Department of Clinical Therapies
Speech and Language Therapy
Final Year Project

‘Captain Grey and the Greedy Aliens’: Obtaining normative data on a new narrative assessment for the production of verbs at sentence level in children.

Submitted in part fulfilment of the regulations for the award of the Masters Degree in Speech and Language Therapy, University of Limerick

Word Count: 8206
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May 2014

Proposed Journal of Submission: International Journal of Language and Communication Disorders
Acknowledgements

I would like to start by thanking my lecturer and supervisor for this project, Dr Carol-Anne Murphy, who showed constant support, guidance and empathy from the beginning of this project until the very end.

I would sincerely like to thank the principals of the schools, the participants and their families for allowing us to carry out this research project.

I would like to acknowledge and thank the other student researchers on this project- Nicola, Leanne, Sinead and Kelly- for their hard work and support throughout it.

I wish to thank my housemates and best friends, Suzanne and Áine, for their constant support, friendship and laughter throughout this course. I would have been lost without you both!

Last but by no means least, I wish to say a big thank you to my friends and family for their unwavering support during the last two years particularly to Mam, Dad, Naoimh, Aoife and Seán. I could not have done this without you all.
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Abstract

Background: Children with language impairment frequently present with verb knowledge difficulties and incorrect use of verbs and their associated structures. However standardized assessment tools for children contain very few verb-specific subtests. A story retell tool was designed to assess a range of semantic-syntactic verb classes and their associated argument structures.

Aims: The study aimed to gather normative data from n=91 Typically Developing (TD) Children aged between 4;06-12;0 years on their verb production and related structures and complexity of sentences used, on the newly developed story retell tool. It aimed to assess the sensitivity of the tool across the age range. This data was also compared to comprehension scores on the Test of Verb Knowledge (Murphy, 2011b) to determine the relationship between verb knowledge and correct verb production and sentence complexity.

Methods and Procedures: Children were told the ‘Captain Grey and the Greedy Aliens’ narrative and then asked to retell the story using the wordless picture book. Target verbs elicited were marked and graduated prompting (question; then giving the target verb to the child to make a sentence) were given if they were not elicited in the first instance. Samples were analysed and scored for correct verb comprehension score, correct verb argument structure and mean sentence complexity.

Outcomes and Results: The mean increased with age for both correct verb argument structure (VAS%) and mean sentence complexity (MSC). There was a strong positive correlation between verb semantic knowledge and sentence production. One age group (8;06-9;05) showed a higher mean score on all variables than age groups above this. This could be attributed to a small sample for this age (n=9) and all participants scoring highly in this age band, demonstrating that there is a wide range of ability in TD children.

Conclusions and Implications: Scoring on the narrative tool indicated a gradual progression of higher correct verb argument structure and increased complexity of sentences. The tool could be used clinically to identify verb impairments if more normative data was gathered. Furthermore, the correlation between verb knowledge and verb production has important implications for assessment and intervention.

Keywords: Verb argument structure, narrative, sentence complexity, normative study
Introduction:

This review will provide an overview of the acquisition of verb knowledge and use in Typically Developing (TD) children, the difficulties with verbs and verb argument structure reported in children with Specific Language Impairment (SLI), the relationship between verb knowledge and sentence production and the need for assessment tools in this area. Children with SLI have difficulty with areas of language including syntax and selection of verb arguments (Ebbels, 2008). The review will outline the development of a new tool designed to assess verb use in sentences, leading to the current research project, which is sensitive enough to detect differences in the language of TD children and those with SLI.

Syntax and Verb Acquisition:

Syntax allows a child to combine and communicate about events in their environment, permitting far greater communication possibilities than single words. To construct simple sentences, children must identify syntactic categories such as noun and verb, learn the correct ordering of these categories in a sentence (e.g. SVO) and learn the appropriate restrictions on verbs (intransitive, transitive, ditransitive) (Ambridge and Lieven, 2011). There are generativist and constructivist proposals for how children accomplish these tasks (Ambridge and Lieven, 2011). Verb acquisition and use in children, has been shown to play a central role in developing language, providing a framework for organizing word classes into sentences (Tomasello, 1992). Tomasello (1992) concluded that his data showed evidence of ‘verb islands’ where word order rules appeared to be restricted to particular verbs rather than applying to a verb category generally. There are limitations to this hypothesis for example that it is an intuitively plausible assumption that verbs are more central to the meaning of children’s utterance and that there are aspects of children’s early production that do not fit a strict verb island account (Akhtar and Tomasello, 1997). However, despite these, when semantics are taken into account, verb islands maintain a central role.

According to Ebbels et al (2012) ‘verb argument structure is at the interface of syntax and semantics’ (p1312), which is why some verbs can only appear in certain syntactic constructions, highlighting the central role of verb knowledge in the production of correct syntactic structure.

Garrett’s (1988) model of sentence processing comprises a message level, functional level and positional level (cited in Marshall, 1997). An advantage of Garrett’s model is that it
highlights that not all sentence level weaknesses are related to syntax, and that sentence production difficulties can arise at the earlier semantic (functional) level, consistent with the types of difficulties reported in adults with aphasia (Berndt et al, 1997b) and children with language impairment (Ebbels et al, 2007). This does not however explain how a speaker knows where to map nouns in order to convey their intended meaning. Levelt (1989) and Haegemann (1991) agree that where nouns are mapped on a sentence is largely dependent on the verb, particularly when producing simple sentences (cited in Marshall, 1997). Verb knowledge is crucial to production, as the verb dictates the number of arguments involved in an event and where they appear in a sentence (Marshall, 1997).

TD children are able to make connections between the semantics and the syntax of verbs from an early age, that is, they are able to work out the structural properties of verbs from their meanings (Pinker, 1989). Therefore we can see how verb impairment, such as linking arguments to incorrect syntactic positions, (Ebbels et al, 2007) could result in an inability to acquire verb semantic meaning which would impair the development of syntactic knowledge. Pinker (1989) hypothesized that children use linking rules (which link verb semantics to syntactic structure) to bootstrap into the syntax of their language and identify sentence structure. If children have inaccurate semantic representations, this may result in errors, as seen in TD children from 3 -6 years (Pinker et al, 1991b) and older children with language impairment (Ebbels, 2005). Children with language disorders may present with difficulties understanding or producing sentences (e.g. errors in selection of verb arguments, omitting syntactic markers and comprehending syntactic structure which may occur in conjunction with lexical difficulties (Marshall, 1997). Looking at verb development in TD children can help us to examine why verbs are problematic in children with SLI (Conti-Ramsden and Jones, 1997).

**Children with Specific Language Impairment:**

SLI occurs when children present with delayed development in their language (van Weerdenburg et al, 2006), and where the child has appropriate scores on non-verbal tests of intelligence and shows no signs of neurological or socio-emotional impairment or hearing loss (Johnson and Wilson, cited in Redmond, 2005). Much of the earlier research on the
lexical difficulties experienced by children with SLI, focussed on their use of nouns (Leonard 1988; Rice, 1991), indicating that children with SLI are delayed in using their first words and add new words at a slower rate than their TD peers (cited in Conti-Ramsden and Jones, 1997). The study of semantic and syntactic and development in TD children, has more recently highlighted the important role of verbs in language development, and thus verb acquisition and use is an important area for investigation (Conti-Ramsden and Jones, 1997).

A study of TD children and children with SLI aged 8;1-13;0, by Pizzioli and Schelstraete (2011), aimed to distinguish whether comprehension problems evidenced by children with SLI were as a result of structural complexity of a sentence or length. Their findings report that argument structure complexity had a greater effect on comprehension in children with SLI than with comparative groups and that sentence length did not appear to affect comprehension. Similarly, with reference to production, Pizzioli et al (2008) found that children with SLI used articles and auxiliaries in obligatory contexts significantly less often than younger children matched for grammatical level and a group matched for chronological age. Furthermore, the highest number of grammatical morpheme omissions were evident in more complex argument structures and the length of sentences failed to show any influence on the production of grammatical morphemes (Pizzioli et al, 2008) indicating complexity had a greater effect than length. Verb argument structure may be particularly challenging for children with SLI due to the mapping between semantic and syntax in verb roles (Thordardottir and Ellis Weismer, 2002). Grela and Leonard (2000) examined the effect of argument structure complexity on auxiliary inclusion in preschool children with SLI compared with MLU-matched normal language children. They found that children with SLI were more likely to omit auxiliaries in sentences with ditransitive verbs, even when sentence length was the same. King (2000) found that children with SLI tended to use verbs that require fewer obligatory arguments and they omit more optional arguments.

Children with SLI have been found to learn fewer novel words than age controls, particularly with learning verbs (Oetting et al, 1995) which can have an impact on producing sentences. Additionally they tend to omit more obligatory arguments for verbs requiring 3 arguments. They tend to use incorrect argument structure for verbs where the object changes state but not location e.g ‘the lady is filling sweets into the jar’ (Ebbels, 2005 cited in Ebbels et al 2007). An intervention carried out by Ebbels et al (2007) explored the possible nature of the
underlying difficulties with verb argument structure that children with SLI experience. The study focused on two interventions based on different theoretical underpinnings, (semantic only and syntactic-semantic) on pupils with SLI aged 11;0-16;1. Their conclusion was that both interventions were effective at improving overall accuracy of verb argument structure, so that their difficulty was likely to lie with verb semantic representations. This is contrast to van der Lely (2005) who argues that underlying difficulties of children with SLI are due to difficulties with syntax.

Theories why verbs are challenging:

Many researchers have attempted to answer why verbs present as challenging for children with SLI. Verbs refer to relational concepts, which show more variability in how they map onto the world, than nouns (Tomasello, 1992). Furthermore, the nature of actions and changes of states within events mean that verbs are not as salient as nouns and thus harder to learn (Conti-Ramsden and Jones, 1997). There are a variety of factors contributing to a verb’s level of complexity and affect use in sentences. Kim and Thomson (2000) state that when the number of syntactic arguments increases, verb selection also increases in complexity. However to account for limitations with this finding, Thompson (2003) re-evaluated the argument complexity theory to consider the linguistic distinctions between unergative verbs and unaccusative verbs and concluded that verbs with a greater number of argument structures or with argument structures which generate movement are more complex. Black and Chiat (2003) give an alternative interpretation of this complexity, pointing to the number of sub-events encoded in the verb semantics as a source of complexity.

It can be difficult to assess where the difficulty arises with certain verbs for children with SLI; it is hard to separate the argument structure (syntax) and thematic role (semantics) bases for their difficulties (Schwartz, 2009). Cognitive state verbs, a category of verbs that encode mental states can be difficult for children with SLI (Johnston et al, 2001) and due to their cognitive, semantic and syntactic demands may also be challenging for children with typical language development (Owens and Leonard, 2007). A study by Johnston et al in 2001, was designed to investigate the use of cognitive state predicates by children with SLI (4;4-4;11),
comparing their performance to mental age and language age peers (2;8-2;11). The results indicated that children with SLI did not use cognitive state verbs at the same rate as normally developing younger children with equivalent language skills, and failed to indicate advanced knowledge of cognitive state predicates despite the fact that they were considerably older than the language matched group. Cognitive state verbs tend to require more complex complements and this syntactic structure could inhibit their acquisition and use (Johnston et al, 2001). Yet interestingly Owen Van Horne and Lin (2011) looked at an older age group (5-8 years) and found that children with SLI, along with their age-matched and vocabulary matched peers, performed similarly in all measures of their test, suggesting that children with SLI are as capable as their peers in the use of CSVs in conversational language. They did find that children with SLI do not tend to vary their verb choice, relying on use of high frequency verbs. Studies of older children with SLI (e.g. Norbury and Bishop, 2003) found that there was a significant correlation between the use of CSV’s and overall complexity of syntax used.

Elicitation Methods:

Method of elicitation may effect sentence production. Conversational samples, although the most naturalistic, do not elicit the most complex language (Thorrdardottir and Ellis Weismer, 2002). Ebbels et al (2007) used short video scenes, depicting the actions of the target verb, in their study. Pizzioli and Schelstraete (2008) used pictures depicting the verb and read words in a random order; the child then proceeded to produce a sentence using all the words. Owen Van Horne and Lin (2011) found that children in the three groups they tested (children with SLI, age matched TD children and vocabulary matched TD children), were able to use a wider variety of verbs in the narrative/ expository samples, even though they may use them in less flexible ways. Consequently tasks such as story retells can lead to longer and more complex sentences and may show increased error rates (Southwood and Russell, 2004 as cited in Owen Van Horne and Lin, 2011). Narrative assessment can provide a great deal of information about a child’s linguistic, pragmatic and cognitive abilities and is not as formal as standardized language tests. Script based frameworks are a good choice of elicitation method as they are organized around a central theme that contains both obligatory and optional arguments, (Hayward, et al 2007). The success of using narrative assessment to measure language ability can be seen from use of The Bus Story (Renfrew,
1991), which has been shown to be a strong predictor of persistent language impairment and a good indicator of later language and literacy ability (Stothard 1998 as cited in Paul and Norbury, 2012).

Clearly it is essential to find out the underlying deficits individual children with SLI have when it comes to using verbs, which are central to syntax acquisition and use. The Verb and Sentence Test (VAST) is a test of verb and sentence knowledge for adults, but there is no equivalent test for children. The Clinical Evaluation of Language Fundamentals (CELF 4) contains very few verbs for probing sentence production. Other papers have reported assessing children’s verb knowledge (e.g. Ebbels, 2012), however there is no easily accessible tool for clinicians to use. Currently there is a lack of tools that specifically assess verb and sentence production in children with SLI. ‘Captain Grey and the Greedy Aliens’, a story retell tool, has been developed to encompass a number of verbs and a wide range of verb types. It was piloted with a small group of TD children and children with SLI for use as a baseline measure in an intervention study (Murphy, 2013), with subsequent modification to include cognitive state verbs which have been identified as a potential area of weakness in children with SLI (Johnston et al, 2001; Owens and Leonard, 2007). The tool may have potential for wider clinical application.

Conclusion:

Children with SLI have problems with verbs, verb argument structure and related aspects of sentence production. Weaknesses in verb semantic knowledge are proposed to underlie some of their difficulties. It is important that the clinician has access to reliable and representative assessment tools with which they can accurately base their analysis and subsequent intervention planning. As previously indicated, sentence formulation probes in widely used language assessments for children contain few verbs and we need a verb specific test with good clinical utility. This newly developed story retell tool, designed to incorporate a range of verbs may have clinical utility but has not been standardised.
Current Study

The current study aims to gather pilot normative data from children who do not have language impairment, using the narrative tool, and assess its potential for future clinical use. It further aims to explore the relationship between verb semantic knowledge and sentence production. The study draws on a previous study by Murphy 2011 (b) which standardized a comprehension test (Test of Verb Knowledge),

The specific objectives are to:

- Gather normative data from children aged 4;06-12;0 years on their production of verbs and their associated structures, and mean length and complexity of sentences, using a newly developed story retell tool called ‘Captain Grey and the Greedy Aliens’.
- To assess the sensitivity of this tool to developmental progression across the age range.
- To assess the inter-rater reliability in scoring.
- To investigate the relationship between stored verb knowledge and sentence production accuracy and length as determined from the story retell tool.
- To investigate which verbs children in this sample found most difficult to use correctly.
- To assess children’s test related behaviours and reactions to the story retell.
**Methodology**

Ethical Approval for this research project was obtained from UL Research ethics committee (EHS REC). Parental consent was obtained for each child prior to data collection. A parental information sheet, a child information sheet and a consent form for children age 9 years and older was included in the recruitment pack.

**Criteria**

The inclusionary criteria for this study were that children were aged between 4;06 and 12;0 years, that their first language was English and that they had normal hearing, speech, language and learning abilities. Exclusionary criteria included the presence of intellectual disabilities, hearing difficulties and known speech and language difficulties.

**Recruitment Process**

Convenience sampling was used to recruit children from schools where the principal of the school was known to the primary investigator or to a student researcher. Recruitment packs were sent to the school and distributed to children by the principal. This study was a cross sectional design where data was collected from the population under investigation at one point in time with the aim of gathering data on all participants in the study.

**Participants**

We aimed to collect data from 85 children, 20 children in the 4;05- 5;06 age band, 20 children in the 8;7-12;0 year age band and 15 children in each of the mid age bands (5;07-6;06; 6;07-7;06; 7;07-8;06;). Data was collected from 91 primary school children, aged between 4;10- 12;0, in 4 different primary schools in counties Cork and Clare. The schools were of mixed size and comprised of rural and suburban locations. It was hypothesized that there would be some children at ceiling from 8;0 years onwards, which is why recruitment focused on higher numbers at the lower end of the range and lower numbers at the upper end. Despite best efforts we were unable to gather data from 20 children in the 4;05-5;06 age band, due in part to the timing of the data collection (February/March of the academic year). Furthermore, a large majority of the Junior Infants in one school had been receiving or had received speech and language provision previously, excluding them from our criteria. Therefore the numbers were not evenly distributed across age bands.
Table A. Age bands and number of children

There was a mixture of male and female participants, however gender was not evenly distributed. When the numbers of participants for an age group exceeded that required, the children were selected at random.

**Design and Materials**

A wordless picture book story (narrative assessment) ‘Captain Grey and the Greedy Aliens’, devised by the Primary Investigator (PI) Carol-Anne Murphy and illustrated by Laura Colgan, was used for the main part of the assessment. It consisted of 14 scenes (updated from the version of the story used in the pilot study). The scenes incorporated a number of verbs. The chosen verbs were a mixture of high and low frequency from the British National Corpus (BNC) (Leech and Nicholas, 2000) and included verbs from a range of semantic-syntactic classes as well as cognitive state verbs (e.g. pretend, think).

To assess verb semantic knowledge, a Test of Verb Knowledge (TOVK) (Murphy 2011 b) - a picture pointing test of verb comprehension comprising 3 trial items and 36 test items- was used. The target verbs in this test also encompassed a mixture of verb semantic-syntactic classes balanced for frequency. Each target verb was accompanied by two related and one unrelated distractor item.
Procedure

Each child was assessed individually by a pair of student researchers in a quiet room in their school. Each session lasted approximately 25-45 minutes depending on the age and ability of the child. All children completed both the TOVK and the narrative assessment. The instructions provided for the TOVK were that the child was asked to point to the picture depicting the target verb. 3 trial items were used to familiarize the child with the test and ensure they understood the task. The TOVK was administered first as it required no verbal response and thus placed no pressure on the child to verbalize in the initial part of the session which allowed them to be more comfortable with the researchers.

The story retell was presented as a wordless picture book. The child looked at the pictures while the researcher told the child the story. The same script was used across the story retell (Appendix 1). The child was then instructed to retell the story. Graduated prompts (asking the child to tell the researcher about the picture again; giving the child the target verb and asking them to make a sentence about the picture) were offered when the child did not use the target verb.

The sessions were audio recorded using a Dictaphone and the narrative was subsequently transcribed by the researcher with each student researcher transcribing and analysing an equal share of the sample. Confidentially was maintained by assigning a code to each child and not using their name on the recording.

Scoring and Data Analysis

For the analysis of the narrative, all participants’ samples were transcribed and entered into a pre-designed scoring form.

Utterances were scored on a number of measures. Firstly a measure was included to ensure that the researcher had prompted the target verb or if they had accidently missed it (so as not to penalise the child for this). This was the ‘Elicited’ column. Next each utterance which contained a target verb was given a score of 0 or 1 if the target verb was produced with correct accompanying argument structure, this was the ‘Verb Argument Structure Correct’ column (see Table B for example).
<table>
<thead>
<tr>
<th>Target Utterance</th>
<th>VAS Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘The Captain poured water into bottles’</td>
<td>1</td>
</tr>
<tr>
<td>‘The Captain poured water’</td>
<td>0 (missing an obligatory argument)</td>
</tr>
</tbody>
</table>

*Table B-VAS Correct*

A scoring rubric for ‘Length’ was set up (Table C) and utterances were given a score of between 1 and 6.

<table>
<thead>
<tr>
<th>Sentence</th>
<th>Score</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>1-3</td>
<td>One to three arguments/adjuncts with the target verb</td>
</tr>
<tr>
<td>Complex</td>
<td>4</td>
<td>2 arguments and 2 adjuncts; 3 arguments and adjunct; simple infinitive sentence; simple conjoining</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Subordination/embedding</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Conjoining and embedding occurring in the same utterance or multiple embedding</td>
</tr>
</tbody>
</table>

*Table C. Scoring Rubric for length*

A column to determine whether the target verb was said in the first retell or after a subsequent prompt was included ‘Pre’ or ‘Post’. The VAS% score was calculated by dividing the VAS raw score by the Elicited and multiplying by 100. The Mean Sentence Complexity (MSC) score was obtained by dividing the length score by the number of utterances produced by a child which contained a target verb.

For the Verb Comprehension Score, a raw score was obtained from the TOVK by adding up the correct responses and marking out of the overall number of test items (36).

*Statistical Analysis*

The independent variable (IV) was Age. The dependant variables (DV) were Verb Comprehension Score (VCS), Verb Argument Structure percent correct (VAS %) and Mean Sentence Complexity (MSC). After calculating the scores from the variables, these were input into SPSS, Version 21. Descriptive statistics and normality testing was conducted across the variables. Correlational analyses and partial correlations (with exploration of scatter plots) were used to assess progress with age on the dependent variables and relationship between VCS, VAS% and MSC when age was controlled for. Standard multiple
regression was used to analyse the relationship between an independent variable and a
dependant variable to explain how much the IV explained the variance of the DV (Pallant,
2011). Additional qualitative analysis and frequency counts for error verbs were also
conducted.

**Inter-rater reliability**

In order to ensure that the scoring and analysis of the data was consistent, the student pairs
analysed a random sample (30%) of another researchers sample -2 children from the
younger age band (>8:0) and 1 child from the older age band (<8:0). Scoring revealed an
overall scoring agreement of **95.54%** for Mean Sentence Complexity and **97.34%** for Verb
Argument Structure. Scoring agreement for the TOVK (verb comprehension test) was **100%**.
When items were scored differently by different researchers, these were discussed and
rationalized. Subsequently, further scoring information and examples were added to the
rubric for clarity.
## Results

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Trimmed mean 5%</th>
<th>Range</th>
<th>Skewness</th>
<th>Normality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>91</td>
<td>7.86</td>
<td>2.11</td>
<td>7.83</td>
<td>4.10-12.0</td>
<td>.176</td>
<td>.000</td>
</tr>
<tr>
<td>Age (months)</td>
<td>91</td>
<td>98.73</td>
<td>25.44</td>
<td>98.40</td>
<td>58-144</td>
<td>.235</td>
<td>.000</td>
</tr>
<tr>
<td>VCS on TOVK</td>
<td>91</td>
<td>29.35</td>
<td>3.40</td>
<td>29.50</td>
<td>21-36</td>
<td>-.680</td>
<td>.000</td>
</tr>
<tr>
<td>MSC</td>
<td>91</td>
<td>2.83</td>
<td>.425</td>
<td>2.84</td>
<td>1.33-3.61</td>
<td>-.705</td>
<td>.012</td>
</tr>
<tr>
<td>VAS %</td>
<td>91</td>
<td>92.21</td>
<td>10.66</td>
<td>93.73</td>
<td>27.08-100</td>
<td>-3.321</td>
<td>.000</td>
</tr>
</tbody>
</table>

*Table 1. Summary normative data*

Table 1 shows a summary of the normative data for the main independent variables- Verb Argument Structure percent correct (VAS%), Mean Sentence Complexity (MSC) and Verb comprehension score (VCS). The Shapiro-Wilk normality test showed that all independent variables were negatively skewed.
Fig 1. shows the distribution of age in months. As expected the age of our sample was not normally distributed, despite best efforts to acquire more subjects from the lower age band.
Fig 2.

Figure 2 shows the normality distribution of the Verb Comprehension Score (VCS) on the Test of Verb Knowledge (TOVK), VAS% and MSC.
Table 2 shows VCS on TOVK summary data. In the first age band there is a difference between the mean and the trimmed mean, this can be attributed to a notable outlier who scored 21/36. The age bands 4;06-5;05; 5;06-6;05 and 8;06-9;05 are positively skewed. The age bands 6;06 -7;05; 7;06-8;05; 9;06-10;05 and 10;06-12;0 are negatively skewed. The ceiling score of 36 (100% correct) was achieved by 1 child in the age band 8;06-9;05. Near ceiling (34) was reached by 1/12 children in age group 6 (9;06-10;05) and 4/20 children in age group 7 (10;6-12;0).

<table>
<thead>
<tr>
<th>Age Bands</th>
<th>Mean</th>
<th>5% Trimmed Mean</th>
<th>Median</th>
<th>Std Dev</th>
<th>Range</th>
<th>Interquartile Range</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4;06-5;05</td>
<td>28.43</td>
<td>24.31</td>
<td>25.00</td>
<td>3.047</td>
<td>9 (21-30)</td>
<td>4</td>
<td>.765</td>
</tr>
<tr>
<td>5;06-6;05</td>
<td>26.18</td>
<td>26.14</td>
<td>26.00</td>
<td>2.877</td>
<td>9 (22-31)</td>
<td>6</td>
<td>.228</td>
</tr>
<tr>
<td>6;06-7;05</td>
<td>28.71</td>
<td>28.84</td>
<td>29.00</td>
<td>2.801</td>
<td>11 (22-33)</td>
<td>4</td>
<td>-.857</td>
</tr>
<tr>
<td>7;06-8;05</td>
<td>31.11</td>
<td>31.18</td>
<td>31.00</td>
<td>1.691</td>
<td>5 (28-33)</td>
<td>3</td>
<td>-.420</td>
</tr>
<tr>
<td>8;06-9;05</td>
<td>30.78</td>
<td>30.64</td>
<td>31.00</td>
<td>2.489</td>
<td>8 (28-36)</td>
<td>4</td>
<td>.717</td>
</tr>
<tr>
<td>9;06-10;05</td>
<td>31.08</td>
<td>31.09</td>
<td>31.00</td>
<td>1.929</td>
<td>6 (28-34)</td>
<td>4</td>
<td>-.049</td>
</tr>
<tr>
<td>10;06-12;0</td>
<td>31.85</td>
<td>31.94</td>
<td>32.00</td>
<td>1.785</td>
<td>6 (28-34)</td>
<td>2</td>
<td>-.860</td>
</tr>
<tr>
<td>Age Bands</td>
<td>Mean</td>
<td>5% Trim Mean</td>
<td>Median</td>
<td>Std Dev</td>
<td>Range</td>
<td>IQ Range</td>
<td>Skewness</td>
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<td>------------</td>
<td>-------</td>
<td>--------------</td>
<td>--------</td>
<td>---------</td>
<td>------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>4;06-5;05</td>
<td>74.14</td>
<td>75.56</td>
<td>80.43</td>
<td>24.67</td>
<td>68.66 (27.02-95.74)</td>
<td>35.29</td>
<td>-1.324</td>
</tr>
<tr>
<td>5;06-6;05</td>
<td>87.65</td>
<td>88.36</td>
<td>89.58</td>
<td>9.24</td>
<td>37.50 (62.50-100)</td>
<td>9.31</td>
<td>-1.357</td>
</tr>
<tr>
<td>6;06-7;05</td>
<td>92.19</td>
<td>92.51</td>
<td>95.83</td>
<td>7.52</td>
<td>21.28 (78.22-100)</td>
<td>12.81</td>
<td>-0.623</td>
</tr>
<tr>
<td>7;06-8;05</td>
<td>95.52</td>
<td>95.50</td>
<td>95.83</td>
<td>3.61</td>
<td>8.89 (91.11-100)</td>
<td>7.30</td>
<td>-0.002</td>
</tr>
<tr>
<td>8;06-9;05</td>
<td>95.59</td>
<td>96.03</td>
<td>97.91</td>
<td>5.15</td>
<td>16.67 (83.33-100)</td>
<td>4.18</td>
<td>-2.07</td>
</tr>
<tr>
<td>9;06-10;05</td>
<td>97.65</td>
<td>98.02</td>
<td>97.92</td>
<td>3.24</td>
<td>11.37 (88.63-100)</td>
<td>3.67</td>
<td>-2.17</td>
</tr>
<tr>
<td>10;06-12;0</td>
<td>96.18</td>
<td>96.49</td>
<td>97.91</td>
<td>4.40</td>
<td>13.05 (86.95-100)</td>
<td>7.34</td>
<td>-1.08</td>
</tr>
</tbody>
</table>

*Table 3. Summary data on age bands for Verb Argument Structure Percent (VAS%)*

Table 3 shows the statistics for VAS %. The trimmed mean and mean are quite similar but outliers were identified through inspection of the statistical output and graphs. From the 5;06-6;05 range onwards, some children in each age band reached ceiling for using correct verb argument structure while floor effects were absent. All data was negatively skewed.
<table>
<thead>
<tr>
<th>Age Bands</th>
<th>Mean</th>
<th>5% Trim Mean</th>
<th>Median</th>
<th>Std Dev</th>
<th>Range</th>
<th>IQ Range</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4;06-5;05</td>
<td>2.2786</td>
<td>2.284</td>
<td>2.100</td>
<td>.61039</td>
<td>1.8 (1.33-3.13)</td>
<td>.81</td>
<td>-.132</td>
</tr>
<tr>
<td>5;06-6;05</td>
<td>2.4971</td>
<td>2.4956</td>
<td>5.5200</td>
<td>.27825</td>
<td>1.02 (2.00-3.02)</td>
<td>.38</td>
<td>.087</td>
</tr>
<tr>
<td>6;06-7;05</td>
<td>2.6688</td>
<td>2.67</td>
<td>2.69</td>
<td>.30812</td>
<td>1.38 (1.91-3.29)</td>
<td>.38</td>
<td>-.420</td>
</tr>
<tr>
<td>7;06-8;05</td>
<td>2.9656</td>
<td>2.9684</td>
<td>3.1400</td>
<td>.4149</td>
<td>.94 (2.47-3.41)</td>
<td>.85</td>
<td>-.155</td>
</tr>
<tr>
<td>8;06-9;05</td>
<td>3.2444</td>
<td>3.2472</td>
<td>3.2500</td>
<td>.26154</td>
<td>.78 (2.83-3.61)</td>
<td>.47</td>
<td>-.286</td>
</tr>
<tr>
<td>9;06-10;05</td>
<td>3.0392</td>
<td>3.0496</td>
<td>3.0550</td>
<td>.239</td>
<td>.69 (2.60-3.29)</td>
<td>.37</td>
<td>.879</td>
</tr>
<tr>
<td>10;06-12;0</td>
<td>3.0710</td>
<td>3.0767</td>
<td>3.0900</td>
<td>.21572</td>
<td>.86 (2.59-3.45)</td>
<td>.35</td>
<td>-.379</td>
</tr>
</tbody>
</table>

Table 4. Summary Data on age bands for Mean Sentence Complexity.

Table 4. shows the summary data for Mean Sentence Complexity. The age bands 4;06-5;05, 5;06-6;05 and 9;06-10;05 were positively skewed. All other age bands were negatively skewed.
Fig. 3

The box plot graphs in Fig.3 show that the mean increases with age for all three dependant variables. For both VCS on TOVK and VAS%, some children in each age band from 5;06-6;05 reach ceiling. For VAS% there is an increase in mean score with age until the 7;06-8;05 age group. This has been hypothesized as some children will acquire correct verb argument structure at this age.
Progression with age

Correlation analysis was carried out to explore the relationship between age and the dependant variables. Due to the non-normal distributions on key variables, non-parametric testing using Spearman’s rho was conducted.

Verb Argument Structure (%) and Age

![Graph showing correlation between Verb Argument Structure (%) and Age]

**Fig. 4**

Some of the TD children in the younger age bands (from 5;06-6;05 and upwards) had acquired correct verb argument structure. A large positive correlation with statistical significance was observed ($r=.53$, $r^2=0.28$, $n=91$, $p = 0.000$).
Mean Sentence Complexity and Age

Similarly there was a strong positive correlation between age and MSC which was of significance ($r=.646$, $r^2=0.40$, $n=91$, $p=0.000$).
Verb Comprehension Score on the TOVK and Age

Fig. 6

The relationship between age and VCS on the TOVK also showed a strong correlation and was statistically significant (r=.674, $r^2$, n=91, p=0.000).

All 3 dependant variables showed a large correlation which Cohen (1988) defines as ‘the r value being between .50-1.0’ (as cited in Pallant, 2011). Correlation is significant at the 0.01 level (2-tailed).
**Standardized Data**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>-3</th>
<th>-2.5</th>
<th>-2</th>
<th>-1.5</th>
<th>-1</th>
<th>-0.5</th>
<th>MEAN</th>
<th>+0.5</th>
<th>+1</th>
<th>+1.5</th>
<th>+2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 4;06-5;05</td>
<td>1.11</td>
<td>13.45</td>
<td>25.79</td>
<td>38.13</td>
<td>50.47</td>
<td>62.81</td>
<td><strong>74.14</strong></td>
<td>86.49</td>
<td>98.83</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2 5;06-6;05</td>
<td>59.87</td>
<td>64.50</td>
<td>69.13</td>
<td>73.76</td>
<td>78.39</td>
<td>83.02</td>
<td><strong>87.65</strong></td>
<td>92.28</td>
<td>96.91</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>3 6;06-7;05</td>
<td>69.58</td>
<td>73.35</td>
<td>77.12</td>
<td>80.89</td>
<td>84.66</td>
<td>88.43</td>
<td><strong>92.20</strong></td>
<td>95.97</td>
<td>99.74</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>4 7;06-8;05</td>
<td>84.71</td>
<td>86.51</td>
<td>88.31</td>
<td>90.11</td>
<td>91.91</td>
<td>93.71</td>
<td><strong>95.51</strong></td>
<td>97.31</td>
<td>99.11</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>5 8;06-9;05</td>
<td>80.12</td>
<td>82.7</td>
<td>85.28</td>
<td>87.86</td>
<td>90.44</td>
<td>93.02</td>
<td><strong>95.60</strong></td>
<td>98.18</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>6 9;06-10;05</td>
<td>87.93</td>
<td>89.55</td>
<td>91.17</td>
<td>92.79</td>
<td>94.41</td>
<td>96.03</td>
<td><strong>97.65</strong></td>
<td>99.27</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>7 10;06-12;00</td>
<td>82.93</td>
<td>85.14</td>
<td>87.35</td>
<td>89.56</td>
<td>91.77</td>
<td>93.98</td>
<td><strong>96.19</strong></td>
<td>98.40</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

*Table 5- Raw scores per standard deviations from the mean for Verb Argument Structure % correct*

Table 5 shows the mean raw score for each age group for VAS%, mapped against standard deviations from the mean, presented in 0.5 SD increments to allow for more precise identification of show more variance. These measures show how this test could be clinically utilized.
<table>
<thead>
<tr>
<th>Age Groups</th>
<th>-3</th>
<th>-2.5</th>
<th>-2</th>
<th>-1.5</th>
<th>-1</th>
<th>-.5</th>
<th>MEAN</th>
<th>+.5</th>
<th>+1</th>
<th>+1.5</th>
<th>+2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4;06-5;05</td>
<td>15.25</td>
<td>16.78</td>
<td>18.31</td>
<td>19.84</td>
<td>21.37</td>
<td>22.90</td>
<td><strong>24.43</strong></td>
<td>25.96</td>
<td>27.49</td>
<td>29.02</td>
<td>30.55</td>
</tr>
<tr>
<td>5;06-6;05</td>
<td>17.54</td>
<td>18.98</td>
<td>20.42</td>
<td>21.86</td>
<td>23.30</td>
<td>24.74</td>
<td><strong>26.18</strong></td>
<td>27.62</td>
<td>29.06</td>
<td>30.50</td>
<td>31.94</td>
</tr>
<tr>
<td>6;06-7;05</td>
<td>20.31</td>
<td>21.71</td>
<td>23.11</td>
<td>24.51</td>
<td>25.91</td>
<td>27.31</td>
<td><strong>28.71</strong></td>
<td>30.11</td>
<td>31.51</td>
<td>32.91</td>
<td>34.31</td>
</tr>
<tr>
<td>7;06-8;05</td>
<td>26.01</td>
<td>26.86</td>
<td>27.71</td>
<td>28.56</td>
<td>29.41</td>
<td>30.26</td>
<td><strong>31.11</strong></td>
<td>31.96</td>
<td>32.81</td>
<td>33.66</td>
<td>34.51</td>
</tr>
<tr>
<td>8;06-9;05</td>
<td>23.28</td>
<td>24.53</td>
<td>25.78</td>
<td>27.03</td>
<td>28.28</td>
<td>29.53</td>
<td><strong>30.78</strong></td>
<td>32.03</td>
<td>33.28</td>
<td>34.53</td>
<td>35.78</td>
</tr>
<tr>
<td>9;06-10;05</td>
<td>25.26</td>
<td>26.23</td>
<td>27.20</td>
<td>28.17</td>
<td>29.14</td>
<td>30.11</td>
<td><strong>31.08</strong></td>
<td>32.05</td>
<td>33.02</td>
<td>33.99</td>
<td>34.96</td>
</tr>
<tr>
<td>10;06-12;00</td>
<td>26.45</td>
<td>27.35</td>
<td>28.25</td>
<td>29.15</td>
<td>30.05</td>
<td>30.95</td>
<td><strong>31.85</strong></td>
<td>32.75</td>
<td>33.65</td>
<td>34.55</td>
<td>34.45</td>
</tr>
</tbody>
</table>

*Table 6-Standard Verb Comprehension Scores on the TOVK for the age groups.*

Table 6 shows the mean for each age group for verb comprehension score and scores presented in 0.5 increments above and below the mean.
<table>
<thead>
<tr>
<th>Age Group</th>
<th>-3</th>
<th>-2.5</th>
<th>-2</th>
<th>-1.5</th>
<th>-1</th>
<th>-0.5</th>
<th>MEAN</th>
<th>+0.5</th>
<th>+1</th>
<th>+1.5</th>
<th>+2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4;06-5;05</td>
<td>.42</td>
<td>.73</td>
<td>1.04</td>
<td>1.35</td>
<td>1.66</td>
<td>1.97</td>
<td><strong>2.28</strong></td>
<td>2.59</td>
<td>2.9</td>
<td>3.21</td>
<td>3.52</td>
</tr>
<tr>
<td>5;06-6;05</td>
<td>1.66</td>
<td>1.8</td>
<td>1.94</td>
<td>2.08</td>
<td>2.22</td>
<td>2.36</td>
<td><strong>2.50</strong></td>
<td>2.64</td>
<td>2.78</td>
<td>2.92</td>
<td>3.06</td>
</tr>
<tr>
<td>6;06-7;05</td>
<td>1.61</td>
<td>1.77</td>
<td>1.93</td>
<td>2.09</td>
<td>2.35</td>
<td>2.51</td>
<td><strong>2.67</strong></td>
<td>2.83</td>
<td>2.99</td>
<td>3.15</td>
<td>3.31</td>
</tr>
<tr>
<td>7;06-8;05</td>
<td>1.71</td>
<td>1.92</td>
<td>2.13</td>
<td>2.34</td>
<td>2.55</td>
<td>2.76</td>
<td><strong>2.97</strong></td>
<td>3.18</td>
<td>3.39</td>
<td>3.60</td>
<td>3.81</td>
</tr>
<tr>
<td>8;06-9;05</td>
<td>2.46</td>
<td>2.59</td>
<td>2.72</td>
<td>2.85</td>
<td>2.98</td>
<td>3.11</td>
<td><strong>3.24</strong></td>
<td>3.37</td>
<td>3.5</td>
<td>3.63</td>
<td>3.76</td>
</tr>
<tr>
<td>9;06-10;05</td>
<td>2.32</td>
<td>2.44</td>
<td>2.56</td>
<td>2.68</td>
<td>2.80</td>
<td>2.92</td>
<td><strong>2.04</strong></td>
<td>3.16</td>
<td>3.28</td>
<td>3.40</td>
<td>3.52</td>
</tr>
<tr>
<td>10;06-12;00</td>
<td>2.41</td>
<td>2.52</td>
<td>2.63</td>
<td>2.74</td>
<td>2.85</td>
<td>2.96</td>
<td><strong>3.07</strong></td>
<td>3.18</td>
<td>3.29</td>
<td>3.40</td>
<td>3.51</td>
</tr>
</tbody>
</table>

Table 7 shows the mean for each age band for Mean Sentence Complexity and standard deviations from this in increments of 0.5.
**Z scores**

Z scores have a mean of 0 and a standard deviation of 1 (Paul and Norbury, 2012) and refer to the number of standard deviations that a client’s score falls from the mean within a population.

![Graph](image)

**Fig. 7**

The Z scores were calculated for this data set and were shown to increase with age. For MSC there was the highest increase in the 8;06-9;05 age band which can be attributed to high MSC scores for all children in that age band.
Partial Correlation

Partial correlation, controlling for age was conducted to investigate the relationship between Verb Comprehension Score and Mean Sentence Complexity:

<table>
<thead>
<tr>
<th>Not controlled for age:</th>
<th>Controlled for age:</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>r</em> = .632</td>
<td><em>r</em> = .355</td>
</tr>
<tr>
<td><em>p</em> = 0.000</td>
<td><em>p</em> = 0.001</td>
</tr>
</tbody>
</table>

This shows that, although weaker, there was still a significant (medium) positive correlation between VCS and MSC which remained statistically significant (*p*<0.01) when age was controlled for.

Partial correlation was used to explore the relationship between VCS on the TOVK and VAS%:

<table>
<thead>
<tr>
<th>Not Controlled for age:</th>
<th>Controlled for age:</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>r</em> = .555</td>
<td><em>r</em> = .365</td>
</tr>
<tr>
<td><em>p</em> = 0.000</td>
<td><em>p</em> = 0.000</td>
</tr>
</tbody>
</table>

There was a medium, positive correlation between VCS and VAS% where the significance remained the same even when controlled for age.

An inspection of the zero order correlation (*r* value) suggests that controlling for age has only a medium effect on the strength of relationship between the two variables. However as there was a violation in the assumption of normality these results must be interpreted with caution.
**Standard Multiple Regression**

Standard multiple regression was conducted in order to evaluate the predictive power of each independent variable (Pallant, 2011). In addition to this, standard multiple regression was able to inform the researcher of how much unique variance in the dependent variable each of the independent variables explained. Standard multiple regression showed correlation (above .3). The correlation between any pair of variables was not too high (> .7) as suggested in Pallant, 2011.

<table>
<thead>
<tr>
<th>Correlations</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VCS and Age</td>
<td>.642</td>
<td>VCS and VAS%</td>
</tr>
<tr>
<td>VAS% and Age</td>
<td>.490</td>
<td>VCS and MSC</td>
</tr>
<tr>
<td>MSC and Age</td>
<td>.631</td>
<td></td>
</tr>
</tbody>
</table>

Outliers were checked by inspecting the Mahalanobis distances and outlier (coded CT17) was outside the critical value and was removed from the data. The maximum value for Cook’s D for CT17 was 1.005 (a value of above 1). The analysis was rerun excluding the outlier.
Verb Argument Structure %

The Tolerance value was given at .588 and the VIF value at 1.699. These values have not violated the multicollinearity assumption (Tolerance <.10; VIF >10).

Fig. 8

The $R^2$ value for VAS%, VCS and Age is .316 indicating that the model (VCS and influence of age) on VAS% explains 31.6% of the variance and is statistically significant, ANOVA- Sig =0.000 so $p<.0005$. The Beta value for the influence of age was .260 and for VCS was .359 indicating that VCS has the largest influence and was significant at 0.003. The value for the Part correlation coefficient is .199 for age and .275 for VCS indicating that age uniquely explains 19% of the variance in VAS% and VCS uniquely explains 27% of the variance in VAS%.
Mean Sentence Complexity

The Tolerance value was given at .571 and the VIF value at 1.750. These values have not violated the multicollinearity assumption (Tolerance <.10; VIF >10).

The R\(^2\) value for MSC, VCS and Age is .473 indicating that the model (VCS and influence of age) on MSC explains 47% of the variance and is significant, ANOVA- Sig = 0.000 so p<.0005. The Beta value for influence of age was .394 and for VCS was .362 indicating that age had a greater influence on MSC than VCS and was significant at 0.000. The value for Part correlation coefficient is .298 for age and .274 for VCS indicating that age uniquely explains 29% of the variance in MSC and VCS uniquely explains 27% of the variance in MSC.
Qualitative Results

The majority of the errors produced were due to omission of arguments (particularly the subject being omitted with younger children), incorrect interpretation of the verb, incorrect mapping of a verb, overgeneralization and talking around the verb (circumlocution) suggesting they were using word finding techniques if they couldn’t remember the target verb. These are further expanded on in the discussion. The 5 verbs most often produced in error are displayed in the table below. Other verbs which proved problematic in this sample were the cognitive state verbs ‘tell’ and ‘think’.

<table>
<thead>
<tr>
<th>Verbs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>26.37%</td>
</tr>
<tr>
<td>Pour</td>
<td>23.07%</td>
</tr>
<tr>
<td>Bet</td>
<td>18.68%</td>
</tr>
<tr>
<td>Fill</td>
<td>18.68%</td>
</tr>
<tr>
<td>Told</td>
<td>13.18%</td>
</tr>
</tbody>
</table>

*Fig. 10*

The percentage errors for these verbs across the data set were Clear (26.37%), Pour (23.07%), Bet (18.68%), Fill (18.68%) and Told (13.18%).
Test Behaviours

Throughout the testing process several test behaviours were noted. The administration of TOVK first allowed the child to relax with the researchers as no verbal output was required. This appeared to decrease shyness for some of the children. Some of the younger children found the narrative too long and had difficulty attending. Some children expressed concern that they would not be able to remember the entire narrative. These behaviours are important to assess qualitatively in order to consider modifications to the test for future use.

Discussion

The language samples of 91 Irish, English-speaking children aged 4;10-12;0 years were analysed to obtain normative data on Typically Developing (TD) children’s production of verbs and their argument structures and mean sentence complexity. In light of the importance of verb semantic knowledge and sentence production, the relationship between verb semantic knowledge and the sentence variables in the new tool was also explored. It was hypothesized that correct percentage of verb argument structure would increase with age. It was further hypothesized that verb knowledge would influence verb production. The results supported these hypotheses. The types of verbs TD children had most difficulty producing were also identified as well as test behaviours and subsequent modifications.

Developmental Progression

Analysing performance in six-monthly age bands revealed a gradual progression of higher percentage of correct verb argument structure and increased sentence complexity. The final age band spanned 18 months as we were more interested in the sensitivity of younger age bands (as correct verb argument structure and complexity is often acquired earlier than our oldest age band). Some children reached ceiling for correct production of verb argument structure from the earlier age band of 5;06-6;05. From inspecting the data, it was clear that lower percentages of children in the earlier age bands reached ceiling thus showing a developmental progression and as we know, demonstrating that there is a wide range of
variability in TD children. Therefore it is not unusual that some younger children with well-developed language abilities would score highly on the test. For the sentence complexity, MSC values were also shown to increase with age. The age band 8;06-9;05 showed the greatest overall score with most participants in this age band gaining an MSC score of 3.2 and above (6 out of 9 participants). The reason this age band may have had the highest overall score could be due to the smaller number of participants in this group (n=9), in comparison with the older age groups (9;06-10;05 n=12, 10;6-12;0 n=20). Outliers were shown to affect our analysis and so were removed. Due to the ceiling effects seen in these age bands it would be imperative to gather further data with a bigger sample which includes more younger children to improve the sensitivity of the test.

Influence of verb knowledge on sentence production

Consistent with Ebbels et al (2007) work on semantic features of verbs, there was a strong correlation between verb knowledge and sentence production in this study. Partial correlation showed that, independent from age, verb knowledge affects sentence production and so should be assessed clinically when production is problematic. Therefore an important finding is that addressing verb knowledge is a key factor in intervening with sentence production.

Inter-rater reliability

As some scoring in this test was subjective (particularly with length score) it was important to get a good inter-rater reliability score. When a score varied between researchers, this was discussed and reasoned and further scoring examples were added to the rubric. This ensured the tool became more reliable and robust.

Verbs most commonly produced in error

The five verbs most frequently produced in error across the data set were: Clear, Pour, Bet, Fill and Told. The verb ‘Clear’ was presented in the form ‘The alien cleared the food off the shelves’ requiring 3 arguments for a correct VAS score. From analysing the raw data many children produced the utterance ‘They cleared the food’. 54% of errors made on this verb were by children in the youngest 2 age groups. Errors on the verb ‘Pour’ were most often
due to omission of obligatory arguments e.g. ‘He poured the water (into the bottle)’. There was more of an even spread across the age group for children who got this verb incorrect. The verb ‘Bet’ was interesting and was misinterpreted by some children, particularly in one school so possibly dialectal, (Washington, 2010 as cited in Schwartz), as ‘beat’ e.g. ‘The man bet the alien up’. Fill was most often produced incorrectly due to incorrect mapping e.g. ‘Captain Grey filled petrol into the ship’. 76% of those who produced ‘Fill’ in error were aged 8;04 or younger. Finally ‘Told’ was most often produced in error due to omission of an obligatory argument ‘The soldier told all about the aliens’. Upon analysing the properties of these verbs, more of these are low frequency verbs and include alternating change of state, change of location and cognitive state verbs in terms of their semantic classes (Levin, 2003). Frequency of verbs has been shown to have an effect on their acquisition (Ambridge et al, 2008). According to Black and Chiat (2003) events are built of different sub situations (act, process and state). Verbs that encompass more than one sub-situation are semantically more complex (e.g. Act that causes the process of change of state/location). Clear is a change of location verb and Fill is a change of state verb, Tell and Bet are cognitive state verbs, hence the higher rates of errors on these verbs is consistent with previous research. Further qualitative analysis showed errors patterns most commonly relating to:

- Omission of arguments, most commonly omission of the subject in younger children ‘Stealing the food’ ‘Sank down’
- Children having incorrect meaning of the verb e.g. ‘He betted at them’, ‘He groaned to puke’
- Overgeneralization of past tense e.g ‘He sspreaded the butter’ ‘She rung the phone’
- Circumlocution e.g. turned = ‘made in to’, peeled = ‘chopped the skin off’

**Test Behaviours and possible modifications**

During testing it is important to note test behaviours amongst individual children, even if these cannot be analysed quantitatively, (Norbury and Bishop, 2003) to see if modifications need to be made to the test. It was beneficial to administer the TOVK picture pointing test first as children were seen to become more at ease with the researchers, possibly because it didn’t require verbal output. Many of the younger children found the narrative quite long
and appeared to find it difficult to attend to the full story being told by the researcher. Some children mentioned that they wouldn’t be able to remember the complete story, but they were encouraged to retell the story as best they could and made to feel at ease by the student researchers. A modification could be to split the narrative into two sections for all children, so that the child would be able to retell one part of the story at a time. Further to this, memory may impinge on the child not being able to remember the verbs and what happened in the story.

**Prompting**

Graduated prompting (a question; proving the verb) was used to elicit target verbs if they were not produced in the first instance. Exploring results using only verbs elicited in the first instance may not provide a true reflection of a child’s ability to use certain verbs and consequently particular structures or sentence complexity. On the other hand, limitations on a clinician’s time may need to be taken into account. In terms of dynamic assessment, prompting could help determine the child’s needs. Dynamic assessment supports the child’s performance so that an optimal level of achievement can be identified (Olswand and Bain as cited in Paul and Norbury, 2012). Furthermore it allows observation of a clients’ learning progress which attempts to promote change.

**Limitations**

Although training was given by the Primary investigator (PI) prior to administration of the test, it is possible that the amount and type of feedback and marking given varied among researchers (e.g. the amount of prompting given in the first instance, comparing our rationales for how items were scored). However this could be overcome with additional preparation and set rules for administration.

Salvia and Ysseldyke, 2000 (cited in Paul and Norbury, 2012) recommends a minimum of 100 participants per age band when standardizing a test for it to be representative of the overall population being tested. Our sample size across age bands was small (n=91). Despite efforts to recruit more participants from the younger age bands we were unable to obtain the numbers anticipated. Having said that, the results were still significant in terms of our analysis, even when adjusted (e.g. using r square value) indicating that the tool is robust.
Overall test utility

As normative data showed an increase in VAS% correct and MSC with age, it would appear that the tool is of clinical use. The statistical output was used to derive tables illustrating raw scores against standard deviations. This could potentially be used to relate a child’s test score to the observed scores for their age band in this normative sample. Furthermore, it is shown in these tables that the mean increases with age. However as the sample size was small, data would be required from more TD children and particularly at the lower age bands in order for the tool to become widely clinically available and robust. Other factors such as administration and scoring of the test should also be reviewed with the recommendations suggested in order to produce a robust tool. Intervention should take into account that some verbs and their argument structure take longer to acquire and this tool could help to dictate verbs to include in intervention.

Conclusion

The narrative tool ‘Captain Grey and the Greedy Aliens’ was shown to be sensitive to measure progression in TD children’s use of correct verb argument structure and sentence complexity with age. Additions to the scoring rubric and high levels of inter-rater reliability show that this tool could be a robust measure of children’s verb production if it was standardized on a larger sample and with younger children. The findings showed that increased verb semantic knowledge is intertwined with increased verb argument structure and sentence complexity which has important clinical implications in regards to targeting intervention around verb knowledge. Further research in this area could include carrying out the test on a group of children with SLI and comparing the results both quantitatively and qualitatively to TD children to see if this test would be sensitive and robust enough for clinical use in children with language disorders. Based on the results, there is scope for the development and use of this narrative tool to specifically evaluate and target children’s verb production and sentence complexity.
References:


Appendix 1

Narrative for ‘Captain Grey and the Greedy Aliens’

(Target verbs in **bold**)

SCENE 1: Captain Grey **lived** in a city on planet Bog. Greedy aliens came to planet Bog to **steal** food, they stole vehicles and they sometimes stole people. Captain Grey’s job was to **capture** the aliens. When that didn’t work he **chased** them to back to planet Zirk from where they came.

SCENE 2: Last year Captain Grey’s Mother **swept** the leaves from the path at her house. Aliens came with guns and lasers. They **destroyed** the plants in the field. They **cleared** all the food from the shelves. Then they **emptied** the rubbish from the bins on to the streets.

SCENE 3: Mrs Grey came out later and saw the mess. She was very cross and **phoned** her son. “Do something about those aliens” she said.

SCENE 4: Captain Grey was out in his flying machine. He **flew** the machine back to his office. He **emailed** the best soldiers. They had a meeting. He **leaned** against his desk and said “We have to stop them or there will be no food left. They will destroy Planet Bog with pollution. Let’s go and find them”.

SCENE 5: Captain Grey went to get sandwiches and drinks for everyone to take on the journey. He hadn’t much petrol. His petrol tank was empty. So he **pushed** his space machine along the road to his mother’s house. He **ran** into the house. We need drinks and sandwiches for the journey to catch the aliens.

SCENE 6: Captain Grey **poured** magic juice into bottle. Some apples **fell** on the floor. His mother **picked** them up. She **spread** butter on bread. She **peeled** the apples. Then she **grated** some cheese. She made cheese and apple sandwiches. Then she **covered** the sandwiches with cling film.
SCENE 7: Captain Grey **turned** water into petrol with his light sabre. He **filled** the space machine with petrol and flew it to meet the others.

SCENE 8: He **gave** the food to the men. They **stuffed** the sandwiches into their backpacks and **left** planet Bog.

SCENE 9: They **landed** on the planet Zirk and **looked around**. They **covered** their spaceships with shields.

SCENE 10: One of the soldiers **stayed** to mind the spaceships He **yawned** and **leaned** his gun against the rock. He **took** his lunch out to eat. The rock **shook** and he **jumped**. It was an alien. There were aliens everywhere. He **dropped** his lunch and **ran**.

SCENE 11: The aliens sat and ate the sandwiches. The alien captain came and saw them eating. He **groaned**. “Oh no” he said. “You know we can’t eat cheese”. The aliens **threw** the rest of the sandwiches into a hole. The sandwiches **sank** all the way to the bottom. The aliens got sick and **crawled** to the rocks.

SCENE 12: The soldier who ran away, hid behind some trees. He **pretended** he was dead. Captain Grey came along and saw the soldier. I **think** he’s dead said Captain Grey. The soldier opened his eyes and **told** Captain Grey there were aliens everywhere.

SCENE 13: “Come on everyone”! **shouted** Captain Grey. I want to find them now. The soldiers **marched** off to find the aliens and came to the “picnic” site. I **bet** they’re sorry they ate my lunch, laughed the soldier

SCENE 14: The soldiers **captured** the aliens and **brought them back** to planet Bog. They **put** the aliens into prison. Captain Grey, his mother and the other people on the planet lived happily ever after.