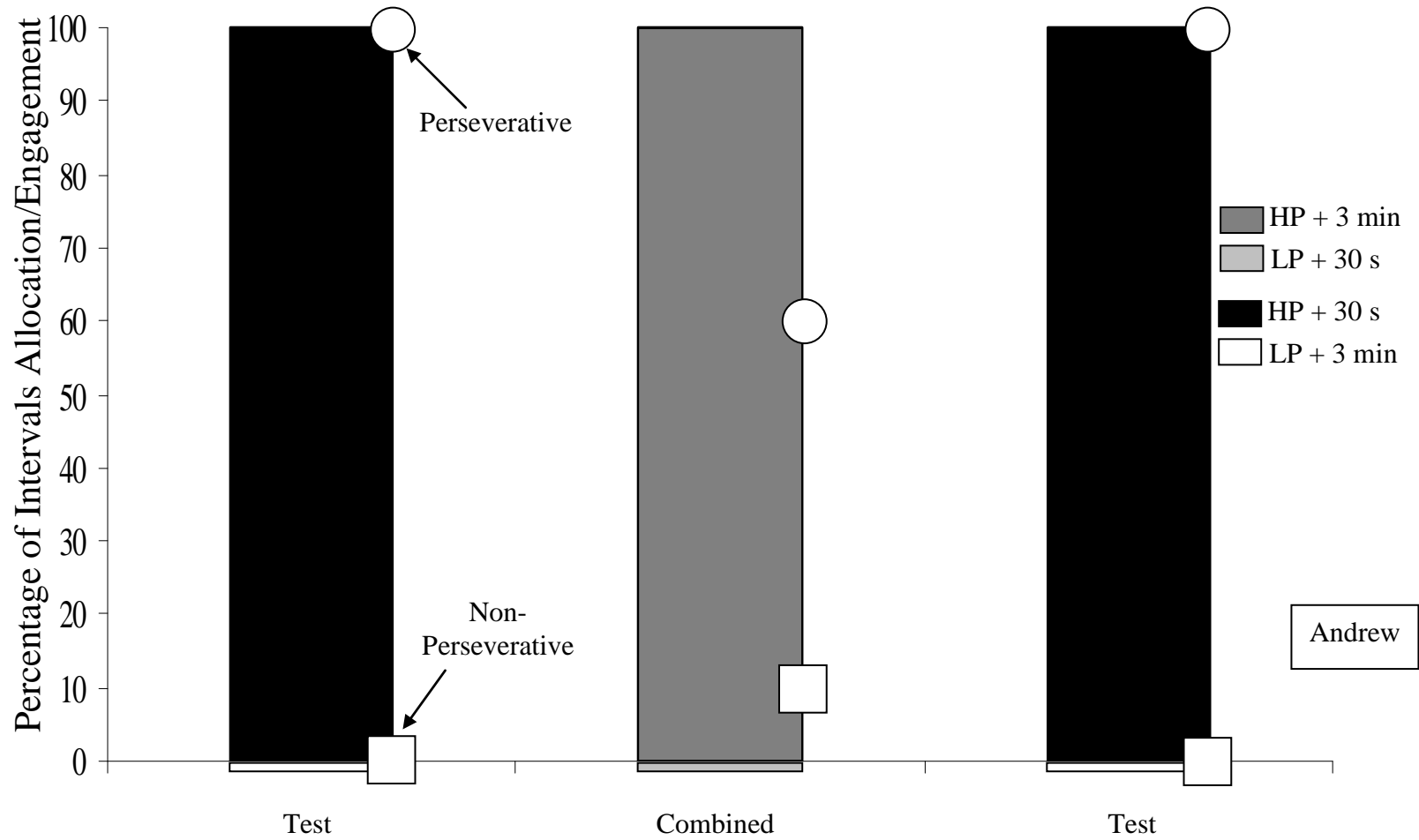


Figure A16. Phase III: Content vs. Style Results for Clint

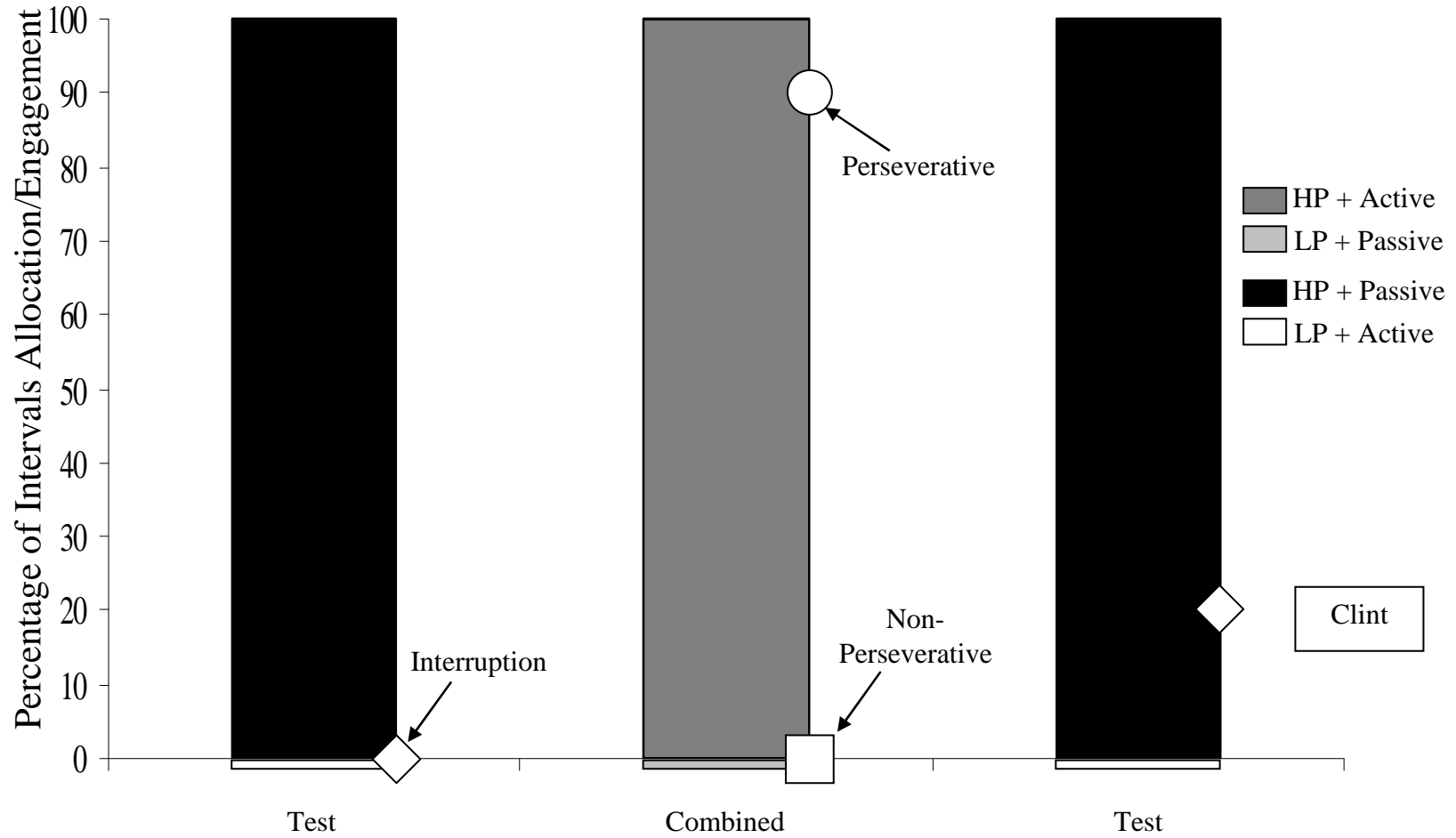


Figure A17. Phase III: Duration vs. Style Results for Clint

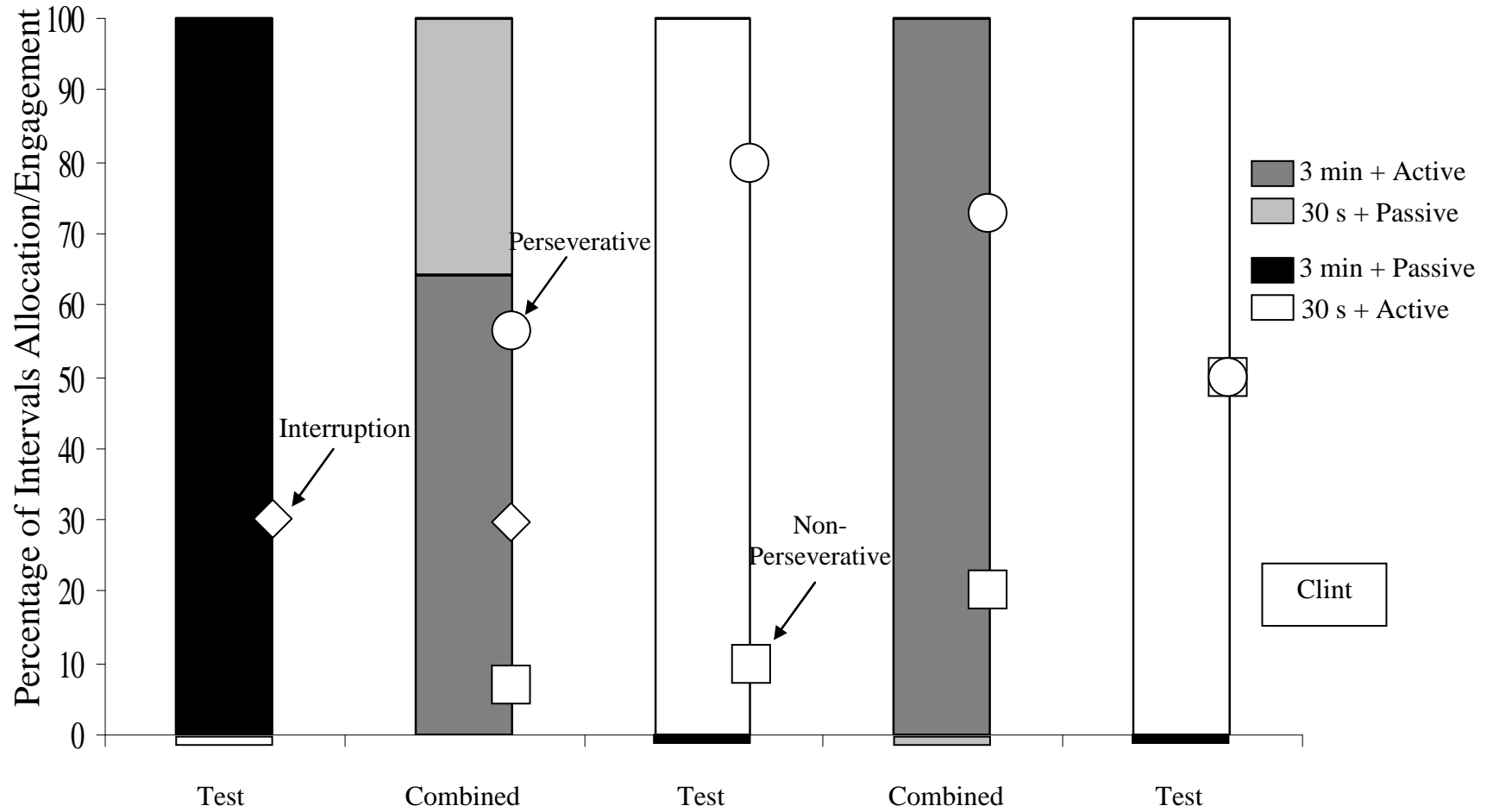


Figure A18. Phase III: Content vs. Duration Results for Clint

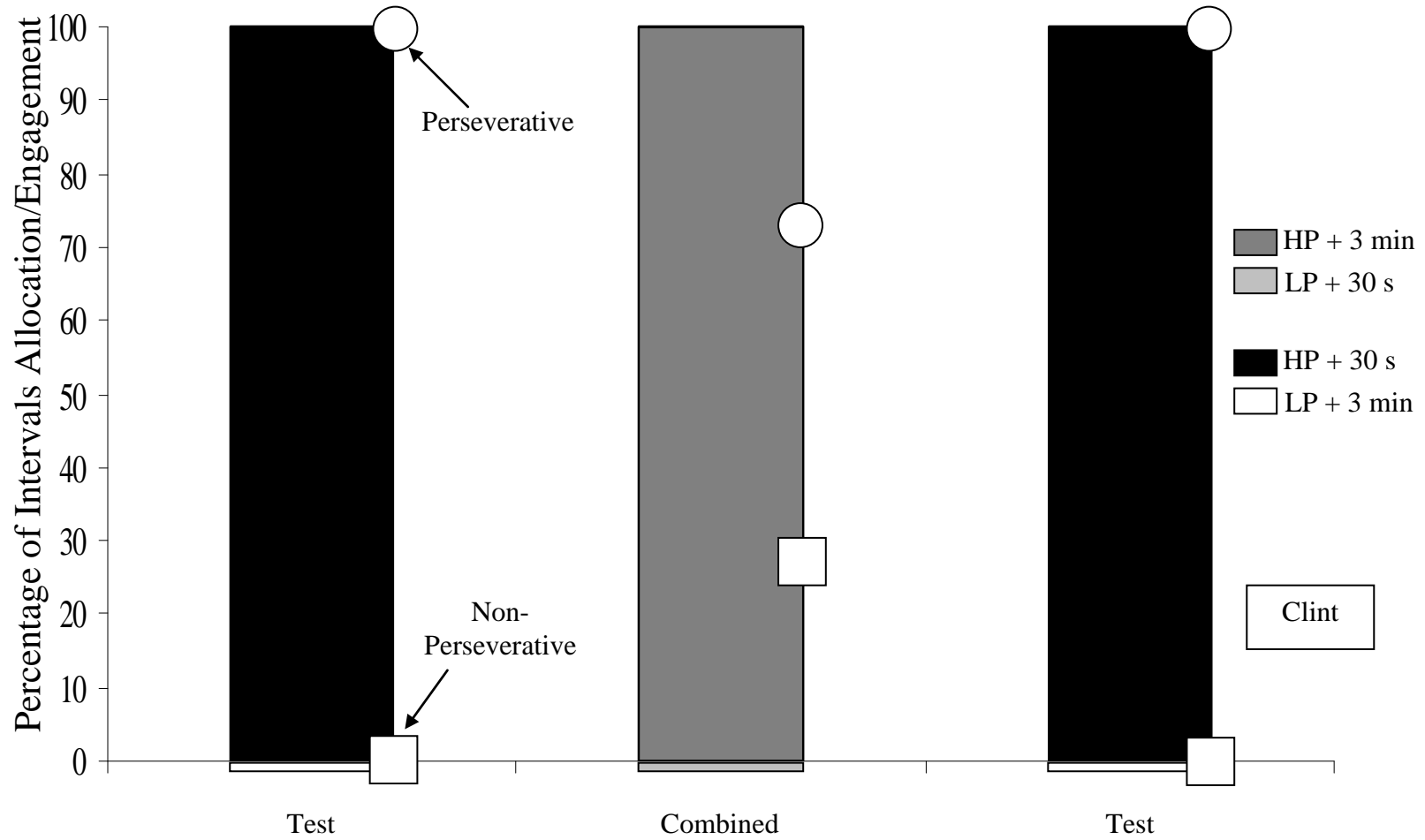


Figure A19. Phase III: Content vs. Style Results for Juan

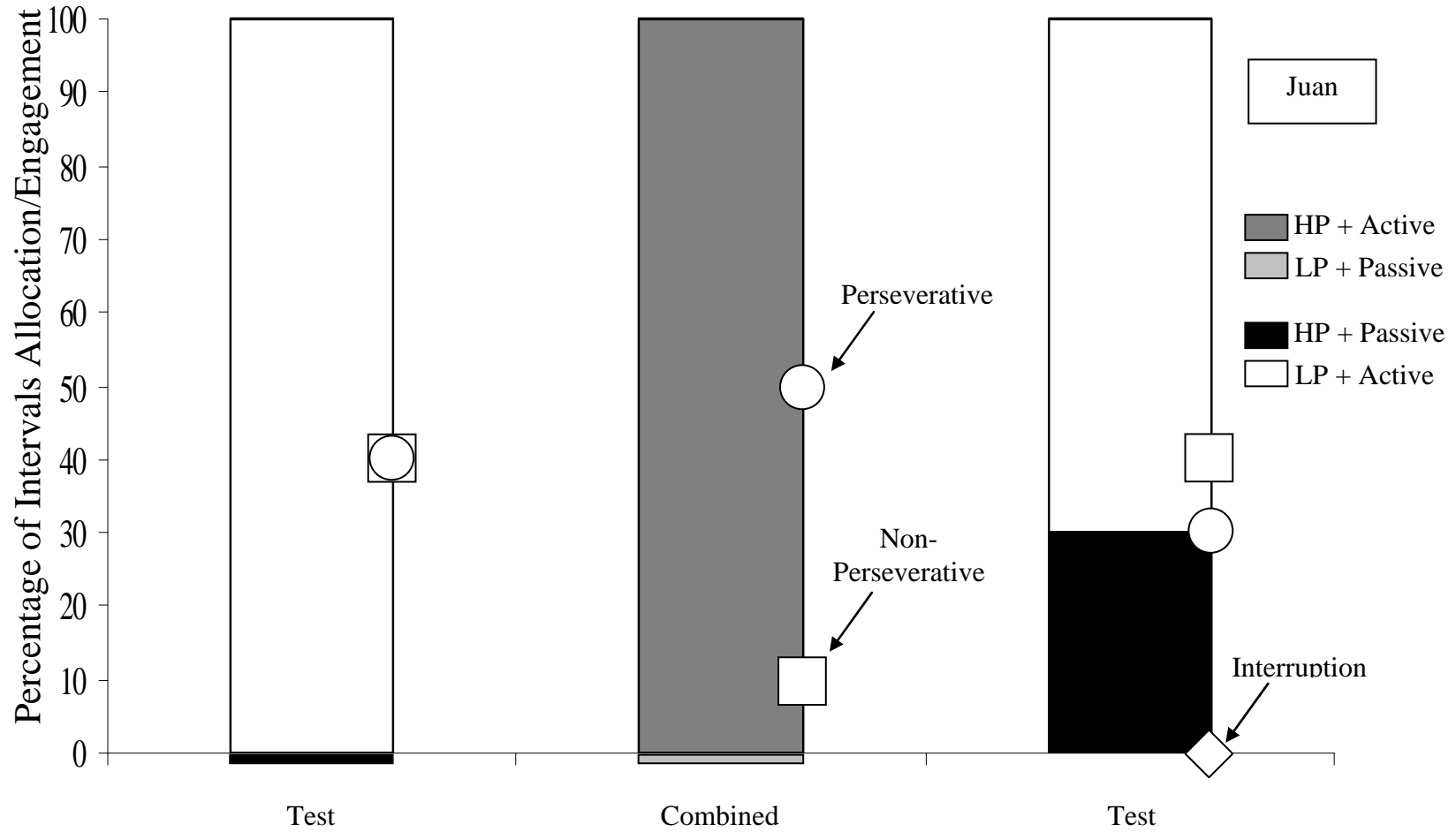


Figure A20. Phase III: Duration vs. Style Results for Juan

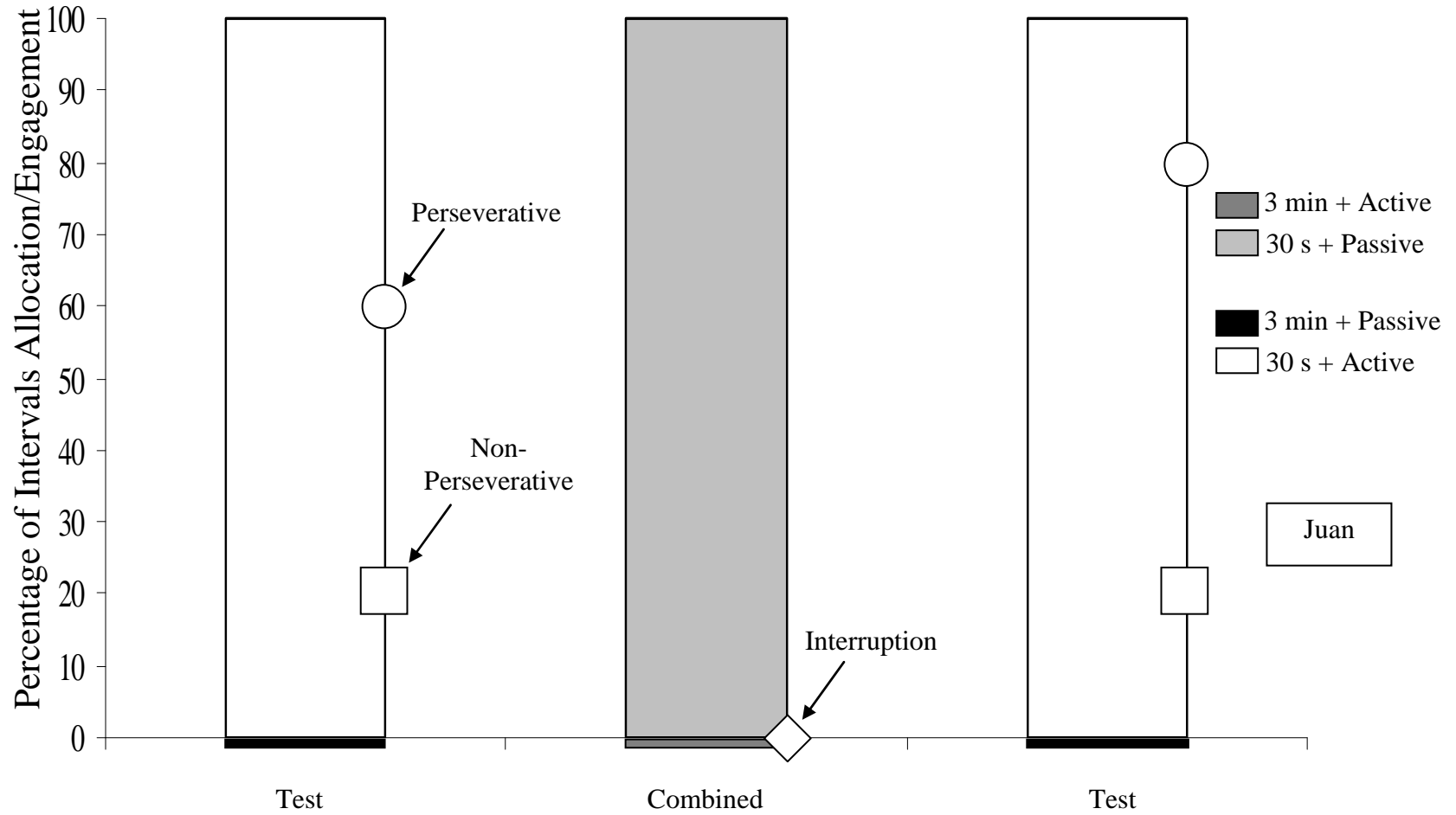


Figure A21. Phase III: Content vs. Duration Results for Juan

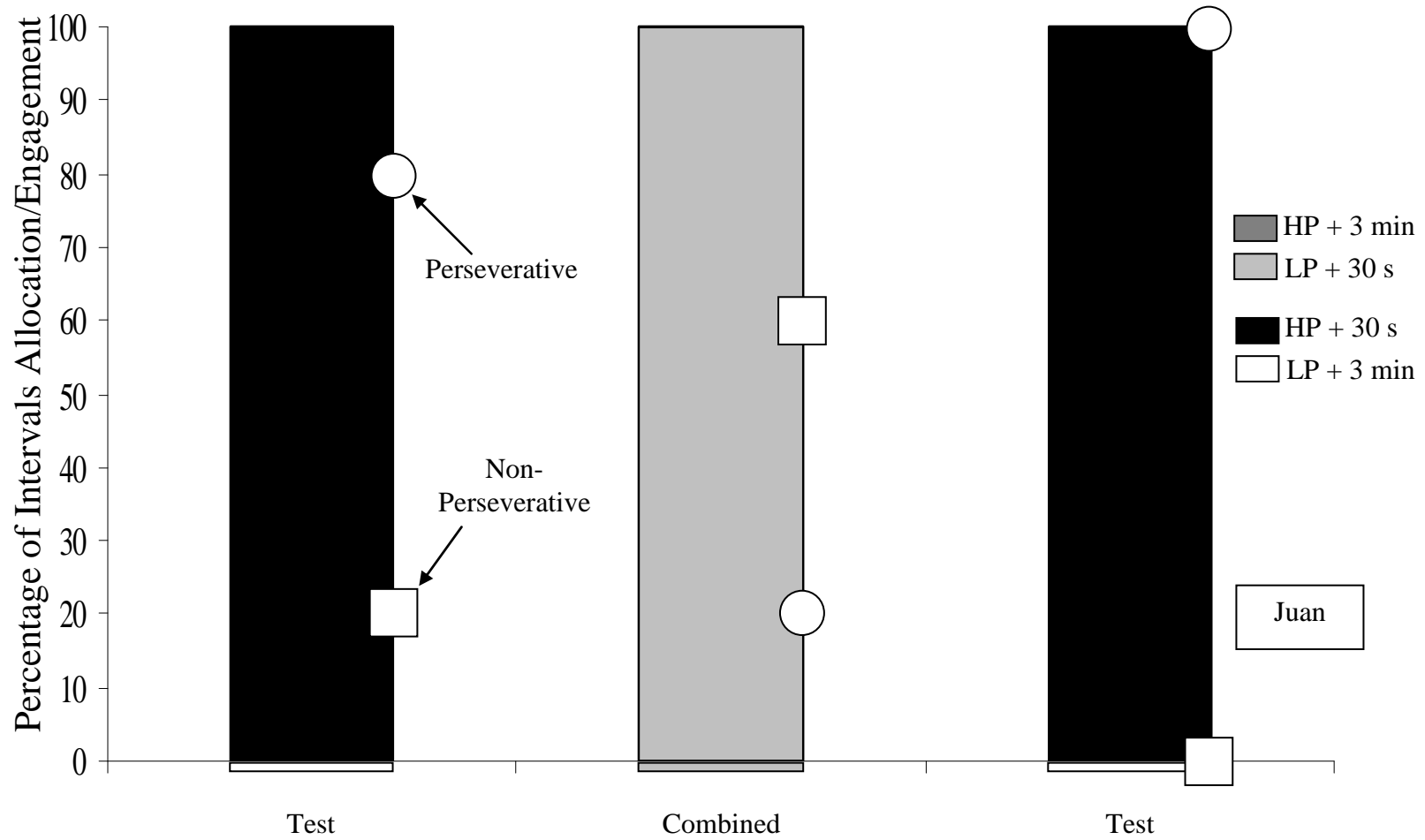


Figure A22. Phase III: Content vs. Style Results for Michael

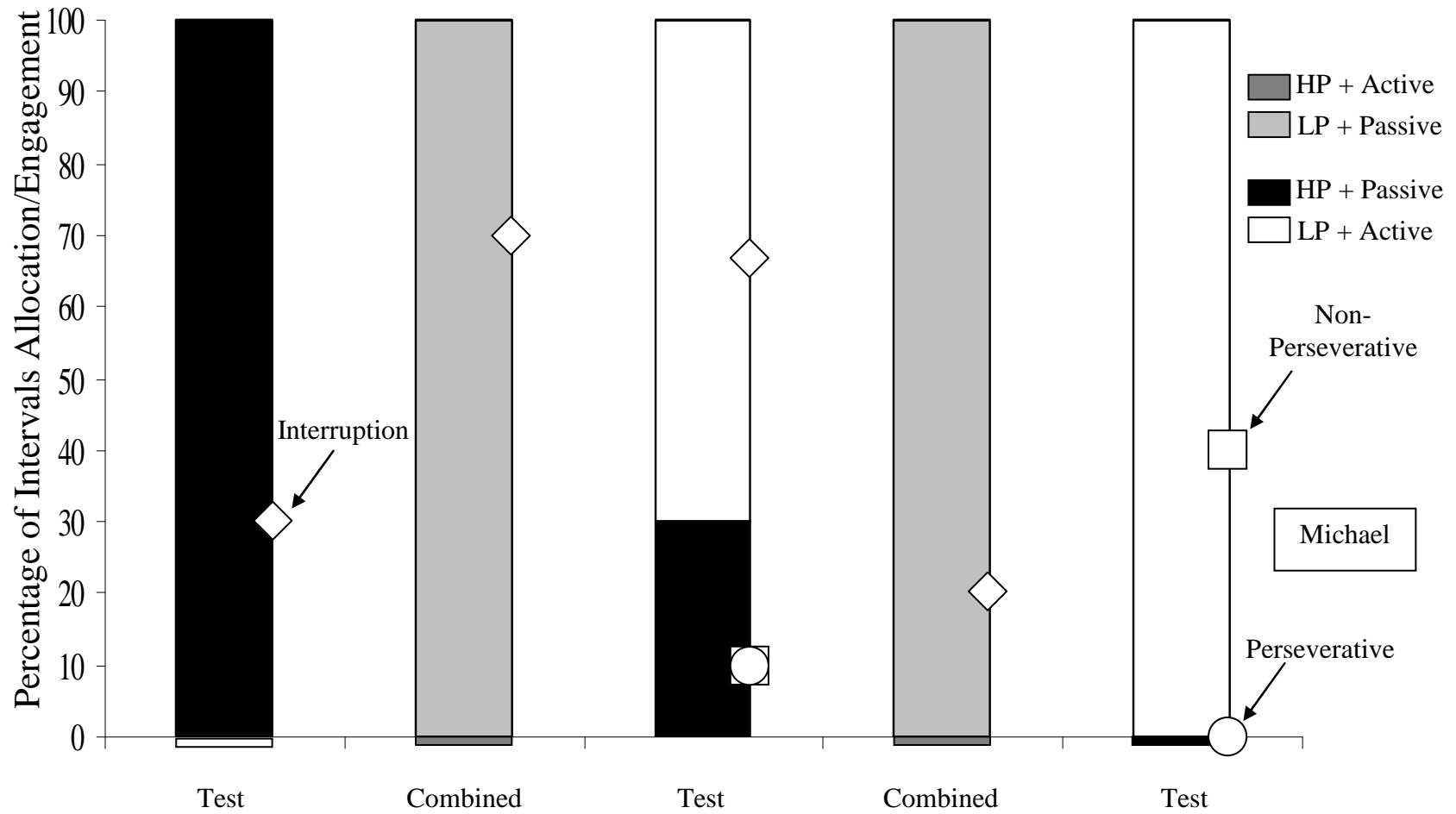


Figure A23. Phase III: Duration vs. Style Results for Michael

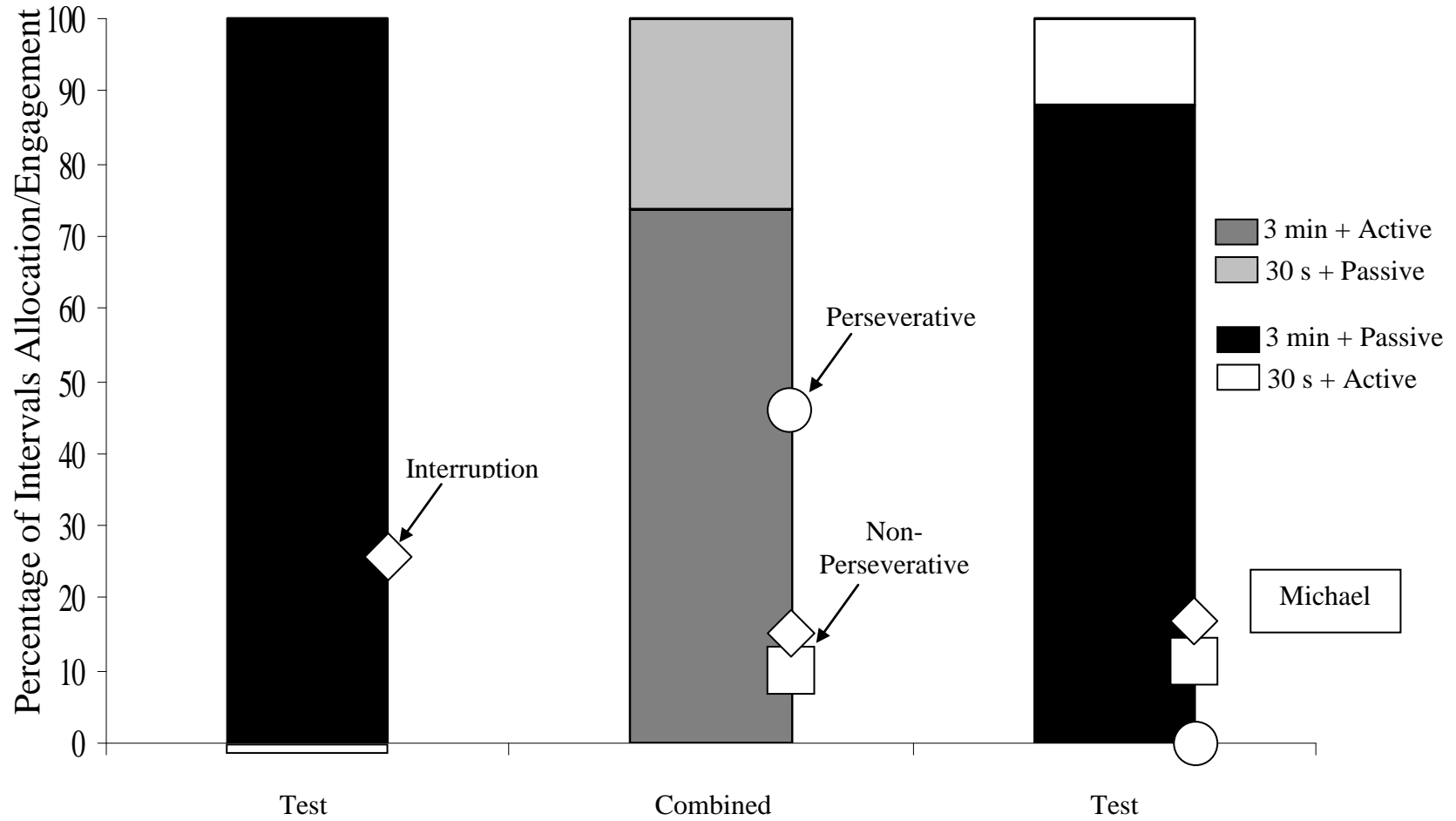


Figure A24. Phase III: Content vs. Duration Results for Michael

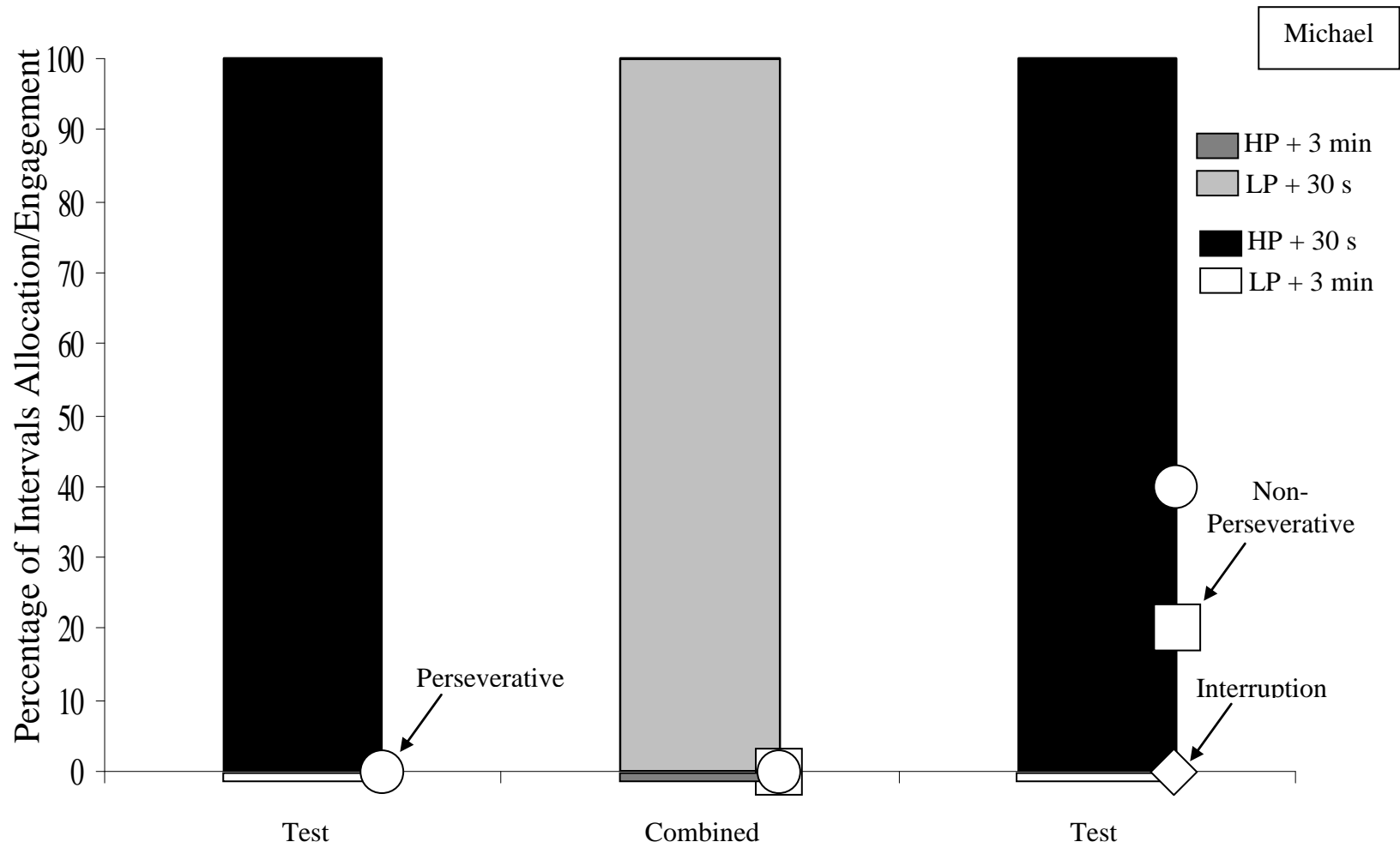


Figure A25. Phase III: Content vs. Style Results for Oscar

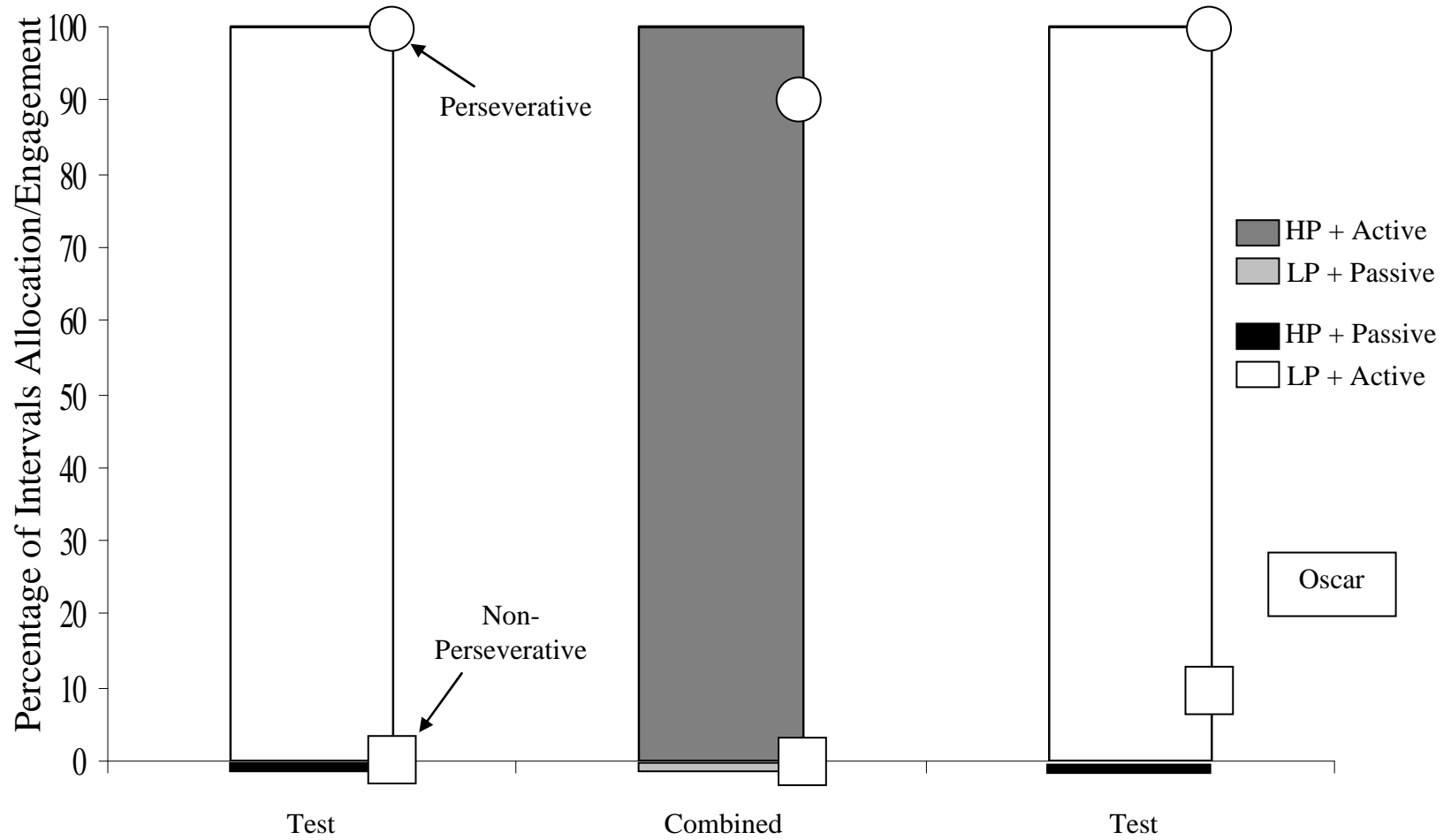


Figure A26. Phase III: Duration vs. Style Results for Oscar

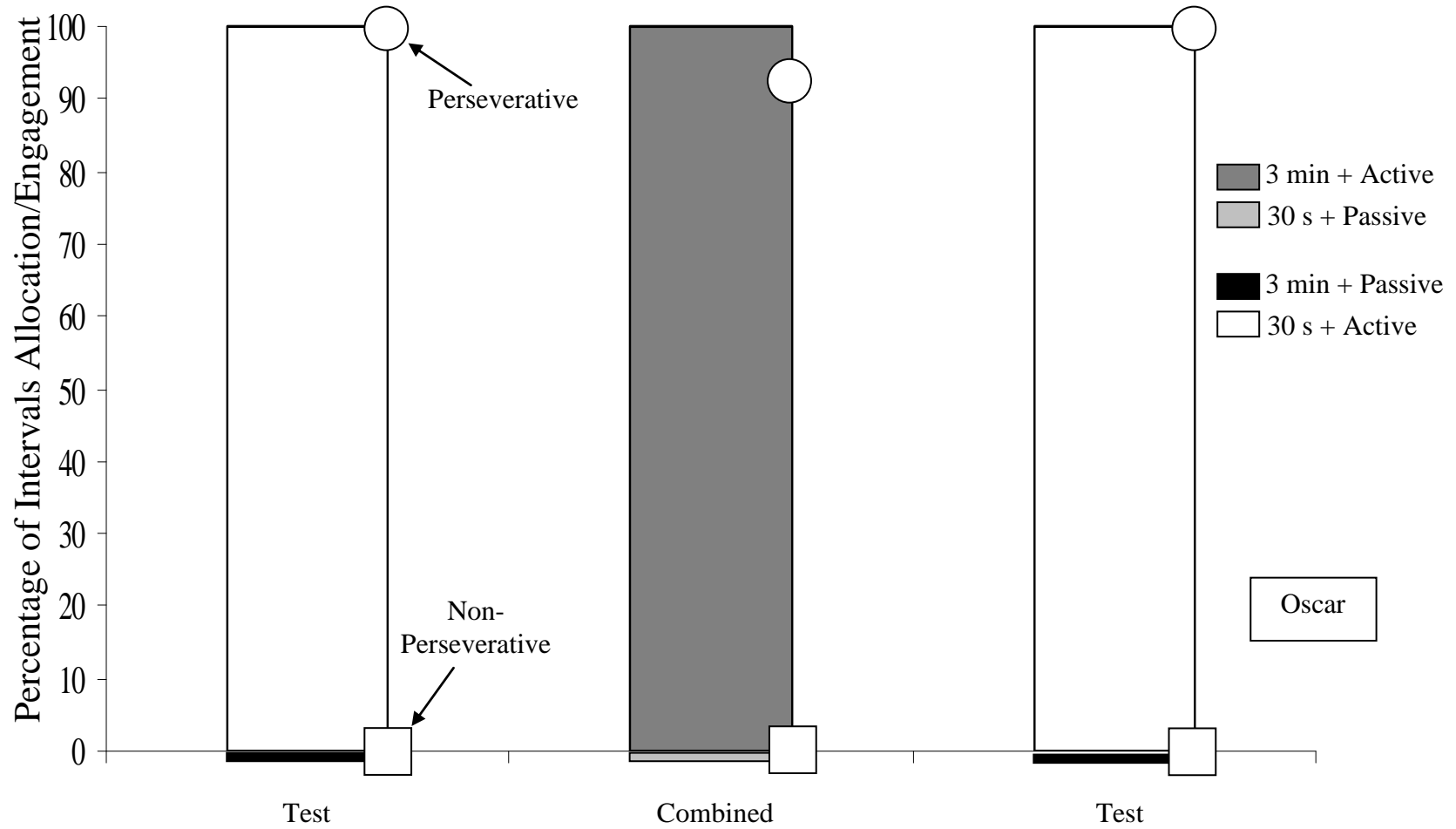
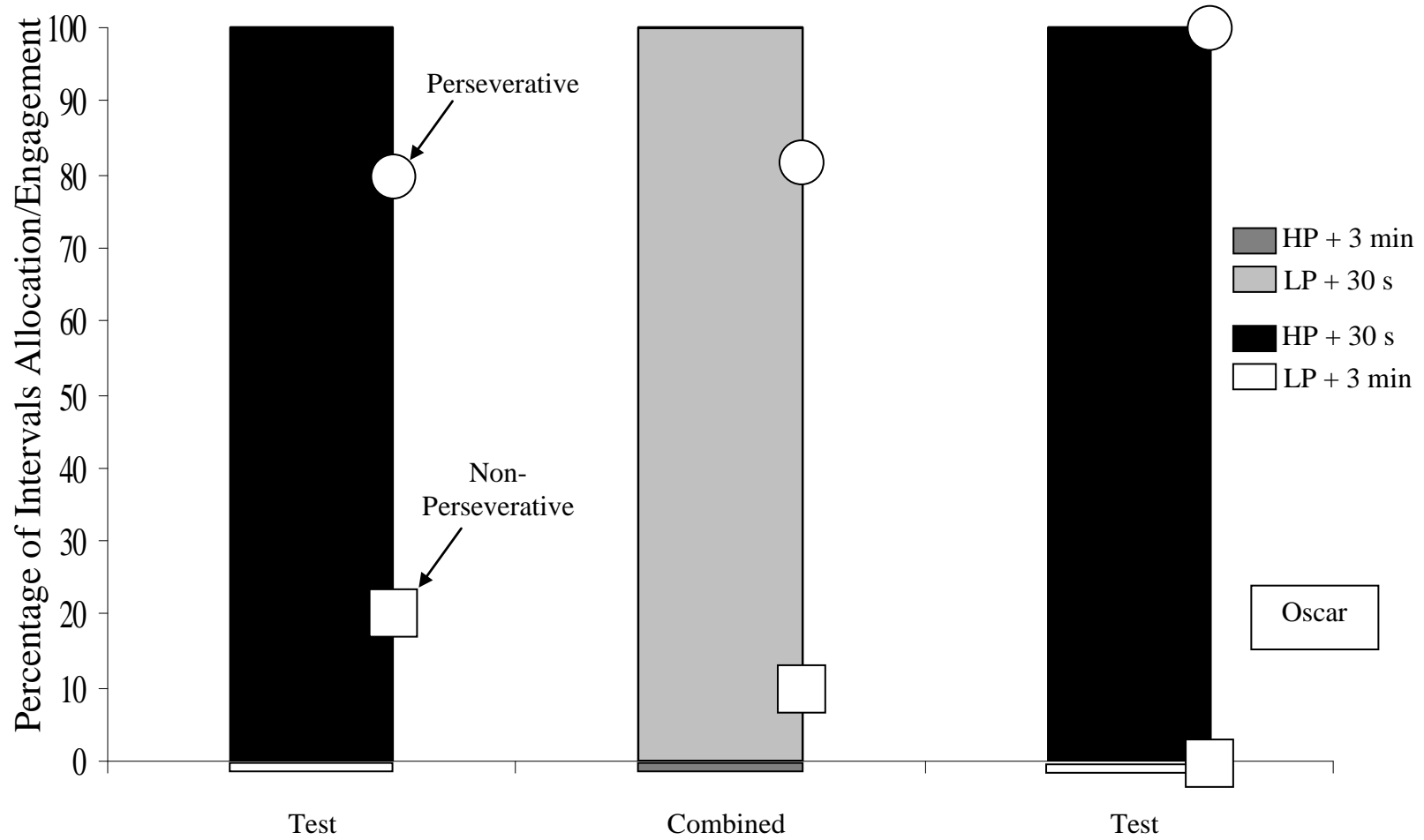


Figure A27. Phase III: Content vs. Duration Results for Oscar



APPENDIX B
DSM-IV-TR CRITERIA FOR ASPERGER'S DISORDER

DSM-IV-TR Diagnostic Criteria for 299.80 Asperger's Disorder

- A. Qualitative impairment in social interaction, as manifested by at least two of the following:
 - 1. marked impairment in the use of multiple nonverbal behaviors such as eye-to eye gaze, facial expression, body postures, and gestures to regulate social interaction
 - 2. failure to develop peer relationships appropriate to developmental level
 - 3. a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)
 - 4. lack of social or emotional reciprocity

- B. Restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least one of the following:
 - 1. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity of focus
 - 2. apparently inflexible adherence to specific, nonfunctional routines or rituals
 - 3. stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
 - 4. persistent preoccupation with parts of objects

- C. The disturbance causes clinically significant impairment in social, occupational, or other important areas of functioning.

- D. There is no clinically significant general delay in language (e.g., single words used by age 2 years, communicative phrases used by age 3 years).

- E. There is no clinically significant delay in cognitive development or in the development of age-appropriate self-help skills, adaptive behavior (other than in social interaction), and curiosity about the environment in childhood.

- F. Criteria are not met for another specific Pervasive Developmental Disorder or Schizophrenia.

APPENDIX C
CAREGIVER INTERVIEW FORM

-CONFIDENTIAL-
Perserverative Conversation Research
Introductory Parent/Caregiver Interview

Section 1: Identifying Information

Patient ID #: _____

Date: _____

Relationship of interviewee(s) to participant: _____

Participant present for interview (circle): Yes or No

Section 2: Patient Demographics

Q1.Grade in school: _____

Q2.Gender (circle): male or female

Q3.Race/Ethnicity (circle): American Indian
 Asian
 Black or African American
 Hispanic or Latino
 White or Caucasian
 Other or More than one race

Section 3: Diagnostic History

Q4.Current mental health diagnoses other than Asperger's disorder, title of person who diagnosed the mental health disorder, and when it was first diagnosed:

<u>Name of disorder</u>	<u>Diagnosed by</u>	<u>Approximate date of diagnosis</u>
-------------------------	---------------------	--------------------------------------

Q5.Past mental health diagnoses no longer applicable:

Q6.Title of person who diagnosed Asperger's disorder: _____

Q7.Age when first diagnosed (years and months if possible): _____ yr. _____ mo.

Section 4: Problem Behavior

Q8. Describe the participant's perseverative conversation (PC):

Q9. Describe the most recent example of PC:

Q10. Estimate how often PC occurs:

_____ per week _____ per day _____ per hour

Q11. Estimate the duration of PC, on average (in hours, minutes, seconds, if possible):

_____ hours _____ minutes _____ seconds

Q12. Describe known antecedents to this behavior:

Q13. Do problems/issues with sleep, diet, physical/medical conditions, or medications seem to effect PC? (if "Yes" then describe):

Yes or No

Q13. Indicate specific times during the day when PC is more or less likely to occur:

More likely: _____

Less likely: _____

Q14.Indicate settings where PC is more or less likely to occur:

More likely: _____

Less likely: _____

Q15.Indicate with whom the PC is more or less likely to occur:

More likely: _____

Less likely: _____

Q16.Indicate what activities are more or less likely to produce PC:

More likely: _____

Less likely: _____

Q17.Describe the participant's response when PC is interrupted:

Q18.Describe the typical consequences associated with PC:

Q19.Do you have a hypothesis as to the function of the PC (if "Yes" describe):

Yes or No

Section 5: Circumscribed Interests

Q20.List, indicate the date of initial interest in, and describe current or recurring circumscribed interests:

<u>Interest</u>	<u>Date initiated</u>	<u>Description</u>
-----------------	-----------------------	--------------------

Q21.List and describe past circumscribed interests:

<u>Interest</u>	<u>Description</u>
-----------------	--------------------

Q22.List all of the aforementioned interests discussed by the participant in PC and estimate how often the circumscribed interests are discussed:

<u>Interest</u>	<u>Per week</u>	<u>Per day</u>	<u>Per hour</u>
-----------------	-----------------	----------------	-----------------

Section 6: Impaired Functioning

Q23.Has PC impaired the participant's social development? (if "Yes" describe):

Yes or No

Q24.Has PC impaired the participant's productivity with regards to work and daily functioning at school and home? (if "Yes" describe):

Yes or No

Q25.Has restricting PC resulted in other problem behavior? (if "Yes" describe):

Yes or No

Q26.Has PC impaired functioning in any other way? (if "Yes" describe):

Yes or No

Section 7: Assessment/Treatment History

Q27.List the date, title of evaluator and assessment results of any previous assessments related to PC:

<u>Date</u>	<u>Evaluator</u>	<u>Assessment results</u>
-------------	------------------	---------------------------

Q28.List the date, treatment type, and results of any previous or current attempts for treatment:

<u>Date</u>	<u>Treatment type</u>	<u>Results</u>
-------------	-----------------------	----------------

Q29.List strategies you have used to prevent PC and the results:

<u>Strategy</u>	<u>Effectiveness</u>
-----------------	----------------------

Q30.List management strategies to decrease PC when it is already occurring and the effectiveness of the strategy:

<u>Strategy</u>	<u>Effectiveness</u>
-----------------	----------------------

Q31.List strategies used by other entities (e.g., school, child care, sports programs):

<u>Strategy</u>	<u>Effectiveness</u>
-----------------	----------------------

APPENDIX D

PREFERENCE ASSESSMENT RECORD FORM

Preference Assessment Data Sheet

ID # _____

Date _____

Primary/Reliability _____

Part I: Multiple Stimulus Preference Assessment Without Replacement

1st Choice _____2nd Choice _____3rd Choice _____4th Choice _____5th Choice _____6th Choice _____7th Choice _____

Final Topic _____

Topic 1 =

Topic 2 =

Topic 3 =

Topic 4 =

Topic 5 =

Topic 6 =

Topic 7 =

Topic 8 =

Part II: Forced-Choice Assessment

A vs. B

B vs. C

C vs. D

A vs. C

B vs. D

A vs. D

A (1st Choice) =B (2nd Choice) =

C (Second to Last) =

D (Last Choice) =

Results

Most Preferred =

2nd =3rd =

Least Preferred =

APPENDIX E
SIX-SECOND INTERVAL DATA COLLECTION FORM

COA Data Collection

ID # _____

Date _____

Phase: II / III

Condition: _____

Session: 1 or 2 or 3

Primary/Reliability

6	12	18	24	30	36	42	48	54	60
1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N
1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N
1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N
1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N	+ P _ N	I O _ N

REFERENCES

- Adams, C., Green, J., Gilchrist, A., & Cox, A. (2002). Conversational barriers of children with Asperger syndrome and conduct disorder. *Journal of Child Psychology and Psychiatry*, 43, 679 - 690.
- Ahearn, W. H., Clark, K. M., DeBar, R., & Florentino, C. (2005). On the role of preference in response competition. *Journal of Applied Behavior Analysis*, 38, 247 - 250.
- Ahearn, W. H., Clark, K. M., MacDonald, R. P., & Chung, B. I. (2007). Assessing and treating vocal stereotypy in children with autism. *Journal of Applied Behavior Analysis*, 40, 263 - 275.
- Alberto, P. A., & Troutman, A. C. (2006). *Applied behavior analysis for teachers* (7th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.
- Allen, D., Evans, C., Hider, A., Hawkins, S., Peckett, H., & Morgan, H. (2008). Offending behaviour in adults with Asperger's syndrome. *Journal of Autism and Developmental Disorders*, 38(4), 748 - 758.
- Allen, K. D., & Stokes, T. F. (1987). The use of escape and reward in the management of young children during dental treatment. *Journal of Applied Behavior Analysis*, 20, 381-390.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev. ed.). Washington, DC.
- Asperger, H. (1944). Die "Autistischen Psychopathen" im Kindesalter. *Arch Psychiatr Nervenkr*, 117, 76 - 136.
- Asperger, H. (1991). Autistic psychopathology in childhood. In U. Frith (Ed.), *Autism and Asperger syndrome* (pp. 37 - 92). Cambridge, England: Cambridge University Press.
- Athens, A. S., Vollmer, T. R., Sloman, K. M., & St. Peter Pipkin, C. S. (2008). An analysis of vocal stereotypy and therapist fading. *Journal of Applied Behavior Analysis*, 41, 291 - 297.
- Attwood, T. (1998). *Asperger's syndrome: A guide for parents and professionals*. London: Jessica Kingsley Publishers Ltd.
- Attwood, T. (2003). Understanding and managing circumscribed interests. In M. Prior, *Learning and behavior problems in Asperger syndrome* (pp. 126 - 147). New York: Guilford Press.
- Attwood, T. (2006). *The complete guide to Asperger's syndrome*. Philadelphia: Jessica Kingsley.
- Ayllon, T., & Houghton, E. (1964). Modification of symptomatic verbal behavior of mental patients. *Behaviour Research and Therapy*, 2, 87-97.

- Ayllon, T., & Michael, J. (1959). The psychiatric nurse as a behavioral engineer. *Journal of Experimental Analysis of Behavior*, 2, 323 - 334.
- Ayllon, T., & Roberts, M. D. (1974). Eliminating discipline problems by strengthening academic performance. *Journal of Applied Behavior Analysis*, 7, 71-76.
- Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, 1, 91 - 97.
- Baron-Cohen, S. (1988). An assessment of violence in a young man with Asperger's syndrome. *Journal of Child Psychology and Psychiatry*, 29, 351 - 360.
- Baron-Cohen, S. (1989). Do autistic children have obsessions and compulsions? *The British Journal of Clinical Psychiatry*, 28, 193 - 200.
- Baron-Cohen, S., & Wheelwright, S. (1999). 'Obsessions' in children with autism or Asperger syndrome: Content analysis in terms of core domains of cognition. *British Journal of Psychiatry*, 175, 484 - 490.
- Barton, E. S. (1970). Inappropriate speech in a severely retarded child: A case study in language conditioning and generalization. *Journal of Applied Behavior Analysis*, 3, 299-307.
- Bashe, P., & Kirby, P. L. (2001). *The OASIS guide to Asperger syndrome: Advice, support, insight and inspiration*. New York: Crown.
- Bejerot, S., Nylander, L., & Lindstrom, E. (2001). Autistic traits in obsessive-compulsive disorder. *Nordic Journal of Psychiatry*, 55(3), 169 - 176.
- Bijou, S. W., Peterson, R. F., & Ault, M. H. (1968). A method to integrate descriptive and experimental field studies at the level of data and empirical concepts. *Journal of Applied Behavior Analysis*, 1, 175-191.
- Bishop, D. V., & Adams, C. (1989). Conversational characteristics of children with semantic-pragmatic disorder: II: What features lead to a judgment of inappropriacy? *British Journal of Disorders of Communication*, 24, 241-263.
- Bodfish, J. W., Lam, K. S., & Lewis, M. H. (2006). *Empirically-derived phenotypes of repetitive behavior in autism spectrum disorders*. Paper presented at the International Meeting for autism research. Montreal, Canada.
- Bostow, D. E., & Bailey, J. (1969). Modification of severe disruptive and aggressive behavior using brief timeout and reinforcement procedures. *Journal of Applied Behavior Analysis*, 2, 31-37.
- Bouxsein, K. J., Tiger, J. H., & Fisher, W. W. (2008). A comparison of general and specific instructions to promote task engagement and completion by a young man with Asperger's syndrome. *Journal of Applied Behavior Analysis*, 41, 113 - 116.
- Bowman, L. G., Piazza, C. C., Fisher, W. W., Hagopian, L. P., & Kogan, J. S. (1997). Assessment of preference for varied versus constant reinforcers. *Journal of Applied Behavior Analysis*, 30, 451-458.

- Broussard, C., & Northup, J. (1997). The use of functional analysis to develop peer interventions for disruptive classroom behavior. *School Psychology Quarterly, 12*, 65–76.
- Brown, K. A., Wacker, D. P., Derby, K. M., Peck, S. M., Richman, D. M., Sasso, G. M., Knutson, C. L., & Harding, J. W. (2000). Evaluating the effects of functional communication training in the presence and absence of establishing operations. *Journal of Applied Behavior Analysis, 33*, 53-71.
- Buchanan, J. A., & Fisher, J. E. (2002). Functional assessment and noncontingent reinforcement in the treatment of disruptive vocalization in elderly dementia patients. *Journal of Applied Behavior Analysis, 35*, 99–103.
- Burgoine, E., & Wing, L. (1983). Identical triplets with Asperger's syndrome. *British Journal of Psychiatry, 143*, 261 - 265.
- Campbell, M., Locascio, J. J., Choroco, M. C., Spencer, E. K., Malone, R. P., Kafantaris, V. et al. (1990) Stereotypies and tardive dyskinesia: Abnormal movements in autistic children. *Psychopharmacology Bulletin, 26*, 260 - 266.
- Carr, E. G. (1977). The motivation of self-injurious behavior: A review of some hypotheses. *Psychological Bulletin, 84*, 800–816.
- Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18*, 111–126.
- Carr, J. E., & Britton, L. N. (1999). On the effects of noncontingent delivery of differing magnitudes of reinforcement. *Behavioral Interventions, 14*, 37–43.
- Carruthers, P. (1996). Autism as mind-blindness: An elaboration and partial defense. In P. Carruthers, & P. K. Smith, *Theories of theories of mind* (pp. 257 - 273). Cambridge, United Kingdom: Cambridge University Press.
- Cederlund, M., Hagberg, B., Billstedt, E., Gillberg, I. C., & Gillberg, C. (2008). Asperger syndrome and autism: A comparative longitudinal follow-up study more than 5 years after original diagnosis. *Journal of Autism and Developmental Disorders, 38*, 72 - 85.
- Chapman, S., Fisher, W., Piazza, C. C., & Kurtz, P. F. (1993). Functional assessment and treatment of life-threatening drug ingestion in a dually diagnosed youth. *Journal of Applied Behavior Analysis, 26*, 255–256.
- Charlop, M. H. (1992). Echolalia. In E. Konarski, & J. Favell (Eds.), *Manual for the assessment and treatment of behavior disorders of people with mental retardation* (pp. 1 - 13). Morgantown, NC: WCC Foundation.
- Charlop, M. H. (1986). Setting effects on the occurrence of autistic children's immediate echolalia. *Journal of Autism and Developmental Disorders, 16*, 473 - 483.
- Charlop, M. H., Kurtz, P. F., & Casey, F. G. (1990). Using aberrant behaviors as reinforcers for autistic children. *Journal of Applied Behavior Analysis, 23*, 163 - 181.

- Chen, P. S., Chen, S. J., Yang, Y. K., Yeh, T. L., Chen, C. C., & Lo, H. Y. (2003). Asperger's disorder: A case report of repeated stealing and the collecting behaviours of an adolescent patient. *Acta Psychiatrica Scandinavia*, *107*, 73 - 76.
- Chesterman, P., & Rutter, S. C. (1993). Case report: Asperger's syndrome and sexual offending. *Journal of Forensic Psychiatry*, *4*, 555 - 562.
- Church, C., Alisanki, S., & Amanullah, S. (2000). The social, behavioral, and academic experiences of children with Asperger's syndrome. *Focus on Autism and Other Developmental Disabilities*, *15*(1), 12 - 20.
- Cohen, L., & Dehaene, S. (1998). Competition between past and present: Assessment and interpretation of verbal perseverations. *Brain*, *121*, 1641 - 1659.
- Colle, L., Baron-Cohen, S., Wheelwright, S., & van der Lely, H. K. (2008). Narrative discourse in adults with high-functioning autism or Asperger syndrome. *Journal of Autism and Developmental Disorders*, *38*, 28 - 40.
- Cooper, L. J., Wacker, D. P., Sasso, G. M., Reimers, T. M., & Donn, L. K. (1990). Using parents as therapists to evaluate appropriate behavior of their children: Application to a tertiary diagnostic clinic. *Journal of Applied Behavior Analysis*, *23*, 285-296.
- Cunningham A.B., & Schreibman L. (2008). Stereotypy in autism: The importance of function. *Research in Autism Spectrum Disorders*, *2*(3), 469 - 479.
- de Villiers, J., Fine, J., Ginsberg, G., Vaccarella, L., & Szatmari, P. (2007). Brief report: A scale for rating conversational impairment in autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *37*, 1375 - 1380.
- Deitz, S. M., & Repp, A. C. (1973). Decreasing classroom misbehavior through the use of DRL schedules of reinforcement. *Journal of Applied Behavior Analysis*, *6*, 457-463.
- Delano, M. E. (2007). Improving written language performance of adolescents with Asperger's syndrome. *Journal of Applied Behavior Analysis*, *40*, 345 - 351.
- DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of multiple stimulus presentation format for assessing reinforcer preference. *Journal of Applied Behavior Analysis*, *29*, 519 - 533.
- DeLeon, I. G., Arnold, K. L., Rodriguez-Catter, V., & Uy, M. L. (2003). Covariations between bizarre and nonbizarre speech as a function of the content of verbal attention. *Journal of Applied Behavior Analysis*, *36*, 101 - 104.
- DePaepe, P. A., Shores, R. E., Jack, S. L., & Denny, R. K. (1996). Effects of task difficulty on the disruptive and on-task behavior of students with severe behavior disorders. *Behavioral Disorders*, *21*, 216-225.
- Derby, K. M., Wacker, D. P., Sasso, G., Steege, M., Northup, J., Cigrand, K., & Asmus, J. (1992). Brief functional assessment techniques to evaluate aberrant behavior in an outpatient clinic: A summary of 79 cases. *Journal of Applied Behavior Analysis*, *25*, 713-721.

- Dietz, S. M., & Repp, A. L. (1973). Decreasing classroom misbehavior through the use of DRL schedules of reinforcement. *Journal of Applied Behavior Analysis*, 7, 457 - 463.
- Dixon, M. R., Benedict, H., & Larson, T. (2001). Functional analysis and treatment of inappropriate verbal behavior. *Journal of Applied Behavior Analysis*, 34, 361 - 363.
- Dixon, M. R., Guercio, J., Falcomata, T. S., Horner, M. J., Root, S., Newell, C., & Zlomke, K. (2004). Exploring the utility of functional analysis methodology to assess and treat problematic verbal behavior in persons with acquired brain injury. *Behavioral Interventions*, 19, 91-102.
- Doleys, D. M., & Slapion, M. J. (1975). The reduction of verbal repetitions by response cost controlled by a sibling. *Journal of Behavior Therapy and Experimental Psychiatry*, 6(1), 61-63.
- Ducharme, J. M., Sanjuan, E., & Drain, T. (2007). Errorless compliance training: Success-focused behavioral treatment of children with Asperger's syndrome. *Behavior Modification*, 31(3), 329 - 344.
- Durand, V. M., & Carr, E. G. (1987). Social influences on "self-stimulatory" behavior: Analysis and treatment application. *Journal of Applied Behavior Analysis*, 20, 119 - 132.
- Durand, V. M., & Carr, E. G. (1991). Functional communication training to reduce challenging behavior: Maintenance and application in new settings. *Journal of Applied Behavior Analysis*, 24, 251-264.
- Durand, V. M., & Crimmons, D. B. (1987). Assessment and treatment of psychotic speech in an autistic child. *Journal of Autism and Developmental Disorders*, 17, 17 - 28.
- Durand, V. M., Crimmins, P. B., Caulfield, M., & Taylor, J. (1989). Reinforcer assessment: Using problem behavior to select reinforcers. *The Journal of the Association for Persons with Severe Handicaps*, 12, 2-10.
- Ehlers, S., Nyden, A., Gillberg, C., Dahlgren Sandberg, A., Dahlgren, S., Hjelmquist, E., et al. (1997). Asperger syndrome, autism and attention disorders: A comparative study of the cognitive profiles of 120 children. *Journal of Child Psychology and Psychiatry*, 38(2), 207 - 217.
- Eisenmajer, R., Prior, M., Leekam, S., Wing, L., Gould, J., Welham, M., et al. (1996). Comparison of clinical symptoms in autism and Asperger's disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 35, 1523-1531.
- Ellingson, S. A., Miltenberger, R. G., Stricker, J. M., Garlinghouse, M. A., Roberts, J., & Galensky, T. L. (2000). Analysis and treatment of finger sucking. *Journal of Applied Behavior Analysis*, 33, 41-52.
- Ewing, C. B., Magee, S. K., & Ellis, J. (2002). The functional analysis of problematic verbal behavior. *The Analysis of Verbal Behavior*, 18, 51 - 60.

- Facon, B., Beghin, M., & Riviere, V. (2007). The reinforcing effect of contingent attention on verbal perseverations of two children with severe visual impairment. *Journal of Behavior Therapy and Experimental Psychiatry*, 38, 23 - 28.
- Falcomata, T. S., Roane, H. S., Hovanetz, A. N., Kettering, T. L., & Keeney, K. M. (2004). An evaluation of response cost in the treatment of inappropriate vocalizations maintained by automatic reinforcement. *Journal of Applied Behavior Analysis*, 37, 83 - 87.
- Fecteau, S., Mottron, L., Berhiau, C., & Burack, J. A. (2003). Developmental changes of autistic symptoms. *Autism*, 7, 255 - 268.
- Fine, J., Bartolucci, G., Szatmari, P., & Ginsberg, G. (1994). Cohesive discourse in pervasive developmental disorders. *Journal of Autism and Developmental Disabilities*, 24, 315 - 330.
- Fischer, J., & Nehs, R. (1978). Use of a commonly available chore as contingent punishment to reduce a boy's rate of swearing. *Journal of Behavior Therapy, and Experimental Psychiatry*, 9(1), 81-83.
- Fisher, W. W., & Mazur, J. E. (1997). Basic and applied research on choice responding. *Journal of Applied Behavior Analysis*, 30, 387 - 410.
- Fisher, W. W., Ninness, H. A. C., Piazza, C. C., & Owen-DeSchryver, J. S. (1996). On the reinforcing effects of the content of verbal attention. *Journal of Applied Behavior Analysis*, 29, 235-238.
- Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, 25, 491 - 498.
- Fisher, W. W., Piazza, C. C., Bowman, L. G., Kurtz, P. F., Sherer, M. R., & Lachman, S. R. (1994). A preliminary evaluation of empirically derived consequences for the treatment of pica. *Journal of Applied Behavior Analysis*, 27, 447-457.
- Foley-Nicpon, M., O'Brien, M. (2007, October). *The paradox of giftedness and autism*. Paper presented at the annual conference for the Iowa Talented and Gifted Association, Des Moines, IA.
- Fombonne, E. (1999). The epidemiology of autism: A review. *Psychological Medicine*, 20, 769 - 786.
- Frea, W. D., & Hughes, C. (1997). Functional analysis and treatment of social-communicative behavior of adolescents with developmental disabilities. *Journal of Applied Behavior Analysis*, 30, 701 - 704.
- Friman, P. C. (1990). Nonaversive treatment of high-rate disruption: Child and provider effects. *Exceptional Children*, 57(1), 64-69.
- Frith, C. D., & Done, D. J. (1990). Stereotyped behavior in madness and in health. In S. J. Cooper, & C. T. Dourish (Eds.), *Neurobiology of stereotyped behaviors* (pp. 232 - 259). Oxford, United Kingdom: Clarendon Press.

- Frith, U. (Ed.). (1991). *Autism and Asperger syndrome*. New York: Cambridge University Press.
- Frith, U. (2003). *Autism: Explaining the enigma*. Oxford, United Kingdom: Blackwell.
- Frith, U., & Happe, F. (1994). Autism: Beyond "theory of mind". *Cognition*, *50*, 115 - 132.
- Ghaziuddin, M. (2002). Asperger syndrome: Associated psychiatric and medical conditions. *Focus on Autism and Other Developmental Disabilities*, *17* (3), 138 - 144.
- Ghaziuddin, M. (2008). Defining the behavioral phenotype of Asperger syndrome. *Journal of Autism and Developmental Disorders*, *38*, 138 - 142.
- Ghaziuddin, M., & Gerstein, L. (1996). Pedantic speaking style differentiates Asperger syndrome from high-functioning autism. *Journal of Autism and Developmental Disorders*, *26*(6), 585 - 595.
- Ghaziuddin, M., & Mountain-Kimchi, K. (2004). Defining the intellectual profile of Asperger syndrome: Comparison with high-functioning autism. *Journal of Autism and Developmental Disabilities*, *34*, 279 - 284.
- Ghaziuddin, M., Tsai, L. Y., & Ghaziuddin, N. (1992). Brief report: A comparison of the diagnostic criteria for Asperger syndrome. *Journal of Autism and Developmental Disabilities*, *22*, 643 -649.
- Ghaziuddin, M., Weidmer-Mikhail, M., & Ghaziuddin, N. (1998). Comorbidity of Asperger syndrome: A preliminary report. *Journal of Intellectual Disability Research*, *42* (Pt. 4), 279 - 283.
- Gilchrist, A., Green, J., Cox, A., Burton, D., Rutter, M., & LeCouteur, A. (2001). Development and current functioning in adolescents with Asperger's syndrome: A comparative study. *Journal of Child Psychology and Psychiatry and other Allied Disciplines*, *42* (2), 227 - 240.
- Gillberg, C. (1989). Asperger syndrome in 23 Swedish children. *Developmental Medicine and Child Neurology*, *31*, 529 - 531.
- Gillberg, C. (1991). Clinical and neurobiological aspects of Asperger syndrome in six family studies. In U. Frith (Ed.), *Autism and Asperger syndrome* (pp. 142 - 146). New York: Cambridge University Press.
- Gillberg, C., & Gillberg, I. C. (1989). Asperger's syndrome - some epidemiological considerations: A research note. *Journal of Child Psychology and Psychiatry*, *30*, 631 - 638.
- Goh, H., Iwata, B. A., Shore, B. A., DeLeon, I. G., Lerman, D. C., Ulrich, S. M., et al. (1995). An analysis of the reinforcing properties of hand mouthing. *Journal of Applied Behavior Analysis*, *28*, 269-283.
- Green, J., Gilchrist, A., Burton, D., & Cox, A. (2000). Social and psychiatric functioning in adolescents with Asperger's syndrome compared with conduct disorder. *Journal of Autism and Developmental Disorders*, *30*(4), 279 - 293.

- Hake, D. F. (1982). The basic-applied continuum and the possible evolution of human operant social and verbal research. *The Behavior Analyst*, 5, 21–28.
- Hall, S. S. (2005). Comparing descriptive, experimental and informant-based assessments of problem behaviors. *Research in Developmental Disabilities*, 26, 514–526.
- Hanley, G. P. Iwata, B. A. & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis*, 36, 147-185.
- Happe, F. G. (1995). Understanding minds and metaphors: Insight from the study of figurative language in autism. *Metaphor and Symbolic Activity*, 10, 275 - 295.
- Happe, F. (1991). The autobiographical writings of three Asperger syndrome adults: Problems of interpretation and implications for theory. In U. Frith (Ed.), *Autism and Asperger syndrome* (pp. 207 - 242). New York: Cambridge University Press.
- Hanley, G. P. Iwata, B. A., & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis*, 36, 147–185
- Harding, J. W., Wacker, D. P., Berg, W. K., Barretto, A., & Rankin, B. (2002). Assessment and treatment of severe behavior problems using choice-making procedures. *Education and Treatment of Children*, 25(1), 26 - 46.
- Harding, J. W., Wacker, D. P., Berg, W. K., Cooper, L. J., Asmus, J., Mlela, K., & Muller, J. (1999). An analysis of choice making in the assessment of young children with severe behavior problems. *Journal of Applied Behavior Analysis*, 32, 63-82.
- Haring, T. G., & Kennedy, C. H. (1990). Contextual control of problem behavior in students with severe disabilities. *Journal of Applied Behavior Analysis*, 23, 235-244.
- Hoch, H. McComas, J. J. Johnson, L. Faranda, N. & Guenther, S. L. (2002). The effects of magnitude and quality of reinforcement on choice responding during play activities. *Journal of Applied Behavior Analysis*, 35, 171-181.
- Horner, R. H., Carr, E. G., Strain, P. S., Todd, A. W., & Reed, H. K. (2002). Problem behavior interventions for young children with autism: A research synthesis. *Journal of Autism and Developmental Disorders*, 32(5), 423 - 446.
- Howlin, P. (2003). Outcome in high-functioning adults with autism with and without early language delays: Implications for the differentiation between autism and Asperger syndrome. *Journal of Autism and Developmental Disabilities*, 33, 3 - 13.
- Hughes, C., Russell, J., & Robbins, T. W. (1993). Evidence for executive dysfunction in autism. *Neuropsychologia*, 32, 477 - 492.
- Hung, D. W. (1978). Using self-stimulation as reinforcement for autistic children. *Journal of Autism and Childhood Schizophrenia*, 8, 355–366.
- Ingham, R. J. & Andrews, G. (1973). An analysis of a token economy in stuttering therapy. *Journal of Applied Behavior Analysis*, 6, 219-229.

- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, 27, 197–209. (Reprinted from *Analysis and Intervention in Developmental Disabilities*, 2, 3–20, 1982)
- Iwata, B. A., Pace, G. M., Dorsey, M. F., Zarcone, J. R., Vollmer, T. R., Smith, R. G., et al. (1994). The functions of self-injurious behavior: An experimental-epidemiological analysis. *Journal of Applied Behavior Analysis*, 27, 215–240.
- Iwata, B. A., & Worsdell, A. S. (2005). Implications of functional analysis methodology for the design of intervention programs. *Exceptionality*, 13(1), 25–34.
- Johnson, W. L., & Baumeister, A. (1978). Self-injurious behavior: A review and analysis of methodological details of published studies. *Behavior Modification*, 2, 465–484.
- Kahng, S., & Iwata, B. A. (1999). Correspondence between outcomes of brief and extended functional analyses. *Journal of Applied Behavior Analysis*, 32, 149–159.
- Kanner, L. (1943). Autistic disturbances of affective contact. *Nervous Child*, 2, 217–253.
- Kazdin, A. E. (1973). Methodological and assessment considerations in evaluating reinforcement programs in applied settings. *Journal of Applied Behavior Analysis*, 6, 517–531.
- Kennedy, C. H., Meyer, K. A., Knowles, T., & Shukla, S. (2000). Analyzing the multiple functions of stereotypical behavior for students with autism: Implications for assessment and treatment. *Journal of Applied Behavior Analysis*, 33, 559–571.
- Kerbel, D., & Grunwell, P. (1998). A study of idiom comprehension in children with semantic-pragmatic difficulties. Part II: Between-groups results and discussion. *International Journal of Language and Communication Disorders*, 33, 23–44.
- Kerbeshian, J., Burd, L., & Fisher, W. (1990). Asperger's syndrome: To be or not to be? *British Journal of Psychiatry*, 156, 721–725.
- Kern, L., Mauk, J. E., Marder, T. J., & Mace, F. C. (1995). Functional analysis and intervention for breath holding. *Journal of Applied Behavior Analysis*, 28, 339–340.
- Klin, A., Carter, A., & Sparrow, S. S. (1997). Psychological assessment of children with autism. In D. J. Cohen, & F. R. Volkmar, *Handbook of autism and pervasive developmental disorders* (2nd ed., pp. 418–427). New York: Wiley.
- Klin, A., & Volkmar, F. R. (1997). Asperger syndrome. In D. Cohen, & F. R. Volkmar, *Handbook of autism and pervasive developmental disorders* (pp. 94–122). New York: John Wiley & Sons, Inc.
- Klin, A., Volkmar, F. R., & Sparrow, S. S. (2000). *Asperger syndrome*. New York: Guilford.

- Kodak, T., Northup, J., & Kelley, M. E. (2007). An evaluation of the types of attention that maintain problem behavior. *Journal of Applied Behavior Analysis*, *40*, 167-171.
- Kohn, Y., Fahum, T., Ratzoni, G., & Apter, A. (1998). Aggression and sexual offense in Asperger's syndrome. *Israeli Journal of Psychiatry and Related Sciences*, *35*, 293 - 299.
- Koning, C., & Magill-Evans, J. (2001). Social and language skills in adolescent boys with Asperger's syndrome. *Autism*, *5*(1), 23 - 36.
- Kostinas, G., Scandlen, A., & Luiselli, J. K. (2001). Effects of DRL and DRL combined with response cost on perseverative verbal behavior of an adult with mental retardation and obsessive compulsive disorder. *Behavioral Interventions*, *16*, 27 - 37.
- Koyama, T., Tachimori, H., Osada, H., Takeda, T., & Kurita, H. (2007). Cognitive and symptom profiles in Asperger's syndrome and high-functioning autism. *Psychiatry and Clinical Neurosciences*, *61*, 99 - 104.
- Kugler, B. (1998). The differentiation between autism and Asperger's syndrome. *Autism*, *2*, 11 - 32.
- Kuusikko, S., Pollock-Wurman, R., Jussila, K., Carter, A. S., Matilla, M., Ebeling, H., et al. (2008). Social anxiety in high-functioning children and adolescents with autism and Asperger syndrome. *Journal of Autism and Developmental Disorders*, *38*, 1697 - 1709.
- Lalli, J. S., & Casey, S. D. (1996). Treatment of multiply controlled problem behavior. *Journal of Applied Behavior Analysis*, *29*, 391-395.
- Lancaster, B. M., LeBlanc, L. A., Carr, J. E., Brenske, S., Peet, M. M., & Culver, S. J. (2004). Functional analysis and treatment of the bizarre speech of dually diagnosed adults. *Journal of Applied Behavior Analysis* *37*, 395-9.
- Landa, R. (2000). Social language use in Asperger syndrome and high-functioning autism. In A. Klin, F. R. Volkmar, & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 125 - 155). New York: Guilford Press.
- Laws, R. D., Brown, R. A., Epstein, J., & Hocking, N. (1971). Reduction of inappropriate social behavior in disturbed children by an untrained paraprofessional therapist. *Behavior Therapy*, *2*(4), 519-533.
- Leckam, S., Libby, S., Wing, L., Gould, J., & Gillberg, C. (2000). Comparison of ICD-10 and Gillberg's criteria for Asperger syndrome. *Autism: Special Issue: Asperger Syndrome* (4), 11 - 28.
- Lee, H. J., & Park, H. R. (2007). An integrated literature review on the adaptive behavior of individuals with Asperger's syndrome. *Remedial and Special Education*, *28* (3), 132 - 139.
- Lerman, D. C., & Iwata, B. A. (1993). Descriptive and experimental analyses of variables maintaining self-injurious behavior. *Journal of Applied Behavior Analysis*, *26*, 293-319.

- Lerman, D. C., & Iwata, B. A. (1996). A methodology for distinguishing between extinction and punishment effects associated with response blocking. *Journal of Applied Behavior Analysis*, 29, 231–234.
- Lennox, D. B., Miltenberger, R. G., Donnelly, D. R. (1987). Response interruption and DRL for the reduction of rapid eating. *Journal of Applied Behavior Analysis*, 20:279–284.
- Lewis, M. H., & Baumeister, A. A. (1982). Stereotyped mannerisms in mentally retarded persons: Animal models and theoretical analyses. In N. R. Ellis (Ed.), *International Review of Research in Mental Retardation* (Vol. 11, pp. 123 - 161). New York: Academic Press.
- Lewis, M. H., Baumeister, A. A., & Mailman, R. B. (1987). A neurobiological alternative to the perceptual reinforcement hypothesis of stereotyped behavior: A commentary of "self-stimulatory behavior and perceptual reinforcement". *Journal of Applied Behavior Analysis*, 20, 253 - 258.
- Lewis, M. H., & Bodfish, J. W. (1998). Repetitive behavior disorders in autism. *Mental Retardation and Developmental Disabilities Research Reviews*, 4, 80 - 89.
- Lewis, T. J., & Sugai, G. (1996). Descriptive and experimental analysis of teacher and peer attention and the use of assessment-based intervention to improve prosocial behavior. *Journal of Behavioral Education*, 6, 7-24.
- Liberman, R. P., Teigen, J., Patterson, R., & Baker, V. (1973). Reducing delusional speech in chronic paranoid schizophrenics. *Journal of Applied Behavior Analysis*, 6, 57-64.
- Lincoln, A. J., Allen, M., & Kilman, A. (1995). The assessment and interpretation of intellectual abilities in people with autism. In E. Schopler, & G. Mesibov (Eds.), *Learning and Cognition in Autism* (pp. 89 - 117). New York: Plenum.
- Lincoln, A., Courchesne, E., Allen, M., Hanson, E., & Ene, M. (1998). Neurobiology of Asperger syndrome: Seven case studies and quantitative magnetic resonance imaging findings. In E. Schopler, G. Mesibov, & L. J. Kuncze (Eds.), *Asperger Syndrome or High-Functioning Autism* (pp. 145 - 166). New York: Plenum.
- Lindberg, J. S., Iwata, B. A., Kahng, S., & DeLeon, I. G. (1999). DRO contingencies: An analysis of variable-momentary schedules. *Journal of Applied Behavior Analysis*, 32, 123–136.
- Liss, M., Fein, D., Waterhouse, L., Allen, D., Dunn, M., Morris, R., et al. (2001). Executive functioning in high-functioning children with autism. *Journal of Child Psychology and Psychiatry*, 42, 261 - 270.
- Lovaas, O. I., Newsom, C., & Hickman, C. (1987). Self-stimulatory behavior and perceptual development. *Journal of Applied Behavior Analysis*, 20, 45 - 68.
- Mace, F. C. (1994). The significance and future of functional analysis methodologies. *Journal of Applied Behavior Analysis*, 27, 385–392.

- Mace, F. C., & Lalli, J. S. (1991). Linking descriptive and experimental analyses in the treatment of bizarre speech. *Journal of Applied Behavior Analysis, 24* (3), 553 - 562.
- Mace, F. C., Lalli, J., & Lalli, E. (1991). Functional analysis and treatment of aberrant behavior. *Research in Developmental Disabilities, 12*, 155-180.
- Mace, F. C., Neef, N. A., Shade, D., & Mauro, B. C. (1996). Effects of problem difficulty and reinforcer quality on time allocated to concurrent arithmetic problems. *Journal of Applied Behavior Analysis, 29*, 11 - 24.
- Mace, F. C., Webb, M. E., Sharkey, R. W., Matson, D. M., & Rosen, H. S. (1988). Functional analysis and treatment of bizarre speech. *Journal of Behavior Therapy and Experimental Psychiatry, 19*, 289 - 296.
- Macintosh, K., & Dissanayake, K. E. (2006). A comparative study of the spontaneous social interactions and social skills of children with high functioning autism and children with Asperger's disorder. *Autism, 10*, 199 - 220.
- Manjiviona, J., & Prior, M. (1999). Neuropsychological profiles of children with Asperger's syndrome and autism. *Autism, 3*, 327 - 356.
- Martin, A., Patzer, D. K., & Volkmar, F. R. (2000). Psychopharmacological treatment of higher-functioning pervasive developmental disorders. In A. Klin, F. R. Volkmar, & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 210 - 228). New York: Guilford Press.
- Martin, L., Spicer, D. W., Lewis, M. H., Gluck, J.P., & Cork, L.C. (1991). Social deprivation in infant rhesus monkeys alters the chemoarchitecture of the brain: I. Subcortical regions. *Journal of Neuroscience, 11*, 3344 - 3358.
- Matson, J. L., & Taras, M. E. (1989). A 20 year review of punishment and alternative methods to treat problem behaviors in developmentally delayed persons. *Research in Developmental Disabilities, 10*, 85-104.
- Mawson, D., Grounds, A., & Tantam, D. (1985). Violence and Asperger's syndrome. *British Journal of Psychiatry, 147*, 566 - 569.
- McDougle, C. J., Kresch, L. E., Goodman, W. K., Naylor, S. T., Volkmar, F. R., Cohen, D. J., et al. (1995). A case-controlled study of repetitive thoughts and behavior in adults with autistic disorder and obsessive-compulsive disorder. *American Journal of Psychiatry, 152*(5), 772 - 777.
- McDougle, C., Naylor, S., Cohen, D., Aghajanian, G. K., Heninger, G. R., & Price, L.H. (1996). Effects of tryptophan depletion in drug-free adults with autistic disorder. *Archives of General Psychiatry, 53*, 993 - 1000.
- Mesibov, G. B., Adams, L. W., & Klinger, L. G. (1997). *Autism: Understanding the disorder*. New York: Plenum Press.
- Militerni, R., Bravaccio, C., Falco, C., Fico, C., & Palermo, M. T. (2002). Repetitive behaviours in autistic disorder. *European Child and Adolescent Psychology, 11*, 210 - 218.

- Milton, J., Duggan, C., Latham, A., & Tantam, D. (2002). Case history of co-morbid Asperger's syndrome and paraphilic behavior. *Medicine Science and Law*, 42, 237 - 244.
- Mrug, S., & Hodgens, J. B. (2008). Behavioral summer treatment program improves social and behavioral functioning of four children with Asperger's disorder. *Clinical Case Studies*, 7(3), 171 - 190.
- Myles, B. S., Lee, H. J., Smith, S. M., Tien, K., Chou, Y., Swanson, T. C., et al. (2007). A large-scale study of the characteristics of Asperger syndrome. *Education and Training in Developmental Disabilities*, 42(4), 448 - 459.
- Myles, B., & Simpson, R. (2002). Asperger syndrome: An overview of characteristics. *Focus on Autism and Other Developmental Disabilities*, 17, 132 - 138.
- Myles, B. S., & Simpson, R. L. (2003). *Asperger syndrome: A guide for educators and parents*. Austin, TX: Pro-Ed.
- Myles, B. S., & Southwick, J. (1999). *Asperger syndrome and difficult moments*. Shawnee Mission, Kansas: Autism Asperger Publishing.
- National Autistic Society. (2002). *Children with autism and Thomas the Tank Engine*. Retrieved November 21, 2008, from The National Autistic Society: www.nas.org.uk/nas/jsp/polopoly.jsp?d=368&a=2683
- National Institutes of Health. (1989). *NIH consensus development conference on the treatment of destructive behaviors in persons with developmental disabilities*. Bethesda, MD: Author.
- Neef, N. A., & Iwata, B. A. (1994). Current research on functional analysis methodologies: An introduction. *Journal of Applied Behavior Analysis*, 27, 211-214.
- Neef, N. A., Mace, F. C., & Shade, D. (1993). Impulsivity in students with serious emotional disturbance: The interactive effects of reinforcer rate, delay, and quality. *Journal of Applied Behavior Analysis*, 26, 37 - 52.
- Neef, N. A., Shade, D., & Miller, M. S. (1994). Assessing influential dimensions of reinforcers on choice in students with serious emotional disturbance. *Journal of Applied Behavior Analysis*, 27, 575-583.
- Newman, S. S., & Ghaziuddin, M. (2008). Violent crime in Asperger syndrome: The rule of psychiatric comorbidity. *Journal of Autism and Developmental Disorders*, 38, 1848 - 1852.
- Northup, J., Vollmer, T. R., & Serrett, K. (1993). Publication trends in 25 years of the Journal of Applied Behavior Analysis. *Journal of Applied Behavior Analysis*, 26, 527-537.
- Northup, J., Wacker, D., Sasso, G., Steege, M., Cigrand, K., Cook, J., et al. (1991). A brief functional analysis of aggressive and alternative behavior in an outclinic setting. *Journal of Applied Behavior Analysis*, 24, 509-522.

- Nydegger, R. V. (1972). The elimination of hallucinatory and delusional behavior by verbal conditioning and assertive training: A case study. *Journal of Behavior Therapy and Experimental Psychiatry*, 3, 225-227.
- O'Brien, J.S., & Raynes, A.E. (1973). Treatment of compulsive verbal behavior with response contingent punishment and relaxation. *Journal of Behavior Therapy and Experimental Psychiatry*, 4(4), 347-352.
- Ozonoff, S., Dawson, G. & McPartland, J. (2002). *A parent's guide to Asperger syndrome and high-functioning autism: How to meet the challenges and help your child thrive*. New York: Guilford.
- Ozonoff, S., & Miller, J. N. (1996). An exploration of right hemisphere contributions to the pragmatic impairments of autism. *Brain and Language*, 52, 411 - 434.
- Ozonoff, S., South, M., & Miller, J. N. (2000). DSM-IV-defined Asperger syndrome: Cognitive, behavioral, and early history differentiation from high-functioning autism. *Autism*, 4, 29 - 46.
- Pace, G. M., Ivancic, M. T., & Jefferson, G. (1994). Stimulus fading as treatment for obscenity in a brain-injured adult. *Journal of Applied Behavior Analysis*, 27, 301-305.
- Pace, G. M., Iwata, B. A., Cowdery, G. E., Andree, P. A., & McIntyre, T. (1993). Stimulus (instructional) fading during extinction of self-injurious escape behavior. *Journal of Applied Behavior Analysis*, 26, 205 - 212.
- Patterson, R. L., & Teigen, J. R. (1973). Conditioning and post-hospital generalization of nondelusional responses in a chronic psychotic patient. *Journal of Applied Behavior Analysis*, 6, 65-70.
- Pelios, L., Morren, J., Tesch, D., & Axelrod, S. (1999). The impact of functional analysis methodology on treatment choice for self-injurious and aggressive behavior. *Journal of Applied Behavior Analysis*, 32, 185-195.
- Perry, R. (2004). Early diagnosis of Asperger's disorder: Lessons from a large clinical practice. *Journal of the American Academy of Child and Adolescent Psychiatry*, 43, 1445 - 1448.
- Peyton, R. T., Lindauer, S. E., & Richman, D. M. (2005). The effects of directive and nondirective prompts on noncompliant vocal behavior exhibited by a child with autism. *Journal of Applied Behavior Analysis*, 38, 251 - 255.
- Piazza, C. C., Adelinis, J. D., Hanley, G. P., Goh, H., & Delia, M. D. (2000). An evaluation of the effects of matched stimuli on behaviors maintained by automatic reinforcement. *Journal of Applied Behavior Analysis*, 33, 13-27.
- Piazza, C. C. Fisher, W. W. Brown, K. A. Shore, B. A. Patel, M. R. Katz, R. M. Sevin, B. M. Gulotta, C. S. & Blakely-Smith, A. (2003). Functional analysis of inappropriate mealtime behaviors. *Journal of Applied Behavior Analysis*, 36, 187-204.

- Piazza, C. C., Fisher, W. W., Hanley, G. P., Remick, M. L., Contrucci, S. A., & Aitken, T. L. (1997). The use of positive and negative reinforcement in the treatment of escape-maintained destructive behavior. *Journal of Applied Behavior Analysis*, *30*, 279 – 298.
- Piazza, C. C., Hanley, G. P., Bowman, L. G., Ruyter, J. M., Lindauer, S. E., & Saiontz, D. M. (1997). Functional analysis and treatment of elopement. *Journal of Applied Behavior Analysis*, *30*, 653–672.
- Piazza, C. C., Hanley, G. P., & Fisher, W. W. (1996). Functional analysis and treatment of cigarette pica. *Journal of Applied Behavior Analysis*, *29*, 437 - 449.
- Pierce, W. D., & Cheney, C. D. (2004). *Behavior analysis and learning* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
- Piven, J., Harper, J., Palmer, P., & Arndt, S. (1996). Course of behavioral change in autism: A retrospective study of high-IQ adolescents and adults. *Journal of the American Academy of Child and Adolescent Psychiatry*, *35*, 523 - 529.
- Prior, M., & MacMillan, M. (1973). Maintenance of sameness in children with Kanner's syndrome. *Journal of Autism and Childhood Schizophrenia*, *3*, 154 - 167.
- Prizant, B., & Duchan, J. (1981). The functions of immediate echolalia in autistic children. *Journal of Speech and Hearing Disorders*, *46*, 241 - 249.
- Pyles, L. (2000). *Hitchhiking through Asperger syndrome*. London: Jessica Kingsley Press.
- Ramberg, C., Ehlers, S., Nyden, A., Johansson, M., & Gillberg, C. (1996). Language and pragmatic functions in school-age children on the autism spectrum. *European Journal of Disorders of Communication*, *31*(4), 387 - 413.
- Rapp, J. T. (2005). An assessment of preference for caregivers and antecedents for problem behaviors. *Behavioral Interventions*, *20*, 301 - 311.
- Reece, R. M., Richman, D. M., Zarcone, J., & Zarcone, T. (2003). Individualizing functional assessments for children with autism: The contribution of perseverative behavior and sensory disturbances to disruptive behavior. *Focus on Autism and Other Developmental Disabilities*, *18*(2), 87 - 92.
- Reed, P. (1991). Multiple determinants of the effects of reinforcement magnitude on free-operant response rates. *Journal of the Experimental Analysis of Behavior*, *55*, 109-123.
- Rehfeldt, R. A., & Chambers, M. R. (2003). Functional analysis and treatment of verbal perseverations displayed by an adult with autism. *Journal of Applied Behavior Analysis*, *36*, 259 - 261.
- Reichle, J., Brubakken, D., & Tetreault, G. (1976). Eliminating perseverative speech by positive reinforcement and time-out in a psychotic child. *Journal of Behavioral Therapy and Experimental Psychiatry*, *7*, 179 - 183.
- Rickard, H. C., Dignam, P. J., & Horner, R. F. (1960). Verbal manipulation in a psychotherapeutic relationship. *Journal of Clinical Psychology*, *16*, 364-367.

- Ridley, R. M. (1994). The psychology of perseverative and stereotyped behaviour. *Progress in Neurobiology*, *44*, 221 - 231.
- Ringdahl, J. E., Vollmer, T. R., Marcus, B. A., & Roane, H. S. (1997). An analogue evaluation of environmental enrichment: The role of stimulus preference. *Journal of Applied Behavior Analysis*, *30*, 203-216.
- Risley T. R., & Wolf, M. M. (1967). Establishing functional speech in echolalic children. *Behaviour Research and Therapy*, *5*, 73-88.
- Roane, H. S., Vollmer, T. R., Ringdahl, J. E., & Marcus, B. A. (1998). Evaluation of a brief stimulus preference assessment. *Journal of Applied Behavior Analysis*, *31*, 605 - 620.
- Romaniuk, C., Miltenberger, R., Conyers, C., Jenner, N., Jurgens, M., & Ringenberg, C. (2002). The influence of activity choice on problem behaviors maintained by escape versus attention. *Journal of Applied Behavior Analysis*, *35*, 349-362.
- Ross, D. E. (2002). Replacing faulty conversational exchanges for children with autism by establishing a functionally equivalent alternative response. *Education and Training in Mental Retardation and Developmental Disabilities*, *37*, 343-362.
- Sandson, J., & Albert, M. L. (1984). Perseveration in behavioral neurology. *Neurology*, *37*, 1736 - 1741.
- Schopler, E. (1985). Convergence of learning disability, higher-level autism, and Asperger's syndrome. *Journal of Autism and Developmental Disorders*, *15*, 359-360.
- Schopler, E. (1998). Premature popularization of Asperger syndrome. In E. Schopler, G. B. Mesibov, & L. J. Kunce (Eds.), *Asperger syndrome or high-functioning autism?* (pp. 385-399). New York: Plenum.
- Schwartz-Watts, D. M. (2005). Asperger's disorder and murder. *The Journal of the American Academy of Psychiatry and the Law*, *33*, 390 - 393.
- Sciutto, M. J., & Cantwell, C. (2005). Factors influencing the differential diagnosis of Asperger's disorder and high-functioning autism. *Journal of Developmental and Physical Disabilities*, *17*(4), 345 - 359.
- Scragg, P., & Shah, A. (1994). Prevalence of Asperger Syndrome in a secure hospital. *British Journal of Psychiatry*, *165* (5), 679 - 682.
- Shaked, M., & Yirmiya, N. (2003). Understanding social difficulties. In M. Prior (Ed), *Learning and behavior problems in Asperger syndrome* (pp. 104-125). New York: Guilford Press.
- Shao, Y., Cuccaro, M. L., Hauser, E. R., Raiford, K. L., Menold, M. M., Wolpert, C. M., et al. (2002). Fine mapping of autistic disorder to chromosome 15q11 - q13 by use of phenotypic subtypes. *American Journal of Human Genetics*, *72*, 539 - 548.
- Shore, B. A., Iwata, B. A., DeLeon, I. G., Kahng, S., & Smith, R. G. (1997). An analysis of reinforce substitutability using object manipulation and self-injury as competing responses. *Journal of Applied Behavior Analysis*, *30*, 21-41.

- Shriberg, L., Paul, R., McSweeney, J., Klin, A., Cohen, D., & Volkmar, F. (2001). Speech and prosody characteristics of adolescents and adults with high-functioning autism and AS. *Journal of Speech, Language, and Hearing Research*, 44, 1097 - 1115.
- Shtayermman, O. (2008). Suicidal ideation and comorbid disorders in adolescents and young adults diagnosed with Asperger's syndrome: A population at risk. *Journal of Human Behavior in the Social Environment*, 18(3), 301 - 328.
- Slater-Walker, G., & Slater-Walker, C. (2002). *An Asperger marriage*. London: Jessica Kingsley.
- Smith, R. G., Iwata, B. A., Goh, H., & Shore, B. A. (1995). Analysis of establishing operations for self-injury maintained by escape. *Journal of Applied Behavior Analysis*, 28, 515-535.
- South, M., Klin, A., & Volkmar, F. R. (1997, April). *Circumscribed interests in higher functioning autism and Asperger syndrome*. Poster presented at the 1997 biannual meeting of the Society for Research in Child Development. Washington, DC.
- South, M., Ozonoff, S., & McMahon, W. M. (2005). Repetitive behavior profiles in Asperger syndrome and high-functioning autism. *Journal of Autism and Developmental Disorders*, 35(2), 145 - 158.
- Stokes, T. F., and Kennedy, S. H. (1980). Reducing child uncooperative behavior during dental treatment through modeling and reinforcement. *Journal of Applied Behavior Analysis*, 13, 41-49.
- St. Peter, C. C., Vollmer, T. R., Bourret, J. C., Borrero, C. S., Sloman, K. N., & Rapp, J. T. (2005). On the role of attention in naturally occurring matching relations. *Journal of Applied Behavior Analysis*, 38, 429-443.
- Sugai, G., & White, W. J. (1986). Effects of using object self-stimulation as a reinforcer on the prevocational work rates of an autistic child. *Journal of Autism and Developmental Disorders*, 16, 459 - 471.
- Symons, F. J., McDonald, L. M., & Wehby, J. H. (1998). Functional assessment and teacher collected data. *Education and Treatment of Children*, 21, 135-159.
- Szatmari, P., Archer, L., Fisman, S., Streiner, D. L., & Wilson, F. (1995). Asperger's syndrome and autism: Difference in behavior, cognition, and adaptive behavior. *Journal of the American Academy of Child and Adolescent Psychiatry*, 34, 1662 - 1671.
- Szatmari, P., Bartolucci, G., & Bremner, R. (1989). Asperger's syndrome and autism: Comparison of early history and outcome. *Developmental Medicine and Child Neurology*, 31, 709 - 720.
- Szatmari, P., Bartolucci, G., Bremner, R., Bond, S., & Rich, S. (1989). A follow up study of high-functioning autistic children. *Journal of Autism and Developmental Disorders*, 19, 213 - 225.
- Szatmari, P., Bremner, R., & Nagy, J. (1989). Asperger syndrome: A review of clinical features. *Canadian Journal of Psychiatry*, 157, 554 - 560.

- Szatmari, P., Bryson, S. E., Boyle, M. H., Streiner, D. L., & Doku, E. (2003). Predictors of outcome among high functioning children with autism and Asperger syndrome. *Journal of Child Psychology and Psychiatry* (44), 520 -528.
- Szatmari, P., Georgiades, S., Bryson, S., Zwaigenbaum, L., Roberts, W., Mahoney, W., et al. (2006). Investigating the structure of the restricted, repetitive, behaviors and interests domain of autism. *Journal of Child Psychology and Psychiatry*, 47 (6), 582 - 590.
- Tager-Flusberg, H., & Anderson, M. (1994). The development of contingent discourse ability in autistic children. *Journal of Child Psychology and Psychiatry*, 35, 1059 - 1075.
- Tantam, D. (1988). Asperger's syndrome. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 29, 245 - 255.
- Tantam, D. (1991). Asperger syndrome in adulthood. In U. Frith, *Autism and Asperger syndrome* (pp. 147 - 183). Cambridge, United Kingdom: Cambridge University Press.
- Tantam, D. (2003). Assessment and treatment of comorbid emotional and behavior problems. In M. Prior, *Learning and Behavior Problems in Asperger Syndrome* (pp. 148 - 174). New York: Guilford Press.
- Tate, B. G., & Baroff, G. S. (1966). Aversive control of self-injurious behavior in a psychotic boy. *Behaviour Research and Therapy*, 1966, 4, 281 - 287.
- Taylor, B. A., Hoch, H., & Weissman, M. (2005). The analysis and treatment of vocal stereotypy in a child with autism. *Behavioral Interventions*, 20, 239 - 253.
- Taylor, J. C., & Romanczyk, R. G. (1994). Generating hypotheses about the function of student problem behavior by observing teacher behavior. *Journal of Applied Behavior Analysis*, 27, 251-265.
- Tessing, J. L., Napolitano, D. A., McAdam, D. B., DiCesare, A., & Axelrod, S. (2006). The effects of providing access to stimuli following choice making during vocal preference assessments. *Journal of Applied Behavior Analysis*, 39, 501 – 506.
- Tiger, J. H., Bouxsein, K. J., & Fisher, W. W. (2007). Treating the excessively slow responding of a young man with Asperger's syndrome using differential reinforcement of short response latencies. *Journal of Applied Behavior Analysis*, 40, 559 - 263.
- Thompson, R. H., & Iwata, B. A. (2007). A comparison of outcomes from descriptive and functional analyses of problem behavior. *Journal of Applied Behavior Analysis*, 40, 333-338.
- Tincani, M. J., Castrogiovanni, A., & Axelrod, S.A. (1999). Comparison of the effectiveness of brief versus traditional functional analyses. *Research in Developmental Disabilities*, 20(5), 327–338.
- Tonge, B. J., Brereton, A. V., Gray, K. M., & Einfeld, S. L. (1999). Behavioural and emotional disturbance in high-functioning autism and Asperger syndrome. *Autism*, 3, 117 - 130.

- Toth, K., & King, B. H. (2008). Asperger's syndrome: Diagnosis and treatment. *American Journal of Psychiatry*, *165*(8), 958 - 963.
- Trosclair-Lasserre, N. M., Lerman, D. C., Call, N. A., Addison, L. R., & Kodak, T. Reinforcement magnitude: An evaluation of preference and reinforcer efficacy. *Journal of Applied Behavior Analysis*, *41*, 203-220.
- Tsai, L. Y. (1992). Diagnostic issues in high-functioning autism. In L. Y. Tsai (Ed.), *High-functioning individuals with autism* (pp. 11 - 40). New York: Plenum Press.
- Turkington, C., & Anan, R. (2007). *The encyclopedia of autism spectrum disorders*. New York: Facts on File, Inc.
- Turner, M. (1997). Towards an executive dysfunction account of repetitive behavior in autism. In J. Russell (Ed.), *Autism as an executive disorder* (pp. 57 - 100). Oxford, England: Oxford University Press.
- Turner, M. (1999). Annotation: Repetitive behavior in autism: A review of psychological research. *Journal of Child Psychology and Psychiatry*, *40*(6), 839 - 849.
- Van Camp, C. M., Lerman, D. C., Kelley, M. E., Roane, H. S., Contrucci, S. A., & Vorndran, C. M. (2000). Further analysis of idiosyncratic antecedent influences during the assessment and treatment of problem behavior. *Journal of Applied Behavior Analysis*, *33*, 207-221.
- Varni, J. W., Russo, D. C., & Cataldo, M. F. (1978). Assessment and modification of delusional speech in an 11-year-old child: A comparative analysis of behavior therapy and stimulant drug effects. *Journal of Behavior Therapy and Experimental Psychiatry*, *9*, 377-380.
- Vaughn, B. J., & Horner, R. H. (1997). Identifying instructional tasks that occasion problem behaviors and assessing the effects of student versus teacher choice among these tasks. *Journal of Applied Behavior Analysis*, *30*, 299-312.
- Volkert, V. M., Lerman, D. C., & Vorndran, C. (2005). The effects of reinforcement magnitude on functional analysis outcomes. *Journal of Applied Behavior Analysis*, *38*, 147-162.
- Volkmar, F. R., & Klin, A. (2000). Diagnostic issues in Asperger syndrome. In A. Klin, F. R. Volkmar, & S. S. Sparrow (Eds.), *Asperger syndrome* (pp. 25 - 71). New York: Guilford Press.
- Vollmer, T. R., Borrero, J. C., Lalli, J. S., & Daniel, D. (1999). Evaluating self-control and impulsivity in children with severe behavior disorders. *Journal of Applied Behavior Analysis*, *32*, 451 - 466.
- Vollmer, T. R., & Iwata, B. A. (1992). Differential reinforcement as treatment for behavior disorders: procedural and functional variations. *Research in Developmental Disabilities*, *13*(4), 393-417.
- Vollmer, T. R., Marcus, B. A., Ringdahl, J. E., & Roane, H. S. (1995). Progressing from brief assessments to extended experimental analyses in the evaluation of aberrant behavior. *Journal of Applied Behavior Analysis*, *28*, 561-576.

- Wacker, D. P. (1996). Behavior analysis research in JABA: A need for studies that bridge basic and applied research. *Experimental Analysis of Human Behavior Bulletin*, *14*, 11 - 14.
- Wacker, D. P., Berg, W., Harding, J., & Cooper-Brown, L. J. (2004). Use of brief experimental analyses in outpatient clinic and home settings. *Journal of Behavioral Education*, *13*(4), 213-226.
- Wagaman, J. R., Miltenberger, R. G. & Arndorfer, R. E. (1993). Analysis of a simplified treatment for stuttering in children. *Journal of Applied Behavior Analysis*, *26*, 53-61.
- Wahlberg, T. (2001). The control theory of autism. In T. Wahlberg, A. Rotatori, S. Burkhardt & F. E. Obiakor (Eds.), *Autistic Spectrum Disorders: Educational and Clinical Interventions*, Vol. 14 (pp. 19 - 35). Greenwich, CT: JAI Press.
- Wallace, M. D., & Iwata, B. A. (1999). Effects of session duration on functional analysis outcomes. *Journal of Applied Behavior Analysis*, *32*, 175–183.
- Wilder, D. A., Masuda, A., O'Connor, C., & Baham, M. (2001). Brief functional analysis and treatment of bizarre vocalizations in an adult with schizophrenia. *Journal of Applied Behavior Analysis*, *34*, 63 - 68.
- Wilder, D. A., White, H., & Yu, M. L. (2003). Functional analysis and treatment of bizarre vocalizations exhibited by an adult with schizophrenia: A replication and extension. *Behavioral Interventions*, *18*, 43–52.
- Wincze, J. P., Leitenberg, H., & Agras, W. S. (1972). The effects of token reinforcement and feedback on the delusional verbal behavior of chronic paranoid schizophrenics. *Journal of Applied Behavior Analysis*, *5*, 247-262.
- Wing, L. (1981). Asperger's syndrome: A clinical account. *Psychological Medicine*, *13*(7), 115 - 129.
- Winter-Messiers, M. (2007). From tarantulas to toilet brushes: Understanding the special interest areas of children and youth with Asperger's syndrome. *Remedial and Special Education*, *28*(3), 140 - 152.
- Wolery, M., Kirk, K., & Gast, D. L. (1985). Stereotypic behavior as a reinforcer: Effects and side effects. *Journal of Autism and Developmental Disorders*, *15*, 149 - 161.
- Woodbury-Smith, M. R. & Volkmar, F. R. (2009). Asperger syndrome. *European Child and Adolescent Psychiatry*, *18*(1), 2 -11.
- Wong, S. E., Terranova, M. D., Bowen, L., Zarate, R., Massel, H. K., & Liberman, R. P. (1987). Providing independent recreational activities to reduce Stereotypic vocalizations in chronic schizophrenics. *Journal of Applied Behavior Analysis*, *20*, 77-81.
- World Health Organization. (1992). *International classification of diseases and related health problems* (10th rev. ed.). Geneva, Switzerland.
- Wright, C. W., & Vollmer, T. R. (2002). Evaluation of a treatment package to reduce rapid eating. *Journal of Applied Behavior Analysis*, *35*, 89-94.