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ANALYSIS OF RECEPTIVE AND EXPRESSIVE VOCABULARY TEST PERFORMANCE IN CHILDREN OF VARYING LANGUAGE ABILITIES

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Abstract

This study examined the results of receptive and expressive vocabulary tests to investigate the strength of semantic representations. Participants in this research consisted of 24 children, 16 males and 8 females, from ages 5-13. A series of tests measuring language ability and attention were administered to the participants. For the purposes of this research the Expressive Vocabulary Test (EVT II) and the Peabody Picture Vocabulary Picture Test (PPVT IV) were analyzed to determine how the participants' semantic representations were related to their expressive and receptive abilities. In the context of this thesis semantic representation refers to a child's ability to pair the meaning of a word with a referent. Although many of the participants earned scores on the two tests that were comparable, some participants had scores that differed by at least one standard deviation. The hypothesis states, for those that had a difference between their EVT and PPVT score of at least one standard deviation, their receptive scores should be higher than the expressive scores because the receptive test puts less stress on semantic representations. The hypothesis was tested by comparing the results of the EVT and the PPVT. The results from comparing the EVT and PPVT revealed that receptive scores were better than expressive scores. In addition to comparing the EVT and PPVT, the hypothesis was supported through further analysis of the EVT where a pattern of errors was established. The errors were also broken down into seven categories. It was determined that the errors of those who had better receptive scores, could be categorized into category member errors and semantically related responses. The results suggest that fine-grained analysis of receptive and expressive vocabulary scores may provide better understanding of the semantic representations of children with and without language impairment.

Table of Contents

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List of Tables

Analysis of Receptive and Expressive Vocabulary Test Performance in Children of Varying Language Abilities

Developing speech and language is one of the most important milestones in a child's life. Typically developing children will say their first word around 12 months. Researchers are interested in how and when children acquire language. Different batteries of tests have been designed to look at both receptive and expressive language. A child may have difficulty with their expressive language but this is not always associated with receptive language problems. Even though there are expectations about when certain milestones will be reached, every child develops at his or her own rate.

It has been estimated that children learn upwards of nine new words a day between the ages of 18 months and six years. By the age of six it is predicted that they have approximately a 14,000 word vocabulary (Bishop 1997). In order for a child to acquire new words, they need to have knowledge of the concepts, be able to pull out the phonological patterns through listening to other conversations, and map the concept to the phonological pattern (Bishop 1997). When a child learns a new word they form a permanent representation that links the phonological representation (sound pattern) with the semantic representation (meaning) (Bishop 1997).

Specific Language Impairment

There are many factors that can contribute to speech and language difficulties. It is important when a child is being assessed to rule out any physical or mental disabilities that might be impacting their language. These problems could include hearing impairment, neurological dysfunction, low non verbal intelligence scores, atypical oral structure or oral motor function (Leonard, 1998). If all other explanations and possibilities have been ruled out and language is

the only thing being impacted, a child will be diagnosed with specific language impairment or SLI.

Children who experience difficulty learning language, even though they have the necessary abilities to support normal language acquisition, are defined as having SLI (Coady, Evans, Mainela-Arnold, & Kluender, 2007). Children with SLI usually score 1 to 1.5 standard deviations below average on language tests. Typical linguistic characteristics include having late onset of vocabulary and early word combinations. A general profile for children with SLI is weakness in syntax and phonology as well as finding the right word to use. Children with SLI are generally delayed in acquiring their first words (Leonard, 1998). They also have difficulty retrieving words as well as using grammatical morphemes (Mainela-Arnold, personal communication, Fall 2010). A child with SLI usually needs two to three times as many exposures to novel words compared with children who are the same age and who are typically developing (Mainela-Arnold, personal communication, Fall 2010). Besides language being an issue, children with SLI also have trouble in nonverbal areas, such as symbolic play and conservation. Due to the inability to communicate effectively, children with SLI may become more aggressive or less social (Mainela-Arnold, personal communication, Fall 2010).

Unfortunately, the underlying cause of the difficulties that children with SLI have is unknown. However, many studies have been conducted with the hope of finding an answer. McGregor, Friedman, Reilly and Newman (2002) stated that, "word-retrieval problems of children with SLI are one manifestation of slow language development in general and undeveloped semantic representations in long-term lexical memory in particular" (McGregor et al., 2002, p. 999). Their goal was to explore the strength of semantic representations in the lexicons of children with SLI as well as to test the relationships between semantic

representations and naming errors. Their research consisted of multiple tests. One of the tests was a naming test. During this test the children had to identify pictures arranged on a poster board as quickly and accurately as possible. The naming errors were measured by analyzing the frequency and type of semantic errors (McGregor et al. 2002). The researchers chose to explore semantic representations because, since the creation and growth of semantic representations continues over a wide span, it is expected that underdevelopment would be persistent. McGregor et al. (2002) found that measures of semantics and language development predict naming performance. Most naming errors were linked with limited semantic representation.

The way language is organized in typically developing children is important in understanding the development of language in children who have SLI. The study conducted by McGregor et al. (2002) provided insight into childrens' semantic representations during the slow mapping process. Slow mapping is an extended period during which a child must retain a new representation, hypothesize its meaning and update the representation based on the hypothesis. The child then establishes and expands on the representation that better illustrates the relationship between the word and its referent (McGregor et al 2002). It was determined that children map semantic representations based on the frequency and nature of specific opportunities. This study also revealed that semantic errors were the most common error made during naming tasks. If a child mistakes a chair for a saddle, the error suggests they are having trouble with taxonomic organization. Drawings are also a good indication of how a child is organizing material. The final component that McGregor used to analyze organization was verbal definitions.

The errors in these tests were coded to document the types of semantic errors. Among the types were taxonomic errors, thematic and descriptive. Thematic errors include words that

are out of category (e.g., orange juice for pitcher). Descriptive errors involve circumlocutions and novel derivatives. Circumlocutions occur when a child talks around the answer without giving the direct target and a novel derivative is when a child creates a new word (e.g., chopper for axe). The taxonomic errors were the most common error. They can be broken down into coordinate and superordinate substitutions. When a child commits a coordinate error, it indicates that the child has the correct category but has not picked the correct option (e.g., mouse for kangaroo). Superordinate substitutions occur when a child is too general with their answer (e.g., animal for panda bear). Among the subtypes, coordinate substitutions occurred more frequently than superordinate substitutions. This indicates that children were able to identify the correct level in the object hierarchy but could not identify the correct object.

A question proposed by this study was "Why do children make semantic errors during picture naming and why are so many of these errors taxonomically related to the target?" (McGregor 2002, p. 342). Researchers found errors are made to fill lexical gaps, when children do not know the correct word well enough or because they simply forgot the answer even if they knew it. All of these reasons support limited semantic knowledge. This leads to the conclusion, "the degree of knowledge represented in the semantic lexicon makes words more or less vulnerable to retrieval failure" (McGregor et. al 2002, p. 342).

The research of McGregor et. al (2002) helped to determine that the physical properties of the target are an important component in object representations. It also helped conclude that naming errors are organized based on a taxonomic hierarchy (i.e., coordinate and superordinate substitutions). Further research found that limited semantic knowledge is responsible for semantic naming errors. Overall McGregor et. al (2002) found that picture naming and drawing is an effective, reliable way to analyze a child's semantic representations.

It can be concluded that children with SLI have limited semantic knowledge of age appropriate words in their lexicon. Since they do not have this knowledge this affects their naming performance. When a child has limited semantic representation, it includes both missing and sparse representations. Missing representations coincide with the fact that children with SLI have smaller vocabularies and do not always have age appropriate labels. In certain cases the child may have knowledge of the objective, however, it may be sparse. From a clinical standpoint these results revealed the importance of finding not only how many words the child knows, but also, the robustness of their world knowledge. Once this is determined it could be useful to increase the robustness of semantic representations, which could yield improvements in retrieval (McGregor et. al, 2002).

Receptive and Expressive Testing

Administering expressive and receptive vocabulary tests may be one way to determine if a child has a language impairment. Tests such as the PPVT-IV (Dunn & Dunn, 2007) and the EVT-II (Williams, 2007) are given to assess language ability. Although these tests are not traditionally used to provide information about semantic representation and organization, they can provide insight into a child's language development. By analyzing these tests on a deeper level one is able to glean information about semantics.

According to the creators of the PPVT, the purpose of the test is to assess comprehension and measure the success in acquiring vocabulary. (Dunn & Dunn, 2007) The test is supposed to be an achievement test of receptive vocabulary as well as a screening test of verbal ability. The EVT (Williams, 2007) is a test of expressive vocabulary and word retrieval. The EVT can be used as an indicator of children who have expressive language problems (Gray, 1990). In this current study the PPVT and the EVT were broken down and analyzed in new ways. The standard

score of the EVT and the PPVT were compared to one another. The children were analyzed further if they scored significantly higher on one of the tests (greater than or equal to one standard deviation between the scores on the two tests). Their age and the average of the group were taken into consideration.

The PPVT and the EVT share vocabulary and semantic concepts. The tests were designed for the PPVT to be administered followed by the EVT, so that receptive ability is being tested, then expressive. According to the EVT manual there are multiple reasons why there may be score differences between the two tests. A few of the reasons include: the participant may give a response that would be acceptable on the EVT but may be unfamiliar with the stimulus words on the PPVT. Another reason given was that they may have used one label on the PPVT but that label was not used as the stimulus word on the EVT (Williams, 2007).

Current Study

This thesis was motivated by interest in the lexical development in children with SLI. However, this study will not compare data of children with SLI to typically developing. The purpose of this thesis is to complete a qualitative/quantitative analysis of individual performance on measures of receptive and expressive language, which will provide information about their semantic representations. Although there have been numerous studies that analyzed semantic representations, this study is focusing on using expressive and receptive language tests, which is an area that has not been researched as in-depth, as an indicator of semantic representation. The hypothesis of this study is that receptive scores will be higher than expressive because there is less stress on semantic representations in the receptive test. In order to determine this, PPVT and EVT scores were compared. The data was also broken down into categories and an EVT error pattern was established and analyzed. This research is looking for information from within the

EVT or between the EVT and the PPVT that could be informative and be useful to study SLI in the future. The hope is to gain a better understanding of semantic representations in children with a wide range of abilities. Although most of the participants in this current study had normal scores on overall language, the results for this thesis will be able to be used in the future to help with further investigation of children with SLI. The contribution of this thesis will be a better understanding of whether information about a child's semantic knowledge can be gained from fine-grained analysis of vocabulary test performance.

Methods

Participants

The data collected from the EVT II (Williams, 2007) and the PPVT IV (Dunn and Dunn, 2007) came from the Penn State Language and Literacy Research Initiative (LLRI), an ongoing research project. The children who participated in the current study ranged in age from 5 to 13. There were 24 children recruited from local schools. There were 8 females and 16 males. Most of the participants followed a typical trend in development. The tables below are divided according to age. Table 2.1 is a summary of the entire sample. The mean and standard deviation for all of the tests were calculated for the sample as a whole. Tables 2.2 and 2.3 show data for preschool age children and school age children respectively. The IQ and overall language tests used for children age 2-5 were different than for children ages 6-12. Tables 2.2 and 2.3 also include the means and standard deviations on the tests for each age group. Children were excluded if they had a cognitive disability, or autism spectrum disorder. Of the 25 participants, eight were receiving services for speech language and reading through Individualized Educational Plans (IEPs).

Table 2.1. *Means and standard deviations of test scores for entire sample.*

Entire Sample	**Age (Years)**	**Overall Language**	**IQ**	**Expressive Score (EVT)**	**Receptive Score (PPVT)**
Mean	7.5	102.9	108.6	102.7	107.7
SD	41.3	18.3	17.2	17.5	17.4

Note: *The test scores are based on a scale of 100, which is the age appropriate mean*

Table 2.2 *Means and standard deviations of test scores for Pre School participants.*

Pre School	**Age (Years)**	**Overall Language** (CELF P2)[a]	**IQ** (Leiter)[b]	**EVT**[c]	**PPVT**[d]
Mean	3.8	100.2	112	100.4	111.8
SD	0.92	16.4	20.2	16.9	17.7

Note: *The test scores are based on a scale of 100, which is the age appropriate mean*

[a] CELF P2 Clinical Evaluation of Language Fundamentals–Preschool, Second Edition
[b] Leiter Intelligence Test
[c] EVT Expressive Vocabulary Test, Second Edition. (2nd ed.)
[d] PPVT Peabody Picture Vocabulary Test, Fourth Edition

Table 2.3 *Means and standard deviation of test scores for School aged participants.*

School Age	**Age (Years)**	**Overall Language** (CELF 4)[a]	**IQ** (WASI)[b]	**EVT**[c]	**PPVT**[d]
Mean	9.7	105.9	104.6	111	112.4
SD	2.3	20.5	12.7	17.2	17.8

Note: *The test scores are based on a scale of 100, which is the age appropriate mean*

[a] CELF 4 Clinical Evaluation of Language Fundamentals (4th ed.)
[b] WASI Wechsler Abbreviated Scale of Intelligence
[c] EVT Expressive Vocabulary Test, Second Edition. (2nd ed.)
[d] PPVT Peabody Picture Vocabulary Test, Fourth Edition

Materials

Out of the ten tests that were given during the LLRI testing protocol, the PPVT-IV (Dunn and Dunn, 2007) and the EVT II (Williams, 2007) were further analyzed to help provide insight into children learning new words. The PPVT-IV is a receptive vocabulary skills test. The test booklet is set up in front of the participant. Each page is broken into four quadrants containing four different images. The examiner reads a prompt, which asks the participant to identify a certain object (e.g., if the prompt is "show me laughing", the participant would have to point to the picture of the child laughing). Before the start of the test two practice questions are administered in order to check the child's understanding of the directions. The test is broken down into sections according to age. The child starts at the appropriate age and continues until they reach the ceiling, which occurs when they answer more than eight wrong in a set of 12.

The EVT has a similar test format, except that the participant is only shown one picture and they are asked to give one word to describe the picture. The examiner gives the participant a prompt and the participant has to respond using only one word. (e.g., "what is the girl doing" – singing) Similar to the PPVT, the EVT starts with two practice items, and then the examiner begins the test in the age appropriate section. The ceiling for this test is five consecutive incorrect answers.

The overall purpose for the LLRI battery of tests was to analyze receptive and expressive language as well as to look at the cognitive ability through memory and attention tests. The testing occurred in two sessions. The tests that were administered included a hearing screening, a computer-based test of attention, CELF- 4 digits forward and backwards (Semel,Wiig and Secord, 2003), CTOPP non-word repetition (Wagner, Torgesen, and Rashotte, 1999), a vision

screening, a computerized test of executive function, a reading comprehension test and a spatial memory test.

Procedure

The participants in the current study were from a pool of participants who participated in a larger battery of tests as described above. The tests measured attention and memory skills, as well as receptive and expressive vocabulary. The participants were scheduled for two one-hour testing sessions.

The first session started with a hearing screening. The hearing screening was followed by PPVT-IV. After the PPVT, they completed the attention test, CELF and the CTOPP. The second session started with a basic vision screening. The vision screening was followed by the EVT. After the EVT test, the children completed the remaining tests.

Certain tests in each session, including the EVT, were audio recorded. The audio recording was used when scoring the tests. Following each session the research assistants scored each test. The tests were later scored a second time by another assistant. The second person verified the scores by listening to the audio recording and double-checking the answers.

Results

The purpose of this research required examination of the scores and errors made on the PPVT and EVT in order to determine if the hypothesis was supported. The hypothesis stated that the receptive scores would be higher than the expressive scores because receptive tests are less stressful on semantic representations.

In order to compare the two tests, any participant that had a discrepancy between their PPVT and EVT greater than or equal to 15 (the standard deviation for both tests), was considered to have a notable difference. It is important to note that most of the scores fell within normal limits. However, of the 24 participants, 4 participants had a greater receptive score. After reviewing the results of the PPVT and the EVT it can be concluded that when a noticeable difference between the tests occurred, the receptive score was likely to be higher.

Typically, the errors on these tests are not analyzed in as much depth as in the current study. Since there was a new system used, a coding system was created. The EVT is designed to elicit a specific response from the child. The examiner has a list of correct responses, as well as a list of incorrect responses that were common responses when the test was normed.

When coding the data, errors in which the child produced one of the incorrect responses listed on the test form, were coded with a '2'. Incorrect responses that were not among those listed on the test form were marked with a '3' and when a child said, "I don't know", this was marked as a '4.' After investigating each participant's answers and errors committed, it was found that the most common selection pattern was *4>3>2.* This means that the participants chose "I don't know" more often than they produced a word on items that they did not know.

While analyzing the patterns of error types, the scores on the PPVT and EVT were compared. The participants who followed the 4>3>2 pattern had no notable difference between

their PPVT and EVT scores. These participants typically had receptive and expressive scores that were within one standard deviation of each other. There were two participants who followed the 4>3>2 pattern and scored better on expressive than receptive. However, not all of the participants followed this pattern. The participants that deviated from 4>3>2 pattern were found to have better receptive scores than expressive. The chart below illustrates only the participants who scored more than one standard deviation higher on the PPVT. These participants also deviated from the "typical" error pattern and had receptive scores that were greater than their expressive scores.

Table 3.1 *Error Pattern Chart*

Participant	EVT	PPVT	Receptive vs Expressive	Pattern
BAA 16	103	128	Receptive	2>3>4
BAA 19	106	130	Receptive	3>2=4
AAA 06	117	140	Receptive	3>2>4
AAA 67	112	132	Receptive	4=2>3

Another way of coding the EVT errors was to categorize the responses of all of the participants. The responses were broken down into seven categories. The categories included responses that were semantically related, addressed the wrong aspect of the picture, or repeated the same word instead of giving another word. They could also be categorized by responses that gave the opposite of the word, a supercategory/subcategory of the word or were not related at all. Overall, after reviewing all of the errors, most of the errors committed could be broken down into either the semantically related category or the category members group. The table below

provides a breakdown of how many of each type of error occurred from all of the participants as well as an example for each category.

Table 3.2 *Category Analysis*

Error Category	Examples	Number of Errors
Wrong Aspect of Picture	**Saying "diamond" for "ring"**	**6**
Same word Error	**Saying "printing" when the prompt was "printing"**	**4**
Subcategory	**Saying "grapes" for "fruits"**	**3**
Supercategory	**Saying "person" for "judge"**	**5**
Semantically Related	**Saying "vision" for "see"**	**26**
Category Members	**Saying "square" for "rectangle"**	**15**
Not Related	**Saying "adventurous" for "doorway"**	**6**

Discussion

Summary of Results

In summary, the results suggested that when the EVT and PPVT were compared and a participant was found to experience difficulty on one of the tests, they typically would score lower on the EVT. This can be interpreted as having weak semantic representations. This supports the hypothesis because if a child has difficulty connecting the image with the meaning than they will in turn have difficult verbally expressing what the image is. The scores on the EVT and PPVT were compared, and the participants that had a difference greater than one standard deviation were analyzed more in depth.

When analyzing the EVT error responses, a common trend across all of the participants and the types of errors being committed was found. The error responses could be grouped into categories. The responses fell into seven different categories. The majority of the participants, as a whole, made errors by choosing a response that was either semantically related or part of the same category.

The results also revealed that the most common answer when children committed an error on the EVT test was to say, "I don't know", and the next most common answer was to produce a word that was not often produced by the norming sample. This pattern was coded a 4>3>2. The majority that followed the pattern of saying "I don't know" had comparable EVT and PPVT scores. Those that deviated from the common error pattern had better receptive scores than expressive.

Interpretation

These tests were examined in order to analyze different components of semantic representation that are not typically investigated using these tests. It was important to first

compare the overall scores of the PPVT and the EVT. By comparing the two scores, the hypothesis was supported. The main question of this paper was whether expressive or receptive scores were higher. This is an important question when trying to better understand children's semantic representation and how children link words with an imagae.

Most of the participants had scores on the PPVT and EVT that were comparable and within one standard deviation of each other. However, all of the participants shown in Table 3.1 are typically developing and they had receptive scores that were greater than their expressive scores. One aspect to keep in mind are the possible reasons for the differences in the PPVT and EVT scores offered by the creators of the EVT. The participant may give a response that would be acceptable on the EVT but may be unfamiliar with the stimulus words on the PPVT. Another reason given was that they may have used one label on the PPVT but that label was not used as the stimulus word on the EVT (Williams, 2007). It would be important to rule out these reasons.

After eliminating any of these possibilities, if score differences remain, researchers would want to further investigate the child's results on other tests. For example, a comprehensive language test (e.g. CELF-4), to determine what the reason is for the discrepancy, especially if they are thought to be typically developing. .

The EVT responses were broken down by type of error response. The answers were categorized and analyzed to see if there was a common category that a participant had trouble with. This is important because these categories may each represent a different process in language learning, and it provides evidence of what the child is struggling with or where they might need further testing. In the McGregor et. al (2002) research explained earlier, their experiment categorized responses as well. Although the current study broke the errors down into different categories, similar information can be deduced and in agreement with the former

research. The most common category were words that were semantically related, which is similar to what McGergor et. al (2002) found, that representations were organized according to semantic category.

The EVT errors were also coded and organized into a pattern, in order to determine what was the most common type of error response. The participants that did not follow the pattern were looked at even further. The common pattern was to say "I don't know". For those participants that did not say "I don't know", researchers can ask the questions "do children with relatively weak expressive scores know when they don't know or are they unaware of their lack of knowledge?" More testing would need to be done where the goal would be to elicit "I don't know" from the child. The child would be given explicit instructions, informing them to say "I don't know" if the answer or target word is unfamiliar to them. If the child does not produce "I don't know" this would be an indication that they are not skilled at monitoring their responses as appropriate responses. It would also help to confirm that the EVT is harder if a child has weak semantic representations. Additionally, since the scores of the PPVT and the EVT were within normal limits, the participants that had "significant differences" would need further testing to solidify that they in fact were doing better with receptive tasks than expressive tasks.

Future Direction

After analyzing all of the data and results there are still questions to be answered. This study had some limitations. First, the sample size was small, making it difficult to generalize the information found to a large group of children. The participants in this study were mostly typically developing. In order for this information to be even more effective it would be important for future researchers to gather information from children with SLI. The researchers would need to analyze the errors that were produced by the children with SLI. These results

would need to be compared to the information of the typically developing children. Through this comparison researchers would better be able to determine if the results above were generalizable. It would be worth while for clinicians or researchers to use these tests because they act as a starting point. By examining a child's errors in more detail, the clinician or researcher gains information about which area of language the child is having trouble with.

The results on the PPVT and EVT will also be useful in future research with children who have SLI. Typically, children with SLI have smaller vocabularies, which leads to limited representations. Even though this study had eight participants who had IEPS, only two of them fell within the participants who had scores that showed a noticeable difference. Since this was such a small sample it was difficult to draw any conclusions from the participants with IEPs.

Although the current study does not specifically deal with children who have SLI, a possible future hypothesis that could be developed is, when administering these tests to children with SLI, researchers should expect that both scores on the PPVT and EVT would be low. This can not be confirmed from the current data, but it is an area that researchers should be interested in discovering to help further develop what is known about SLI.

They should look for similar trends and patterns among the scores of the PPVT and EVT. According to the information that is known about children with SLI, they have difficulty finding the right word. This is a possible predictor of weak semantic representations. As seen in the research from the literature found above, children who have weak semantic representations often have a more difficult time expressing the target word. Researchers should look for those with SLI to have lower expressive than receptive scores.

Even though were no participants that could be confirmed as having SLI, the participants that did not follow the pattern had scores that were at least one standard deviation apart. In the

future, researchers should start by analyzing these participants more in depth. This information will be important for future research because it acts as a starting point for the next step in developing research toward gaining a better understanding of language in both typically developing children and those with SLI.

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