THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF COMMUNICATION SCIENCES AND DISORDERS

# NONVERBAL ATTENTION DEFICITS IN CHILDREN WITH POOR LANGUAGE ABILITIES

ALEXANNA KASSY KUBLER
Spring 2011

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Communication Sciences and Disorders
with honors in Communication Sciences and Disorders

Reviewed and approved* by the following:

Elina Mainela-Arnold
Assistant Professor
Thesis Supervisor

Carol Miller
Associate Professor
Honors Adviser

*Signatures are on file in the Schreyer Honors College.

## ABSTRACT

This study examined the link between language abilities and nonverbal attention, or inhibition, in school-age children. The participants in our research consisted of 13 children, 8 males and 5 females from ages 6-14. Several standardized tests were administered to gauge each child's language abilities; in particular, vocabulary. These tests included the Clinical Evaluation of Language Fundamentals – Fourth Edition (CELF-4), Expressive Vocabulary Test (EVT) and the Peabody Picture Vocabulary Test (PPVT). These scores were then correlated with a measure of each child's nonverbal attention (inhibition), using a version of the Flanker task, which was designed by Eriksen & Eriksen in 1974 to examine how well attention is regulated; or how easily an individual is able to focus on an object while other stimuli surround or flank that object. The current study utilized a child-friendly version of the Flanker task, the Attention Networks Task (ANT), developed by Rueda et al in 2004. Measures of accuracy and response latencies were gathered for each participant, and were later used to calculate interference effects for each variable. We hypothesized that children with lower vocabulary scores would demonstrate longer reaction times and less accurate responses during the task, implicating a stronger "interference effect" in those participants. Such results may suggest that children with poor language abilities have difficulties with inhibition as result of a limited working memory capacity and/or speed of processing. From our results we were able to conclude that although response accuracy does not serve as a reliable indicator of the interference effect, PPVT standard scores correlated significantly with the interference effect measured in reaction times, suggesting a relation between nonverbal attention and receptive language.

# TABLE OF CONTENTS

## ACKNOWLEDGEMENTS

I would like to thank everyone who has been a part of this ongoing study, and finally my thesis. It was, without a doubt, a joint endeavor which involved the cooperation of several women. First and foremost I'd like to express my gratitude to Dr. Elina Mainela-Arnold, who has taught me so much about the strategy, creativity and precision which goes in to accurate and truthful research. I would also like to thank Dr. Carol Miller for her expertise and willingness to answer questions at any time. Additionally, Ph.D. candidate Ji-Sook Park has shown us all that effort, energy and dedication lead to quality results—thank you for all of your hard work and support. This project would not have been a success without the help of Katharine Donnelly Adams, who has shared her time, knowledge and passion for research. Last but certainly not least, thank you to my fellow research assistants, especially Rachel Marodi, Noelle Smith, Kristen Rivotti, Rachel Alberts and Kate O'Malia.

**LIST OF TABLES**

# Chapter 1: Specific Language Impairment and Attention

## What is Specific Language Impairment?

The diagnosis of specific language impairment (SLI) denotes a population of children who display a particular difficulty with the acquisition and use of language in the context of otherwise normal development. Sometimes referred to as childhood dysphasia or developmental language disorder, SLI describes a disorder in which language problems occur in the absence of any factor which would commonly affect language learning, such as hearing, intellectual, emotional or neurological impairments, including autism or mental retardation. This developmental condition typically leads to a delayed development of spoken language that often results in enduring limitations in speaking and listening skills. Children with SLI do not acquire language at the natural speed and ease with which their same-age peers are able to (Leonard, 1998).

Other characteristics of SLI include marked difficulty using inflection and word forms such as omitting endings when forming verb tenses, as well as problems using context to acquire novel vocabulary. Furthermore, a child with SLI might produce relatively short spontaneous utterances that are characteristic of those produced by children who are more than a year younger. These difficulties often extend into the school years where the disorder can impair the reading and writing abilities of affected children (Leonard, 1998).

Extensive research has shown that in English, and in other languages, particular difficulties with grammatical morphology are characteristic of SLI (Leonard, 1998). Some theories suggest that grammar is a distinct element of language, and focus exclusively on linguistic impairments to explain the disorder. According to this account of SLI, within the child’s abstract grammatical system there may exist either a delay in the setting of parameters, a representational deficit for dependent relationships, or an absence of specific grammatical features (Gopnik & Crago, 1991; Rice & Wexler, 1996).

However additional theories question if other, more general-purpose processing or cognitive mechanisms might underlie the cause of SLI. Researchers have claimed that the principal cause of poor language learning may be limited processing capacity; including limited verbal or nonverbal working memory capacity, slow speed of processing or limited scope of attention (Leonard et al., 2007). Our aim in this study is to determine the possible link between language impairments and one of these processing/cognitive mechanisms, namely attention. In order to do so we’ve evaluated participants who exhibit a great deal of individual variability with regard to language abilities. While some participants are typically developing, others have been diagnosed as having language disorders, although not all have scored within the SLI range.

## Theories Surrounding Processing Capacity Limitation

Frequently children with poor language abilities and especially children with SLI display difficulties in areas of functioning that appear to have little or nothing to do with language. Some have even hypothesized that in children with SLI, evidence of nonlinguistic deficits suggests that specific cognitive attainments are closely related to, or perhaps are responsible for language. These nonlinguistic weaknesses are not typically severe; however they occur so frequently among the population that no theory of SLI is complete without their consideration. To some researchers, the nonlinguistic deficits are an essential part of the problem in children with SLI.

The argument here is that some kind of limitation of processing capacity results in *language learning* difficulties, which ultimately leads to their difficulties with language itself, and measurably poor performance when language is assessed specifically (Leonard, 1998).

In general, the suggestion of a limited processing capacity assumes that with respect to a particular domain, the explicit nature of the material is not as important as the way that material is handled mentally. Three theoretical points of view may be considered when describing the idea of processing capacity deficits— space, energy and time (Kail & Salthouse, 1994). The argument of space assumes that there is a limit on the region of memory which computes and interprets stimuli—an inadequate work space. Interpretations based on energy refer to insufficient mental fuel, or premature expenditure of that fuel needed to complete a task. Lastly, interpretations based on time refer to the rate of information processing; if information is processed too slowly, it is susceptible to degeneration and interference from other incoming stimuli (Leonard, 1998).

Studies have shown that processing capacity limitations may be an explanation for difficulties with word recall and retrieval, morphology, phonology, and even pragmatics. For example, during a task in which participants were asked to describe toys to blindfolded puppets, Johnston, Smith and Box (1988) confirmed that children with SLI were able to produce fewer "quantitative descriptions", for example, "two green ones", which require greater processing capacity. The available data regarding the comprehension abilities of children with language impairments also seems to indicate processing capacity limitations as a contributor to language weakness. A study by Tallal in 1975 established that children with SLI had difficulty following instructions including grammatically complex phrases, which require the participant to hold information in their working memory in order to comprehend the second clause, e.g. "Before touching the yellow circle, pick up the red square." One of these arguments suggests that these children with working memory and processing capacity limitations also have limitations in their nonverbal attention and inhibition (Leonard, 1998).

**Limitations in Attention and Inhibition Resulting in Poor Language Development**

"Attention is the cognitive brain mechanism that facilitates processing" – William James, 1980.

While these previous studies show that processing limitations exist in children diagnosed with poor language skills including SLI, the underlying mechanisms which promote or permit these deficits have not been considered thoroughly using methods based in theory. In order to challenge those who believe SLI deficits to be strictly linguistic, Im-Bolter, Johnson and Pascual-Leone conducted a more in depth examination of the unconventional, non-linguistic explanations of difficulties experienced by children with SLI in 2006. They framed their research using the theory of constructive operators (TCO). The study investigated the role of mental attentional capacity, interruption, inhibition, updating of working memory and shifting of mental sets in both normally developing participants and those with SLI (Im-Bolter et al., 2006). The age range of their participants was very similar to that of the current study. Their experimental tasks included a variety of complex direction-following procedures to be executed by the participant, most of which involved geometric visual stimuli including line intersections that were to be pointed to or marked by tokens.

In support of their hypothesis, overall group differences did exist among measures of performance in updating working memory, verbal and visual mental attention and inhibition of responses. All in all, general processing deficits were present in children with SLI, as they predicted. The results of the 2006 Im-Bolter et al. study support the foundation that although inhibition may not contribute directly to language ability, it may indirectly influence language by way of its link to attention.

In 2009, Finneran, Francis and Leonard sought to investigate whether processing limitations were in fact associated with attentional limitations, even in children without medically diagnosed attentional deficits. The study examined 4-6 year old children, and utilized a visual continuous performance task (CPT) to assess sustained attention in order to compare participants with SLI to their typically developing peers. Accuracy and response time were considered to establish if the experimental task could differentiate between the 2 groups, congruent with the experimental measures used in the current study. Finneran et al concluded that although the children with SLI were considerably less accurate during the experimental task, they were not noticeably slower on the CPT than the typically developing participants. Their discussions include that children without clinically diagnosed attentional deficits, and who display poor language skills do have a limited capacity for sustained attention which could interfere with language learning over time (Finneran et al, 2009).

An additional study, performed by Spaulding, Plante and Vance 2008 also examined sustained selective attention skills among preschool children with SLI and their typically developing (TD) same-age peers. The participant’s attentional abilities were examined using varying stimuli types, including linguistic, non-verbal auditory, and visual computerized tasks, under both low and high attentional load conditions. Spaulding et al concluded that children with SLI performed poorer on sustained selective attention tasks than the TD group when stimuli were presented auditorily under then high attentional load condition. However, they also found that under low attentional load conditions, children with SLI performed comparably with the TD group, and also performed similarly to TD participants on the tasks with visual stimulus presentations, despite attentional load level. Their findings suggest that distinct and separate attentional capacities exist in preschool children for varying stimulus modalities (Spaulding et al, 2008). This experiment involved an in depth examination of sustained attention. Whereas the experimental task of the current study investigates the participants' ability to resist or inhibit distractions or irrelevant information. This type of visual inhibition has not yet been evaluated, and we assume that it will be more important or relevant than sustained attention with regard to language learning.

Based on research by T.J. Spaulding in recent years, the current study also considers the influence of distracter interference while investigating attentional capacities in children. The Spaulding study assessed both children with SLI and typically developing participants with regard to two suppression mechanism. One being resistance to distracter interference and two, inhibition of a prepotent response. One task involved the suppression of nonverbal auditory, linguistic and visual distracters that were unrelated to the task goal. The other assessed inhibition through the use of a stop-signal paradigm; which ultimately evaluated the participant's ability to suppress a conflicting prepotent response. A decreased resistance to distracter interference was displayed in the SLI group, in spite of their low inhibitory control relative to TD peers or distracter modality. These findings indicate that children with poor language abilities (specifically children with SLI) show marked difficulties suppressing information unrelated to the task at hand (Spaulding, 2010).

To reiterate, numerous studies have suggested that children with poor language abilities have difficulty attending, and in particular, have issues blocking out irrelevant or contradictory stimuli when asked to focus on one item. In theory, if a child is shown to have attentional deficits, i.e. working memory or processing capacity limitations in comparison to typically developing children, the input they are receiving is, at least in part, poorly processed. This leads to their incomplete learning of language and subsequent difficulties in the area of language specifically (Leonard, 2007). As the link between attentional skills, inhibition and language abilities has already been identified, we aim to determine to what extent children's nonverbal attention abilities are related to their language through our own analysis of attention and inhibition.

## The Flanker Task and Inhibition

In agreement with Pascual-Leone's theory of constructive operators, "the inhibitory component or mental attentional interruption corresponds to the ability to actively *inhibit* or interrupt (i.e., lower the activation of) schemes that are not relevant to the task at hand" (Im-Bolter et al., 2006). Accordingly, the Flanker paradigm, developed by B. A. Eriksen and Eriksen in 1974, is well suited for determining how well attention is regulated to a specific object or location; and is therefore an appropriate indicator of the participants' attentional capacity. In flanker tasks, participants are instructed to make decisions about a target object and to disregard other stimuli that flank, or surround that object. Despite instructions to ignore the "flankers", response times to the target object usually vary according to the type of flanker, with regard to direction, color, size and spatial orientation. For example, faster response times typically result when the target object is flanked by stimuli that are identical, similar or have been assigned the same response as the target. In contrast, when target objects are surrounded by dissimilar stimuli which have not been assigned the same response as the target, a slower response correlates (Miller, 1991). For example, flanking arrows that point in another direction are therefore “incongruent” and correspond to a less accurate and slower performance. This pattern of results has been coined the “flanker compatibility effect” (Eriksen, 1979).

## The Fish Flanker Task

Our experimental Flanker task was modeled after the child-friendly version of the Attention Networks Test (ANT) developed by Rueda et al in 2004 for the purpose of evaluating the three networks of anatomical regions which implement the functions of executive control, alerting and orienting in children, in order to compare with existing adult data (Rueda et al, 2004). The success of this study shows that the task can be used reliably on children as young as 6, in congruence with our participant group. The results of their study proposed that similar to adults, children showed independence between the three networks under some conditions.

. . .

To review, researchers suspect that general-purpose processing or cognitive mechanisms might underlie the cause of poor language abilities in children. Studies have claimed that limited processing capacity; including limited verbal or nonverbal working memory capacity, slow speed of processing or limited scope of attention may be the primary cause of poor language *learning* in children, which lead to lower language scores when compared to typically developing children their age (Leonard et al., 2007). Our aim in this study is to determine the possible link between language impairments and one of these processing/cognitive mechanisms, namely nonverbal attention.

While these previous studies have shown that processing limitations exist in children diagnosed with poor language skills including SLI, the underlying mechanisms which promote or permit these limitations have not been theoretically examined. The current study investigates the participants' ability to resist or inhibit distractions or irrelevant information. The results of the 2006 Im-Bolter et al. study support the foundation that although inhibition may not contribute directly to language ability, it may indirectly influence language by way of its link to attention, which leads to our hypothesis: that nonverbal attention deficits, as measured by the Fish Flanker task, might be displayed more clearly in children with weaker language abilities. We hypothesize that participants with lower vocabulary scores will demonstrate less accuracy and slower reaction times on the Flanker task, therefore displaying a larger "interference effect". This would mean that children with lower language skills allow the flankers to interfere more on their decisions during the experimental task, suggesting a deficit, or relative weakness in the area of inhibition/nonverbal attention. A correlation such as this would suggest that nonverbal attention and inhibition are in fact related to language abilities.

# Chapter 2: Method

## Participants

The participants in this study were 13 school-age children ranging from ages 6 to 14 years of age, 8 boys and 5 girls. The mean age was 11 years 1 month. The participants were recruited from the Penn State Language and Literacy Research Initiative database, and attended elementary and middle schools in the State College school district and surrounding areas. Participant characteristics can be seen in Table one, with ages included.

Performance Intelligence Quotients, as measured by Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) ranged from 96 to 129. The average participant IQ was 107.31. Parents reported service delivery for language, reading or learning disabilities in 5 out of the 13 children. Children's oral language skills were assessed using the Clinical Evaluation of Language Fundamentals 4 (CELF 4; Semel, Wiig, & Secord, 2003). The CELF 4 Core Language scores ranged from 96 to 123 with an average of 112.5 and a standard deviation of 11.99. The expressive language skills of the participant were measured by the Expressive Vocabulary Test (EVT) on which scores ranged from96 to 135. Children's receptive or comprehensive language abilities were assessed using the Peabody Picture Vocabulary Test (PPVT). PPVT standard scores ranged from 93 to 140. This information appears in Table 2.1. Informed consent for participation was obtained from a parent or guardian of each child, and a verbal consent was gathered by the administrator from children under 12 years of age.

**Table 2.1**
**Participant Description**

| | Age | WASI Performance IQ | CELF -4 | PPVT Raw | PPVT Standard | EVT Raw | EVT Standard |
|---|---|---|---|---|---|---|---|
| Mean | 11; 01 | 100.57 | 104.69 | 177.92 | 115.69 | 129.22 | 116.38 |
| Standard Deviation | - | 13.01 | 11.98 | 12.13 | 14.29 | 21.06 | 10.59 |
| Range | 8;2 | 47 | 34 | 79 | 47 | 66 | 39 |

## Equipment

In order to ensure accurate scoring of our normative language assessment, the Expressive Vocabulary Test, that portion of the testing session was audio recorded in addition to the written score forms completed by examiner during administration. A computer software program called E-Prime was used to administer the Flanker on a desktop computer. In order to record responses of our participants, a remote box with left and right buttons was used, and placed in front of the computer screen.

## Procedure

Each child was asked to complete our “Fish Flanker” task. This test was administered on a computer (Dell, PC). The child sat in front of the screen and was given instructions on how to use the box-controller, placed in front of them. The following instructions were read aloud by the examiner from the computer screen in front of the participant:

> "This is an experiment testing how you pay attention. Please stay as still as possible during the experiment. You will be shown a center fish swimming left or right. The fish is named Fun. Fun will be surrounded by other fish on both his left and right sides. Your task is to catch him by pressing the left button if Fun is swimming to the left or pressing the right button of Fun is swimming to the right. Press as quickly as you can to make sure you catch him!"

To begin the experiment, the examiner pressed the space bar and a practice portion of the assessment began. Two asterisks marked the center of the screen, drawing the participant's attention to where "Fun" would soon be shown. A line of five yellow fish, touching nose to back fin, appeared on the screen, each with a horizontal line dissecting their bodies. Some of the fish appeared to be swimming to the left, some to the right, as indicated by the placement of their faces and tales. Fun is always the 3rd or middle fish, surrounded by two "flanking" fish on either side of him.

The child's task was to press the button on the box-controller which corresponded to the direction Fun was swimming, while attempting to ignore the other fish and only focus on Fun. Pressing the button would "catch" the Fish, for entertainment purposes. Each time the left or right button was pressed, a response time and accuracy were recorded by the computer. Fun, like the flanking fish, also changed directions randomly during each stimulus presentation. Some presentations were considered "congruent" in which all 5 fish would be swimming to the right, or all to the left, including Fun. Others were considered "incongruent" flankers. In these cases for example, the first two fish would be swimming to the right, Fun would be swimming to the left, and the final two fish to the right again. Any combination of fish in which all fish were not swimming the same direction as Fun were considered “incongruent” and were expected to yield lower accuracy and response time measures.

During the “practice” portion of the examination, “correct” or “incorrect” along with the response time in seconds was displayed on the screen after each presentation, so the child could become accustomed to this task. After 16 practice presentations, the message “Great! You have completed the practice. Now the experiment can be started,” was displayed on the screen and read aloud by the examiner. This stimulus-presentation process continued for 96 trials, and lasted approximately 18-20 minutes. A chart of these response times was automatically saved in the E-Prime program on that computer. Images of the fish stimulus items can be found in the appendix.

# Chapter 3: Results

First, response accuracy and reaction times on the Flanker task for each participant were averaged. The numbers showed that responses were either the same, or less accurate and slower for incongruent flanker stimulus presentations across all participants which was to be expected based on previous research using this task. Next, reaction time interference effects and response accuracy interference effects were calculated by subtracting the incongruent flanker averages from the congruent flanker averages. A Pearson's correlation of these interference effects was then conducted among CELF-4, EVT and PPVT scores, as shown in Table 3.1.

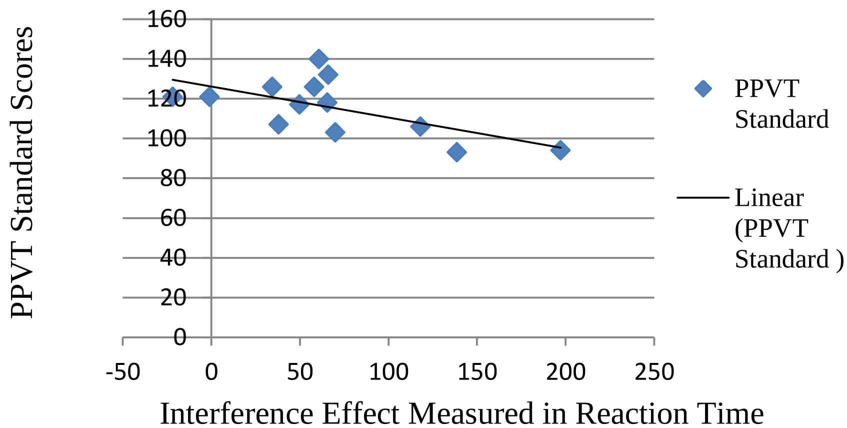
**Table 3.1**
**Pearson's Correlations**

| Reaction Time Interference Effect | Accuracy Interference Effect | |
|---|---|---|
| -.329 | -.387 | CELF |
| -.455 | -.657* | EVT Raw Score |
| -.383 | -.193 | EVT Standard Score |
| -.664* | -.617* | PPVT Raw Score |
| -.628* | .098 | PPVT Standard Score |
| -.316 | -.764* | Age |

***Correlation is significant at the 0.05 level (2-tailed)**

Note that the closer to 1 or -1 the correlation or *r* value, the stronger the association. The interference effect for *response accuracy* significantly correlated with EVT raw, *r* = -.66 and PPVT raw, *r* = -.62. However, response accuracy did not significantly correlate with EVT standard, *r* = -.19, or PPVT standard scores, *r* = .10. When the interference effect was measured in reaction time however, a significant correlation was found among PPVT raw scores, *r* = -.66 and PPVT standard scores, *r* = -.63. Figure 3.2 illustrates the correlation among PPVT standard scores and the interference effect measured in reaction time.

**Figure 3.2**
**PPVT Standard Correlated with Interference Effect Measured in Reaction Time**




The interference effect for reaction times did not significantly correlate with EVT raw, *r* = -.46 or EVT standard scores, *r* = -.38. CELF-4 scores did not significantly correlate with interference effects for accuracy, *r* = -.39, or reaction time, *r* = -.33. Age showed a significant correlation with accuracy interference effect, *r* = -.76, but there was not a significant correlation between age and reaction time interference effect, *r* = -.32.

We noticed that in general, standard vocabulary scores were not showing significant correlations with the interference effects, whereas raw language scores were. This trend, paired with the remarkably high correlation among accuracy interference effect and age, *r* = -.76, led us to believe that age might be underlying the correlation. To address this possibility, a partial correlation controlling for age was conducted, as shown in Table 3.3. In essence, this partial correlation removes the effect of age.

**Table 3.3**
**Partial Correlation Controlling for Age**

| **Accuracy Interference Effect** | |
|---|---|
| **-.106** | **PPVT Raw** |
| **-.021** | **EVT Raw** |

***Correlation is significant at the 0.05 level (2-tailed)**

After an analysis of this partial correlation, controlling for age, the correlation between accuracy interference and PPVT raw reduced dramatically to a non-significant *r* = -.11. Congruently the correlation between accuracy interference and EVT raw also reduced to a non-significant value, *r* = -.02. In both cases, the result is that when we control for age the association among accuracy interference effect goes away.

# Chapter 4: Discussion

## Are Poor Language Skills Linked to Nonverbal Attention?

There was a significant correlation between PPVT (both standard and raw scores) and interference effect measured by reaction times. This supports our hypothesis with regard to the limited speed of processing theories. The most accurate description from our results is that there is evidence of an association between receptive vocabulary, as demonstrated by PPVT, and inhibition, through the use of our experimental ANT Flanker task.

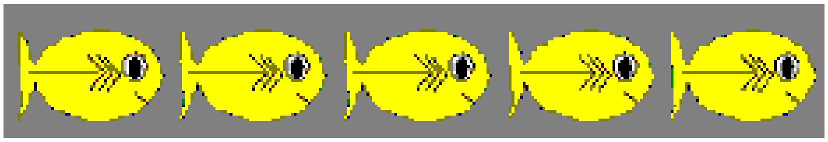
Our results suggest that the correlations between EVT/PPVT scores and interference effect measured in accuracy were mediated by age. This outcome is to be expected if younger children in the sample size are relatively less accurate during the Flanker task than older participants. According to our individual data for each child's performance on the Flanker task, the older children were near the ceiling for accuracy, while younger children made occasional errors. Therefore, there is not enough variance in the interference effect measured in accuracy to make a claim about the relation of inhibition to language scores—if several participants were completely accurate, the interference effect does not show in accuracy. Furthermore, if a significant proportion of this association is accounted for beyond age, then the size of the correlation between raw language scores and interference effect for accuracy is insignificant.

The sample size in this experiment was small. Subsequently, relatively large correlations (for example, between interference effect in reaction time and EVT raw, $r = -.46$ and EVT standard scores, $r = -.39$) did not reach significance. It is possible that with additional power—adding more participants—those correlations are likely to reach significance in further projects.

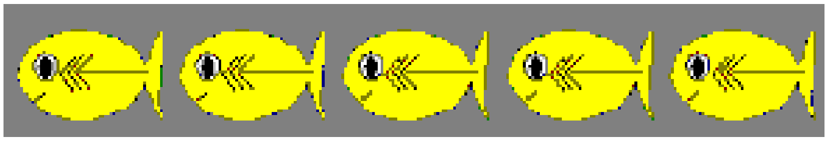
Additional research on this topic would be valuable in determining what types of attention-based therapy techniques might be used to help guide language learning in children with poor language skills, and even those with SLI.

## APPENDIX

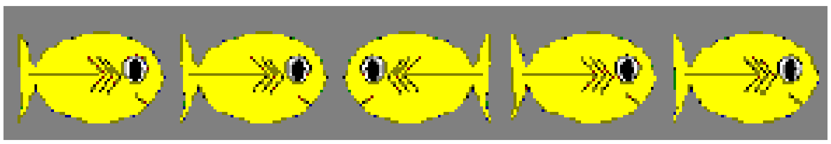
### Flanker Task Stimulus Items



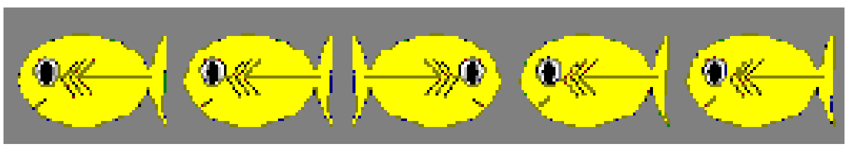
**RRRRR Congruent flankers**



**LLLLL Congruent flankers**



**RRLRR Incongruent flankers**



**LLRLL Incongruent flankers**

**References**

Eriksen, C. W., & Schultz, D. W. (1979). "Information processing in visual search: A continuous flow conception and experimental results". *Perception & Psychophysics* 25 (4): 249–263. PMID 461085.

Finneran, D. A., Francis, A. L., & Leonard, L. B. (2009). Sustained attention in children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 52,* 915-929.

Gopnik, M. & Crago, M. B. (1991). Familial aggregation of a developmental language disorder. *Cognition*, 39, 1-50.

Im-Bolter, N., Johnson, J., & Pascual-Leone, J. (2006). Processing limitations in children with specific language impairment: the role of executive function. *Child Development, 77*, 1822-1841.

Kail R., & Salthouse, T. (1994). Processing speed as a mental capacity. *Acta Psychologica*, 86, 199-225.

Leonard, L.B., (1998). *Children With Specific Language Impairment.* Cambridge, Massachusetts: The MIT Press.

Leonard, L. B., Ellis, W. S., Miller, C. A., Francis, D. J., Tomblin, J. B., & Kail, R. V. (2007). Speed of processing, working memory, and language impairment in children. *Journal of Speech, Language, and Hearing Research, 50*, 408-428.

Miller, J. (1991). The Flanker Compatibility effect as a function of visual angle, attentional focus, visual transients, and a perceptual load: A search for boundary conditions. Perceptions & Psychophysics, 49, 270-288

Rice, M.L. & Wexler, K. (1996). Toward tense as a clinical marker of specific language impairment in English-speaking children. *Journal of Speech Language and Hearing Research,* 39, 1239-1257.

Spaulding, T. J. (2010). Investigating mechanisms of suppression in preschool children with specific language impairment. *Journal of Speech, Language, and Hearing Research, 53,* 725-738.

Spaulding, T. J., Plante, E., & Vance, R. (2008). Sustained selective attention skills of preschool children with specific language impairment: evidence for separate attentional capacities. *Journal of Speech, Language, and Hearing Research, 51,* 16-34.

VITA

**Alexanna Kassy Kubler**

**Education**

Bachelor of Science in Communication Sciences and Disorders, May 2011

Schreyer Honors College

College of Health and Human Development

The Pennsylvania State University, University Park, PA

**Thesis**

Title: Nonverbal Attention Deficits in Children with Poor Language Abilities

Thesis Supervisor: Elina Mainela-Arnold, Associate Professor of Communication Sciences and Disorders.

**Grant**

Richard and Victoria Mallory Scholarship, Fall 2007

Edward and Helen Skade Hintz Trustee Scholarship, Fall 2009

Department of Education Pediatric Hearing Loss Grant, Fall 2011

University of North Carolina, Chapel Hill

**Awards**

President’s Freshman Award, Fall 2007

Alumni Recognition of Student Excellence Award, January 2011

Evan Pugh Scholar Award, Senior, February 2011

**Community Service Involvement**

PA Literacy Corps ESL tutor, 2009-2010

IFC/Panhellenic Dance Marathon Participant (NSSLHA)

Schlow Library Literacy Event Volunteer

**International Education**

Schreyer Honors College London Study Tour, Winter 2009-2010