BACKGROUND

Among the elicited and observed procedures used to describe, classify, diagnose, measure change, quantify severity, and plan intervention for persons with aphasia, the measurement of connected spoken language has become a stable and valued procedure for many of these purposes. Though recognized, the most valid, reliable, and efficient methods for sampling connected language has received relatively little experimental attention from clinical and experimental aphasiologists. The recently developed Story Retell Procedure (SRP) (Doyle, et al, 2000) has the unique measurement advantage of predetermined targets for the retold stories thus increasing the validity of measuring the accuracy of the connected sample. However, linguistic measures of SRP performance reflect both comprehension and production processing. While the reliability and concurrent validity of the scoring methods for the forms of the SRP have been investigated (McNeil, et al, 2001; McNeil, et al, 2002), concurrent validation of this procedure with other established connected language sampling procedures has not been investigated. This study sought to compare several aspects of the language generated from one of the four forms of the SRP with two other published procedures for eliciting spoken language in persons with aphasia; the "Cinderella Story" (Berndt, Wayland, Rochon, Saffran, & Schwartz, 2000) and the five elicitation tasks (WAB & BDAE picture, two sequenced picture; two novel pictures, two procedural language tasks, and two personal information tasks) published by Nicholas and Brookshire (1993).

METHOD

To date, thirteen persons with aphasia who were defined by their performance on the *Porch Index of Communicative Ability* (Porch, 1981), the *Revised Token Test* (McNeil & Prescott, 1978) and on an immediate and delayed language recall task of the *Assessment Battery of Communication in Dementia* (Bayles & Tomoeda, 1993) have completed the seven language elicitation procedures describe above and their data have been analyzed. The data from seven additional subjects will be included for the final presentation. Biographical and selection data are summarized for each subjects in **Table 1**. The experimental tasks were administered in random order across participants and later transcribed and analyzed using *SALT* (Miller & Chapman, 1998) software. Eight measures of *verbal productivity* [number of story propositions (#Prop), number, percent, and number per minute Correct Information Units (# and %CIU and CIU/Min), number and percent Story Propositions (# and %SP), number of Utterances (#U), number of words (#W), and number of words per minute (#WPM), mean length of utterance (MLU), type-token ratio (TTR)]; two measures of *syntactic complexity* [number of conjunctions (#C), number of grammatically well-formed sentences (#GWF)], and three measure of *verbal disruption* [number of mazes (#Mz), number of abandoned sentences (#AS), percent of intelligible words (%IW)] were calculated for each of the seven language elicitation tasks. Data were analyzed within measure across sampling procedure using Pearson Product Moment Correlation Coefficients and repeated measures ANOVA. Alpha was set at $p<.01$ for all comparisons and the tests of difference were adjusted for multiple comparisons. Correlations exceeding .70, with a confidence of $p<.01$were considered meaningful.

RESULTS

Results illustrated in **Figure 1, panels 1-13**, show substantial inter-subject variability across language sampling procedures for some dependent measures. This figure also shows large intra-subject variability for some measures. Nonetheless, patterns consistent with the statistical effects summarized below illustrate that the majority of subjects followed the group effects for most measures.

Figure 2, panels 1-13, summarizes the group data for each measure across the seven language elicitation procedures. These data are displayed in **Table 2,** where the derived values and correlation coefficients for each dependent measure can be compared across measures and elicitation tasks. The correlation coefficients were computed between the SRP and each elicitation task. The results for each of these measures are summarized below, segmented into the type of language measure calculated.

Word-level Productivity: The total ***#W*** produced on the three stories of the SRP were significantly larger, by a factor of two to three, than all other elicitation tasks. The SRP did not correlate highly with any other task. The ***WPM*** efficiency measure was not significantly different across tasks except for the significantly greater ***WPM*** on the Nicholas and Brookshire (N&B) picture descriptions. The SRP correlated highly and positively across all other elicitation tasks. The ***#CIU*** produced on the SRP was two to four times greater than all other tasks; however, correlation criteria was reached only with N&B pictures. The ***%CIU*** and the ***#CIU/min*** was not significantly different across tasks and the correlations reached criteria with all but one elicitation task. ***TTR*** was significantly lower on the SRP than all other tasks and scores did not correlate significantly across tasks. SRP ***MLU*** was significantly higher than the WAB/BDAE picture tasks and all SRP scores correlated highly with all other elicitation tasks.

Sentence-level Productivity: The ***#UTT*** (correct clausal units) produced on the SRP was significantly greater (two to three times) than that elicited with all other tasks. No cross-task correlation reached criteria.

Story-level Productivity: The ***#Prop*** produced in the SRP was not significantly different from the other elicitation tasks and the SRP correlated highly with each task.

Syntactic Complexity: The ***# C*** produced under the SRP task was significantly greater (two to six times) than the other elicitation tasks. Only the Procedural elicitation task correlated highly with the SRP. The ***# GWF*** sentences produced on the SRP was significantly greater than the Cinderella Story and the WAB/BDAE picture descriptions and correlated highly with all other elicitation tasks.

Verbal Disruptions: The ***#IW*** produced on all tasks was near ceiling and the significantly greater ***#IW*** on the WAB/BDAE Pictures, along with the high correlations between the SRP and the Cinderella Story, the WAB/BDAE pictures and the N&B pictures are difficult to interpret given the small variability among participants on this measure. The ***#AS*** produced on the SRP was significantly greater than on all other tasks and the correlations between SRP scores and all other tasks (save the Procedural Description task) met study criteria. The ***#Mz*** produced on the SRP was not significantly different for the other tasks except the Cinderella Story which elicited significantly more mazes. Correlation coefficients met criteria between the SRP and all other tasks except the Personal Information task.

In general, the #W and #CIU generated on the SRP were significantly greater than the other elicitation tasks. Likewise, the #W/Min, %CIU and #CIU/Min and MLU did not differ between the SRP and the other tasks. These nonsignificant contrasts across all

dependent measures were generally highly correlated with the same dependent measures between the SRP and the other tasks while the dependent measures that were significantly different (generally higher) on the SRP typically did not reach correlation criterion with the other tasks.

DISCUSSION

The Story Retell Procedure generated a language sample that was greater or equal in quantity to the other elicitation tasks used in this study for the great majority of the linguistic variables computed. When there were no significant differences across the language sampling tasks the behaviors elicited on the SRP correlated highly across tasks, with the overall average correlations across tasks and measures achieving .84 for those that reached the criterion. Interestingly, when the SRP task yielded significantly greater linguistic behaviors compared to the other elicitation tasks, the correlations tended to not reach the r=.71 criterion. The comprehension demands of the SRP, as compared to the other tasks used in this study, do not appear to restrict the quantity or the nature of language that is produced on the retelling. The advantages of having known production targets appears to offer a sufficient advantage to the accuracy and efficiency of transcribing and scoring the language sample to warrant its consideration over other language elicitation procedures.

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Table 1. Biographical and criteria participant information

Subject	Gender	Age (Yrs.)	Education (Yrs.)	MPO	RTT OA Percentile	PICA OA Percentile	ABCD Story Ratio
1	F	52	18	74	68	80	100
2	F	66	11	63	3	52	133
3	F	75	12	61	22	58	100
4	F	63	12	73	45	81	113
5	F	49	14	30	50	69	75
6	F	49	17	121	63	86	82
7	M	82	13	N/A	40	85	111
8	M	43	14	66	51	85	100
9	F	55	16	96	82	88	100
10	F	72	14	24	50	89	100
11	M	61	14	30	77	79	92
12	F	60	12	91	1	76	100
13	M	73	14	3	39	64	100
Mean	(8F;5M)	61.54	13.92	61.00	45.46	76.31	100.46
SD		11.75	2.06	34.01	25.20	11.96	14.11

MPO= Months Post Onset

RTT= *Revised Token Test* (McNeil and Prescott 1978)

PICA= *Porch Index of Communication Ability* (Porch 1981)

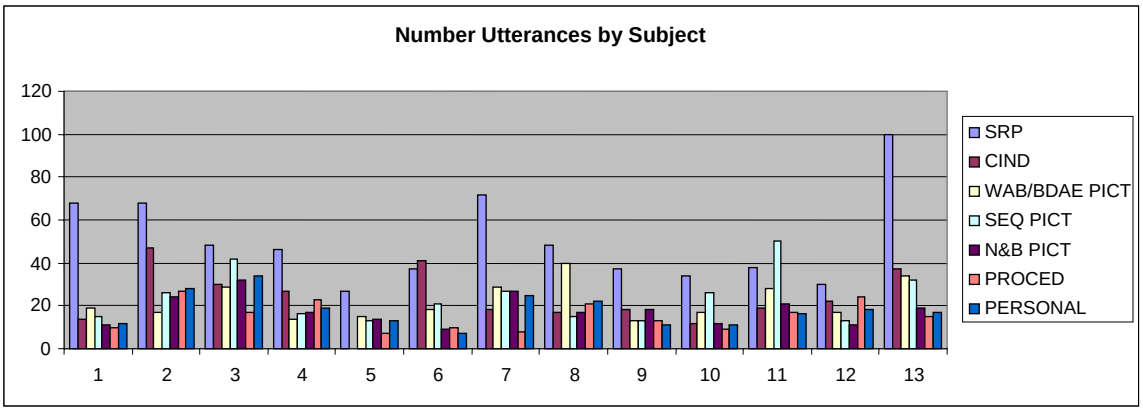
ABCD Ratio = *Arizona Battery for Communication Diosrders of Dementia* (Bayles and Tomoeda 1993), determined by number of delayed recall items/ number of immediate recall items × 100

Table 2. Computed value and Pearson Product Moment Correlation Coefficient between SRP and the other connected language sampling procedures

	SRP	*CIND*	*WAB/BDAE*	*SEQ PICT*	*N&B PICT*	*PROCED*	*PERSON*
	NO.	NO./r	NO./r	NO./r	NO./r	NO./r	NO./r
Word-level Productivity							
# Words	431	225/ns	157/ns	197/ns	150/ns	127/ns	153/ns
# Words/Min	98	101/.91	99/.88	107/.90	113/.85	106/.94	91/.85
# CIU's	226	113/ns	95/.ns	109/ns	85/.75	65/ns	85/ns
% CIU's	52	50/.77	58/.84	55/ns	57/.81	51/.80	59/.78
# CIU's/Min	53	54/.82	57/.91	57/.72	63/.80	51/.79	48/ns
TTR	.56	.58/ns	.69/ns	.65/ns	.68/ns	.65/ns	.71/ns
MLU	8	7/.77	6/.88	7/.77	8/.76	7/.81	8/.90
Sentence-level Productivity							
# Utt.	50	25/ns	22/ns	24/ns	18/ns	15/ns	18/ns
Story-Level Productivity							
# Propositions	.64	.46/.77	.64/.82	.54/.86	.61/.82	.60/.78	--
Syntactic Complexity							
# Conj.	29	15/ns	5/ns	9/ns	5/ns	10/.79	10/ns
# Gram. WF	.73	.64/.89	.62/.95	.67/.86	.67/.91	.69/.74	.70/.85
Verbal Disruptions							
# Intell. Words	98	98/.81	99/.96	96/ns	97/.75	98/ns	99/ns
# Aband. Utt.	8	6/.91	2/.79	3/.79	3/.79	2/ns	3/.86
# Mazes	10	13/.90	12/.92	9/.95	12/.95	11/.92	11/ns

Shaded numbers represent those contrasts that were significantly different from the SRP
All reported correlations significant $p<.01$ (2-tailed) and greater than .71 ($R^2 > .50$).

Figure 1.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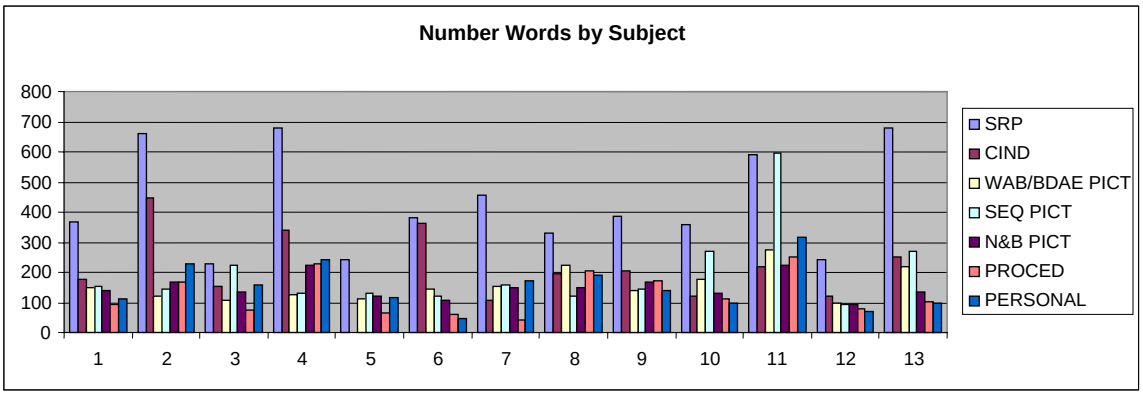
1
2
3
4
5
6
7
8
9
10
11
12
13
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL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300
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100
0
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2
3
4
5
6
7
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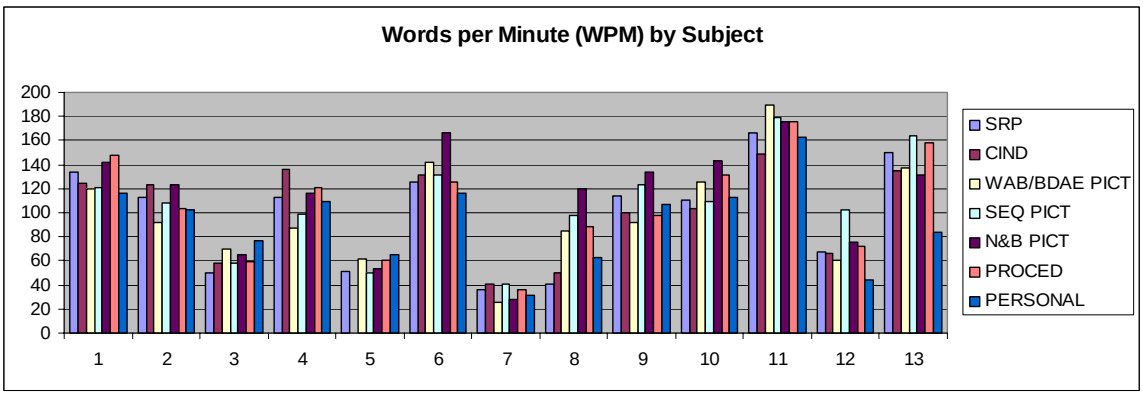
10
11
12
13
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL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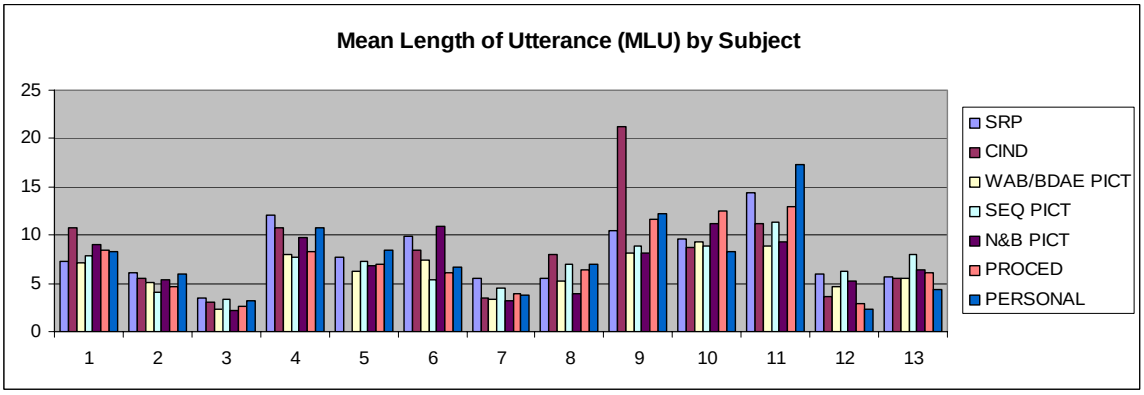
140
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
11
12
13
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL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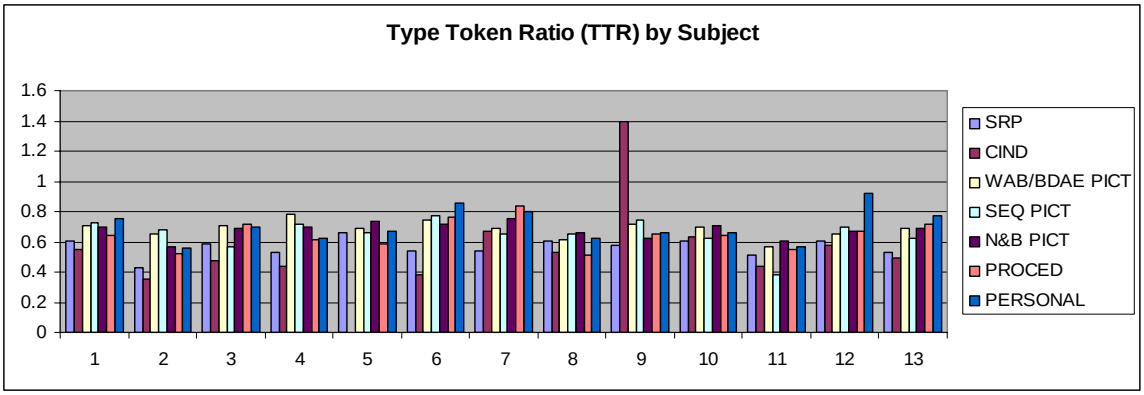
20
15
10
5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL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1.2
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0.8
0.6
0.4
0.2
0
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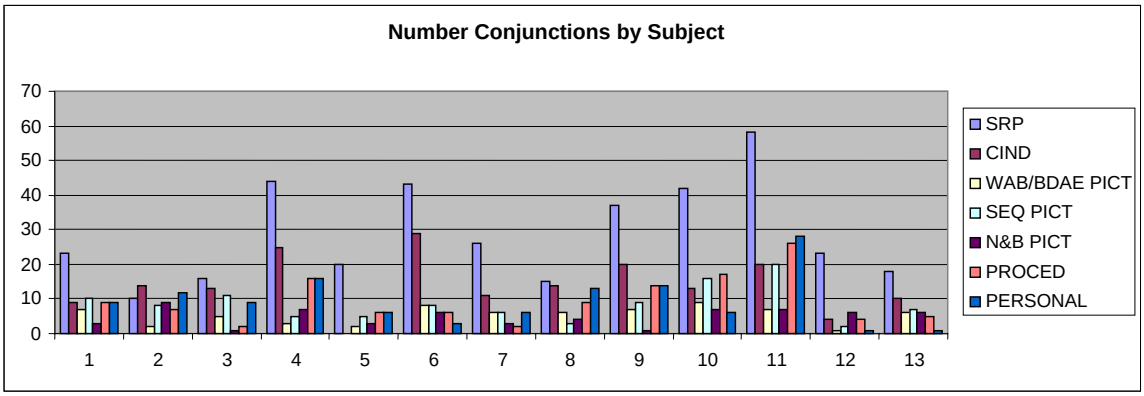
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


Number Conjunctions by Subject
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50
40
30
20
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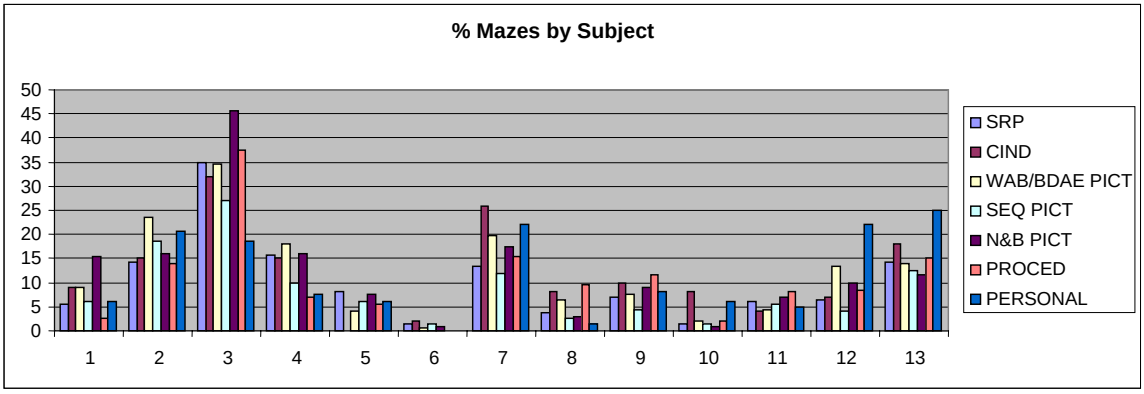
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


% Mazes by Subject
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40
35
30
25
20
15
10
5
0
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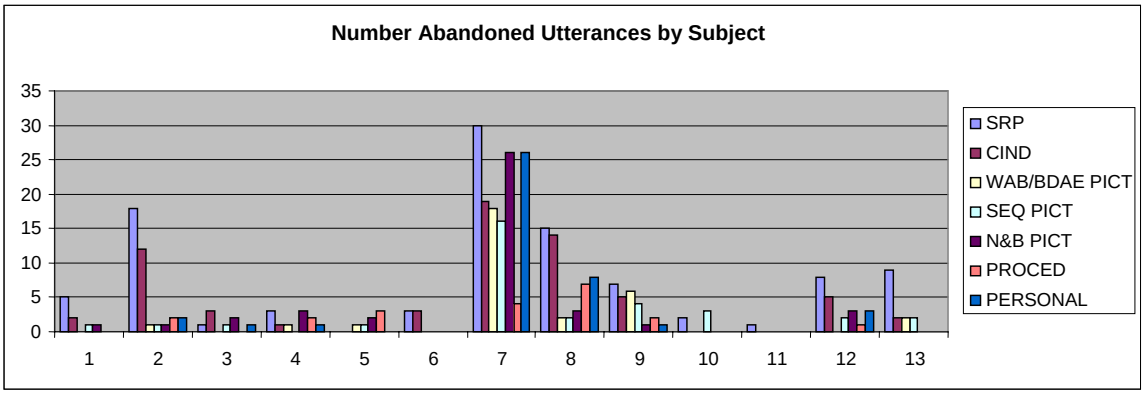
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


Number Abandoned Utterances by Subject
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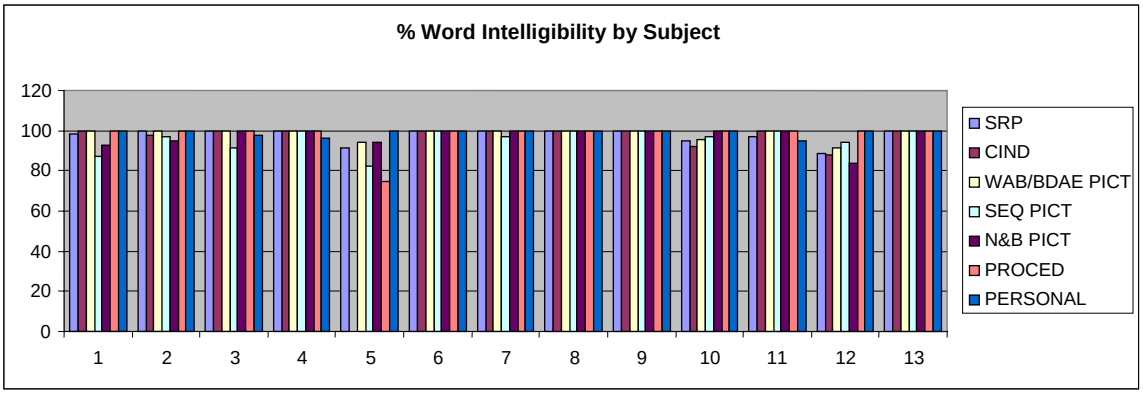
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


% Word Intelligibility by Subject
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0
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2
3
4
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6
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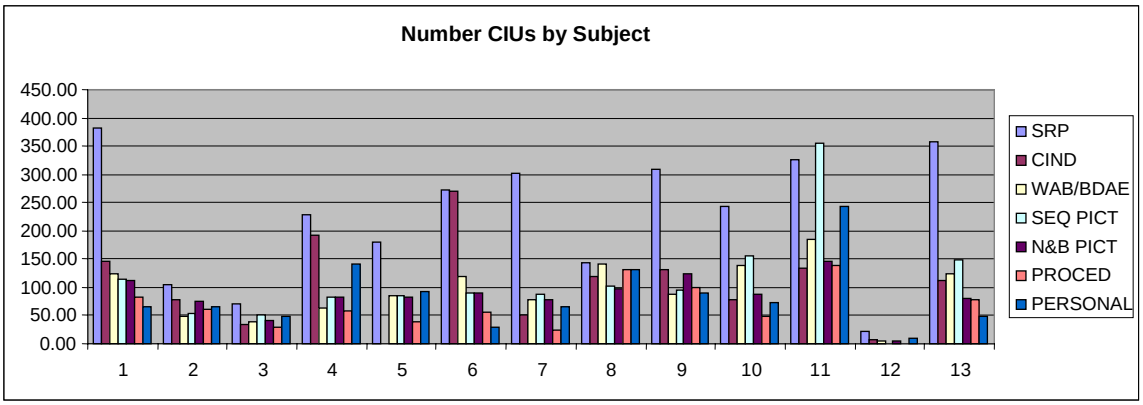
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL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350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
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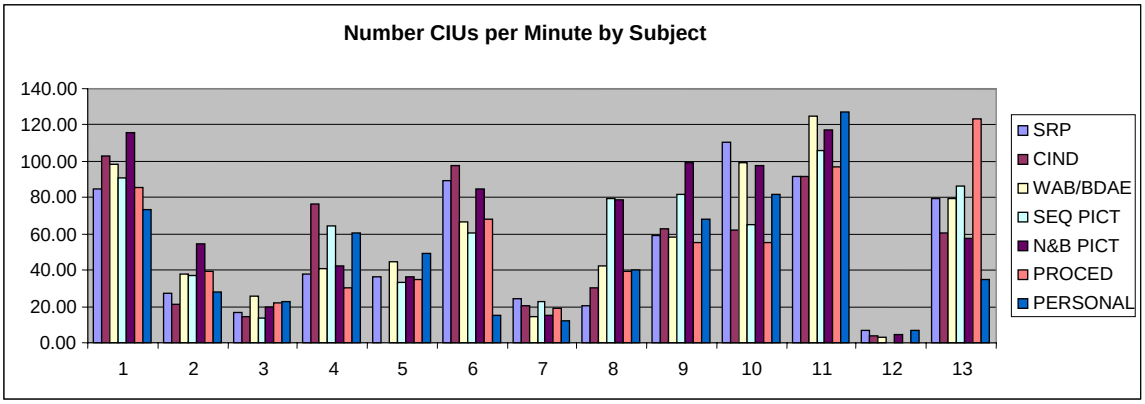
2
3
4
5
6
7
8
9
10
11
12
13
SRP
CIND
WAB/BDAE
SEQ PICT
N&B PICT
PROCED
PERSONAL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120.00
100.00
80.00
60.00
40.00
20.00
0.00
1
2
3
4
5
6
7
8
9
10
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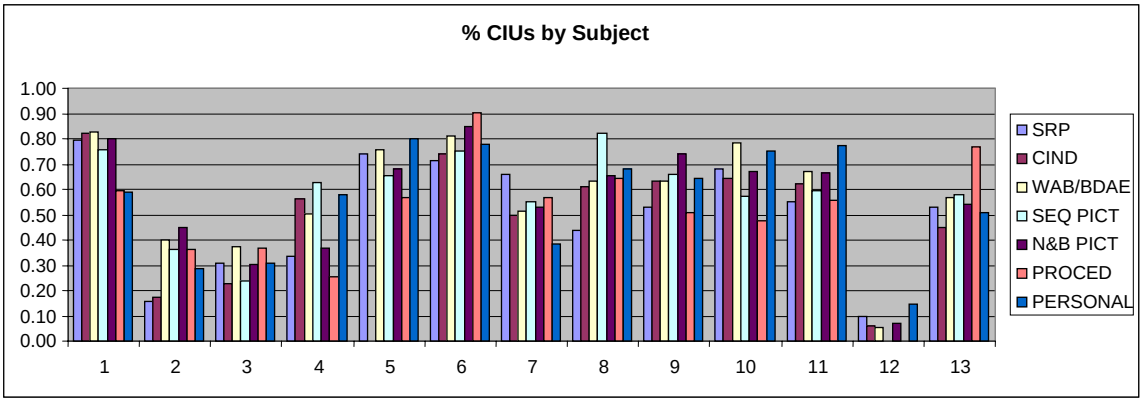
12
13
SRP
CIND
WAB/BDAE
SEQ PICT
N&B PICT
PROCED
PERSONAL


% CIUs by Subject
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0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1
2
3
4
5
6
7
8
9
10
11
12
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SRP
CIND
WAB/BDAE
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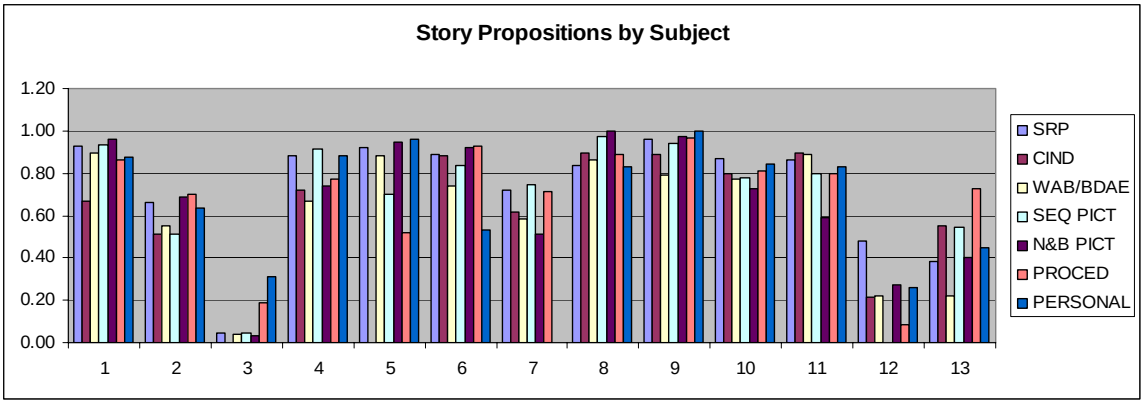
N&B PICT
PROCED
PERSONAL


Story Propositions by Subject
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0.60
0.40
0.20
0.00
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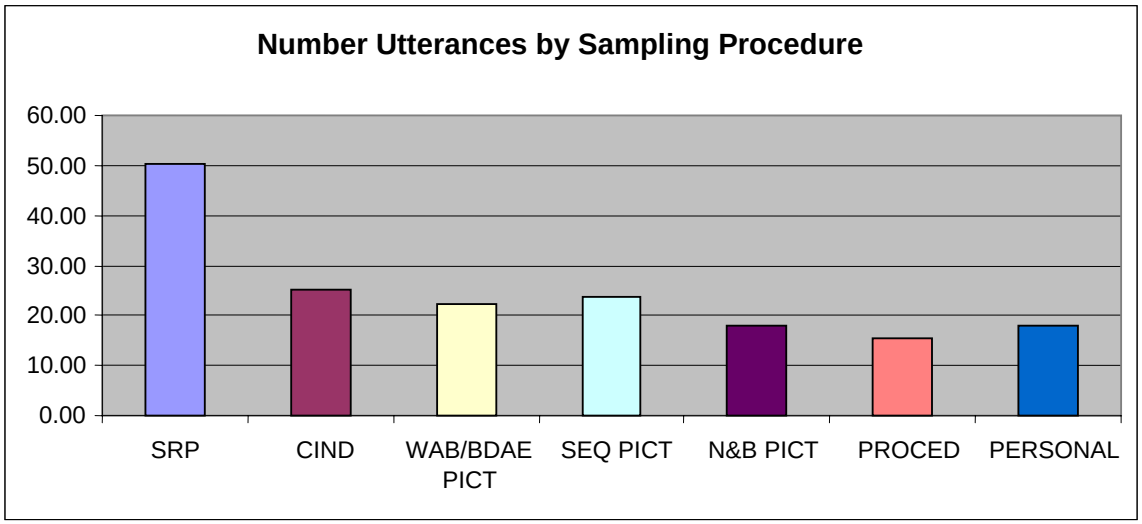
2
3
4
5
6
7
8
9
10
11
12
13
SRP
CIND
WAB/BDAE
SEQ PICT
N&B PICT
PROCED
PERSONAL

Figure 2.


Number Utterances by Sampling Procedure
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40.00
30.00
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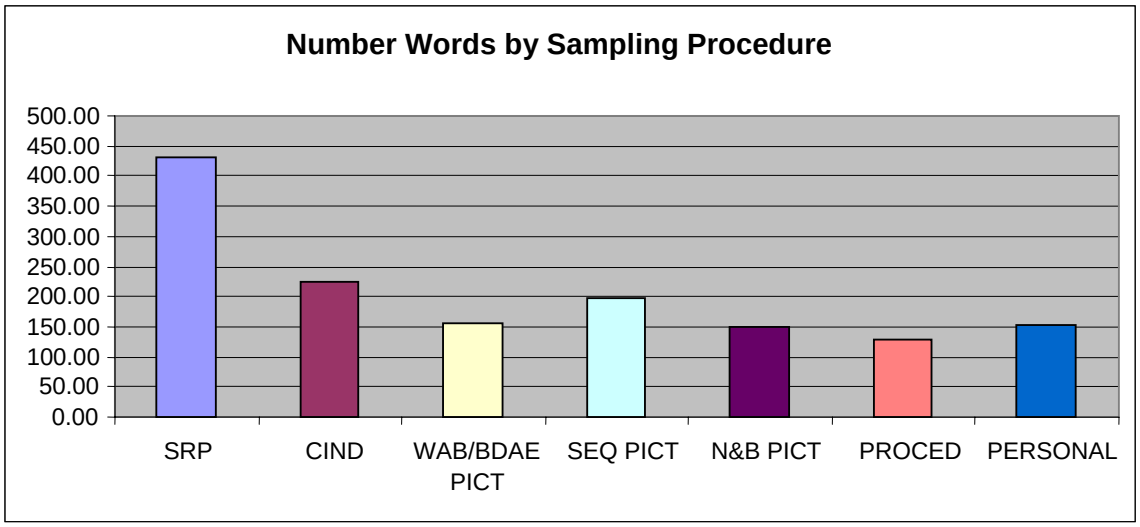
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


Number Words by Sampling Procedure
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250.00
200.00
150.00
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50.00
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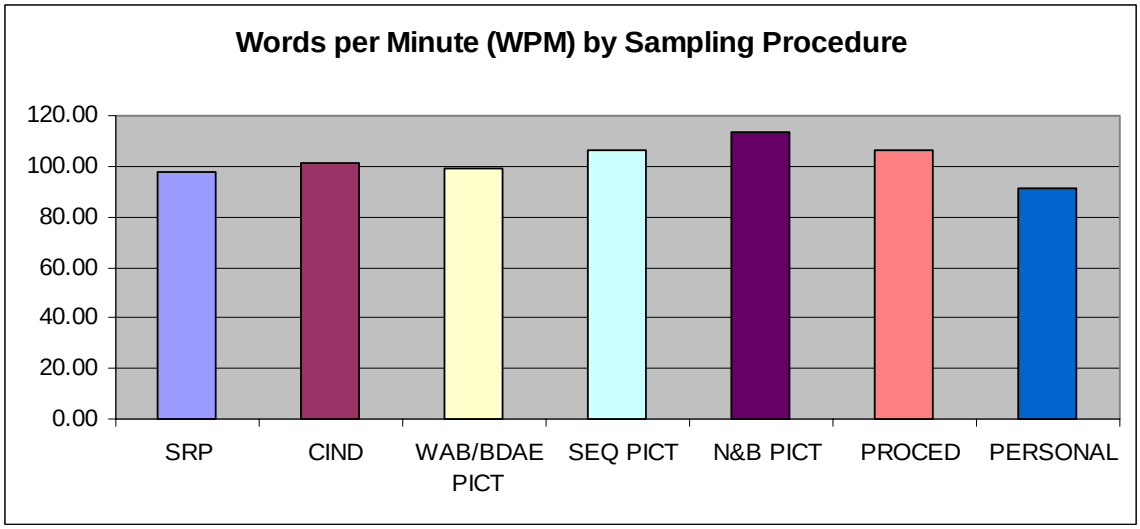
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


Words per Minute (WPM) by Sampling Procedure
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100.00
80.00
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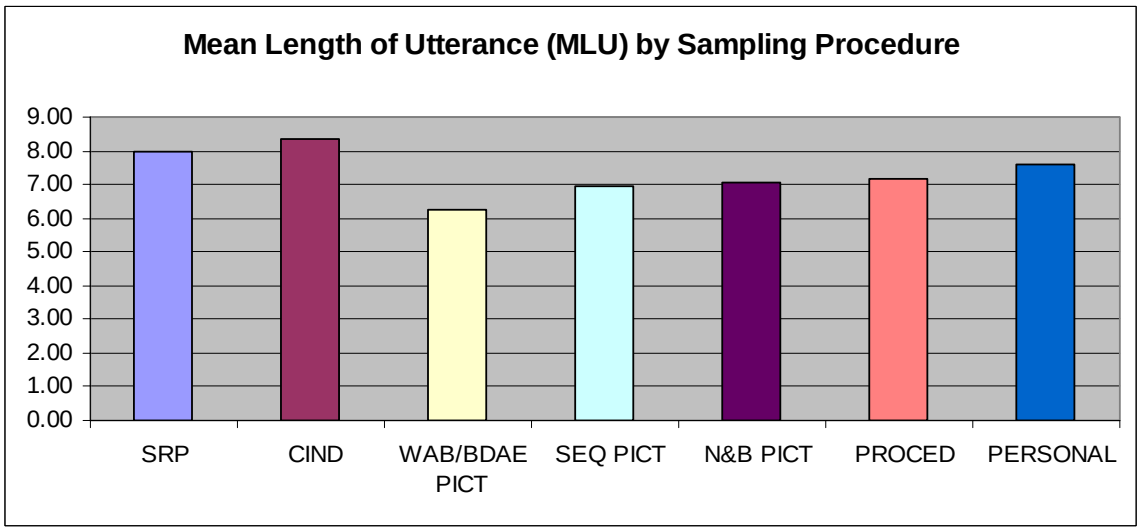
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


Mean Length of Utterance (MLU) by Sampling Procedure
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8.00
7.00
6.00
5.00
4.00
3.00
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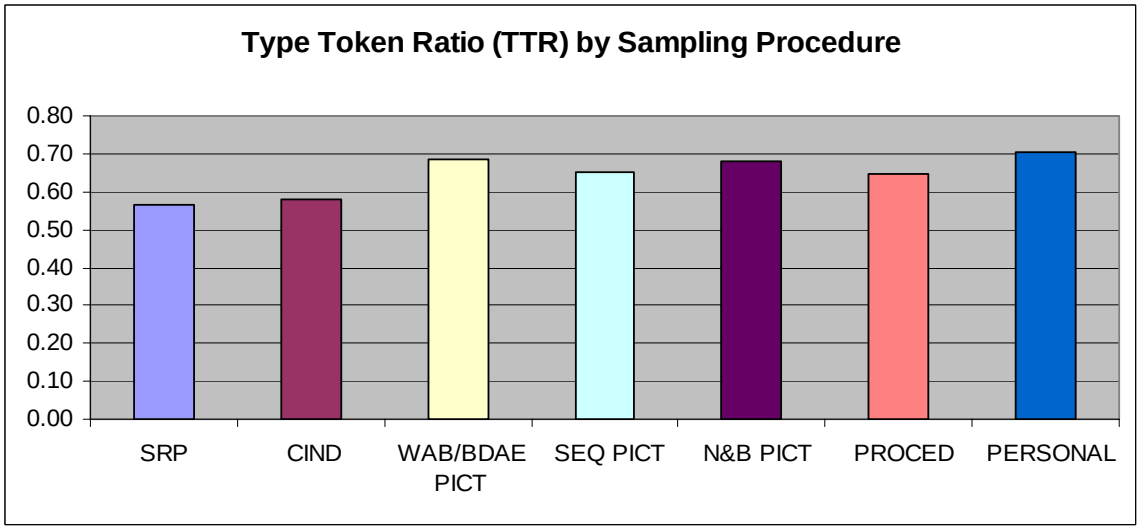
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL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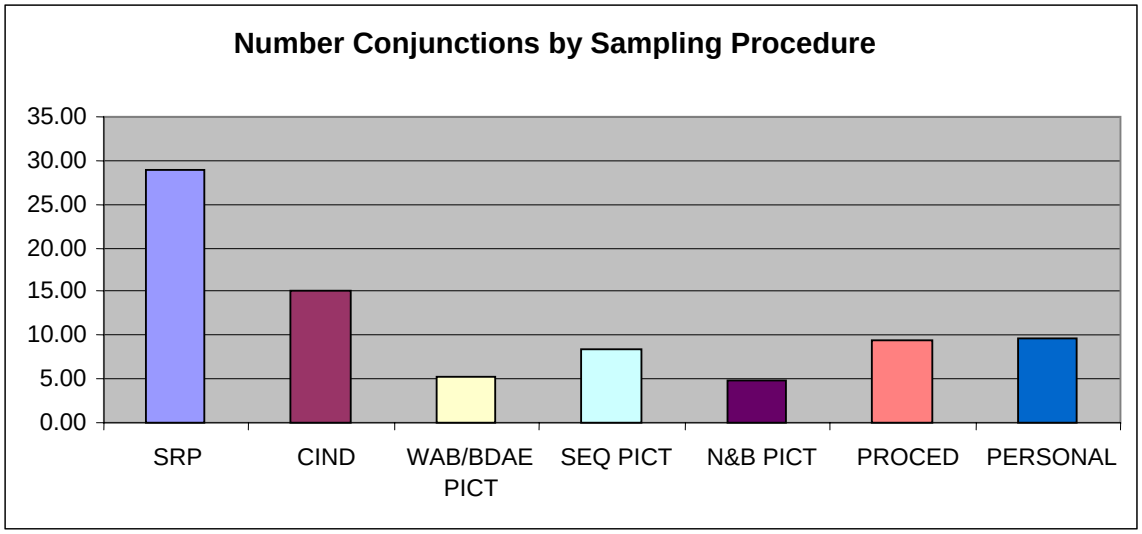
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL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CIND
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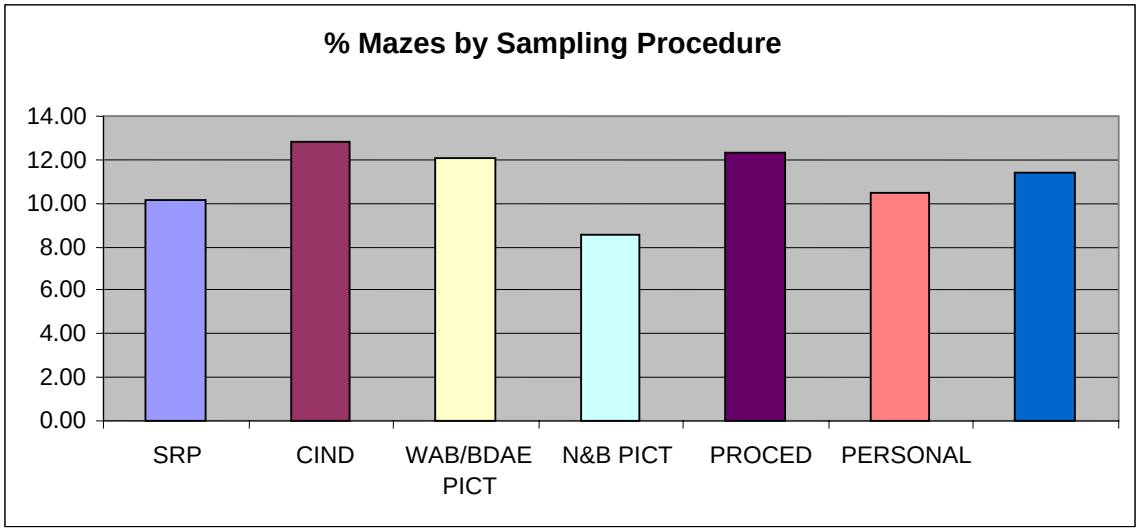
SEQ PICT
N&B PICT
PROCED
PERSONAL


% Mazes by Sampling Procedure
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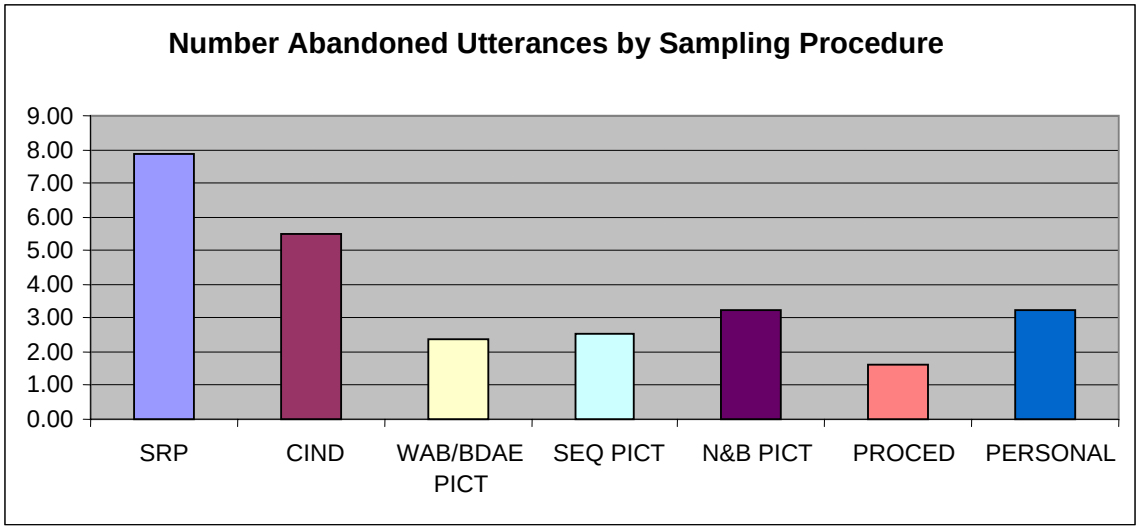
4.00
2.00
0.00
SRP
CIND
WAB/BDAE PICT
N&B PICT
PROCED
PERSONAL


Number Abandoned Utterances by Sampling Procedure
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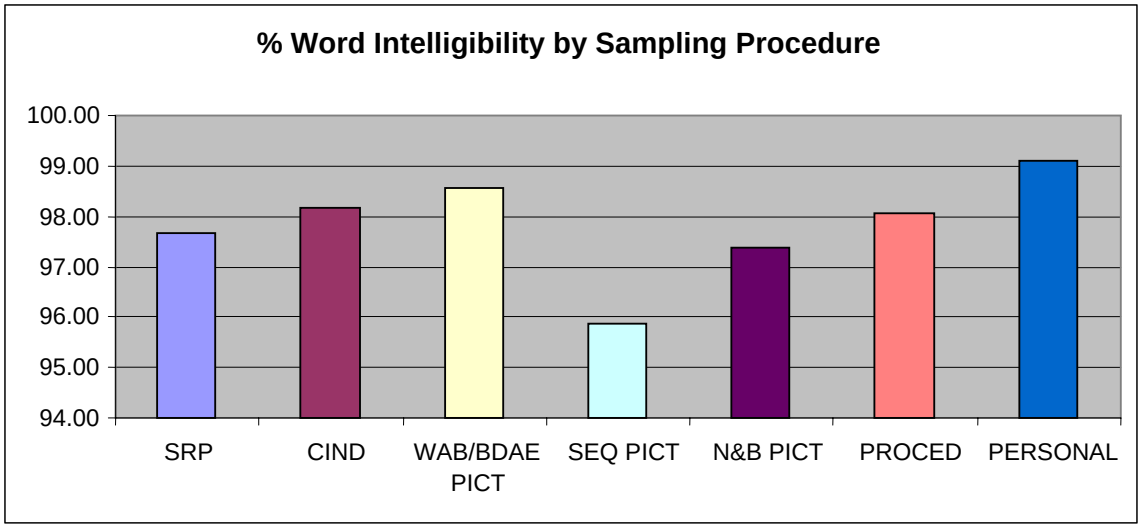
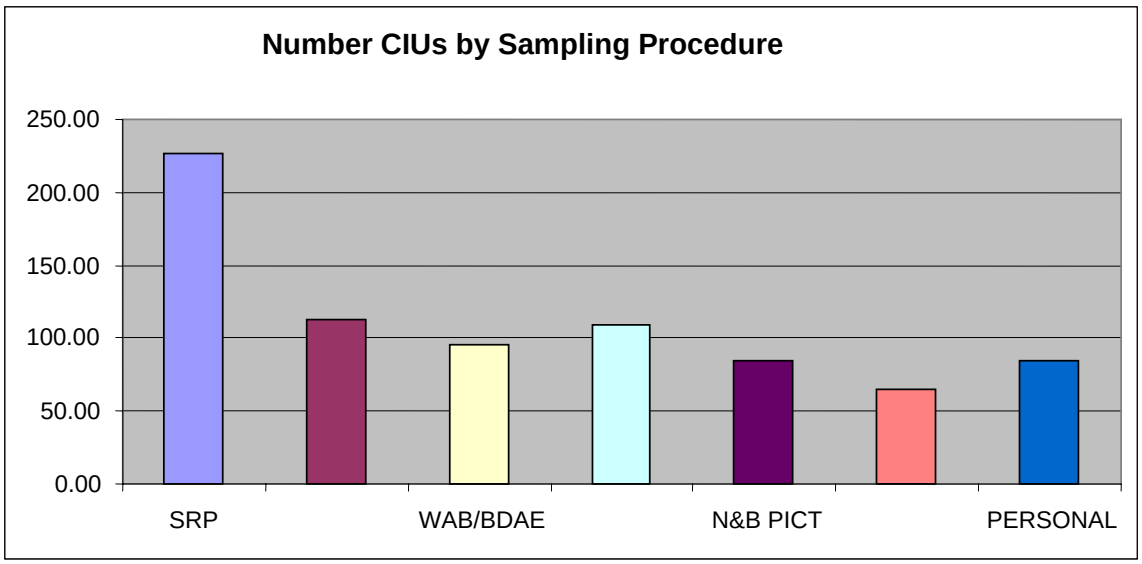
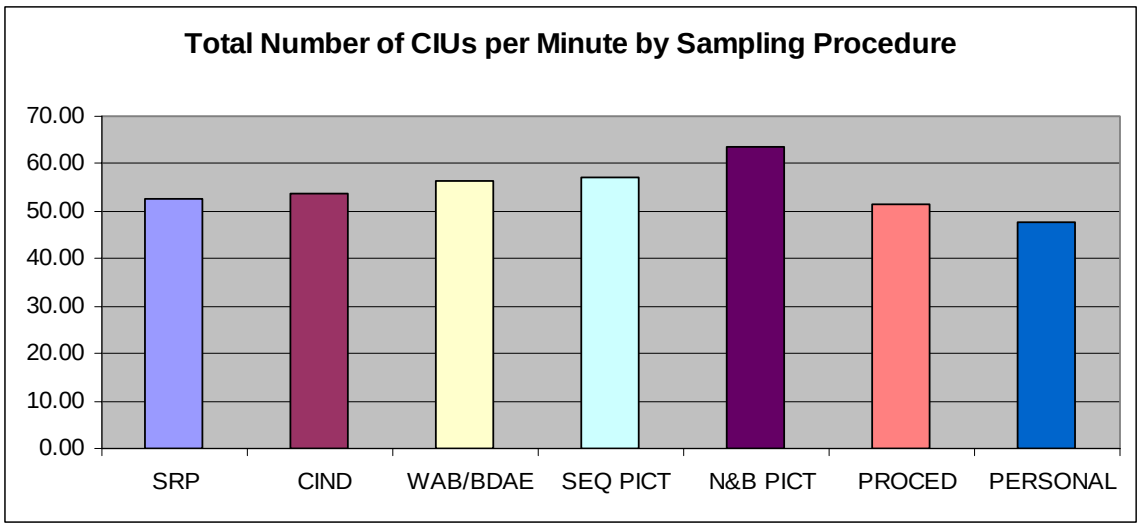
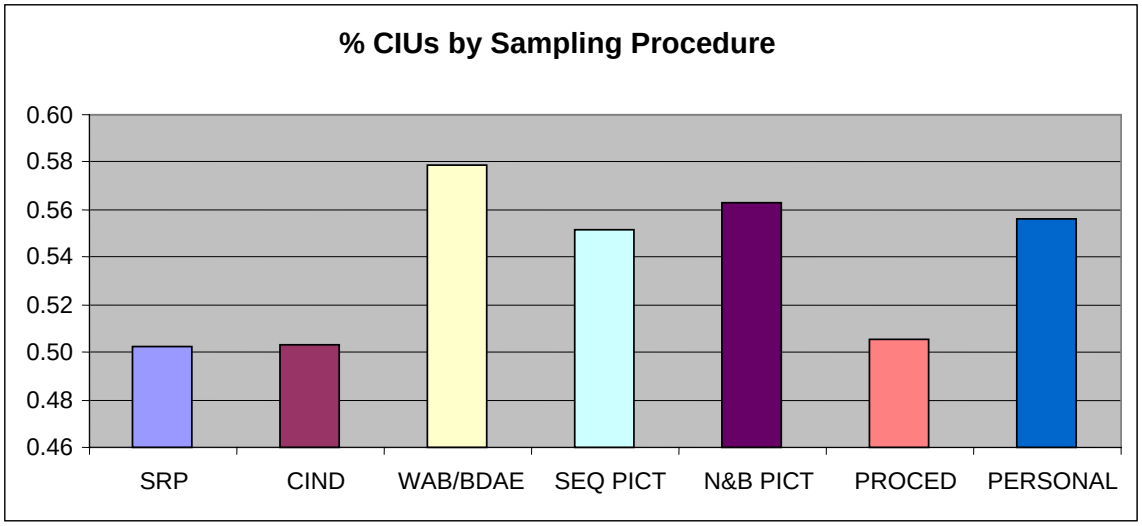
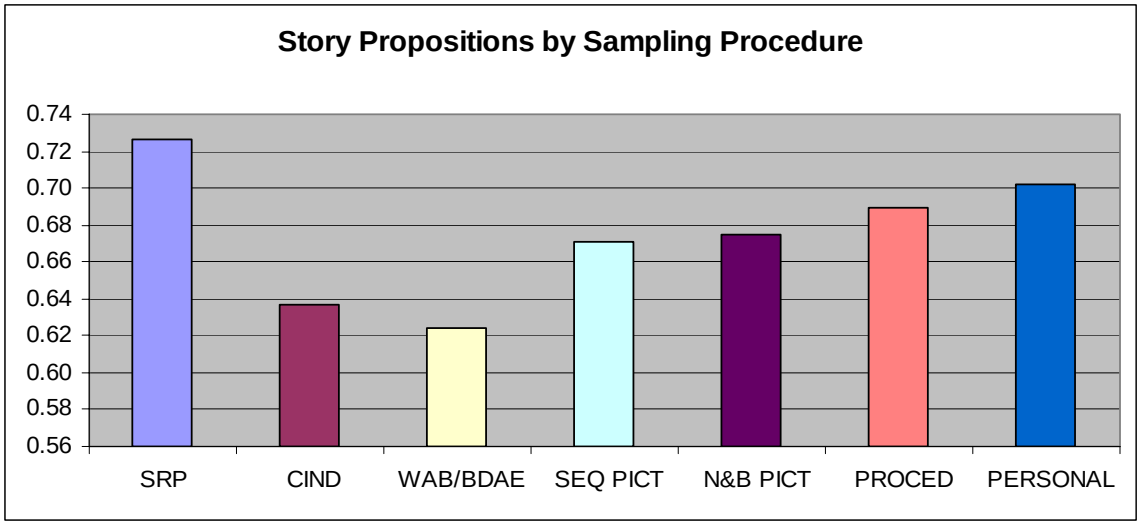
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


% Word Intelligibility by Sampling Procedure
100.00
99.00
98.00
97.00
96.00
95.00
94.00
SRP
CIND
WAB/BDAE PICT
SEQ PICT
N&B PICT
PROCED
PERSONAL


Number CIUs by Sampling Procedure
250.00
200.00
150.00
100.00
50.00
0.00
SRP
WAB/BDAE
N&B PICT
PERSONAL


Total Number of CIUs per Minute by Sampling Procedure
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
SRP
CIND
WAB/BDAE
SEQ PICT
N&B PICT
PROCED
PERSONAL


% CIUs by Sampling Procedure
0.60
0.58
0.56
0.54
0.52
0.50
0.48
0.46
SRP
CIND
WAB/BDAE
SEQ PICT
N&B PICT
PROCED
PERSONAL


Story Propositions by Sampling Procedure
0.74
0.72
0.70
0.68
0.66
0.64
0.62
0.60
0.58
0.56
SRP
CIND
WAB/BDAE
SEQ PICT
N&B PICT
PROCED
PERSONAL