Presentation Speed and Vocabulary in Closed Captioned Television

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Introduction

In 1972, WGBH in Boston did a unique experiment in which they open-captioned a cooking program called "The French Chef" featuring Julia Child. The success of this first attempt at captioning led WGBH to rebroadcast daily an open captioned version of "ABC World News Tonight" for hearing impaired people. During the 1970's this was the only regularly broadcast television program in America designed to be accessible to deaf people. It was wildly popular in the deaf community because it was the only televised news program they could understand.

When WGBH began rebroadcasting the "ABC World News Tonight" there were no rules for captioning. Captioning policy was developed on a day to day basis as captioning problems arose. The guiding principle at that time was to make the program accessible to every deaf viewer, regardless of their individual reading ability. Since studies conducted by the Gallaudet University Office of Demographic Studies and others indicated that the average graduate from an educational program for hearing impaired students had about a third grade reading level, WGBH extensively edited the program dialogue. The number of words were cut by about a third and the reading level was cut from roughly the sixth grade level to the third grade level. All passive voice sentence construction was removed, nearly all idioms were removed, contractions were eliminated, clauses were converted into short declarative sentences, and even jokes and puns were changed if it was felt the hearing impaired audience would not understand them.

These captioning techniques, which almost everyone now considers over-editing, continued for many years. Part of the reason for this was that deaf people were so delighted to have captions that they accepted almost anything thrown on the screen. As captioned television became more entrenched as a standard part of television services in the late 1980's, deaf people began to examine the quality of captioning more closely. In general, deaf people indicated they wanted access to whatever was spoken on the audio and that captioners should not play the role of censors. Caption companies have tended to interpret this as meaning deaf people want straight verbatim captioning.

Counting both broadcast and cable, there are now roughly 100 hours of captioned television programs shown each day, yet we have no formal data on the characteristics of the captions on these programs. Are programs now captioned verbatim? How much editing is done? What is the caption presentation speed of programs currently being shown on television? How does this presentation speed vary with the type of program? These and other questions are addressed in the research study reported here.

Method

Recording

Caption data for this study was obtained from a sample of television programs recorded off-air. Based on the recommendations of an advisory panel of captioning experts, a sample of 183 programs stratified by program type was selected and recorded in late 1994. Table 1 gives a breakdown of the program types and number of programs selected for each. The programs varied from a half-hour to four hours, with the film "Gettysburg" being the longest. The programs represented a total of approximately 180 hours of air time. Recording was done using the cable television service in a number of different homes. The exception was for some movies shown over premium cable channels. It proved easier to rent the films from a local video store than to record them off the cable system. All recording was done on an ordinary consumer-quality 4-head videocassette recorder (VCR).

In addition, the project staff gained access to 22 captioned music videos, each of which was between two and five minutes in length. These were analyzed separately because they were so different from the regular programming.

Table 1
Sample of Programs

Regular Programs	N	%
Kids Animation	20	11
Kids Educational	11	6
Kids Action	6	3
Prime Time Drama	26	14
Situation Comedie	26	14
Films	21	11
News	20	11
Documentaries	17	9
Talk Shows	10	5
Soap Operas	9	5
Music Specials	6	3
Sports	6	3
Live Performances	5	3
Total Programs	**183**	**100**
Music Videos		
2 to 5 minute song	22	
Total	**205**	

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Data Extraction

The videotapes which were obtained were replayed and the signal was run through a special closed caption decoder which read the captions from line-21 and fed them into a computer file. Special software was written to read the computer's clock and attach a start time and an end time to each line of caption data. This time-and-caption file was the basic raw data which was analyzed for each program.

Those programs which were recorded off commercial channels had advertisements, and even those on PBS or pay channels had station breaks or promotional material. All this non-program material had to be edited out of each data file. This was done by importing each data file into a spreadsheet and deleting the non-program parts, a lengthy and time consuming process. The result was a final "clean" data file for each program.
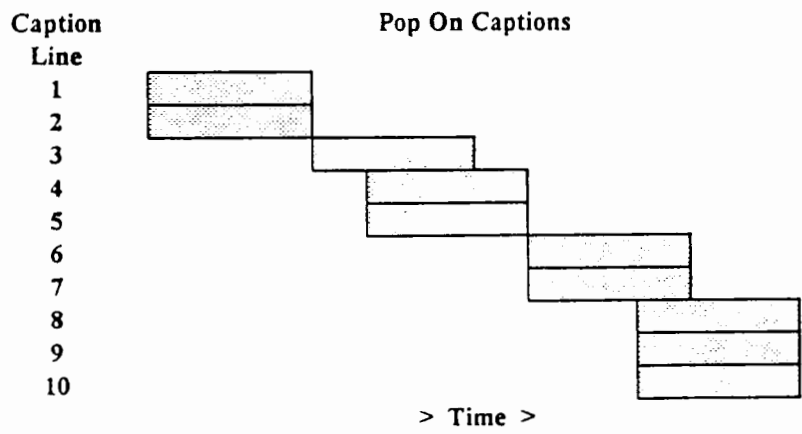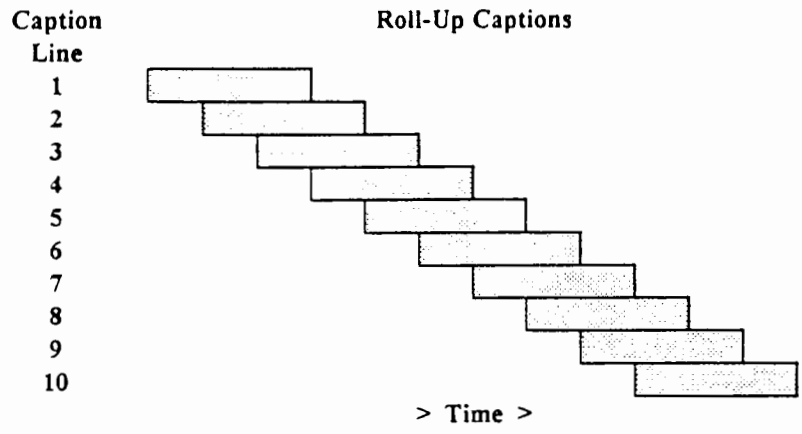
Time Analysis

Analysis of the time data was much more complex than it might seem. The captions and the control codes associated with them are transmitted in a steady binarily-coded stream in the television signal, but the actual appearance of captions on the screen is not necessarily exclusively sequential. There is a great deal of time overlap in the caption lines.

There are two kinds of captions, each with different characteristics. Roll-up captions scroll up the screen, usually in a three-line format. As one line rolls off, a new line rolls up. Although three lines are usually used, two line and four line captions are also possible. The roll usually has a steady speed, but the captioner can make it speed up or slow down as needed to keep up with the program audio. Pop on captions are blocks of words which may have anywhere from one to four lines. They pop onto the screen and pop off after a few seconds. There may be more than one block of pop on captions on the screen at one time. Figure 1 shows a schematic of how roll-up and pop on captions overlap in time. The words are transmitted as one long stream of data, but control codes in the data stream make the decoder divide the words into caption lines and these caption lines have an overlap in screen display time.

The "clean" data files in this study were analyzed with a custom computer software program. Table 2 gives a list of the information outputted by the computer program. "Total time of program" is the actual time from when the program begins to when it ends, including break time and commercial time. It does not include commercials or break time before and after the program. "Total time of captions on screen" is the time during which program captions are present on the screen. It does not include break time, commercial time, or program time during which no captions are shown. All of the analysis in this study is based on "total time of captions on screen".

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Figure 1
Schematic Representation of
Caption Presentation Over Time

Caption
Line

Roll-Up Captions

1
2
3
4
5
6
7
8
9
10

> Time >

Caption
Line

Pop On Captions

1
2
3
4
5
6
7
8
9
10

> Time >

Table 2
Output from Caption Time Analysis Program

Total time of program
Total time of captions on screen
Total # of caption lines
Total # of words
Total # of characters
Mean caption lines per minute
Mean # of words per line
Mean # of characters per line
Mean # of words per minute
Mean characters per minute

Editing Level

Hearing impaired people have repeatedly indicated that they prefer verbatim captioning. They know they are not always getting perfect verbatim captioning because they sometimes see an actor speak a word or group of words for which there is no caption on the screen. The problem is that no one seems to know how much editing is done and how much is lost in the conversion from audio to captioning. In this study, 26 programs were randomly selected and for each program a sample of 10 minutes of audio was compared to the words which were captioned. The results were tabulated to give an indication of the percent of program audio which is usually captioned.

Word Analysis

What words are used in captioning? What is the frequency with which words appear in captions? To provide some insight into these questions, all the words in all the programs in this study were combined into one large computer file. This file, which contained 834,726 words, was sorted and the 16,102 unique words were arranged into a frequency table.

Results and Discussion

Program Characteristics

A total of 205 programs were analyzed, 183 regular programs and 22 short (2-5 minute) music videos. Table 3 provides a breakdown of the programs by length. Overall, there were roughly 180 hours of video.

Table 3
Program Length

Length	Number of Programs
5 minutes	22
.5 hour	78
1 to 1.5 hours	75
2 hours	25
over 2 hours	5
Total	**205**

Table 4 shows the number of programs in this study which were captioned by each of the major caption companies. However, it should not be assumed that the distribution of programs reflects the size of a caption company's business. For example, VITAC captions the one-hour Jay Leno program included in this study, but it captions that program five nights a week. This is about 10 times as much business as captioning a weekly half-hour sitcom.

Table 4
Caption Companies

	Number of Programs Captioned
Regular Programs	
NCI	113
WGBH	45
Captions, Inc.	9
Vitac	8
All Others	8
Music Videos	
NCI	3
WGBH	19
Total	**205**

Caption Speed

Table 5 gives various breakdowns of caption statistics for the 183 programs analyzed. (The 22 short music videos will be discussed separately.) For each program grouping, the mean, standard deviation, maximum value, minimum value, and range are given for words-per-minute (WPM), characters-per-minute (CPM), characters-per-word, caption-lines-per-minute, words-per-line, and characters-per-line. Over all programs, the mean values were 141 WPM, 736 CPM, 5.2 characters per word, 38.7 lines per minute, 3.7 words per line, and 19.2 characters per line. WPM and CPM are the two indexes usually used to measure caption speed. WPM has more intuitive meaning for most people, but it can be influenced by differences in word length. Figures 2 and 3 present the mean WPM and CPM in graphic form. The graphs for WPM and CPM are very similar in shape.

There are two kinds of captions, popping and rolling. In this study, it was found that rolling captions generally present more words over a given period of time as compared to popping captions (151 WPM vs. 138 WPM), but that rolling captions are used for a wide range of audio speeds, from very slow (74 WPM) to very fast (231 WPM).

Sports and music specials have the slowest caption rates. Sports tend to be visual in nature and most viewers are more interested in screen action than in the commentary. Music specials follow the pace of the music and the words to music are often sung more slowly than they would be spoken, resulting in a slower caption rate. Of course, there are exceptions, as will be seen in the discussion of music videos later.

Children's programming also has a slow captioning rate, but that rate was faster than expected. For children's educational, animation, and action programs, the rates were 124, 125, and 131 WPM, respectively. The overall mean for children's programs was 126 WPM. Program speed ranged from 87 WPM for "Sesame Street" to 154 WPM for "Bill Nye". There is clearly a trend toward faster caption rates for programs aimed at older children, but beyond that little is known about matching caption speed with the reading speed of children. Much more research is needed in this area.

In the mid range of caption speed are live performances (137 WPM), documentaries (139 WPM), films (140 WPM), prime time drama (146 WPM), and sitcoms (147 WPM). These kinds of programs tend to be clustered around the mean captioning speed of 141 WPM found over all 183 programs analyzed.

The categories of soaps (154 WPM), news (157 WPM), and talk shows (177 WPM) provided the fastest caption speeds. The mean speed for talk shows was increased by the presence of two late-night programs, "Later With Greg Kinnear" (231 WPM) and "Last Call" (229 WPM). Table 6 provides statistics for the programs with the five fastest and slowest caption speeds. The five fastest programs have more than twice the caption rate of the five slowest programs.

Table 5
Caption Speed Statistics

		Words Per Minute	Characters Per Minute	Characters Per Word	Caption Lines Per Min	Words Per Line	Characters Per Line
All Programs (n=183)	Mean	141	736	5.2	38.7	3.7	19.2
	St.Dev.	21	108	0.2	6.0	0.5	2.7
	Maximum	231	1,171	6.2	55.3	5.0	25.9
	Minimum	74	357	4.7	19.1	2.8	14.0
	Range	157	814	1.5	36.2	2.2	11.9
Rolling Captions (n=48)	Mean	151	781	5.2	34.8	4.4	22.5
	St.Dev.	31	165	0.2	7.2	0.3	1.8
	Maximum	231	1,171	5.6	55.3	5.0	25.9
	Minimum	74	357	4.8	19.1	3.4	16.3
	Range	157	814	0.8	36.2	1.6	9.6
Popping Captions (n=135)	Mean	138	719	5.2	40.0	3.5	18.1
	St.Dev.	15	73	0.2	4.9	0.3	2.0
	Maximum	177	832	6.2	49.6	4.4	22.9
	Minimum	87	463	4.7	24.4	2.8	14.0
	Range	89	369	1.5	25.2	1.6	8.9
Talk Shows (n=10)	Mean	177	897	5.1	40.4	4.4	22.2
	St.Dev.	30	151	0.1	6.4	0.3	1.3
	Maximum	231	1,171	5.3	55.3	5.0	24.6
	Minimum	142	713	4.9	33.2	4.1	20.7
	Range	89	458	0.4	22.1	0.9	4.0
Sports (n=6)	Mean	106	535	5.1	23.2	4.6	23.0
	St.Dev.	15	79	0.1	3.0	0.2	1.2
	Maximum	126	645	5.2	26.3	4.9	25.0
	Minimum	88	442	4.9	19.1	4.1	21.4
	Range	38	203	0.3	7.2	0.7	3.6
Soaps (n=9)	Mean	154	778	5.1	36.7	4.2	21.2
	St.Dev.	15	72	0.1	3.3	0.3	1.2
	Maximum	178	896	5.2	44.1	5.0	24.3
	Minimum	138	696	4.9	33.1	4.0	20.3
	Range	40	200	0.3	11.0	1.0	4.0

Table 5 (Continued)
Caption Speed Statistics

		Words Per Minute	Characters Per Minute	Characters Per Word	Caption Lines Per Min	Words Per Line	Characters Per Line
Sitcom (n=26)	Mean	147	758	5.2	43.1	3.4	17.7
	St.Dev.	10	51	0.1	3.8	0.3	1.3
	Maximum	162	825	5.4	49.6	4.0	20.3
	Minimum	119	593	5.0	35.3	3.0	15.5
	Range	43	232	0.4	14.3	1.1	4.8
Prime Time (n=24)	Mean	146	748	5.1	42.9	3.4	17.5
	St.Dev.	10	52	0.1	3.5	0.2	1.1
	Maximum	164	814	5.4	48.5	3.9	19.6
	Minimum	120	605	4.9	35.6	3.2	16.0
	Range	45	210	0.5	12.9	0.7	3.5
News (n=20)	Mean	157	835	5.3	36.2	4.3	23.1
	St.Dev.	15	86	0.2	4.1	0.3	1.5
	Maximum	183	978	5.7	43.2	4.9	25.9
	Minimum	123	652	4.9	28.7	3.9	20.7
	Range	60	326	0.7	14.5	1.0	5.2
Music Specials (n=6)	Mean	107	551	5.2	29.0	3.7	19.2
	St.Dev.	24	135	0.2	8.1	0.5	2.6
	Maximum	144	729	5.4	41.6	4.5	22.4
	Minimum	74	357	4.8	19.2	3.2	16.3
	Range	70	372	0.6	22.4	1.3	6.1
Live Performances (n=5)	Mean	137	725	5.3	36.5	3.7	19.8
	St.Dev.	19	88	0.1	2.6	0.4	1.9
	Maximum	156	808	5.4	39.3	4.4	22.5
	Minimum	115	623	5.2	34.4	3.3	17.8
	Range	41	185	0.3	4.9	1.1	4.7

Table 5 (Continued)
Caption Speed Statistics

		Words Per Minute	Characters Per Minute	Characters Per Word	Caption Lines Per Min	Words Per Line	Characters Per Line
Kids Educational (n=10)	Mean	124	667	5.4	34 6	3.5	18.7
	St.Dev.	18	99	0.2	4 9	0.3	1.7
	Maximum	154	791	5.7	38.8	4.1	21.7
	Minimum	87	463	5.0	24.4	3.1	16.8
	Range	66	328	0.7	14.4	1.0	4.9
Kids Animation (n=20)	Mean	125	660	5.3	39 4	3.2	16.8
	St.Dev.	13	61	0.2	3.9	0.2	1.0
	Maximum	148	784	5.7	46.3	3.5	19.0
	Minimum	›105	574	4.9	33.4	2.9	15.2
	Range	43	210	0.8	12.9	0.6	3.9
Kids Action (n=6)	Mean	131	685	5.2	40.2	3.3	17.0
	St.Dev.	20	101	0.1	5.0	0.2	1.4
	Maximum	152	788	5.5	45.7	3.5	19.1
	Minimum	95	494	5.1	33 2	2.9	14.9
	Range	57	294	0.4	12.6	0.6	4.2
Film (n=22)	Mean	140	710	5.1	41 3	3.4	17.3
	St.Dev.	13	59	0.2	3 9	0.4	1.9
	Maximum	177	832	5.4	47 9	4.2	20.5
	Minimum	121	607	4.7	32.1	2.8	14.0
	Range	56	225	0.7	15 8	1.4	6.4
Documentary (n=17)	Mean	139	766	5.5	35.7	3.9	21.6
	St.Dev.	12	43	0.2	3 4	0.4	1.7
	Maximum	161	829	6.2	45 6	4.9	25.4
	Minimum	113	698	5.2	31 0	3.3	18.1
	Range	48	131	1.0	14 6	1.6	7 3

Table 6
Programs with Fastest and Slowest Caption Rates

	Type	Caption Type	Mean Words Per Minute	Mean Characters Per Minut	Mean Caption Lines Per Mi	Mean Words Per Line	Mean Characters Per Line	Mean Char Per Word
Fastest Programs								
Later w/Greg Kinnear	Talk show	roll 3	231	1171	55	4.2	21	5.1
Last Call	Talk show	roll 3	229	1134	46	5.0	25	5.0
Connie Chung	News	roll 3	183	920	38	4.8	24	5.0
Guiding Light	Soap	roll 3	178	870	36	5.0	24	4.9
Meet the Press	Talk show	roll 3	177	930	40	4.4	23	5.3
		Mean	**199**	**1005**	**43**	**4.7**	**24**	**5.0**
Slowest Programs								
ABC Sports: Golf	Sports	roll 2	94	463	20	4.7	23	4.9
TNT Basketball	Sports	roll 3	88	442	19	4.6	23	5.0
Sesame Street	Kids Educational	pop	87	463	27	3.2	17	5.3
Billboard Music Awards	Music Special	roll 3	87	430	19	4.5	22	5.0
Whitney Houston	Music Special	roll 3	74	357	22	3.4	16	4.8
		Mean	**86**	**431**	**22**	**4.1**	**20**	**5.0**

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For comparison purposes, the mean WPM and CPM for various breakdown categories are presented in Figures 2 and 3. Since for most programs the number of characters per word does not vary greatly from the overall mean of 5.2 characters, the WPM and CPM graphs closely resemble each other in shape. The finding that word length does not vary greatly among programs is important. It had been suspected that programs considered more difficult to read might have a longer mean word length. This was not the case. For example, although "Sesame Street" is obviously easier to read than "Meet the Press", both have a mean word length of 5.3 characters.

The music videos were analyzed as a separate category. Music videos were included in this study mostly as a matter of curiosity because they represent a unique kind of caption material. Figure 4 presents the caption speed for each of the 22 music videos. The speed varies from 60 to 311 WPM, a much wider range than was found in the regular program categories. Many music videos flash images on the screen for a brief time. This makes captions harder to read because the viewer's attention is distracted. The fastest and most difficult to read captions were found in rap music. For example, the captions for the song "Freak It" proved impossible to understand without repeated viewing.

Caption Editing

For each of the program categories, two programs were selected and a 10-minute segment of each was carefully analyzed to see if there were any words spoken but not captioned. The results are given in Table 7. Several programs were 100% captioned. The most edited program was an ABC golf program where only 81% of the spoken words were captioned. This program was clearly an anomaly because it was captioned live and rolling captions were used, meaning that there were many times when captions could not be put on screen without covering up a player putting or a ball rolling toward a cup.

Among the 26 programs, the average was 94% captioned. When the golf program was excluded, the average was 95% captioned. To take a closer look at the material being edited, two programs were selected and a word-by-word inspection was made. "Hanging with Mr. Cooper" was selected as the most edited (87% captioned) program with pop on captions. The NBC "Today" show was selected as an example of a highly edited (91% captioned) program with roll-up captions.

Table 8 shows the changes made in a segment of the "Mr. Cooper" program. The first column gives the exact words which were spoken. The second column gives the words which were removed, the third column gives the words added, and the fourth column gives the actual captions which appeared on the screen. Most of the editing does not change the meaning of the text. The changes usually just provide a slight simplification of the sentence structure. The editing does not really seem necessary. Perhaps some of the changes were made because the captioner's supervisor gave instructions to caption at a certain WPM rate. For example, replacing "he likes to listen" with "he likes listening" changes the line from four words to three words, but it doesn't make the line shorter or easier to read. Another possibility is that the studio provided the captioner with a script and the captioner captioned the program verbatim, then the studio decided to go over the program again and "sweeten" the audio after it was captioned.

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Figure 2
Mean Words Per Minute

All Programs — 141

Popping Captions — 138
Rolling Captions — 151

Sports — 106
Music Specials — 107
Kids Educational — 124
Kids Animation — 125
Kids Action — 131
Live Performances — 137
Documentary — 139
Film — 140
Prime Time — 146
Sitcom — 147
Soaps — 154
News — 157
Talk Shows — 177

Mean WPM

20 40 60 80 100 120 140 160 180

13
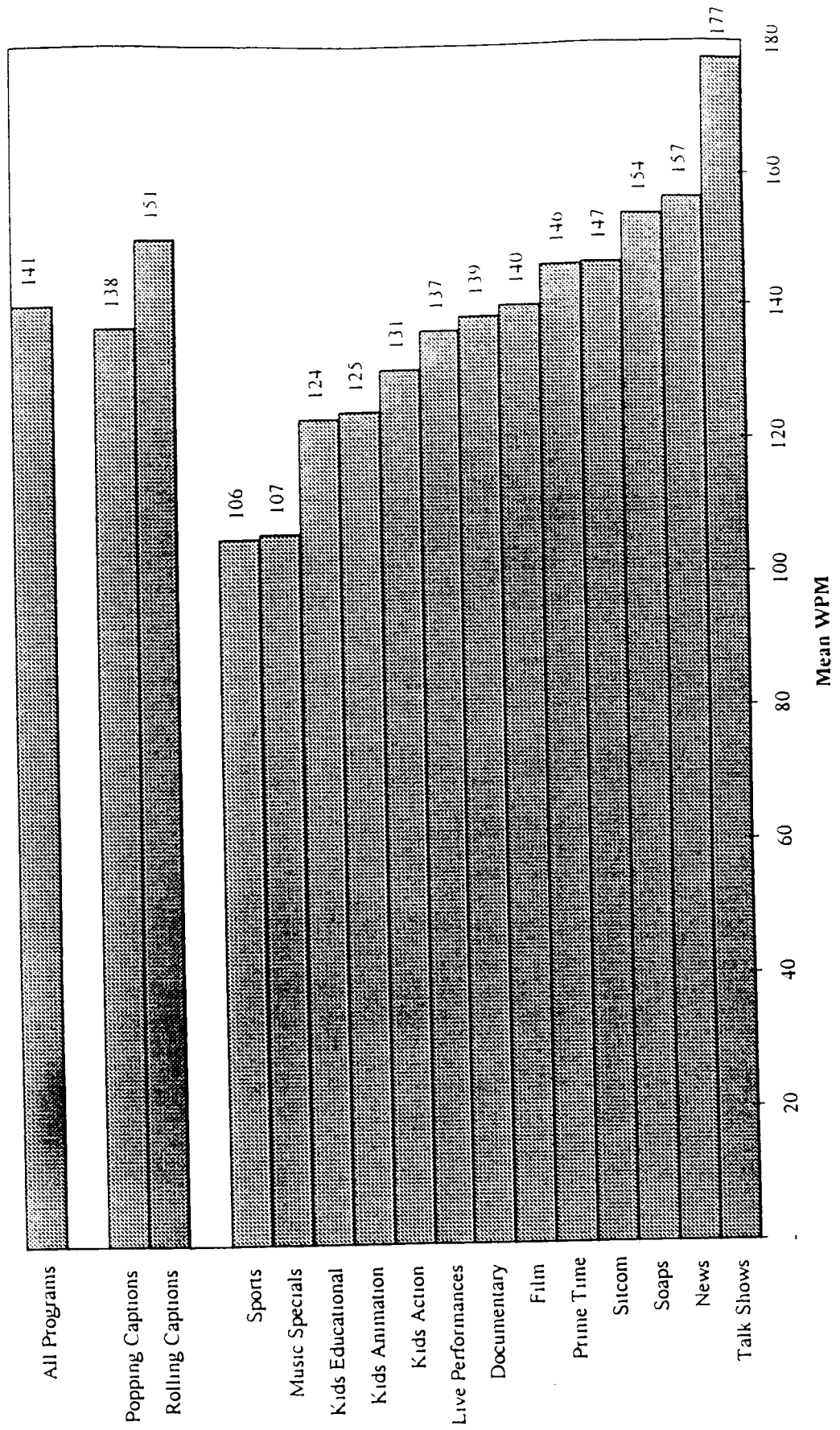
Figure 3
Mean Characters Per Minute

Program	Mean CPM
All Programs	730
Popping Captions	719
Rolling Captions	781
Sports	535
Music Specials	551
Kids Animation	660
Kids Educational	667
Kids Action	685
Film	710
Live Performances	725
Prime Time	748
Sitcom	758
Documentary	766
Soaps	778
News	835
Talk Shows	897

Mean CPM
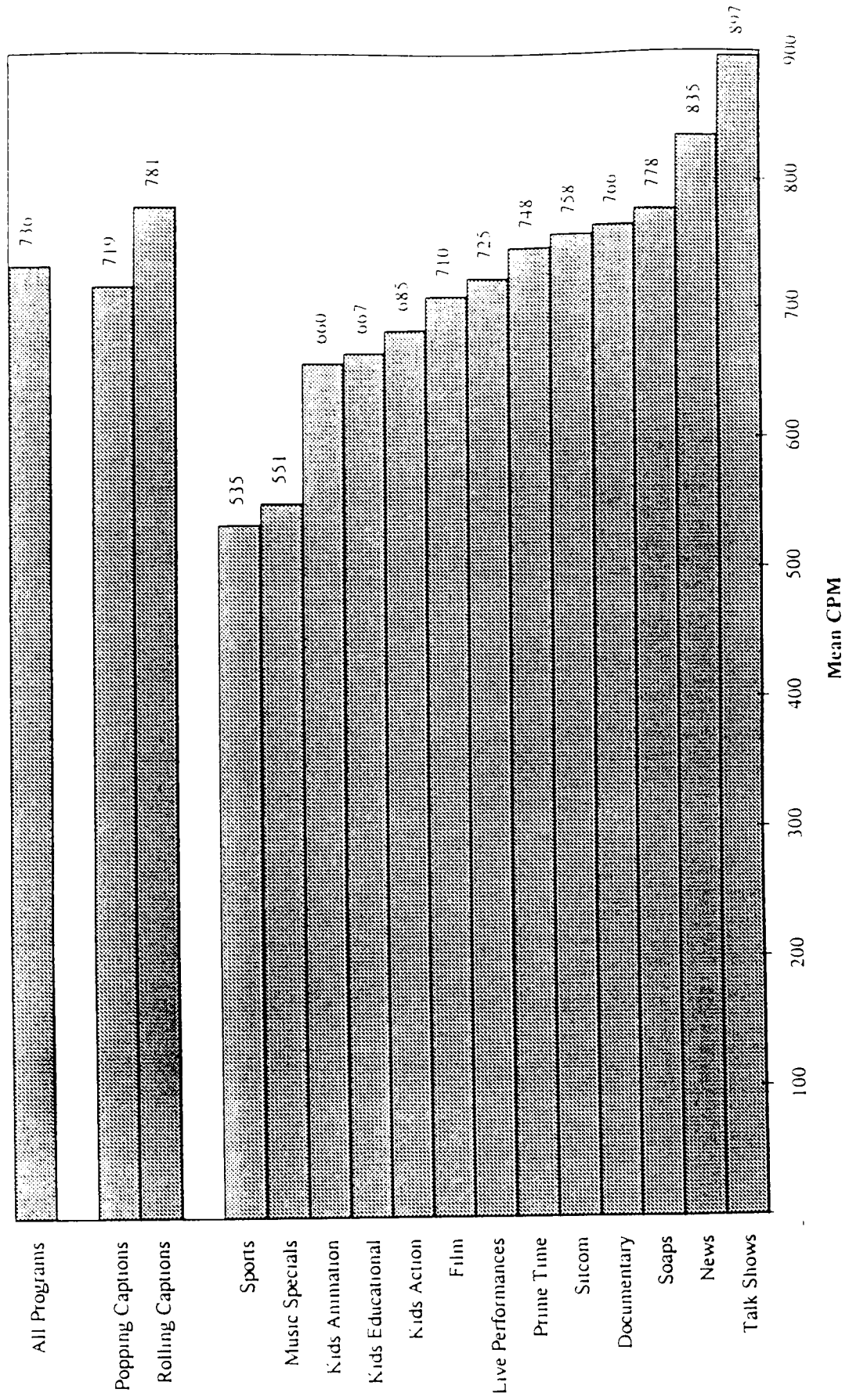
Figure 4
Music Video Words per Minute

Song	Words per Minute
Human Behavior	60
Big Time Sensuality	60
Evaleline	68
Come Undone	76
Into Your Arms	76
One Caress	78
Not Quite Sonic	82
Blue	83
My Sister	86
Cannonball	87
Rain Will Fall	96
The Gift	99
God	118
Runaway Love	119
Paying the Price of Love	124
Work for Food	127
Push Th' Little Daisies	152
Who Was in My Room Last Night?	158
Classic Material	170
Whatta Man	196
What's Next	230
Freak It	311

Table 7
Percentage of Audio Captioned

Program Type	Program Title	Percent Captioned
Soap	The Bold and the Beautiful	100
	Guiding Light	100
Documentary	Wild America	100
	Great Railroad Journey	99
Film	Ace Ventura	98
	Madame Butterfly	97
Talk Show	David Letterman	99
	Jay Leno	96
Live Performance	Clio Awards	97
	Seigfried and Roy	95
Prime Time	Arly Hanks	97
	ER	94
Music Special	Whitney Houston	100
	Billy Ray Cyrus Special	91
News	ABC News	98
	TODAY	91
Kids Action	Power Rangers	96
	California Dreams	90
Kids Animation	Animaniacs	97
	Batman - The Series	89
Kids Educational	Kids Songs	93
	Barney	88
Sitcom	In Living Color	91
	Hangin With Mr. Cooper	87
Sports	CBS Sports: Figure Skatin	90
	ABC Sports: Golf	81

Table 8
Changes in "Mr. Cooper"

Spoken	Remove	Add	Caption
TURN IT UP. I CAN'T HEAR ANYTHING	I CAN'T HEAR ANYTHING		TURN IT UP.
SHH' HE'S ON THE PHONE			SHH' HE'S ON THE PHONE
COME ON, BABY			COME ON, BABY
YOU KNOW YOU DON'T HAVE	YOU KNOW		YOU DON'T HAVE
TO GO SHOPPING			TO GO SHOPPING
YOU KNOW WHAT BIG DADDY			YOU KNOW WHAT BIG DADDY
WANT FOR HIS BIRTHDAY			WANT FOR HIS BIRTHDAY
HOLD ON			HOLD ON
LET ME CALL YOU BACK. ALL RIGHT	ALL RIGHT		LET ME CALL YOU BACK.
WHAT DOES HE WANT?			WHAT DOES HE WANT?
HEY, BIG DADDY			HEY, BIG DADDY
WE'RE SORRY COUSIN MARK.	COUSIN MARK		WE'RE SORRY
WE WERE JUST TRYING TO FIND OUT	WERE JUST TRYING	WANTED	WE WANTED TO FIND OUT
WHAT YOU WANTED			WHAT YOU WANTED
FOR YOUR BIRTHDAY			FOR YOUR BIRTHDAY
WELL YOU KNOW YOU TWO SHOULDN'T	WELL YOU KNOW TWO		YOU SHOULDN'T
BE EAVESDROPPING.			BE EAVESDROPPING.
'CAUSE YOU NEVER KNOW	CAUSE		YOU NEVER KNOW
WHAT YOU MIGHT HEAR,			WHAT YOU MIGHT HEAR,
LIKE HOW TYLER'S			LIKE HOW TYLER'S
PARENTS ARE SENDING HIM	PARENTS ARE SENDING HIM	BEING SENT	BEING SENT
TO MILITARY SCHOOL.			TO MILITARY SCHOOL.
THE FEW, THE PROUD,			THE FEW, THE PROUD,
THE BIG-HEADED.			THE BIG-HEADED.
NOW WHERE'D YOU GET	NOW		WHERE'D YOU GET
THE WALKIE-TALKIE?			THE WALKIE-TALKIE?
IT'S A BABY MONITOR.			IT'S A BABY MONITOR.
MY DAD USES IT TO LISTEN IN	MY		DAD USES IT TO LISTEN IN
ON THE BABYSITTER.			ON THE BABYSITTER.
YOU MEAN YOUR BABY SISTER.	YOUR		YOU MEAN BABY SISTER.
NO. I MEAN THE BABYSITTER.			NO. I MEAN THE BABYSITTER.
HE LIKES TO LISTEN	TO	ING	HE LIKES LISTENING
TO HER READ BEDTIME STORIES,			TO HER READ BEDTIME STORIES
OR AT LEAST UNTIL	OR		AT LEAST UNTIL
MY MOTHER CAUGHT HIM.			MY MOTHER CAUGHT HIM.
MOM REALLY RAKED IT IN			MOM REALLY RAKED IT IN
THIS CHRISTMAS.			THIS CHRISTMAS.
WELL, ALL RIGHT, GOMER.			WELL, ALL RIGHT, GOMER.
GET OUT OF HERE			GET OUT OF HERE
AND TAKE PRIVATE BENJAMIN			AND TAKE PRIVATE BENJAMIN
WITH YOU. GET OUT.	GET OUT.		WITH YOU
KIDS AND THEIR TOYS.			KIDS AND THEIR TOYS.
THIS IS A GOOD WAY			THIS IS A GOOD WAY
FOR ME TO FIND OUT			FOR ME TO FIND OUT
WHAT I'M GETTING			WHAT I'M GETTING
FOR MY BIRTHDAY THOUGH.			FOR MY BIRTHDAY THOUGH.
HI, MARK.			HI, MARK.
HEY' HEY.	HEY	HA HA	HEY' HA HA.
WHAT'S IN THE BAGS, GIRLS?			WHAT'S IN THE BAGS, GIRLS?
UH, BIRTHDAY PLATES.			UH, BIRTHDAY PLATES.
PARTY CANDLES,			PARTY CANDLES,
60 OF MY CLOSEST			60 OF MY CLOSEST
FRIENDS, WHAT?			FRIENDS, WHAT?
GEE MARK, I DON'T KNOW WHAT YOU	I DON'T KNOW	ARE	GEE MARK, WHAT ARE YOU
TALKING ABOUT?			TALKING ABOUT?

Tables 9a, 9b, and 10 show two different kinds of editing for the "Today" program. This program is partly scripted and partly live. For the scripted part, the caption company is given a copy of the script before the show airs. They convert the script to captions and feed these captions into the broadcast at air time. The announcers on the screen see the same script on a teleprompter, but they do not always say exactly the same words that they read. The result is "editing" which is actually ad-libbing on the part of the announcers. Table 9a shows a scripted segment where several people are interacting. There is considerable ad-libbing. Table 9b shows a scripted segment which is straight news reporting, the announcer stays with the script and there is very little difference between the spoken and captioned versions. Table 10 shows a segment of "Today" which was captioned live by a stenocaptioner. There is a great deal of editing, but the essential information is still there.

Word Analysis

The caption scripts from all the programs in this study were combined into one large computer file. This file was edited to remove punctuation and anything else which was not a word. Certain non-standard "words", such as "uh", "mmmmm", and "ahhhh", were kept, since they are commonly used in captioning to indicate certain sounds in the audio. The resulting word list was sorted and arranged into a frequency table. The file had 843,726 words, of which 16,102 were unique. Just 10 words (the, you, to, a , I, and, of, in, it, that) accounted for 176,793 of the 834,726 words (21%). Half of all the words captioned were accounted for by just 79 unique words. Figure 5 gives a graph of the cumulative frequency of the 4,000 most frequent unique words. The horizontal axis gives the number of unique words and the vertical axis gives the percent of the entire word file accounted for by those unique words. Table 11 gives a list of the 250 most frequent unique words. These words account for more than 2/3 of all words used in the captions in this study.

For comparison, the frequency distributions of the words in about a dozen individual programs were examined. All the cumulative frequency graphs for these programs were very similar. Figure 6 provides a cumulative frequency graph for the 678 unique words used in an episode of "Wings", a typical situation comedy. For comparison purposes, the graph also includes the cumulative frequency curve for the 678 most frequently used words among all programs. The "All Programs" line provides a lower bound for the frequency curve of any individual program, since it represents all unique words available among all programs in this study.

In this instance, just 51 unique words accounted for half of all words used in the captions for this "Wings" episode and 174 words accounted for 75% of the words used. The important point is that captioned television (and by inference, the audio which the captions represent) use relatively few unique words. There are at least 500,000 words in the English language, but learning less than 500 words will cover most of the vocabulary in any television program shown in the United States today.

Table 9a
Changes in Scripted "Today"

Spoken	Remove	Add	Caption
AND WELCOME TO "TODAY"			>>> AND WELCOME TO "TODAY"
ON THIS THURSDAY MORNING			ON THIS THURSDAY MORNING
I'M KATIE COURIC			I'M KATIE COURIC
AND I'M MATT LAUER, FILLING IN FOR	FILLING IN FOR		>> AND I'M MATT LAUER,
BRYANT GUMBELL WHO IS ON	GUMBELL WHO		BRYANT IS ON
VACATION THIS WEEK			VACATION THIS WEEK
AND MATT AHEAD IN OUR FIRST HALF	AND MATT		>> AHEAD IN OUR FIRST HALF
HOUR THIS MORNING,	THIS MORNING		HOUR.
WE'RE GOING TO GET AN UPDATE	RE GOING TO	LL	WE'LL GET AN UPDATE
ON THE LATEST DEVELOPMENTS			ON THE LATEST DEVELOPMENTS
IN THE O J SIMPSON CASE			IN THE O J SIMPSON CASE
AND HEAR WHAT NICOLE BROWN			AND HEAR WHAT NICOLE BROWN
SIMPSON'S SISTER HAD TO SAY			SIMPSON'S SISTER HAD TO SAY
OUTSIDE THE COURTROOM			OUTSIDE THE COURTROOM
WE'LL ALSO LOOK			WE'LL ALSO LOOK
AT THE BIZARRE AND VERY TRAGIC	VERY		AT THE BIZARRE AND TRAGIC
STORY OUT OF SWITZERLAND,			STORY OUT OF SWITZERLAND,
WHERE 48 PEOPLE DIED			WHERE 48 PEOPLE DIED
IN A MASS SUICIDE.			IN A MASS SUICIDE.
MATT, AND ANOTHER SAD	MATT	VERY	>>AND ANOTHER VERY SAD
STORY THIS MORNING – KATIE	KATIE		STORY THIS MORNING
THE PARENTS OF A YOUNG AMERICAN BOY	AMERICAN		THE PARENTS OF A YOUNG BOY
KILLED BY BANDITS IN ITALY			KILLED BY BANDITS IN ITALY
A WEEK AGO TODAY			A WEEK AGO TODAY.
THEY DONATED HIS ORGANS		ALL	THEY DONATED ALL HIS ORGANS
SO ITALIANS MIGHT LIVE.			SO ITALIANS MIGHT LIVE.
ALSO AHEAD ACTOR JOHN TRAVOLTA IS	ALSO AHEAD IS	WILL BE	ACTOR JOHN TRAVOLTA WILL BE
HERE TO TALK ABOUT			HERE TO TALK ABOUT
HIS LATEST MOVIE, WHICH IS			HIS LATEST MOVIE, WHICH IS
GETTING A LOT OF CRITICAL			GETTING A LOT OF CRITICAL
ACCLAIM, IT'S CALLED "PULP FICTION."	IT'S CALLED		ACCLAIM, "PULP FICTION."
BASEBALL GREAT MICKEY MANTLE			BASEBALL GREAT MICKEY MANTLE
WILL BE ALONG AND WE'LL			WILL BE ALONG AND WE'LL
LEARN SOME HEALTHY AND TASTY			LEARN SOME HEALTHY AND TASTY
WAYS TO PREPARE SEAFOOD	SEAFOOD	FISH	WAYS TO PREPARE FISH.
WHAT KIND OF SEAFOOD?			>> WHAT KIND OF SEAFOOD?
I THINK TODAY WE'RE DOING			>> I THINK TODAY WE'RE DOING
STEAMED SHRIMP AND YOU'RE GO			STEAMED SHRIMP AND YOU'RE GO
TO HELP			TO HELP.
I AM, I'M GONNA BE YOUR SOUS-CHEF	AM, I'M GONNA	WILL	>> I WILL BE YOUR SOUS-CHEF
YOU'RE THE STEAMER.	YOU'RE THE STEAMER.		
OK, BUT LET'S GET STARTED	OK, BUT GET STARTED	GO TO	LET'S GO TO
WITH THE MORNING'S	WITH THE MORNING'S		
TOP NEWS STORY OVER AT	TOP NEWS STORY OVER AT		
THE NEWSDESK			THE NEWSDESK
AND FOR THAT WE WILL TURN TO	FOR THAT		AND WE WILL TURN TO
ELIZABETH VARGAS			ELIZABETH VARGAS.
GOOD MORNING, KATIE AND MATT	KATIE AND MATT.		>> GOOD MORNING,
GOOD MORNING, EVERYONE	GOOD MORNING		EVERYONE.
JURY SELECTION WILL BE			>>> JURY SELECTION WILL BE
ON THE SIDELINES AGAIN TODAY			ON THE SIDELINES AGAIN TODAY
AT THE O J SIMPSON TRIAL			AT THE O J SIMPSON TRIAL
IN THE CONTINUING DEBATE			IN THE CONTINUING DEBATE
OVER EVIDENCE TAKEN			OVER EVIDENCE TAKEN
FROM SIMPSON'S CAR.			FROM SIMPSON'S CAR.

Table 9b
Changes in Scripted "Today"

Spoken	Remove	Add	Caption
THE GRIM SEARCH			>>> THE GRIM SEARCH
CONTINUES THROUGH THE RUINS			CONTINUES THROUGH THE RUINS
OF BURNED-OUT HOMES	HOMES	HOUSES	OF BURNED-OUT HOUSES
IN SWITZERLAND			IN SWITZERLAND
IT'S THE AFTERMATH			IT'S THE AFTERMATH
OF AN APPARENT MASS SUICIDE			OF AN APPARENT MASS SUICIDE
BY MEMBERS OF A DOOMSDAY			BY MEMBERS OF A DOOMSDAY
CULT THAT HAS LEFT AT LEAST			CULT THAT HAS LEFT AT LEAST
50 PEOPLE DEAD			50 PEOPLE DEAD
IN SWITZERLAND AND IN CANADA.	IN		IN SWITZERLAND AND CANADA.
DETAILS NOW FROM NBC'S	NOW		DETAILS FROM NBC'S
KEITH MILLER.			KEITH MILLER.
THE POLICE SAY THE DEATH			>> THE POLICE SAY THE DEATH
TOLL COULD GO HIGHER.			TOLL COULD GO HIGHER.
INVESTIGATORS WAITED UNTIL			INVESTIGATORS WAITED UNTIL
THIS MORNING TO SEARCH			THIS MORNING TO SEARCH
A BURNT-OUT SKI CHALET	T	ED	A BURNED-OUT SKI CHALET
FEARING IT COULD BE			FEARING IT COULD BE
BOOBY-TRAPPED			BOOBY-TRAPPED.
A RELIGIOUS SECT CALLED			A RELIGIOUS SECT CALLED
THE ORDER OF THE SOLAR			THE ORDER OF THE SOLAR
TEMPLE IS BEHIND, WHAT			TEMPLE IS BEHIND, WHAT
POLICE CALL, A BIZARRE			POLICE CALL, A BIZARRE
RITUAL SLAUGHTER.			RITUAL SLAUGHTER.
23 BODIES WERE FOUND IN THIS			23 BODIES WERE FOUND IN THIS
BURNED-OUT FARMHOUSE			BURNED-OUT FARMHOUSE
IN THE VILLAGE OF CHEIRY,			IN THE VILLAGE OF CHEIRY,
80 MILES NORTHEAST			80 MILES NORTHEAST
OF GENEVA			OF GENEVA
ANOTHER 25 BODIES WERE			ANOTHER 25 BODIES WERE
DISCOVERED IN THREE SKI			DISCOVERED IN THREE SKI
CHALETS 90 MILES AWAY.			CHALETS 90 MILES AWAY.
MASS SUICIDE IS POSSIBLE.			MASS SUICIDE IS POSSIBLE.
SO IS MURDER.			SO IS MURDER.
TWENTY OF THE VICTIMS			TWENTY OF THE VICTIMS
IN THE FARMHOUSE HAD BEEN			IN THE FARMHOUSE HAD BEEN
SHOT.			SHOT.
MOST OF THE BODIES WERE			MOST OF THE BODIES WERE
FOUND IN AN UNDERGROUND ROOM			FOUND IN AN UNDERGROUND ROOM
THAT MAY HAVE BEEN USED			THAT MAY HAVE BEEN USED
FOR RELIGIOUS RITUALS.			FOR RELIGIOUS RITUALS.
EVERYTHING LOOKED LIKE			>> EVERYTHING LOOKED LIKE
LIKE PEOPLE LIKE IN A WAX MUSEUM.	LIKE		PEOPLE LIKE IN A WAX MUSEUM.
SIMILAR CIRCUMSTANCES			>> SIMILAR CIRCUMSTANCES
SURROUNDED THE DEATHS OF TWO			SURROUNDED THE DEATHS OF TWO
PEOPLE NEAR MONTREAL			PEOPLE NEAR MONTREAL
ON TUESDAY.			ON TUESDAY.
THEY WERE DISCOVERED			THEY WERE DISCOVERED
IN THE BURNT-OUT DUPLEX			IN THE BURNT-OUT DUPLEX
ADJACENT TO THE ONE OWNED			ADJACENT TO THE ONE OWNED
BY THE SECT'S LEADER,			BY THE SECT'S LEADER,
LUC JOURET			LUC JOURET

Table 10
Changes in Live "Today"

Spoken	Remove	Added	Caption
WHAT HAPPENED?			WHAT HAPPENED?
>>WELL, UH INDIVIDUAL INVESTORS	WELL, UH		>> INDIVIDUAL INVESTORS
ACTUALLY HUNG IN THERE			ACTUALLY HUNG IN THERE
THE MARKET WAS DOWN THE			THE MARKET WAS DOWN THE
WORST WE'VE HAD ALL YEAR			WORST WE'VE HAD ALL YEAR
MOSTLY BECAUSE TECHNOLOGY STOCKS			BECAUSE TECHNOLOGY STOCKS
TOOK A REAL HIT			TOOK A REAL HIT
>>AND DO YOU NOW RECOMMEND THAT, UH, SMALL	AND, NOW, THAT, UH,		DO YOU RECOMMEND SMALL
INVESTORS GET BACK INTO			INVESTORS GET BACK INTO
TECHNOLOGY STOCKS?			TECHNOLOGY STOCKS?
>>YES	>>YES		
>>AS A LOT OF PEOPLE ARE DOING	AS		A LOT OF PEOPLE ARE DOING
RIGHT NOW	RIGHT NOW	THIS?	THIS?
>> THEY ARE THEY ARE	THEY ARE		>> THEY ARE
THEY HAVEN'T HAD MUCH CHANCE TO	MUCH		THEY HAVEN'T HAD A CHANCE TO
GET INTO THESE THINGS AT LOWER	THINGS		GET INTO THESE AT LOWER
PRICES			PRICES
BUT THEY'VE DONE THAT AND ALREADY THEY'VE	BUT, ALREADY THEY'VE	HAVE	THEY'VE DONE THAT AND HAVE
COME BACK QUITE STRONGLY. SO I THINK	QUITE, SO I THINK		COME BACK STRONGLY
IT IS TIME TO GET BACK INTO	IS	S	IT'S TIME TO GET BACK INTO
TECHNOLOGY			TECHNOLOGY
THEY'RE GOING MUCH HIGHER	MUCH		THEY'RE GOING HIGHER
>> SCARY TIMES ALSO SCARY THE ORANGE, UH	SCARY TIMES, UH		>> ALSO SCARY THE ORANGE
COUNTY'S MUNICIPAL BOND	S		COUNTY MUNICIPAL BOND
DEFAULT UH	UH		DEFAULT
WHAT'S THE FALLOUT FROM THAT?	FROM THAT		WHAT'S THE FALLOUT?
>> WELL, WHAT HAPPENED WAS THEY DEFAULTED JUST TWO	WELL, WHAT HAPPENED WAS		>> THEY DEFAULTED JUST TWO
WEEKS AGO, OR SO, ON 679 MILLION DOLLARS WORTH OF MUNICIPAL	679 MILLION DOLLARS WORTH OF		WEEKS OR SO AGO ON MUNICIPAL
BONDS			BONDS
THAT'S REALLY PUT A FRIGHT INTO THE	REALLY		THAT'S PUT A FRIGHT INTO THE
MUNICIPAL BOND MARKET			MUNICIPAL BOND MARKET
WE HAVEN'T HAD ANYTHING LIKE			WE HAVEN'T HAD ANYTHING LIKE
THAT BEFORE, PARTICULARLY A VERY RICH	BEFORE, VERY		THAT, PARTICULARLY A RICH
COUNTY DEFAULTING ON ITS BONDS SO.	DEFAULTING ON ITS BONDS, SO.		COUNTY
PEOPLE ARE GETTING VERY SHY	VERY		PEOPLE ARE GETTING SHY
THEY'VE TAKEN $13 BILLION OUT OF	THEY'VE		TAKEN $13 BILLION OUT OF
MUNICIPAL BOND FUNDS IN THE			MUNICIPAL BOND FUNDS IN THE
LAST TWO OR THREE WEEKS			LAST TWO OR THREE WEEKS
>>THERE'S BEEN SOME DISCUSSION ABOUT A FLAT TAX	THERE'S BEEN SOME DISCUSSION ABOUT		>> A FLAT TAX
HOW WOULD THAT AFFECT THE			HOW WOULD THAT AFFECT THE
MUNICIPAL BOND MARKET?	MUNICIPAL		BOND MARKET?
>> DEVASTATING	DEVASTATING	TERRIBLE	>> TERRIBLE
THAT WOULD BE TERRIBLE FOR THE	THAT WOULD BE TERRIBLE FOR THE	DEVASTATING	DEVASTATING
MUNICIPAL BOND MARKET BECAUSE, UH	MUNICIPAL BOND MARKET BECAUSE, UH		
IT WOULD NO LONGER BE			IT WOULD NO LONGER BE
TAX-EXEMPT SO ON AN	SO ON AN		TAX-EXEMPT
AFTER TAX BASIS, YOU'D BE WAY BEHIND	YOU'D BE		AFTER TAX BASIS, WAY BEHIND
THAT WOULD HURT MUNIS EVEN MORE	THAT WOULD HURT MUNIS EVEN MORE		

Figure 5
Cumulative Frequency Percentage for
4000 Most Frequent Unique Words
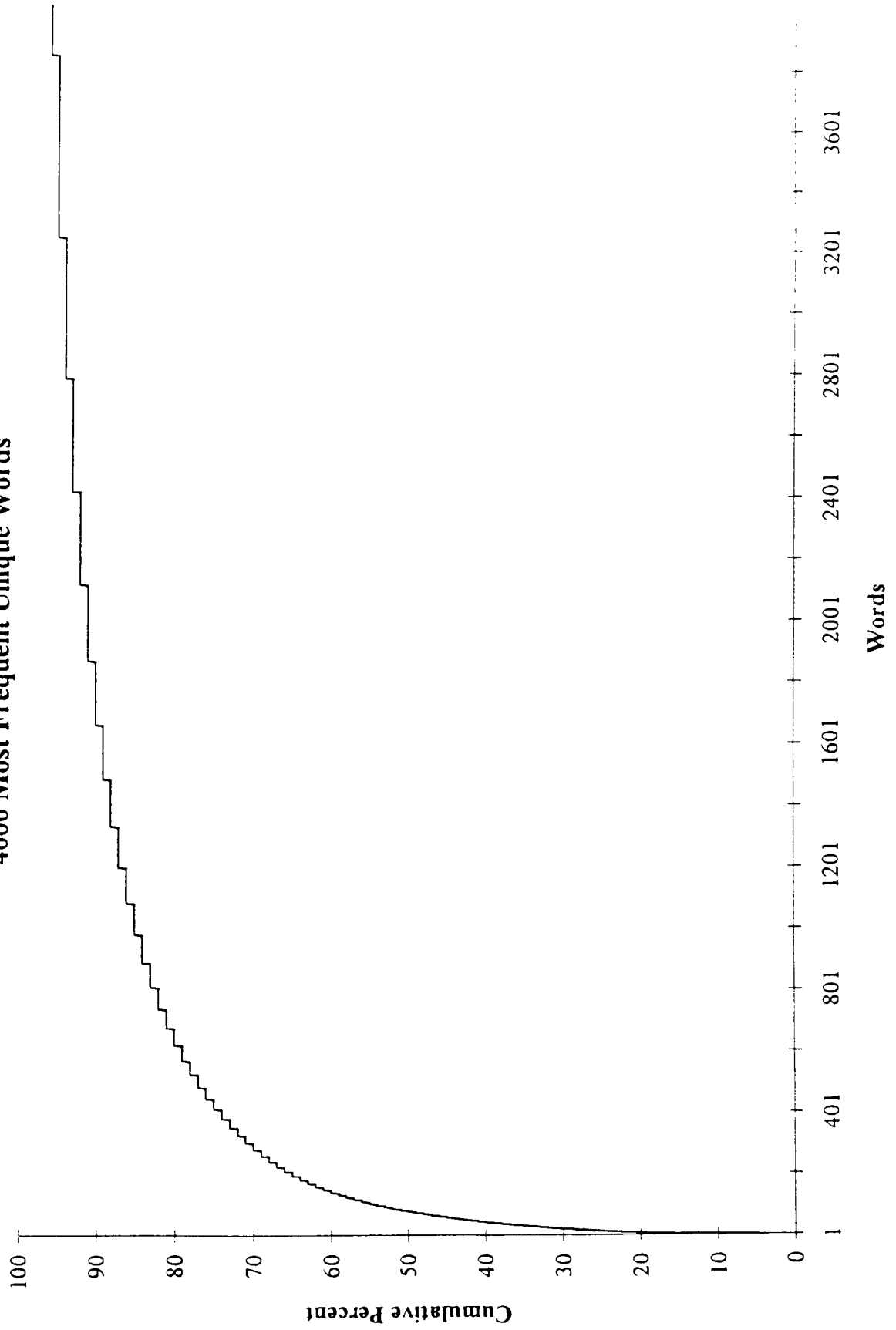
Table 11
Frequently Used Words

Word	Freq.	Percent	Word	Freq.	Percent	Word	Freq.	Percent	Word	Freq.	Percent
THE	30142	3.61	FROM	2373	46.27	TOO	1048	58.06	THOUGHT	652	64.23
YOU	22600	6.32	THAT'S	2343	46.55	DIDN'T	1040	58.18	BELIEVE	650	64.31
TO	22161	8.97	LOOK	2324	46.83	HA	1034	58.31	BOY	646	64.38
A	20023	11.37	HIM	2316	47.1	NEW	1023	58.43	THREE	644	64.46
I	19991	13.77	YOU'RE	2285	47.38	TALK	1020	58.55	EVERY	641	64.54
AND	16130	15.7	TIME	2243	47.65	INTO	1012	58.67	CAPTION	639	64.61
OF	13914	17.37	WHEN	2231	47.91	WORK	1007	58.79	EVER	639	64.69
IN	10941	18.68	SEE	2230	48.18	PLAY	1006	58.91	SHOW	636	64.77
IT	10496	19.93	HOW	2214	48.45	TRY	998	59.03	AWAY	635	64.84
THAT	10395	21.18	SAY	2200	48.71	MUCH	988	59.15	ALWAYS	626	64.92
IS	8764	22.23	GOOD	2155	48.97	GUY	987	59.27	ANYTHING	607	64.99
THIS	7116	23.08	BY	2115	49.22	I'VE	980	59.39	AM	598	65.06
FOR	6679	23.88	HAD	2041	49.47	UH	976	59.5	LONG	593	65.13
ON	6411	24.65	YEAH	1971	49.7	MEAN	954	59.62	ASK	587	65.2
WAS	5945	25.36	AN	1968	49.94	THERE'S	954	59.73	TODAY	587	65.27
HAVE	5804	26.06	WOULD	1899	50.17	ONLY	938	59.84	NAME	583	65.34
ME	5740	26.75	DID	1804	50.38	GIVE	924	59.96	RUN	583	65.41
WE	5521	27.41	TAKE	1794	50.6	OFF	920	60.07	PLACE	581	65.48
WHAT	5464	28.06	WERE	1765	50.81	ANY	917	60.18	STOP	580	65.55
BE	5449	28.71	MAKE	1757	51.02	FEEL	907	60.28	WHICH	570	65.62
HE	5218	29.34	BACK	1739	51.23	THESE	905	60.39	SORRY	566	65.69
WITH	4895	29.93	WHO	1719	51.43	GREAT	884	60.5	FRIEND	564	65.76
MY	4834	30.5	BEEN	1707	51.64	LET'S	884	60.6	BETTER	563	65.82
YOUR	4385	31.03	HAS	1697	51.84	PREPARE	871	60.71	THROUGH	562	65.89
DO	4375	31.55	THEM	1599	52.03	LET	863	60.81	HOUSE	559	65.96
I'M	4258	32.06	OR	1553	52.22	LIFE	859	60.91	DOES	558	66.02
ARE	4224	32.57	SOME	1547	52.4	OTHER	852	61.02	FAMILY	555	66.09
ALL	4129	33.07	MAN	1529	52.59	NIGHT	831	61.12	KIND	554	66.16
NOT	4117	33.56	VERY	1510	52.77	THEY'RE	829	61.22	MAY	551	66.22
IT'S	4111	34.05	OUR	1475	52.94	HELP	805	61.31	MOST	548	66.29
KNOW	3962	34.53	DOWN	1474	53.12	HAPPEN	802	61.41	GOD	530	66.35
NO	3890	34.99	THING	1456	53.3	WHAT'S	800	61.5	WOMAN	524	66.41
BUT	3885	35.46	WAY	1431	53.47	THOSE	784	61.6	MANY	512	66.48
DON'T	3859	35.92	YEAR	1420	53.64	THAN	782	61.69	HI	510	66.54
GET	3739	36.37	PEOPLE	1409	53.81	FIND	776	61.78	NOTHING	509	66.6
THEY	3612	36.8	COULD	1408	53.97	LAST	760	61.88	NEXT	508	66.66
LIKE	3436	37.21	MORE	1383	54.14	WORLD	760	61.97	MOVE	503	66.72
SO	3425	37.62	US	1381	54.31	AFTER	756	62.06	ANOTHER	499	66.78
JUST	3300	38.02	I'LL	1369	54.47	SHE'S	743	62.15	CAME	498	66.84
AT	3295	38.41	YES	1364	54.63	MR	741	62.24	TONIGHT	495	66.9
HERE	3197	38.8	HE'S	1359	54.8	EVEN	740	62.32	LEFT	493	66.96
OUT	3117	39.17	THANK	1352	54.96	HOME	735	62.41	TURN	484	67.02
UP	3074	39.54	LITTLE	1351	55.12	AGAIN	727	62.5	DOESN'T	483	67.07
ABOUT	3031	39.9	LOVE	1340	55.28	MADE	719	62.59	I'D	482	67.13
ONE	2998	40.26	WHY	1278	55.43	BIG	718	62.67	NEITHER	481	67.19
RIGHT	2906	40.61	REALLY	1263	55.58	DOING	718	62.76	MUST	476	67.25
COME	2904	40.95	TELL	1256	55.73	PLEASE	712	62.84	KILL	472	67.3
THERE	2886	41.3	OVER	1249	55.88	PUT	711	62.93	HAND	470	67.36
OH	2781	41.63	CALL	1241	56.03	LOT	709	63.01	STAY	468	67.41
CAN	2772	41.97	CAN'T	1192	56.18	SHOULD	700	63.1	WATCH	467	67.47
IF	2751	42.3	WHERE	1179	56.32	BEFORE	694	63.18	YOU'VE	467	67.53
WANT	2730	42.62	SAID	1169	56.46	AROUND	688	63.26	CHILDREN	465	67.58
AS	2714	42.95	DAY	1163	56.6	WAIT	688	63.34	HEAR	463	67.64
NOW	2696	43.27	NEVER	1158	56.74	STILL	687	63.43	HOPE	462	67.69
SHE	2686	43.59	SOMETHING	1158	56.87	START	684	63.51	MOTHER	455	67.75
THINK	2606	43.9	WE'RE	1155	57.01	LIVE	680	63.59	NICE	455	67.8
HER	2591	44.22	THEN	1140	57.15	USE	675	63.67	REMEMBER	454	67.86
GO	2584	44.52	TWO	1133	57.28	SURE	674	63.75	OWN	453	67.91
WILL	2522	44.83	BECAUSE	1115	57.42	KEEP	671	63.83	WON'T	451	67.96
WELL	2442	45.12	THEIR	1089	57.55	SIR	670	63.91	MORNING	449	68.02
GOING	2428	45.41	HEY	1087	57.68	OLD	667	63.99	EVERYTHING	446	68.07
HIS	2409	45.7	FIRST	1065	57.81	MAYBE	657	64.07			
GOT	2375	45.98	NEED	1049	57.93	WE'LL	653	64.15			

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Figure 6
Cumulative Frequency Percentage
for "Wings" and "All Programs"