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SPA 6918: Independent Research

**Analysis of Macro-Linguistic Structures in Narrative Discourse of Aphasia.**

**Abstract:** While observing clients with aphasia undergoing standardized testing, both client and clinician endured extensive time and effort to establish the results. Standardized testing examines explicit responses along with detailed analysis which weighs heavily on client and clinician. The present study seeks to determine if a more effective means of testing is possible by examining broad areas of language and using a time efficient and objective scoring system. Studying video narratives of 12 clients with aphasia, a proposed method, analyzing at mentioned events, sequencing, and information within events, was compared to scores of standardized tests. Significant findings between several standardized scores and proposed method scores indicated that classifying clients with aphasia is plausible without the need for labor intensive testing. Limitations in the current study and need for further investigation suggest the need for further research before methods can be used in a clinical environment.

**1.1 Introduction**

Classifying clients with aphasia is a fatiguing process for both the client and clinician. After reviewing multiple samples of narratives, several commonalities in the overall structure seemed to be prominent in the different forms of aphasia. This brought forward the curiosity of investigating broad aspects of these narratives to determine if potential similarities in the classification of aphasia. However, it has been stated that analyzing these broader factors of narrative are challenging existed.“ A fundamental problem in analyzing narrative discourse is determining if there can be and how to represent an objective and rule-governed manor to determine the appropriateness on how one utterance is followed by another.” (Labov, 1972). In Labov’s release of Socialinguistic Patterns, the complexity of measuring linguistic discourse and the variability of narratives in a macro-linguistic structure level was addressed. For example, it is difficult to quantify one’s ability to properly transition from one topic to another. It is also difficult to quantify one’s ability to provide adequate information in order to develop a complete and coherent narrative. When observing clients with language disorders such as aphasia, the symptoms of their disorder will likely interfere even more with their ability to relay the information in a narrative to every listener then a speaker without a disorder. Details more narrow linguistic structure (e.g. lexical, grammatical processes, and types of words used) of aphasic speakers have been studied intently. However there is a need to further investigate the broader structure. With these brief pieces of information as the foundation for this investigation, I will attempt to determine if reviewing only a few short narratives can still find a comprehensive classification of aphasia without fatiguing the client or clinician.

**2.1 Literature Review**

In order to sort the information gathered for the literature review and investigation, it is important to understand the differences in the data which are sought after. Many studies have been found that categorize speech samples on the word level which would compare the use, misuse, absence, paraphasias, perseverations, and morphological structure of the words within the narrative. While attempting to develop a time effective method for diagnosis, these data require extended time to sort and measure. For the purpose of this investigation, these types of studies will be considered to be focusing on micro-structures of language due to their need to look at smaller parts of the narrative to collect data. The purpose of this investigation is to focus on a macro-structure of language which will have a broader spectrum of the language use and will be identified and analyzed without need for detailed transcriptions. Aspects of macro-structures will be considered the general collection of presented information, consistency of information, and order of information that is necessary for a cohesive narrative.

In a search to find studies that have explored a similar focus, a study was found by Andreetta, Cantagallo, & Marini in 2012 which focused on a population of ten people with anomic aphasia to determine if the symptoms of their aphasia reflected a lexical disorder or were a sign of difficulty on a macro-linguistic or micro-linguistic level. Ten controls were gathered with age and level of formal education matched. The subjects were introduced to one picture stimuli and two cartoon picture sequence stories with six pictures per story. They were asked to provide a narrative description. Each narrative was analyzed for units, words, speech rate, and MLU. Using the parameters gathered, the investigators developed an index that reflected the cohesiveness of the narrative. This was made by combining several indexes of errors into one. That index was a combination of the misuse of gender agreement, misuse of function words or semantically related content words, sentence completion, and the variables of topic transition from one utterance to another. The results indicated that the aphasic population displayed more errors in global cohesiveness then local cohesiveness. Global cohesiveness was defined as having events at the beginning of a narrative concluded by the end of the narrative. Local cohesiveness was defined by how events present a matching relationship from one event to another. Each sample was also analyzed for a value called “informativeness” which was a number representing the average quantity of details used in the narrative. It was noted that the aphasic group did not vary from the control population for informativeness. This study’s main focus was on the local vs. global cohesiveness of the narratives and only facilitated the informativeness as additional support data. However the informativeness did provide a consistent outcome in the study when compared to the control data. When determining if a method of quantifying macro-structures can be used from this study, I found that all scores were comprised of measurements from the analysis of micro-linguistic structures. By using the micro-structures to determine macro-structures, the investigation required using a detailed analysis in order to quantify its results. This study supports the need to simplify the quantification of macro-structures. This study also provides the suggestion that perhaps a measure of informativeness should be found for consistency.

A search was conducted to find studies which have attempted to quantify macro-structures of linguistics. A study by Capilouto, Wright, &Wagocivh in 2006 investigated a way to quantify the deficits in macro-structures in an aphasic population by developing a checklist system. This system was used to determine the participant’s ability to recall the main events throughout a narrative. The study observed eight participants diagnosed with aphasia compared to eight neurologically intact controls matched for age and education. The discourse task involved presenting each participant with two pictures which they were asked to provide a narrative explanation of and two picture story sequences. Based on the performance of the control speakers, the authors developed a listing of main events that reflected the most commonly mentioned events in each of the stimuli. These events were treated as the ‘target’ events for subsequent quantification of the aphasic samples. Maximum score for these tasks was 24 events throughout all the presentations with one point being awarded when the participant mentions one of the target events. Each participant was rated for the total number of events listed after the prompt. The results of this study indicated the aphasia group was less capable of expressing main events than the control group. This study also provided insight on a time efficient method for calculating a participant’s macro-structures. However the study focused only on participant’s ability to recite events but did not specify if they were organized and presented in a cohesive manor. Further searching was required to determine a more detailed analysis.

Ash, McMillan, Gross, Cook, Morgan, Boller, & Grossman (2011) presented a method of analyzing macro-linguistic structures in oral narratives by using three gross categories of narrative organization. The study used languages samples elicited from of 32 speakers with Lewy body spectrum disorder (LBSD). The participants were required to tell the story of a wordless picture book and their speech was analyzed. Specifically, the narrative descriptions were analyzed based on three aspects: *search theme, local connectedness,* and *global connectedness.* Search theme referred to the participant’s ability to mention the necessary events of the story which would give the listener the main idea of the story. A set number of critical events were pre-determined by reviewing the broad plot of the story. The events used were critical to the flow and comprehensions of the story and, therefore, were expected to be mentioned. The participants were scored for the total number of events mentioned. Local connectedness referred to the participants’ ability to connect the one utterance to the next utterance by providing some form of joining word or statement so that eventswere connected to each other throughout the narrative. The third category was global connectedness which referred to the narratives’ consistency of information from events to events. To obtain a credit for this measurement, the same characters, locations, and events all needed to be consistent from the beginning of the story to the end. However this measurement was subjectively measured and was scored as either present or absent. Although the population was not aphasic, the methods used in this study could be adapted for the purpose of this investigation.

A method called Narrative Assessment Profile (NAP) was described by McCabe and Bliss (2003) to evaluate discourse coherence among speakers with aphasia. Language samples were collected from speakers with European, Asian, Spanish, and African American descents and briefly described in the aphasic speakers. The narratives were measured in three macro-structure categories: *topic maintenance, event sequencing, informativeness,* and three micro-structure categories: *referencing, conjunction cohesion,* and *fluency*. For the purpose of this investigation, a review on the macro-structures were of this method was conducted. Topic maintenance was defined as one’s ability to remain on a topic and avoid tangential rambling or complete loss of topic. In addition, it reflected one’s ability to relate all utterances to a central topic. Narratives were marked for this measurement as being present not- present, or needs further study Event sequencing referred to one’s ability to present the narrative in an organized manner, either logically or chronologically. Note that tangential discourse was not penalized for event sequencing as long as there was a logical or chronological order to the sequences mentioned. Narratives were marked for this measurement as being present not- present, or needs further study. Finally, informativeness addressed the narrative content for its ability to make sense. Narratives were marked for this measurement as being appropriate, inappropriate, variable, or needs further study. For the purpose of the current investigation, the NAP method was concluded to be the most effective means to analyze narrative discourse produced by typical adults as well as those with aphasia across all demographics. More importantly, the results of this study demonstrated the ability of the NAP to analyze difference among narratives in a variety of subjects. However it does not directly present clinically relevant information with the use of the data collected.

**2.2 Aims**

The current investigation proposes the development of an analytic system that focuses on the macro-linguistic structures of narratives from people with aphasia. The following were three aspects of macro-linguistic structures chosen for this investigation: *search event, event sequencing, and informativeness*, *Search event* would allow one to measure the number of important events provide within the narrative that were necessary to portray the narrative in a coherent manor. *Event sequencing* would reflect the individual’s ability to organize and arrange the events in a logical manner that would allow listeners to understand the order or process of the events. *Informativeness* would quantify the lexical use of the events that allowed listeners to understand what is happening within each event and if they relate to other events.

Unlike the reviewed studies, this investigation will attempt to use a modified system to quantifiably measure the coherence of a narrative and compare that to the type of aphasia in a minimally fatiguing process compared to standardized testing. The approach will potentially allow a clinician to review the narrative and effectively classify a client in a timely manner. It is hypothesized that the results would provide useful indicators for clinicians when determining the appropriate form of treatment for clients with aphasia.

**3.1 Participants**

Participants were six male and six female speakers with a previous diagnosis of aphasia. Eleven of them were Caucasian and one was Hispanic. They aged between 29.9 and 73.6 years, one left-handed and eleven right-handed. All of them were pooled for the Talkbank.org’s AphasiaBank research (Mac Whinney, Fromm, Forbes & Holland, 2011)and therefore were initially tested under the AphasiaBank protocols while meeting their entry criterion. All twelve participants in the test population have been clinically evaluated for aphasia using the *Western Aphasia Battery- Revised* (WAB; Shewan & Kertesz, 2007). Table 1 shows the demographic information of the participants. According to self-reports there were no previous reports of neurological or psychological illness. Medical reports and entry surveys indicated all participants suffered a single left hemispheric stroke, have passed a hearing screening, and were proficient in the English language. A control group was formed to establish normative data for comparison purposes. These were also pooled from the Talkbank.org’s AphasiaBank research database (Mac Whinney et al., 2011) that was randomly selected. Each participant from the control group was initially tested under the AphasiaBank protocols while meeting their entry criterion. According to self-reports there were no previous reports of neurological or psychological illness, have passed a hearing screening, and were proficient in the English language. Table 1 shows the demographic information of the control participants.

Table 1: Participant data.
Sample

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Subject | Gender | Age | Years of education | Aphasia Type | Aphasia Quotient | Occupation | Time-post-onset (years) |
| F1 | M | 65 | 12 | Ano | 84 | n/a | n/a |
| F2 | F | 73.6 | 14 | Con | 60.7 | Project Manager | 1 |
| F3 | F | 29.9 | 14 | Con | 82.1 | n/a | 3.4 |
| F4 | M | 49.3 | 14 | Ano | 90.8 | Manager | 4.2 |
| F5 | M | 66.2 | 16 | Wer | 53 | Engineer | 3 |
| F6 | F | 49 | 12 | Ano | 54.3 | Waitress | 8.9 |
| F7 | F | 55.2 | 16 | Con | 88.4 | Real Estate Broker  | 5.4 |
| F8 | F | 69.5 | 14 | Ano | 91.9 | Computer Programmer | 5.8 |
| F9 | M | 62 | 12 | Ano | 88.8 | Mechanic  | 6.5 |
| NF1 | M | 64.3 | 12 | Bro | 48.8 | Manager | 22.8 |
| NF2 | M | 37.7 | 16 | Bro | 54.7 | Geophysicist  | 1 |
| NF3 | F | 30.7 | 14 | Bro | 72.8 | n/a | 1.9 |

Control

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subject | Gender | Age | Years of education | Occupation |
| C1 | M | 74.5 | 20 | College History Professor |
| C2 | F | 76 | 12 | Realtor |
| C3 | M | 71.5 | 16 | Mechanical Engineer |
| C4 | M | 89.5 | 16 | Realtor |
| C5 | F | 71.7 | 13 | n/a |
| C6 | M | 73.5 | 18 | Teacher |
| C7 | F | 81.5 | 12 | Graphic Artist  |
| C8 | M | 75.6 | 18 | Social Worker |
| C9 | F | 36.8 | 14 | Banquet Server |
| C10 | M | 41 | 12 | Advertising  |

**3.2Procedures**

To gather narrative discourse samples, each participant underwent a series of verbalized tasks which were recorded on Sony AVCHD 1080p Handycams with Sony ECMHW2 Bluetooth Microphones. Participants were presented with the following stimuli to elicit narratives following the protocols of Mac Whinny et al. (2011): Refused Umbrella story, Cinderella story, Peanut Butter and Jelly Sandwich. The Refused Umbrella involved presenting a six-picture sequence to the participant s, who was asked to provide a narrative using the pictures that had a beginning middle and an end. The Cinderella story was elicited by providing a stimulus book of only pictures that depicted the story. The book was then removed and participants were asked to tell the story of Cinderella from what they had observed and from what they previously knew about the story. The Peanut Butter and Jelly Sandwich protocol was elicited by asking the participants to recite how to make a peanut butter and jelly sandwich.

In order to gather an in-depth analysis of the sample populations’ aphasia deficits, all participants underwent the following tests in addition to the WAB-R: 1) The *Object and Action Naming Battery* (OAB’s Druks & Masterson, 2000) provided an in-depth analysis of the participants word retrieval ability. The OAB consisted of 162 pictures targeting nouns and 100 pictures that targeted verbs. 2) The Pyramids and Palm Trees Test (Howard &Patterson, 1992) was used to reflect the participants’ associative relationship skills. The test was presented in two forms. While the first form involved the use of three printed words with two of them having a semantic relation, the second presented the same stimuli in a picture format. This test therefore provided insight into how intact or hindered the client’s ability was in recognizing semantic relationships from orthographic lexical and visual decoding. 3) A Spoken word-Picture Matching task and a Written Word-Picture Matching task, compiled using the picture stimuli in Snodgrass and Vanderwart (1980), was also conducted. These tasks presented the participant with a written or spoken target word and three pictures: one of the target words, of a distracter, and one irrelevant. These two matching tasks provided information about the participants’ visual-lexical and auditory lexical abilities.

**3.3 Data analysis**

Several existing methods of quantifying narrative discourse have been researched to determine the appropriate quantification system for this investigation. In particular, each analytic method reported in the studies mentioned in the Literature review section was independently evaluated for appropriateness of outcome, evaluation time, and consistency of results. The category of search theme form McMillan et al. (2011) provided the most efficient definition and method to addressing the main events of a narrative needed for coherence. For this investigation we will reference this as search events. McCabe and Bliss’s (2003) definition of event sequencing provided the most efficient definition and method of addressing the consistency of a narrative to follow a coherent pattern. McCabe and Bliss’s (2003) definition of informativenesss provided the most in-depth definition of detailed information needed to form a coherent narrative.

3.3.1 Search Event

In order to have a cohesive narrative, the narrative must contain the events needed to relay the information. To quantify the events needed for the receiver to follow, a binary system similar to the one used by Capilouto, Wright, and Wagovich (2006) was proposed to determine the presentation of main events needed to develop a cohesive narrative. Data from the control group were review and transposed into the expressed t

The most frequently occurring events, i.e., the events listed by individual speakers were reviewed for commonalities to devise a listing of events. Events are referred to as ‘actions of sufficient importance to the narrative as a whole and are separate from other actions in the narrative’ (p.207, Capilouto et al.,2006).

To select the events for the analysis, language samples from the control group were divided into the main events that were most commonly presented which will be referred to as e.freq. For the Refused Umbrella and Peanut Butter and Jelly narratives, the frequency of occurrence of the events must succeed to be used was 80% or higher. For the Cinderella story, the frequency of occurrence of the events must succeed to be used was 70% or higher. These criteria were formed from reviewing the results of the control group. The increase in tolerance for the Cinderella story was created to accommodate two additional factors. First while reviewing the control group, it was noted that two different versions of the Cinderella book were presented between different clients. Therefore some participants had more stimuli to build their narrative from. Second, the increase in tolerance also allowed for a more detailed analysis of collected data. Of the ten listed events, four were presented in 70% of the narratives. To calculate the scores for search event the following will be accounted for:

* (e.total) A point was given for the total mentioned events by the participant using the initial criteria, which is an event that is independent from the other events in the narrative.
* (e.match) A point was given for each event mentioned that matched the most frequent occurring events collected in the control group. (e.match/efreq = match score)
* (e.miss)A point was given for each event that occurred in the most frequent occurring events collected in the control group but was not mentioned. (e.miss/efreq = miss score)
* (e.irr) A summary score was given for the total number of events which were irrelevant to the narrative. These were events which were of no sufficient importance to the narrative as a whole and were independent from other events in the narrative
* (e.extra) Another summary score was given for the total number of extra events which were mentioned in the narrative. These were events which were of sufficient importance to the narrative as a whole and were independent from other events in the narrative but did not occur in the most frequent occurring list from the control group.(e.total – (e.freq– e.irr) = extra score)

A chart of events can be seen in appendix A

3.3.2 Event sequencing

In order for a narrative to have been comprehensible, the events listed must be formed in a logical order to which the listener can follow. This order can be chronological to the event or systematical to the procedure. To quantify the participants’ ability to present the events of a narrative in a logical order, a scoring system was devised for event sequencing. Data were collected from the control group using e.freq and the order in which they appeared. An event sequences were established for each narrative. The order for events sequencing was created for by following common order of events in 90% of the e.freq. Listing of event order is given in Appendix B.An individual score will be given to each narrative for sequencing. Scoring for event sequencing (s.total) will develop a percentage of correct order using the following criteria:

* A sequence was counted accurate if events were presented in the correct order(e.g., e.1 to e.2 =1 or e2 to e.3 =1)
* A sequence was still counted if the events were presented in the correct order with missing or skipped events (e.g., e.1 to e.3 =1 )
* If an event was mentioned out of order, it was not counted towards the final score (e.g., e.2 to e.1 = 0), but the number of violated event order was tallied If an event was mentioned in repetition, no additional points were awarded or penalized.
* If a self-correction occurred, the scoring was based on the final order in the language sample.
* (s.count) is the sum total of all the event sequences that matched the criterion above.
* Total number of points are divided by total events used in search event score (s.count /e.match = s.total)
* Scores were not penalized for e.irr or e.miss.

A chart of sequences can be seen in Appendix B

3.3.3 Informativeness

The presence and location of events in a narrative allows the narrative to exist and have logic to the presentation. To fully gather a cohesive narrative, a third dimension of consistent information must be present. In order to quantify the narratives for *informativeness*, each narrative was analyzed for the presence and the correct employment key lexical items required for each event, similar to the procedures used in the NAP system (McCabe& Bliss 2003). However, unlike the NAP system, a count of the lexical items used will be collected for different categories of lexical items (e.g., specific characters, objects, locations, actions, and times) mentioned within the event. A list of lexical items for each event was generated from the control population (See Appendix C). The following criteria were used for scoring lexical informativeness:

* Each lexical item was directly mentioned at least once within the event
* A synonym or alternative form of the target item is acceptable.
* If a name or label is used, it may be followed by a pronoun and receive credit as one lexical item.
	+ e.1 The mother waved
	+ e.2 she was still waving.
* If a lexical item is labeled differently in two or more events, then the items label with the highest frequency will be used to compare to the control data. Otherwise the item does not receive credit.
	+ e.1: the boy went to school
	+ e.2 the girl got rained on
	+ e.3 the boy returned home
	+ “boy” will be used as the items label.
* If the item is mentioned differently is two or more events and does not have an outstanding mention then none of the instances will be counted.
	+ e.1: the boy went to school
	+ e.2 the girl got rained on
	+ e.3 the kid returned home
	+ None of the labels will be used and the participant will not receive credit.
* If a self-correction occurs, the final production in that event will be used for scoring.

A chart of lexical items can be seen in appendix C

**3.4 Statistical analysis:**

A Pearson product-moment correlation coefficient was used to compare standardized tests scores to the scores generated for this investigation. A correlation with a value of p>.005 or better was considered to be significant in the findings. The purposes of theses scores are to show any correlation of the proposed method scores and existing standardized methods. For the purpose of this investigation, templates and transcriptions from the AphasiaBank were used to keep track of scores. Examples of the transcriptions used with the templates can be found in appendix D, E, F and G.

**4.2 Results**

4.2.1 Proposed Method score analysis.

The mean, standard deviation, and range for each group’s values are reported in Table 2. A comparison between the values of the fluent and non-fluent group is reported in Table 3. A significant correlation was found between each group for s.total. A review of the means and SD of s.total reveals that the scores for s.total showed a wide spread of scores. Given the s.total scores dependence on e.match, the resulting s.total score did not provide substantial opportunity for error which would cause the scores to result in a “all or nothing” display. A significant correlation was found between each group for i.total. This may represent a potential constant while comparing scores to standard testing.

Table 2: Descriptive Summary of Participants Performance

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | e.total | e.match | e.miss | e.irr | e.extra | s.total | i.pb&j | i.umbr | i.cind | i.total |
| F | Mean | 76.56 | 14.11 | 6.89 | 5.89 | 11 | .78 | 7.67 | 8.44 | 11.67 | 27.78 |
|  | Standard Deviation | 17.22 | 4.28 | 4.285 | 4.98 | 6.55 | .44 | 4.35 | 2.65 | 6.36 | 9.51 |
|  | Range | 54-7 | 19-4 | 17-2 | 14-1 | 21-1 | .842-0 | 15-0 | 13-4 | 21-2 | 41-10 |
| NF  | Mean | 21 | 5.33 | 15.67 | 11.33 | 4.33 | .33 | 3.33 | 3 | 3 | 9.33 |
|  | Standard Deviation | 10.44 | 1.15 | 1.15 | 5.13 | 4.93 | .57 | .577 | 1 | 1.73 | 1.52 |
|  | Range | 33-14 | 6-4 | 17-15 | 17-7 | 10-1 | .8-0 | 4-3 | 4-2 | 5-2 | 11-8 |
| All | Mean | 28.5 | 12.62 | 9.08 | 7.25 | 9.33 | .67 | 10.69 | 12.54 | 22.31 | 45.54 |
|  | Standard Deviation | 14.17 | 5.76 | 5.41 | 5.37 | 6.69 | .49 | 15.354 | 19.93 | 46.62 | 81.43 |
|  | Range | 54-7 | 19-4 | 17-2 | 17-1 | 211 | .841-0 | 15-0 | 13-2 | 21-2 | 41-8 |

*Note:*F= Fluent aphasia group, NF= Non-fluent aphasia group, All = all aphasia participants,i.pb&j = informative score of peanut butter and jelly, i.umbr = informative score of Umbrella Refusal, i.cind =informative score of Cinderella, i.total = sum of all informative scores

Table 3: Statistical Comparison(t-test) between performances of F and NF

|  |  |
| --- | --- |
|  | t-test |
| e.total | -.273 |
| e.match | .954 |
| e.miss | .954 |
| e.irr | -.666 |
| e.extra | -.400 |
| s.total | -1.0\*\* |
| i.total | .999\* |

*Note:* \*p>0.05, \*\*p>0.01, \*\*\*p>0.001

4.2.2 Scores of standardized tests verse proposed method scores analysis

A comparison between the values of the standardized testing and proposed method scores are reported in Table 4. There was a notable correlation between WAB AQ scores and informativeness scores which may reflect the client’s general expressive language abilities. There is a significant correlation between the three WAB spontaneous speech scores (content, fluency, and total,) to the e.match score and the informativeness scores which suggests that the event all matching and informative scores consistently relate to the WAB.

Table 4: Correlation between the performance scores of the standardized tests and proposed method scores in participants

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | e.total | e.match | e.miss | e.irr | e.extra | s.total | i.pb&j | i.umbr | i.cind | i.total |
| WAB: AQ | .107 | .536 | -.536 | -.449 | .154 | .236 | .686\* | .597\* | .584\* | .758\*\* |
| WAB: spontaneous Speech | .354 | .815\* | -.815\*\* | -.391 | .404 | .404 | .761\*\* | .824\*\* | .659\* | .849\*\* |
| PPTT: picture | -.325 | -.236 | .236 | -.279 | -.273 | -.098 | -.049 | -.058 | -.113 | -.100 |
| PPTT: word | -.086 | -.032 | .032 | -.161 | -.026 | .130 | .023 | -.030 | .158 | .091 |
| SPWM | -.285 | -.119 | .119 | -.326 | -.246 | -.042 | .156 | .064 | -.023 | .062 |
| WWPM | -.284 | -.188 | .188 | -.246 | -.252 | -.122 | .126 | .012 | -.074 | .006 |
| OAB: action | .134 | .469 | -.469 | -.335 | .174 | .050 | .700\* | .508 | .489 | .683\* |
| OAB: object | -.74 | .328 | -.328 | -.520 | -.005 | .086 | .650\* | .432 | .445 | .617\* |

*Note* :i.pb&j = informative score of peanut butter and jelly, i.umbr = informative score of Umbrella Refusal, i.cind =informative score of Cinderella, i.total = sum of all three informative scores. \*p>0.05, \*\*p>0.01, \*\*\*p>0.001

4.2.2 Inter/intra rater reliability.

To assess the reliability of the proposed method scores, an analysis of variance (ANOVA) was run for inter-rater and intra-rater scores. A correlation with a value of p>.005 or better was considered to be significant in the findings. Inter-rater assistant was trained by the lead investigator in scoring and testing protocols. Inter-rater assistant observed the video footage of the testing while using the digital transcripts provided by the AphaisaBank to complete the templates for scoring.

Table 5: Reliability measures of proposed method scores

|  |  |  |
| --- | --- | --- |
|  | Inter-rater reliability | Intra-rater reliability |
| e.total | .864 | .990 |
| e.match | .977 | 1.00\*\* |
| e.miss | .977 | 1.00\*\* |
| e.irr | .592 | .991 |
| e.extra | .999\* | .998\* |
| s.total | .-980 | .989 |
| i.total | .975 | .979 |

*Note:* \*p>0.05, \*\*p>0.01, \*\*\*p>0.001

**5.1 Discussion**

5.1.1 General

The aim of this investigation was to determine if a more time efficient and objective means of classifying clients with aphasia by analyzing the macro-structures of language was possible. Previous studies found depended on transcriptions which lead to a time consuming effort for scoring or had scoring systems that were subjective and non-quantifiable. The current investigation sought to find an effective means of adapting and improving other researched methods of analyzing macro-structures which could be used for classifying aphasia types. Capilouto et al.’s search event method was critical in the development of search event for this study. However, this study expanded to also calculate events that were additional to the main events, irrelevant, and a total number of events mentioned. Although the study did not reveal and significant correlations with the sequence of the events, previous studies did not investigate this aspect. The NAP system provided great frame work for the informativeness portion of this study and was improved have more objective measures. This system produced the most significant findings during this investigation.

As per the results, it is suggested that there may be a means to perform such analysis as intended for this study. Specifically, when comparing scores of informativeness, there were several correlations to the clinically found WAB spontaneous speech and WAB AQ scores. The WAB has long been used in clinical settings for classifying aphasia types in an objective manor which suggests that the proposed methods could lead to an improvement on current testing methods while still remaining reliable. From a clinical perspective, it may be possible to conduct testing in a more informal manor which will bring several benefits. First, clients with test anxiety will better portray their abilities during testing. During this investigation, test anxiety caused one participant to dismiss themselves prior to completing all testing. Second, by improving the time efficiency of testing will also contribute to accuracy by minimizing fatigue for client and clinician. Third, the use of videotaping allows the clinician to collect data without missing other clinically important information during testing such as behaviors or answers which clinician missed while scoring. Forth, videotaping also allows for scoring to take place expo-facto. This will allow a more relaxed testing environment because the clinician does not have to keep scoring, take notes, or hide answer sheets during testing. The use of a more informal, conversational style testing can yield multiple benefits for both client and clinician. This study will contribute to the pursuit of this method in the aphasic population.

 As per the results, the proposed measures for informativeness and the OAB object and OAB action suggested a correlation between the two outcomes. This match was anticipated due to the nature of each test requiring the participant to recite specific lexical items. However, the correlation does support the validity of the lexical items used for the informativeness score.

When reviewing the comparison test of F vs NF for proposed methods of scoring, there are only two tests that indicated a correlation. Test may have been affected by the small sample size of the NF population. The F population also scored higher on e.match which allowed more opportunity for scoring in the following scores of s.total and i.total.

The proposed method was sensitive to the participants’ ability to be fluent. Scores in the NF population tend to be much lower due to their ability to score in e.match which then provided opportunity for score/errors in s.total and i.total. As compared to methods found in the literature, the proposed methods offer a more quantifiable and more detailed analysis of the participants’ language abilities by providing numeric values where other methods used subjective values such as in the NAS system. The proposed method also offered simplicity in obtaining scores which was an improvement to scores from studies such as Ash et al., 2011.

5.1.2 Limitations

 This investigation is limited by several factors. It should be noted that testing conducted over the course of 5 months in which some clients were receiving therapy. Narrative tasks were elicited within 3 weeks of the WAB which showed the most correlations during this investigation. Additional testing such as OAB was conducted in the latter portion of data collection which may have contributed to some insignificant findings when performing the statistical analysis. While direct instructions, training, and supervision were present, over 30 graduate student clinicians participated in the data collection during multiple testing dates. This caused difficulty with score checking and collection thus opening the opportunity for errors to be overseen.

When viewing the videos for the control data, additional differences that were noted. Control data was derived from different pooling locations which notably presented stimuli is different manors. Some locations used in the control population had used a different rendition of the Cinderella story which contained less pages and no color. The scripted instructions for the Umbrella story were not read as per the AphasiaBank protocol in some cases of the control population. This may have an effect of the outcome scores for informativeness for the worse and scores may be more reflective then the collected if done by similarly trained investigators with similar protocols. This may have also affected the event scores by limiting the scored events in the proposed method scores.

5.1.3 Inter-rater

 A collaborative discussion was held to refine scores on the inter-rater reliability. After the initial scores were returned, a decision was made to provide a cooperative video viewing with guidance of the narratives in order for the investigators to better understand the tests and scoring systems. After the meeting, a new set of inter-rater reliability scores were submitted which yielded more consistent results. It was also noted that the use of Aphasiabank transcripts require training for use due to the additional coding information used on the transcripts at this time.

5.1.4 Further investigation suggestions

 This investigation brought forth additional questioning which could better define the methods proposed and provide additional clinical value. Future investigations should include an increase in sample size as priority to improve accuracy. A more specifically the increased sample size should include more categories of aphasia including global, transcortical sensory, and transcortical motor. Several tests used during this investigation displayed insignificant results which for future testing can be dismissed in order to reduce on testing time and allow the participants to complete testing in one session rather than the three sessions as used in this investigating. Additional data from the control population may reveal correlations not investigated in this study such as the number of irrelevant events, extra events, and total events.

Some participants were engaged in regular therapy sessions which could have affected scoring in later parts of test collection. A comparative control group by age, gender, and education should also be developed for future investigations in order to better refine what events are scored. With a better controlled pilot study I feel that there may be more data points which will increase accuracy.

This investigation also brought attention to the idea of using untrained observer’s and if the observers are able to comprehend the narratives. This was concept was brought to attention during the inter-rater reliability portion when the investigator was never exposed to the narrative portion of testing and was having difficulty with initial scoring. After reviewing the videos with guidance, scoring was more effective and displayed more consistent results which may suggest that some levels of comprehension could be assessed with untrained observers.

**5.2 Conclusion**

Adults with aphasia are often fatigued when enduring prolonged testing which was noted by some of the student clinicians during testing. Investigating new ways of diagnosing and classifying deficits without over exerting the client will be crucial for accuracy of testing and building client-clinician relationships for therapy. From a clinical perspective, significant correlations were found during testing but additional investigations will be needed to be able to fully apply these methods. These findings do however suggests that it may be plausible to classify clients during guided narratives rather than traditional testing.

**5.3 Acknowledgments**

Thank you to all of the participants for their contribution to this investigation and the AphasiaBank database. A special thanks to Dr. Audrey Holland and Dr. Margie Forbes for extending the opportunity to The University of Central Florida’s Aphasia House to participate in the AphasiaBank project which influenced the current investigation. Additionally I would like to acknowledge all UCF graduate students that participated in the data collection especially Danielle Hills whom contributed additional efforts for the investigation and inter-rater reliability.

This investigation is dedicated to the loving memory of Dr. Raymond “Bruce” Blake and Tang Soo Do Master Robert Massaroni. Both men are highly inspirational icons and were dedicated to helping others with integrity and without bias.

**5.4 Declaration of interest**

The author reports no conflicts of interest. The author alone is responsible for the content and writing of the paper.**6. References**

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**Appendix A**

**Search Events**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Umbrella Refusal**  | UE.1Women warns boy. | UE.2Refused umbrella | UE.3Begins to rain | UE.4Boy returns home | UE.5Accepted the umbrella | UE.6Coda |  |  |  |  | Extra Events | Irrelevant Events |
| **Peanut Butter and Jelly** | PE.1Get ingredients | PE.2Apply peanut butter | PE.3Apply jelly | PE.4Fold together | PE.5Coda |  |  |  |  |  | Extra Events | Irrelevant Events |
| **Cinderella** | CE.1Mention of sisters | CE.2Mention Cinderella is a servant | CE.3Invitation to Ball | CE.4God mother appears | CE.5Cinderella goes to the ball | CE.6Cinderella and prince interact | CE.7Slipper is lost | CE.8Search for slipper owner | CE.9Fit check slipper | CE.10Coda | Extra Events | Irrelevant Events |

**Appendix B**

**Event Sequence**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequences** | US.1 | US.2 | US.3 | US.4 |
| Umbrella Refusal | UE.1 to UE.2 or UE.3 or UE.4 or UE.5 | UE.2 to UE.3 or UE.4 or UE.5 | UE.3 to UE.4 or UE.5 | UE.4 to UE.5 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequences** | PS.1 | PS.2 | PS.3 | PS.4 |
| PB&J | PE.1 toPE.2 or PE.3 or PE.4 or PE.5 | PE.2 toPE.3 or PE.4 or PE.5 | PE.3 to PE.4 or PE.5 | PE.4 to PE.5 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sequences** | CS.1 | CS.2 | CS.3 | CS.4 |
| Cinderella | CE.1 toCE.2 or CE.3 or CE.4 or CE.5 | CE.2 to CE.3 or CE.4 or CE.5 | CE.3to CE.4 or CE.5 | CE4 to CE.5 |

**Appendix C: Tables of Informative lexical items by narrative and event**

**Umbrella Refusal**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Umbrella |  |  |  |  |  |  |  |  |  |  |  |
| **UE1 (warning)** |  | **UE2 (refusal)** |  | **UE3 (rain)** |  | **UE4 (return home)** |  | **UE5 (accept)** |  | **UE6 (coda)** |  |
| backpack |  | (doesn’t) need |  | backpack |  | back |  | head |  | dry |  |
| boy |  | get |  | begins |  | goes |  | her |  | goes |  |
| day |  | him |  | getting |  | hands |  | his |  | her |  |
| gave |  | insists |  | goes |  | he |  | mother |  | him |  |
| getting (ready) |  | it |  | he |  | head |  | prove |  | his |  |
| girl |  | mom |  | it |  | his |  | she |  | knows (best) |  |
| going |  | mother |  | rain |  | house |  | succumbed |  | mother |  |
| heading |  | nope |  | school |  | mother |  | takes |  | out |  |
| het |  | refuses |  | she |  | running |  | told |  | school |  |
| him |  | she |  | starts |  | she |  | umbrella |  | send |  |
| leave |  | trying |  | trots |  | wet |  |  |  | she |  |
| mother |  | umbrella |  | walking |  |  |  |  |  | walks |  |
| rain |  | wanting |  | wet |  |  |  |  |  |  |  |
| school |  | waving |  |  |  |  |  |  |  |  |  |
| take |  |  |  |  |  |  |  |  |  |  |  |
| umbrella |  |  |  |  |  |  |  |  |  |  |  |
| warns |  |  |  |  |  |  |  |  |  |  |  |
| UE1 Total | 0 | UE2 Total | 0 | UE3 Total | 0 | UE4 Total | 0 | UE5 Total | 0 | UE6 Total | 0 |

\*Use of alternative vocabulary accepted according to guidelines. **Peanut Butter and Jelly**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sandwich |  |  |  |  |  |  |  |  |  |
| PE1 (get ingredients ) |  | PE2 ( spread PB) |  | PE3 (spread jelly) |  | PE4 (put together) |  | PE5 (coda) |  |
| basket |  | bread |  | bread |  | cut |  | Eat |  |
| bread |  | finger |  | finger |  | finger |  | Give |  |
| buy |  | knife |  | jam |  | fold (over) |  | happy |  |
| drawer |  | on |  | jelly |  | grill |  | It |  |
| go |  | peanut butter |  | knife |  | knife |  | jelly |  |
| home |  | piece |  | on |  | on |  | Peanut butter |  |
| jar |  | put |  | piece |  | peanut butter |  | sandwich |  |
| jelly |  | slice |  | put |  | put |  | serve |  |
| jiff |  | spread |  | slice |  | slap |  | your |  |
| kitchen |  |  |  | spread |  | slice |  |  |  |
| open |  |  |  |  |  | together |  |  |  |
| peanut butter |  |  |  |  |  | top |  |  |  |
| pieces |  |  |  |  |  |  |  |  |  |
| plate |  |  |  |  |  |  |  |  |  |
| refrigerator |  |  |  |  |  |  |  |  |  |
| slice |  |  |  |  |  |  |  |  |  |
| store |  |  |  |  |  |  |  |  |  |
| supplies |  |  |  |  |  |  |  |  |  |
| take (out) |  |  |  |  |  |  |  |  |  |
| utensils |  |  |  |  |  |  |  |  |  |
| PE1 Total | 0 | PE2 Total | 0 | PE3 Total | 0 | P4 Total | 0 | PE5 Total | 0 |

\*Use of alternative vocabulary accepted according to guidelines.

**Cinderella**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Cinderella** |  |  |  |  |  |  |  |  |  |  |  |
| **CE1 (sisters)** |  | **CE2 (servant)** |  | **CE3 (invite)** |  | **CE4 (god mother)** |  | **CE5 (ball)** |  | **CE6 (prince)** |  |
| (two) daughters |  | (do) everything (Negated) |  | (up)coming |  | (magic) wand |  | (on) time |  | (glass) slipper |  |
| characters |  | Cinderella |  | ball |  | appears |  | ball |  | bride |  |
| Cinderella |  | clean |  | bride |  | attic |  | carriage |  | clock |  |
| faces |  | clothes |  | castle |  | carriage |  | Cinderella |  | dance |  |
| family |  | cruel |  | chores |  | clothes |  | dress |  | found |  |
| father |  | dishes |  | decided |  | coachmen |  | everything |  | he |  |
| girl |  | do |  | find |  | discovers |  | horse |  | impressed |  |
| remarried |  | family |  | gala |  | dress |  | party |  | lady |  |
| stepsister |  | girl |  | go |  | fairy |  | pumpkin |  | meets |  |
| they |  | her |  | home |  | find |  | ride |  | midnight |  |
| women |  | look(down) |  | invited |  | furnishes |  | she |  | prince |  |
|  |  | maid |  | king |  | go |  | take |  | problem |  |
|  |  | servant |  | letter |  | godmother |  | there |  | she |  |
|  |  | they |  | looking |  | her |  |  |  | strikes |  |
|  |  | treat |  | not(go) |  | horses |  |  |  | twelve |  |
|  |  | wash |  | palace |  | makes |  |  |  |  |  |
|  |  | work |  | party |  | midnight |  |  |  |  |  |
|  |  |  |  | prince |  | palace |  |  |  |  |  |
|  |  |  |  | received |  | reading |  |  |  |  |  |
|  |  |  |  | stay |  | she |  |  |  |  |  |
|  |  |  |  | them |  | stick |  |  |  |  |  |
|  |  |  |  | they |  | tells |  |  |  |  |  |
|  |  |  |  | wanted |  | trunk |  |  |  |  |  |
|  |  |  |  | wife |  | twelve |  |  |  |  |  |
|  |  |  |  | word |  | upset |  |  |  |  |  |
|  |  |  |  | work |  | wants |  |  |  |  |  |
|  |  |  |  | young man |  | window |  |  |  |  |  |
| CE1 Total | 0 | CE2 Total | 0 | CE3 Total | 0 | CE4 Total | 0 | CE5 Total | 0 | CE6 Total | 0 |

\*Use of alternative vocabulary accepted according to guidelines.

**Cinderella(Continued)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CE7 (slipper)** |  | **CE8 (search)** |  | **CE9 (fit check)** |  | **CE10 (coda)** |  |
| (glass) slipper |  | (glass) slipper |  | (glass) slipper |  | couple |  |
| back (home) |  | Cinderella |  | (step) sisters |  | ever(after) |  |
| changed |  | comes |  | accepted |  | everybody |  |
| falls |  | countryside |  | Cinderella |  | happy |  |
| gets |  | damsel |  | cutting |  | lived |  |
| home |  | everybody |  | everybody |  | marries |  |
| leave |  | finds |  | feet |  | prince |  |
| leaving |  | he |  | finds |  | she |  |
| loses |  | her |  | fit |  | they |  |
| midnight |  | home |  | foot |  |  |  |
| runs |  | house |  | found |  |  |  |
| she |  | hunt |  | her |  |  |  |
| shoe |  | looking |  | it |  |  |  |
| twelve |  | match |  | nobody |  |  |  |
|  |  | prince |  | puts |  |  |  |
|  |  | scoured |  | shoe |  |  |  |
|  |  | she |  | stepmother |  |  |  |
|  |  | someone |  | toes |  |  |  |
|  |  | town |  | trying |  |  |  |
|  |  | went (through) |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| CE7 Total | 0 | CE8 Total | 0 | CE9 Total | 0 | CE10 Total | 0 |
|  |  |  |  |  |  |  |  |

\*Use of alternative vocabulary accepted according to guidelines.

**Appendix D: Aphasiabank Transcriptions (peanut butter and jelly story)**

Fluent\* \*\*

332 @G: Sandwich

335 \*PAR: two uh bread um

336 \*PAR: bread s bread

337 \*PAR: yeah just two bread.

338 \*PAR: sl slop on uh um peanut.

339 \*PAR: no .

340 \*PAR: strawberry jam on one half.

341 \*PAR: on the other half we have uh Jiffy

345 \*PAR: we have our Jiffy.

346 \*PAR: it's not Jiffy.

347 \*PAR: it's uh...

348 \*PAR: peanut butter on the other side.

349 \*PAR: put em on to th to e each

350 other and eat .

Non-Fluent\* \*\*

248 @G: Sandwich

250 \*PAR: alright yes alright chuckles .

253 \*PAR: um səlɛtnɪm@u no

254 \*PAR: that's alright shudders that's alright

255 \*PAR: that's alright .

256 \*PAR: um eh b bread bread yes uh bread .

257 \*PAR: read bread .

258 \*PAR: um is uh right .

259 \*PAR: this right with right .

260 \*PAR: and jelly jellyjelly .

261 \*PAR: is right .

262 \*PAR: is uh right yes .

269 \*PAR: yes .

270 \*PAR: good jelly .

273 \*PAR: um um burger um

276 \*PAR: yes alright.

281 \*PAR: big biki@uboʊgən@u

282 b butter butter .

283 \*PAR: bread .

284 \*PAR: jelly .

286 \*PAR: yes .

287 \*PAR: yi the bread.

288 \*PAR: use p this one to one .

291 \*PAR: bread and jelly .

293 \*PAR: bidə@u beetle

294 big bɛktlʌr@u.

Control\*\*

55 @G: Sandwich

62 \*PAR: okay I would start by saying I would never make a peanut butter and

63 jelly sandwich cause I don't like the two together.

68 \*PAR: if I were to do it I would start by opening up a jar of peanut

69 butter.

73 \*PAR: I'd take a knife.

75 \*PAR: I'd spread the peanut butter on a piece of bread.

78 \*PAR: then I would open up the jar of jelly.

81 \*PAR: and I would take a separate knife so as not to contaminate the

82 jelly or the peanut butter.

86 \*PAR: and take a bit of jelly on the knife.

89 \*PAR: and I would smooth it over peanut butter.

92 \*PAR: and then I would cut the peanut butter sandwich in half.

95 \*PAR: and put it on a plate.

1. \*PAR: and serve it.

\*Transcriptions were check for accuracy independently from the initial download but were not finalized by AphasiaBank investigators.

\*\* Filtering were used via software to remove a degree of coding which allowed investigators to improve readability of transcripts but did not affect accuracy of verbalized content. Additional filtering of investigator and gestural lines were manually removed to improve readability of transcripts.

**Appendix E: Search Event Template Example**

Fluent

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Match | Extra | Irr | two uh bread um.  |
|  | Match | Extra | Irr | bread bread . |
|  | Match | Extra | Irr | yeah just two bread .  |
| PE.3 | Match | Extra | Irr | sl slop on uh um peanut.  |
|  | Match | Extra | Irr | no. |
| PE2 | Match | Extra | Irr | strawberry jam on one half .  |
|  | Match | Extra | Irr | on the other half we have uh Jiffy |
|  | Match | Extra | Irr | we have our Jiffy. |
|  | Match | Extra | Irr | it's not Jiffy. |
|  | Match | Extra | Irr | it's uh.  |
|  | Match | Extra | Irr | peanut butter on the other side .  |
| PE.4 | Match | Extra | Irr | put em on th to each |
| PE.5 | Match | Extra | Irr | eat . |
|  | total | total | total | \*\*Total number of each event \*\* |
|  | 4 | 5 | 5 | 5(Max match) - (Match) 4= 1 (Events Missed) |

Non-Fluent

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Match | Extra | Irr | alright yes alright um səlɛtnɪm no no that's alright that's alright that's alright |
| PE.1 | Match | Extra | Irr | um eh b bread bread yes uh bread. read bread. |
|  | Match | Extra | Irr | um is uh right. this right with right. |
|  | Match | Extra | Irr | and jelly jellyjelly.  |
|  | Match | Extra | Irr | is right.  |
|  | Match | Extra | Irr | is uh right yes.  |
|  | Match | Extra | Irr | yes. |
|  | Match | Extra | Irr | good jelly. |
|  | Match | Extra | Irr | um um burger um |
|  | Match | Extra | Irr | yes alright. |
|  | Match | Extra | Irr | big bikiboʊgən |
|  | Match | Extra | Irr | butterbutter.  |
|  | Match | Extra | Irr | breadbread.  |
|  | Match | Extra | Irr | jellyjelly.  |
|  | Match | Extra | Irr | yes. |
|  | Match | Extra | Irr | Jelly yi the bread bread. |
|  | Match | Extra | Irr | use p this bread |
|  | Match | Extra | Irr | one to one .  |
|  | Match | Extra | Irr | breadbread and jelly .  |
|  | Match | Extra | Irr | peanut\_butterbidə beetle |
|  | Match | Extra | Irr | bigbɛktlʌr.  |
|  | total | total | total | \*\*Total number of each event \*\* |
|  | 1 | 7 | 12 | 5(Max match) - 1 (Match) = 4 (Events Missed) |

Control

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Match | Extra | Irr | okay I would start by saying I would never make a peanut butter andjelly sandwich cause I don't like the two together .  |
| PE.1 | Match | Extra | Irr | if I were to do it I would start by opening up a jar of peanut butter .  |
| PE.2 | Match | Extra | Irr | I'd take a knife . I'd spread the peanut butter on a piece of bread . |
|  | Match | Extra | Irr | then I would open up the jar of jelly . and I would take a separate knife so as not to contaminate the jelly or the peanut butter . |
|  | Match | Extra | Irr | and take a bit of jelly on the knife . |
| PE.3 | Match | Extra | Irr | and I would smooth it over peanut butter |
| PE.4 | Match | Extra | Irr | and then I would cut the peanut butter sandwich in half |
| PE.5 | Match | Extra | Irr | and put it on a plate and serve it . |
|  | total | total | total | \*\*Total number of each event \*\* |
|  | 5 | 1 | 2 | 5(Max match) - 0 (Match) = 0 (Events Missed) |

**Appendix F: Sequencing Template Example**

Fluent

|  |  |  |
| --- | --- | --- |
| Event Number | Matched event name | Sequence number |
| PE.2 | sl slop on uh um peanut.  |  |
|  |  | PS.2  |
| PE.3 | strawberry jam on one half .  |  |
|  |  | PS.3  |
| PE.4 | put em on th to each  |  |
|  |  | PS.4 |
| PE.5 | eat . |  |
| Event Match \_\_\_\_(4-1)\_\_\_ / Sequencing Points \_\_\_\_3\_\_\_\_ = 1.00 |

Non-Fluent

|  |  |  |
| --- | --- | --- |
| Event Number | Matched event name | Sequence number |
| PE.1 | um eh b bread bread yes uh bread. Read bread. |  |
|  |  |  |
|  |  |  |
| Event Match \_\_\_\_(1-1)\_\_\_ / Sequencing Points \_\_\_\_0\_\_\_\_ = no points awarded |

Control

|  |  |  |
| --- | --- | --- |
| Event Number | Matched event name | Sequence number |
| PE.1 | if I were to do it I would start by opening up a jar of peanut butter . |  |
|  |  | P.1 |
| PE.2 | I'd take a knife . I'd spread the peanut butter on a piece of bread . |  |
|  |  | PS.2 |
| PE.3 | and I would smooth it over peanut butter |  |
|  |  | PS.3 |
| PE.4 | and then I would cut the peanut butter sandwich in half |  |
|  |  | PS.4 |
| PE.5 | and put it on a plate and serve it . |  |
| Event Match \_\_\_\_(5-1)\_\_\_ / Sequencing Points \_\_\_\_4\_\_\_\_ = 1.00 |

**Appendix G: Informativeness Template Examples**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sandwich |  |  |  |  |  |  |  |  |  |
| PE1 (get ingredients ) |  | PE2 ( spread PB) |  | PE3 (spread jelly) |  | PE4 (put together) |  | PE5 (coda) |  |
| basket |  | bread |  | bread |  | cut |  | eat | x |
| bread |  | finger |  | finger |  | finger |  | give |  |
| buy |  | knife |  | jam | x | fold (over) |  | happy |  |
| drawer |  | on | x | jelly |  | grill |  | it |  |
| go |  | peanut butter | x | knife |  | knife |  | jelly |  |
| home |  | piece |  | on | x | on |  | Peanut butter |  |
| jar |  | put |  | piece |  | peanut butter |  | sandwich |  |
| jelly |  | slice |  | put |  | put | x | serve |  |
| jiff |  | spread |  | slice |  | slap |  | your |  |
| kitchen |  |  |  | spread |  | slice |  |  |  |
| open |  |  |  |  |  | together |  |  |  |
| peanut butter |  |  |  |  |  | top |  |  |  |
| pieces |  |  |  |  |  |  |  |  |  |
| plate |  |  |  |  |  |  |  |  |  |
| refrigerator |  |  |  |  |  |  |  |  |  |
| slice |  |  |  |  |  |  |  |  |  |
| store |  |  |  |  |  |  |  |  |  |
| supplies |  |  |  |  |  |  |  |  |  |
| take (out) |  |  |  |  |  |  |  |  |  |
| utensils |  |  |  |  |  |  |  |  |  |
| PE1 Total | 0 | PE2 Total | 2 | PE3 Total | 2 | P4 Total | 1 | PE5 Total | 1 |

\*Use of alternative vocabulary accepted according to guidelines.

Non-Fluent

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sandwich |  |  |  |  |  |  |  |  |  |
| PE1 (get ingredients ) |  | PE2 ( spread PB) |  | PE3 (spread jelly) |  | PE4 (put together) |  | PE5 (coda) |  |
| basket |  | bread |  | bread |  | cut |  | eat |  |
| bread | x | finger |  | finger |  | finger |  | give |  |
| buy |  | knife |  | jam |  | fold (over) |  | happy |  |
| drawer |  | on |  | jelly |  | grill |  | it |  |
| go |  | peanut butter |  | knife |  | knife |  | jelly |  |
| home |  | piece |  | on |  | on |  | Peanut butter |  |
| jar |  | put |  | piece |  | peanut butter |  | sandwich |  |
| jelly |  | slice |  | put |  | put |  | serve |  |
| jiff |  | spread |  | slice |  | slap |  | your |  |
| kitchen |  |  |  | spread |  | slice |  |  |  |
| open |  |  |  |  |  | together |  |  |  |
| peanut butter |  |  |  |  |  | top |  |  |  |
| pieces |  |  |  |  |  |  |  |  |  |
| plate |  |  |  |  |  |  |  |  |  |
| refrigerator |  |  |  |  |  |  |  |  |  |
| slice |  |  |  |  |  |  |  |  |  |
| store |  |  |  |  |  |  |  |  |  |
| supplies |  |  |  |  |  |  |  |  |  |
| take (out) |  |  |  |  |  |  |  |  |  |
| utensils |  |  |  |  |  |  |  |  |  |
| PE1 Total | 1 | PE2 Total | 0 | PE3 Total | 0 | P4 Total | 0 | PE5 Total | 0 |

\*Use of alternative vocabulary accepted according to guidelines.