Linguistic Unit Analysis System for Verbal Instructions

Système d'analyse d'unité linguistique pour instructions verbales

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Abstract

There is currently no consistent or universally accepted system that measures the linguistic complexity of verbal directions. Goals for children often include terms such as "two-step directions," which can encompass a wide variety of memory, conceptual, and syntactic requirements. The proposed Linguistic Unit Analysis System (LUAS) identifies incremental increases in syntactic complexity and verbal length by assigning relative point values to each linguistic structure while holding semantic elements constant. Pilot testing on 470 typically developing children suggests approximate direction-following levels for typically developing children. The LUAS may assist speech-language pathologists in precisely defining goals for direction-following. The system can then be used to determine subsequent goals that may include incremental increases in the direction-following level or increases in semantic difficulty within the achieved direction-following level.

Abrégé

Il n'existe actuellement aucun système cohérent ou universellement accepté pouvant mesurer la complexité linguistique des instructions verbales. Pour des enfants, les objectifs comprennent souvent des expressions comportant des « instructions à deux étapes » qui peuvent englober une grande variété d'exigences mnémoniques, conceptuelles et syntaxiques. Le système proposé d'analyse d'unité linguistique (*Linguistic Unit Analysis System; LUAS*) identifie les augmentations graduelles de la complexité syntaxique et de la longueur verbale en assignant des cotes relatives à chaque structure linguistique tout en maintenant la constance des éléments sémantiques. Les essais pilotes sur 470 enfants à développement typique indiquent des niveaux approximatifs d'exécution d'instructions chez les enfants à développement typique. Le *LUAS* peut aider les orthophonistes à définir avec précision les objectifs d'exécution d'instructions. Le système peut alors servir à déterminer des objectifs ultérieurs pouvant inclure des augmentations graduelles du niveau d'exécution d'instructions ou des augmentations de difficulté sémantique dans le niveau d'exécution d'instructions atteint.

Key words: verbal comprehension, receptive language, verbal directions, verbal instructions, auditory processing, language assessment

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Children with language impairments (LI) often have difficulty understanding and carrying out verbal instructions. This may be particularly debilitating, considering that half of children's instructional day is spent listening to teachers and peers (Anderson & Brent, 1994). Montgomery (1996) noted that everyday classroom situations present particular difficulties for some children because they must process and respond to many verbal directions. Teacher directives can involve such complex and lengthy verbalizations as "Hang up your backpack and put your

homework on my desk. Then get out a piece of blue construction paper and write your name in the lower left corner." Kaplan and White (1980), in a study of typical classrooms, suggested that the length and complexity of classroom directions that children are able to follow increases up through the second grade. However, children with LI often exhibit limitations in their ability to understand teacher directives (Fazio, 1996).

Children with adequate hearing can fail to follow directions for a variety of reasons. The specific deficits can be semantic in nature (Ceci, Ringstrom, & Lea, 1981) or can have grammatical or cognitive components (Bishop, 1979, 1994; Bishop & Adams, 1992; Ellis-Weismer, 1985; Johnston & Ellis-Weismer, 1983; Johnston, Smith, & Box, 1997; van der Lely & Harris, 1990; van der Lely & Howard, 1993). Engle, Carullo, and Collins (1991) found that working memory demands for following verbal instructions increase as children get older; thus, for longer verbalizations, the inability to carry out directions can be attributed to deficits in memory systems or processes. For language tasks, accurate measurement of working memory apart from language functions can be impractical because of the interrelationship between language and memory (Gillam, 1998).

Tasks designed to assist children in increasing their ability to follow directions should be carefully controlled with respect to vocabulary, syntax, and memory demands. These components can then be increased systematically as children achieve skills at each level. The current individual education plans (IEPs) for many elementary students include goals for following one, two or three-part directives; however, there is no universal agreement as to what constitutes various levels of directives. For example, some speech-language pathologists (SLPs) understand a one-step directive to be a structure including only one main verb. In that case, the structure of the sentence might range from an active direction in a *Verb + Noun* form (e.g., *Touch the cup*) to a picture-pointing task which involves a passive voice construction with adverbial and adjectival modifiers (e.g., *The decaying old mansion was unexpectedly torn down during the last rally*). A two-part directive defined as containing two verbs and two nouns might similarly range from a directive containing two independent clauses such as *Verb+Noun* and *Verb+Noun* (e.g., *Touch the cup and push the penny*) to an instruction containing dependent plus independent clauses involving perfect and present tenses with various phrases and modifiers embedded (e.g., *If you have been reading your textbook on science experiments this morning, then bring your list of ideas to the front of the room near my desk.*) Similarly, the length of the sentence does not offer a consistent measure

of its difficulty, because the linguistic structures can vary dramatically in sentences of equal word length, as seen in the following examples of twenty-word sentences: "*Before you put the block in the box, if you ate breakfast this morning, roll three pencils on the floor*" versus "*Put the smallest red marker in the black container on my desk and then go and sit in your seat.*"

The lack of universal understanding of what constitutes a directive level (i.e., one-part direction, two-part direction, etc.) interferes with consistent management of direction-following difficulties. The linguistic unit analysis system (LUAS) was developed to offer a consistent and systematic measure of the difficulty level of directions. The strength of the LUAS is as follows: the number of relevant elements plus the complexity of the structure are weighed, thus tapping the interrelated elements of memory and syntax. In addition, the LUAS offers a simple system that is readily adapted to many linguistic levels.

The purpose of the present report is a) to provide information on the development/modification of the LUAS and b) to present the responses of 470 typically developing children to a set of directions at selected levels of the LUAS. Decisions regarding development and use of the LUAS were based on a series of informal experiments and a formal presentation of a set of directions to children who were developing language normally. The scoring system was developed/refined based on the results of the experiments, while the second condition served to provide preliminary normative data.

Method

Participants

Two sets of children participated in this study. The first group of children, who assisted in modifying the instrument, constituted the subjects for Condition One. Inclusion criteria for children in this group ($n = 27$) was as follows: they had passed a vision and hearing screening at their school, they were enrolled in regular classes and were receiving no special services, they spoke only English, and they had passed a speech/language screening administered by their school SLP. Ages of participants in Condition One ranged from 64 to 123 months, with a mean age of 91 months.

For the second condition, participants were 470 elementary children, ages 65 to 125 months. The participants consisted of children in regular kindergarten through fourth grade classrooms whose first language was English, who had passed a vision and hearing screening, and who had not been identified as requiring any special services such as resource, content-mastery, speech/language therapy, or special education. The

children were drawn from three public elementary schools of different socioeconomic levels, as determined by the percent of free lunch recipients: one low-socioeconomic school (77% free lunches), one mid-socioeconomic school (31% free lunches), and one high socio-economic school (22 % free lunches).

Condition One

In the first condition, the children were individually asked to follow directions of various lengths and complexity to determine which types of constructions presented the most difficulty. In general, increasingly lengthy directions were given until a failure level was established. The experimenter then asked the children to follow directions of a slighter lesser length with various syntactic constructions. The experimenter noted which directions the children were able to complete, which structures were more difficult (when two were of similar length), and if there were similar patterns in other children in the group. A series of observations was collected from those experiments. In tasks involving following directions, for a majority of the children:

1. Addition of the word "you" did not add difficulty to directions.

2. Verbs, adjectives, and prepositions represented by a two or three word structure (*pick up, look at, two of, on top of*) were of equal difficulty with their one-word counterparts (*get, watch, two, under*).

3. When a noun or a verb occurred twice in the same directive, processing was more successful than when the same construction with two different nouns or verbs was produced (e.g., *Put the block in the cup and put the pencil in the cup* vs. *Put the cup on the plate and push the button on the monkey*).

4. A structure containing a list of adjectives preceding a noun added less difficulty than an equally long construction of nouns and/or verbs (e.g., *go get the little round wooden block* vs. *touch the flower and move the apple*).

5. When the structures were the same length, a list of nouns following a verb presented much more difficulty than directions involving several verbs, adjectives and nouns (*put the car, the pencil, the rope, and the block in the box* vs. *put the block in the box and the long pencil in the desk*).

6. Order of mention violations (OMV) were only slightly harder than "first-said, first-done" constructions of equal word length. This may be due to the fact that additional words must be added to indicate order.

7. Passive voice constructions were more difficult to understand than active voice constructions of equal word length.

8. Reversible passives were more difficult than truncated or irreversible passives and considerably more difficult than active voice constructions.

9. Embedded clauses beginning with a relative pronoun were of similar difficulty with nonembedded structures of equal length (e.g., *Put the block that is not broken on the paper* vs. *Put the red block and green pen in the yellow cup.*)

10. More than two ordinals (e.g., *second, last*) in a single directive often caused children to give up their attempt at the directive.

Rationale/Modification for Point System

Many of the observations in Condition One were expected in light of current research on language development. For example, passive voice clearly develops later than active voice (Bever, 1970) and passive voice was found to be more difficult than active voice in our experiments. However, there were some unexpected findings and some findings for which there are not established developmental norms. Assignment of point values in the LUAS was based on developmental literature as well as observation of the responses noted in the current experiments. The initial rationale was to assign a single point per morpheme to account for the memory burden of each word. From there, additional points were added or subtracted depending on the relative burden they appeared to place on the listener. A final criterion was to make the system consistent and simple enough to allow for quick and easy implementation.

In the typically developing child, early linguistic development advances from single words to subject-verb or verb-object constructions, to subject-verb-object sentences. Thus, it appears that the increased length initially represents more difficulty with each word added and, hence, the awarding of one point per word. However, as development continues and syntactic structure advances, each word does not carry equal weight in the comprehension process. From the current experiments, it appears that when children are listening to directions, some words do not seem to place significant burden on the listener. The pronoun "you" appeared not to add additional processing burden because the children seemed to ignore it, clearly understanding that they were designated to carry out the directives. Therefore, we elected to give no points for the word "you."

Children understood two/three-word verbs and prepositions equally well with their comprehension of single word verbs and prepositions. So we decided to

count the verb and preposition groups (e.g., *pick up, on top of*) as only one point. Similarly, quantifiers followed by "of" (e.g., *two of, some of*) appeared to be processed as a single concept. In that case, "of" added no content separate from the quantifier and so was not given additional value.

A few words, though they logically required attention, seemed to demand less processing than one-point words and so were not awarded any points. This occurred when a noun or verb was repeated in the same directive (e.g., *Touch the <u>truck</u> and put the block on the <u>truck</u>* or *<u>Put</u> the block on the paper and <u>put</u> the pen on the paper)*. In this case, it appeared that the repeated word had already been processed and so the children could re-target the object or action more easily. However, we maintained the point awards for articles and descriptors of repeated nouns to allow some credit for the added length of the directive.

In Condition One, many verbs used in the directions were in present tense. However, since verbs represent an especially difficult category due to the breadth of their forms and tenses (Owens, 2000), we elected to count each morphological marker, each unmarked verb, and each auxiliary verb as one point (e.g., *was running* = 3 points; *will run* = 2 points).

Later-occurring structures and transformations were given additional credit because of their relatively late appearance in language development, and because of the additional burdens they placed on the children in our experiments. We decided to add one bonus point for directives that involved OMV, that is, structures in which information had to be processed in an order different from the usual "first stated-first done" rule (e.g., *Before you go outside, pick up the toys*). Two points were added for directions that involved "noun = subject violations" (N=SV), in which the usual rule of Noun +Verb equals the Subject + Verb is altered, such as in passive voice structures (e.g., *The music was heard by the boy*). The points for OMV and the N=SV are bonus points given in addition to the points awarded for each individual word. We decided to give two points for N=SV while only one point for OMV was awarded. This is because the OMV structures typically include more words than N=SV structures, and when more words occur, points are awarded to represent the length of the structure (e.g., *The house was painted by the man* vs. *Before you push the car, put the fork on the plate*). The complexity of one embedded structure, a relative pronoun transformation, is captured by the application of the point-per-word rule. This decision was based on the fact that children had equal difficulty with nonembedded sentences of a length equal to the structures with the relative clause. However, in our experiments, we used only relative clauses following the object and so cannot speculate about more difficult transformations and embedded structures representing more abstract concepts.

All passive voice structures were awarded two bonus points. One additional bonus point was added for the increased difficulty of the reversible passive (e.g., *John was kissed by Mary*). That is, reversible passives were given a point in addition to the points for content words and the award for S=NV for passive voice, making a three-point bonus for reversible passive. The extra point was justified due to the relatively late development of this structure (van der Lely & Harris, 1990) in normally developing children and the increased difficulty observed in the present participants.

The Linguistic Unit Analysis System

The LUAS adopted for Condition Two followed the general rule of assigning a point for each morpheme, extra points for advanced syntactic structures and memory requirements, and no points for selected repeated structures. Each word (e.g., *the, toy, get*) and each inflectional morpheme (e.g., *ed, ing, s*) was given a single point with one exception. Nouns or verbs which were repeated in the same directive were not counted the second time they appeared, though the articles accompanying them were counted to allow some credit for the extended length. Bonus points were awarded for word order changes such as OMVs, which were given one additional point, or N=SV as in passive voice, which were given two bonus points. One additional bonus point was added for irreversible passive voice. Two bonus points were awarded when a list of nouns followed a verb. That is, for each noun which exceeded two successive nouns following a verb, two additional points were added. Finally, if more than two ordinals (e.g., *first, last*) were used in one directive, the third and each successive ordinal was awarded two points. See Appendix A for demonstration of the LUAS scoring system for specific sample elements. Appendix B exemplifies the bonus point awards and Appendix C presents examples of fully scored directives.

Condition Two

In the second condition, preliminary normative data were gathered regarding the LUAS in preparation for development of a formal test of direction-following (the Test of Following Oral Directions, Gill, in review). The LUAS system, modified by the findings in Condition One, was used to construct a set of directions which was administered to the children. (See Appendix D for the set of directions administered in Condition Two.)

After the children demonstrated that they could identify each of the objects presented and could

successfully follow three simple trial directions, the children were asked to follow each of the Condition Two directions. The instructions were individually verbalized to each child, and the set of items was rearranged into its original position following completion of each direction. The examiners noted which directions the children were able to successfully complete. The number of children who were able to carry out directions at each tested point level was calculated and the percentages for each direction level were computed for all children collectively and for groups of children in six month age bands.

Results

In general, the ability to follow directions decreased as the point levels increased. There were a few exceptions in some age groups, the most notable being that a larger percentage of 5½-year-old children passed at level 19b than they did at levels 15, 18, and 19a. However, for most age groups and for all age groups combined, there was a consistent decrease in percentage of passage as the difficulty of the given direction increased. In addition, the percent of children able to follow a specific direction at any level increased with increases in age. Thus, for typically developing children in the present study, the ability to follow directions of increasing difficulty, as defined by the LUAS, increased with age. The percentage of children passing at each point level is presented in Table 1.

These results also demonstrate that typically developing children are able to follow fairly involved directions with a high degree of consistency. For example, over 90% (all ages combined) passed an 11-point direction ("Put the long string and the red cup on the book."). Sixty-six percent of children across all age groups were able to follow the 15-point direction (" Put the yellow block and the short string in the red cup. Push

Table 1
Percentage of children following direction at selected point levels by age

Level	Age in Months										
	$n = 46$	$n = 48$	$n = 54$	$n = 41$	$n = 35$	$n = 31$	$n = 52$	$n = 62$	$n = 55$	$n = 46$	$N = 470$
3	100	100	100	100	100	100	100	100	100	100	100
6	98	96	100	100	100	100	100	100	100	100	99
7	98	98	98	100	100	100	100	100	100	100	99
8	91	93	100		97	97	98		100	100	
9		85		100	100	100	100	100	100	100	96
11a	89	80	89	100	97	100	100	100	98	100	
11b	68	76	83			100	98	100	94		91
11c	68	76	79	72	82	90	91	95	98	95	
12	55	74	60	72	82	87	95	97	94	100	83
13a	68	59	70	92	76	90	91	97	96	100	85
13b	55	67	51	78	76	84	93	98	89	98	80
13c	36	43	51	53	68	77	88	81	81	67	66
15a	18	33	43	67	65	74	91	87	83	84	66
15b	14	39	36	33	65	74	79	90	85	77	61
18	7	22	23	33	44	61	77	66	65	72	49
19a	5	22	18	42	47	45	68	74	72	67	48
19b	20	30	19	28	44	45	65	65	67	74	46
20	0	7	9	19	35	29	44	52	50	46	30
22	2	9	15	19	26	29	49	58	31	47	30
24	0	9	2	8	24	19	40	40	31	19	21

the tape."), and 49 percent were able to follow the 18-point direction (" Put the red and yellow blocks on the blue paper and put the long string beside the white paper.").

Discussion

The LUAS appears to offer a consistent and straightforward system for measuring and incrementally increasing the difficulty of verbal directions for elementary children. In addition, this report presents some preliminary norms for typically developing children in the arena of direction-following. Although no system can anticipate every possible language structure that might be included in a directive, the LUAS addresses many common grammatical structures processed by young children. When clinicians encounter structures not specifically addressed by the LUAS, they can follow the basic principal of awarding one point for each new word (i.e., one not previously stated in that directive) to which the child must attend and two points for sentence structure order violations.

Children's skill level can be determined through a baseline test of direction following using the LUAS system. Once an accurate determination of children's current level of performance has been established, the SLP can then construct appropriate goals in the area of following directions and later collect appropriate post instruction data to assess progress.

The information presented on the LUAS should be used judiciously. The data gathered are preliminary and suggest approximate point levels for ages 5;5 through 10;5. Also, despite the fact that the LUAS taps length and syntactic complexity, it fails to address semantic and pragmatic difficulties. For example, when applying the LUAS scoring system, the following sentences have the same point value: "Put the red blocks in the little cup" and "Reconstruct the polymer structure between the iridescent pylons." It is important that the SLP increase the length and complexity of directions within children's current lexical repertoire and that the SLP expand the lexical repertoire within each directive level. The lexicon presented in Condition Two of the present study was consistently concrete with few advanced conceptual requirements and so the findings are most applicable to children with lower linguistic levels. With more advanced children, the SLP should expand semantic skills to include directions with more conceptually difficult words such as *neither, except,* or *all but one.* As new concepts are acquired, the SLP can introduce them in shorter, then progressively longer units.

The system is also not sensitive to pragmatic aspects of direction following. Factors such as children's presuppositions and ability to make inferences are not measured separately. The SLP should be sensitive to the difficulties that reflect pragmatic interference, and the system should not be used with children with primary pragmatic difficulties.

It is very difficult to measure all elements of verbal directions simultaneously; therefore, it is suggested that the LUAS be used initially to increase the directive unit level with which the child can comply within a concrete vocabulary and consistent pragmatic set, and subsequently to increase the vocabulary or conceptual complexity that the child can process at a given directive unit level. A suggested starting point can be obtained by noting what point level is passed by most other children of the same age (See Table 1). The clinician should determine a baseline direction-following point level and set appropriate goals to increase that level. The point-level should replace the "one-part, two-part" directions which now make up common goals for children.

It is hoped that this systematic analysis of the length and grammatical structure of directions will assist the clinician in determining the exact point at which breakdowns occur. More importantly for children with difficulty following directions, it may help with both the identification of initial performance level and incremental measurement of progress. At a minimum, the practice of teaching such goals as "two-part directions" should be replaced with a system based on a consensus of clearly identified criteria.

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APPENDIX A
Linguistic Unit Analysis System: Scoring of Specific Elements

Element	Point Value of Underlined Structure	Examples
Nouns	1	Touch the <u>cup.</u>
	1	Move the <u>block,</u>
	1	Show me <u>art</u> is fun.
Nouns repeated in the same directive.	0	Put the cup on the plate and the block on the <u>plate.</u>
Verbs or Verbals	1	<u>Touch</u> the cup.
	1	<u>Wake up</u> the puppy.
	1	The dog <u>threw up.</u>
Auxiliary verbs	1	When you <u>are</u> putting the block on the cup…
Implied or actual repeats of verbs	0	Put the block in the cup and <u>(put)</u> the cup on the plate.
Adjectives - determiners, descriptive, quantitative, cardinal and ordinal adjectives.	1	Touch the <u>yellow</u> cup.
	1	Move <u>some</u> blocks.
	1	Pick up <u>two</u> blocks.
	1	Get <u>the</u> straw.
Prepositions or Phrasal Prepositions	1	Put the block <u>in</u> the cup.
	1	Put the book <u>on top of</u> the cup.
Adverbs	1	<u>First</u> put the block in the cup.
	1	Get a pen, <u>then</u> write your name.
	1	Run <u>quickly</u> to the blackboard.
Conjunctions	1	Push the penny <u>and</u> get the block.
	1	Get a cap <u>since</u> your coat is gone
Pronouns	1	Give it to <u>him</u>.
	1	Look at <u>yourself.</u>
	0	Before <u>you</u> get the block
	0	<u>(You)</u> Sit down
Progressive, perfect, and past tense markers.	1	When you are putt<u>ing</u> the…
	1	When you have giv<u>en</u> …
Possessive and plural markers.	1	Get the block<u>s</u>…

Appendix B
Linguistic Unit Analysis System: Bonus Points Awarded for Complexity

Element	Point Value of Underlined Structure	Examples
Order of Mention Violations (when the first direction stated is not the first directive to be carried out or processed)	8 pts (1 for OMV +7 for content words)	Before you put the cup on the plate, put a block in the cup.
	5 pts (1 for OMV + 4 for content words)	Put the penny in the cup if you are a fish.
Noun = Subject Violations (e.g, passive voice)	9 pts (2 pts for N = SV+ 7 for content words)	Show me the window was hit by the boy.
Reversible Passive Voice	10 pts (1 pt for reversible +2 points for N = SV +7 for content words)	Show me the boy was hit by the girl.
Listing of more than two nouns in succession following a verb.	10 pts (2 pts for noun beyond two in a list + 8 for content words)	Put the track, the block, and the penny …
Use of more than two ordinals in a direction.	14 pts (2 pts for a third ordinal + 12 pts for content words)	Write the third letter of the fifth word in the second square…

Appendix C (Part I)
Linguistic Unit Analysis System: Examples of Fully Scored Directives

Directive	Total Points	Explanation of Points
Push the penny.	3	1 for verb (push), 1 for article (the), 1 for noun (penny)
Get the red block.	4	1 for verb (get), 1 for article (the), 1 for adjective (red), 1 for noun (block)
Move the little brown car.	5	1 for verb (move), 1 for article (the), 1 for adjective (little), 1 for adjective (brown), 1 for noun (car)
Drop the ball and push the ball.	6	1 for verb (drop), 1 for article (the), 1 for noun (ball), 1 for conjunction (and), 1 for conjuction (push), 1 for article (the), 0 for repeated noun (ball)
Pick up the cups and the penny.	7	1 for verbal (pick up), 1 for article (the), 1 for noun (cup) , 1 for plural marker (s), 1 for conjunction (and), 1 for article (the), 1 for noun (penny)
Move the little blue steel tracks.	7	1 for verb (move), 1 for article (the), 1 for adjective (little), 1 for adjective (blue), 1 for adjective (steel), 1 for noun (track), 1 for plural marker (s)

note. continued on next page

Appendix C (Part II)
Linguistic Unit Analysis System: Examples of Fully Scored Directives

Directive	Total Points	Explanation of Points
Pick up the green paper and write your name.	8	1 for verbal (pick up), 1 for article (the), 1 for adjective (green), 1 for nouns (paper), 1 for conjunction (and), 1 for verb (write), 1 for genitive adjective (your), 1 for noun (name),
Put the penny and the string on the plate.	9	1 for verb (put), 1 for article (the), 1 for noun (penny), 1 for conjunction (and), 1 for article (the), 1 for noun (string), 1 for preposition (on), 1 for article (the), 1 for noun (plate)
Find the red marker and print your middle name.	9	1 for verb (find), 1 for article (the), 1 for adjectives (red), 1 for noun (marker) , 1 for conjunction (and), 1 for verb (print), 1 for adjective (your), 1 for adjective (middle), 1 for noun (name)
Before you get the block, move the pennies.	9	1 for conjunction (before), 0 for pronoun (you), 1 for verb (get), 1 for article (the), 1 for nouns (block), 1 for verb (move), 1 for article (the), 1 for noun (penny), 1 for plural (ies), 1 for order-of-mention violation
Put the tape on the book. Put the penny on the yellow car.	12	1 for verb (put), 1 for article (the), 1 for noun (tape), 1 for preposition (on), 1 for article (the), 1 for noun (book), 0 for repeated verb (put), 1 for article (the), 1 for noun (penny), 1 for preposition (on), 1 for article (the), 1 for adjective (yellow), 1 for noun (car)
Pick up the football that was not kicked by John.	12	1 for verbal (pick up), 1 for article (the), 1 for noun (football), 1 for relative pronoun (that), 1 for verb (was), 1 for adverb (not), 1 for verb (kick), 1 for past tense marker (ed), 1 for preposition (by), 1 for noun (John) , 2 for OMV (passive voice)
Put the short string by the tape. Put the red block on the plate.	13	1 for verb (put), 1 for article (the), 1 for adjective (short), 1 for noun (string), 1 for preposition (by), 1 for article (the), 1 for noun (tape), 0 for repeated verb (put), 1 for article (the), 1 for article (red), 1 for noun (block), 1 for preposition (on), 1 for article (the), 1 for noun (plate)
Put the penny, the fork and the key on the plate.	13	1 for verb (put), 1 for article (the), 1 for noun (penny), 1 for article (the), 1 for noun (fork), 1 for conjunction (and), 1 for article (the), 1 for noun (key), 1 for preposition (on), 1 for article (the), 1 for noun (plate), 2 for one noun exceeding the two noun list (penny, fork, key)
Put the yellow block and the short string in the red cup. Push the tape.	15	1 for verb (put), 1 for article (the), 1 for adjective (yellow), 1 for noun (block), 1 for conjunction (and), 1 for article (the), 1 for adjective (short), 1 for noun (string), 1 for preposition (in), 1 for article (the), 1 for adjective (red), 1 for noun (cup), 1 for verb (push), 1 for article (the), 1 for noun (tape)
If you are hungry, put the plates that belong to Mom on the old black stove.	16	1 for conjunction (if), 0 for pronoun (you), 1 for verb (are), 1 for adjective (hungry), 1 for verb (put), 1 for article (the), 1 for noun (plate), 1 for plural marker (s), 1 for relative pronoun (that), 1 for verb (belong), 1 for preposition (to), 1 for noun (mom), 1 for preposition (on), 1 for article (the), 1 for adjective (old), 1 for adjective (black), 1 for noun (stove)
Put the short string, the penny and the key in the blue cup. Put the fork beside the book.	20	1 for verb (put), 1 for article (the), 1 for adjective (short), 1 for noun (string), 1 for article (the), 1 for noun (penny), 1 for conjunction (and), 1 for article (the), 1 for noun (key), 1 for preposition (in), 1 for article (the), 1 for adjective (blue), 1 for noun (cup), 0 for repeated verb (put), 1 for article (the), 1 for noun (fork), 1 for preposition (beside), 1 for article (the), 1 for noun (book), 2 for one noun exceeding the two noun list (string, penny, key)

Appendix D
Condition Two Directions Presented to the Children

Directive	Point Value
Set A*	
Touch the cup.	3
Put the pencil on the plate.	6
Put the red block on the string.	7
Put the pencil and the cup on the book.	9
Set B*	
Put the yellow block in the red cup.	8
Put the tape on the book. Put the penny on the car.	11(a)
Put the long string and the red cup on the book.	11(b)
Before you pick up the book, put the car on the plate.	11(c)
Put the long string and the short pencil in the red cup.	12
Put the penny, the fork and the key on the book.	13(a)
Put the short string by the tape. Put the red block on the plate.	13(b)
Before you put the tape on the book, put the car on the penny.	13(c)
Put the long pencil and the car on the book. Put the penny on the plate.	15(a)
Put the yellow block and the short string in the red cup. Push the tape.	15(b)
Put the red and yellow blocks on the blue paper and put the long string beside the white paper.	18
Put the penny, the car and the tape in the blue cup. Put the fork on the plate.	19(a)
Before you put the fork and the penny on the book, put the car and the key on the plate.	19(b)
Put the yellow block, the car and the fork on the red paper. Put the penny beside the book.	20
Put the short pencil beside the red cup, put the long string under the blue paper and put the yellow block beside the red block.	22
Before you put the long string and the yellow block in the blue cup, put the red block and the short pencil on the white paper.	24

* For Set A directives, the following items were arranged in order in front of the child in two lines: a cup, a piece of notebook paper, a book, a short string, a plate, a pencil, a yellow block, a red block, and a penny.
** For set B directives, the following items were arranged in order in front of the child in three lines: a yellow block, a key, a red cup, a long string, a short pencil, a book, a piece of notebook paper, a long pencil, a roll of tape, a blue cup, a red piece of paper, a fork, a red block, a penny, a toy car, a plate, a piece of blue paper, and a short string.