

Political Speech: Poem, Preaching, Performance? A Pilot Computational Study.

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Abstract. Multiple computational tools were used to explore reasons why some political speech might be more effective than others. Although we live in a culture primarily centered on the written word, key elements including political decision-making are primarily based upon oral/aural speech, either directly from a candidate or in other forms such as political ads. This may reflect our preoccupation with the complicated, logical aspects of life and yet an unconscious understanding that other aspects, such as political, are based upon complex dynamics. Other authors have characterized political speeches as “performance poetry” but our investigations suggest political speech may also be closely related to the musicality of song. Analysis of memorable phrases from past political speeches showed they are associated with a high mean pitch slope, an increase in use of monosyllabic words and a decrease in uncommon words. While additional studies are needed, we postulate that this combination of prosodic elements may influence the limbic system to allow the content to more easily reach the decision-making areas in the prefrontal cortex.

Keywords: political speech; oral-formulaic theory; prosodic evaluation; time series analysis; Linguistic Inquiry and Word Count; orality and literacy; mean absolute pitch slope; computational social science; orbital decomposition

1 Introduction

*When Cicero **spoke**, people marveled. When Caesar **spoke**, people marched. Leadership is not simply speech. It is speech that makes people march* (Cato the Younger, emphasis added) [1].

Cato’s personal history testifies to the high stakes of this rhetorical contrast. Cato was the ally of Pompey and both men left Rome when Julius Caesar crossed the Rubicon. Faced with imminent defeat at the hands of Caesar, in 46 BC Cato the Younger committed suicide in Tunisia [2].

What is it about *some* speech that effects action? Is it due entirely to the words themselves and the ideas they represent? Or are there other attributes that distinguish “speech” from other forms of communication, particularly the written word? These questions are not new by any means, but have occupied study for quite some time. For

the most part this has been in the somewhat arcane realm of specialists in Classics, Linguistics and Philosophy. It is our contention however that this question is extremely relevant to all of society, especially as we in the U.S. enter another political season where speech, extended technologically through radio, social media, the internet and television, will again play a role usually taken by written words, be they on paper or the computer screen.

The interplay between orality and literacy was central to the study of “the Homeric Question” by Milman Parry in his investigation into the oral epics of the Balkans reported upon by his successor Albert Lord in “The Singer of Tales” [3]. The “oral-formulaic” hypothesis posited that the works of Homer were primarily oral compositions later committed to writing. The development of the phonetic alphabet had the obvious capabilities to transcend time and space [4], greatly impacting practices in composition, thought and philosophy [5,6].

Under the oral-formulaic approach, the tools of prosody such as rhyme, meter and rhythm played a key role in the composition of the work. Thematic elements were based upon prosodic patterns and enabled astonishing feats of recall on the part of the bard reciting the epic. Phonetic writing sidestepped the need for recall and also ushered in the ability to utilize reason in composition instead of a reliance on phonetic patterns and jingles. Havelock controversially postulated that this apparent preeminence of reason in the written word is at least part of the aversion of Plato to the “emotional” content of poetry [7]. It must be remembered, however, that Plato’s concept of poetry is most likely different from our own.

Transfer of knowledge in our current time is almost entirely accomplished through literary mechanisms. We “read” more than we “listen” to develop expertise. Yet when we approach entertainment, engage in corporate religious worship or pick our political leaders, we usually fall back on the oral/aural methods of communication. Why is that? Why is there an apparent dichotomy between our approach to the “complicated” (primarily written) and our approach to the “complex” (primarily oral/aural)?

In order to investigate this question, we have conducted a pilot project using computational tools to investigate possible differences and similarities among various modes of communication.

2 Materials and Methods

Selected for analysis were 6 well known political speeches, each with memorable lines, as well as 3 poems, 3 songs, 2 screenplay/plays, 2 longer literary sources, 1 television news broadcast and 1 political document to give a diverse cross-section of material (Table 1).

Table 1. Works Studied

Class	Name
Literary	Leaves of Grass-Walt Whitman
Literary	To Kill a Mockingbird-Harper Lee
Poem	Do Not Go Gentle into That Good Night-Dylan Thomas
Poem	Fire and Ice-Robert Frost
Poem	The Road Not Taken-Robert Frost
Political Document	The Declaration of Independence
Screenplay/Play	Hamlet-William Shakespeare
Screenplay/Play	The Sixth Sense-M. Night Shyamalan
Song	Almost Like Being in Love-"Brigadoon", Robert Goulet
Song	I Wanna Hold Your Hand-The Beatles
Song	My Heart Goes On-"Titanic", Celine Dion
Speech	"Fight on the Beaches"-Winston Churchill
Speech	"I Have a Dream"-Martin Luther King, Jr.
Speech	"Tear Down this Wall"--Ronald Reagan
Speech	"Their Finest Hour"-Winston Churchill
Speech	The Gettysburg Address-Abraham Lincoln
Speech	Inaugural Address-John F. Kennedy
TV News Broadcast	NPR Tribute to 1968 Parting Words of Walter Cronkite

Transcripts of the complete works were first analyzed for their lexical aspects using Word Counter 2.10.1 [8] to obtain data on word frequency and number of unique words and Linguistic Inquiry and Word Count (LIWC) for data on distribution of words according to recognized parameters from a standard dictionary [9]. Results were used to determine normalized Shannon entropy and word distributions.

The audio file on a subset of texts available digitally as audio or video was captured with Audacity [10] and transferred to Praat [11]. The sonogram waveform was analyzed for duration, mean and standard deviation of sound intensity, mean and standard deviation of pitch and mean absolute pitch slope. In addition to values for the work as a whole, the speeches by Kennedy, King and Reagan were segmented by their principle focus and subjected to analysis of the segments as a time series.

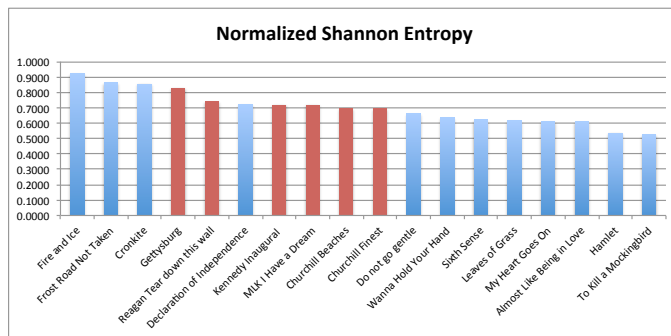
Finally, a subset of texts (excluding those without an audio file and the lengthy texts of *The Sixth Sense*, *Leaves of Grass*, *Hamlet* and *To Kill a Mockingbird*) was viewed as a time series. A novel "Logosome" was constructed as a visual aid in exploring each word's syllabic length and frequency in the time series. Preliminary examination of data revealed segments with a high percentage of monosyllabic and high frequency words. The time series was coded for this and the orbital decomposition examined with ORBDE software [12] to obtain values for topological entropy and fractal dimension of the text coded in that manner.

3 Results

A. Normalized Shannon Entropy

Normalized Shannon entropy ranged from a low for *To Kill a Mockingbird* (0.5268) to a high for “Fire and Ice” (0.9256). The entropies for the political speeches were less than those of the two Robert Frost poems and the television production, but more than everything else (Fig.1).

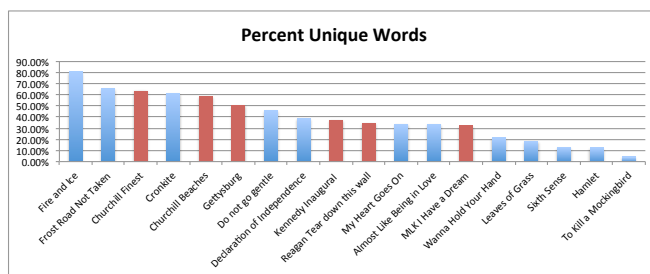
Fig. 1. Normalized Shannon Entropy.



B. Unique Words

Likewise, the political speeches had a lower percentage of unique words than the two Robert Frost poems, but a higher percentage than the longer literary works and the screenplays/plays (Fig. 2),

Fig. 2. Percent Unique Words

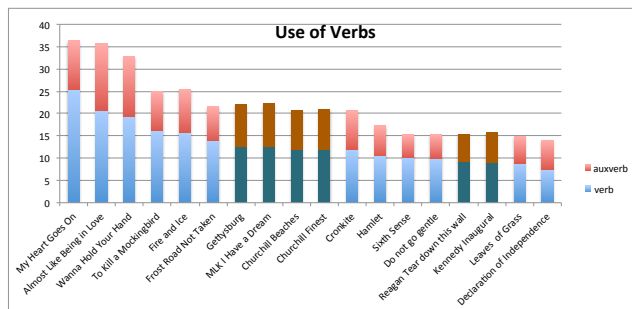


C. LIWC Analysis

Pennebaker reported a study using LIWC to analyze State of the Union Addresses [13]. We anticipated that LIWC would prove useful in differentiating the political speeches

from the other examples but only the total use of verbs, a marker for dynamic rather than categorical thinking, showed differentiation (Fig. 3). In all of the other elements examined through LIWC, the documents varied not by their genre but possibly by their content or context or other, as yet unidentified, parameters.

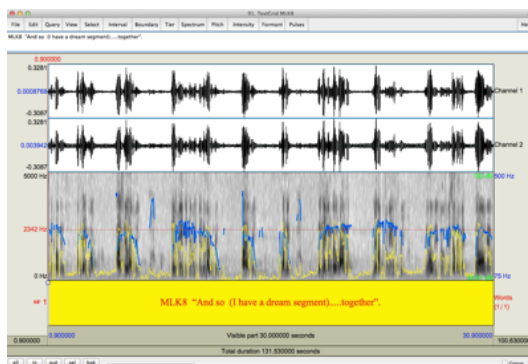
Fig. 3. Use of Verbs



D. Prosody

Praat is a program that allows for sophisticated measurements of acoustic attributes of sound files (Fig. 4.), which were available for 13 of the works. The Gettysburg Address was recorded by an actor attempting to duplicate the spirit of the address. Robert Frost read “The Road Not Taken” himself. The other poems were interpreted by a reader. All other files were taken from original recordings.

Fig. 4. Sonogram of a portion of “I Have a Dream” speech



An analysis of mean pitch (Fig. 5) and mean absolute pitch slope (Fig.6) revealed that, with the exception of the speeches by Winston Churchill, the other speeches showed findings similar to those in the three songs.

Fig. 5. Mean pitch and standard deviation

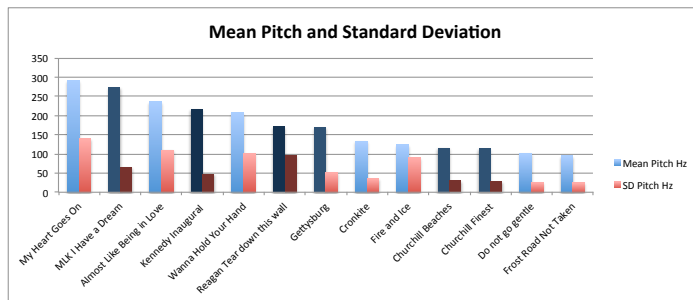
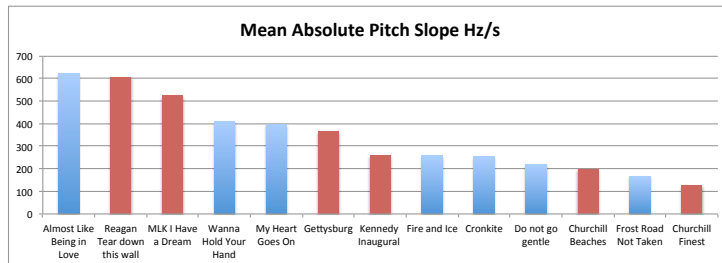


Fig. 6. Mean absolute pitch slope



The influence of mean absolute pitch slope will be revisited in a subsequent section of this study dealing with the segmentation of the speeches by Kennedy, King and Reagan as the importance of the measurement will be made even more clear.

E. Time Series Analysis

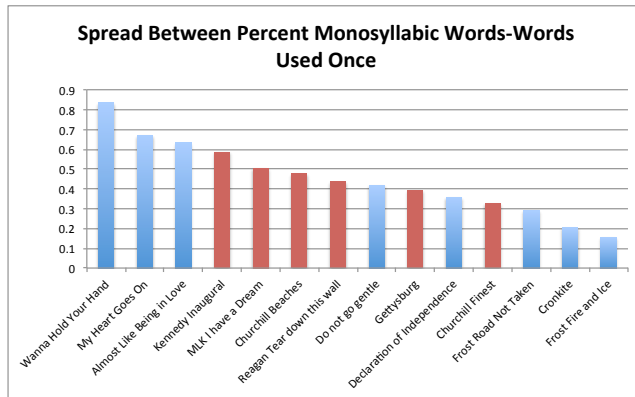
A time series analysis of a subset of the works was also undertaken. Because of their length, *Leaves of Grass*, *To Kill a Mockingbird*, *The Sixth Sense* and *Hamlet* were omitted. The words were loaded into an Excel spreadsheet, the number of syllables and frequency of the word use recorded and a “Logosome”, analogous to a visual representation of a gene segment, constructed (Fig. 7).

Fig. 7. “Logosome” of a segment of Kennedy’s Inaugural Address

	A	B	C	D
1	Word Order	Word	Frequency	Syllable
2	1244	And	41	1
3	1245	so,	2	1
4	1246	my	3	1
5	1247	fellow	4	2
6	1248	Americans:	4	4
7	1249	ask	5	1
8	1250	not	19	1
9	1251	what	5	1
10	1252	your	3	1
11	1253	country	4	2
12	1254	can	9	1
13	1255	do	8	1
14	1256	for	16	1
15	1257	you	7	1
16	1258	ask	5	1
17	1259	what	5	1
18	1260	you	7	1
19	1261	can	9	1
20	1262	do	8	1
21	1263	for	16	1
22	1264	your	3	1
23	1265	country.	4	2

This Logosome was used to investigate the relationship between the percent of monosyllabic words and the percent of words used only once in the work. The spread in this relationship was fairly consistent for the political speeches. It was exceeded only by the songs. The values for the speeches were higher than everything else except the poem by Dylan Thomas and the Declaration of Independence (Fig. 8).

Fig. 8. Percent Monosyllabic Words – Percent Words Used Once



The speeches by Kennedy, King and Reagan were split into segments based upon the principle focus contained therein. The percentage of monosyllabic words, words used once, the spread between the two and the mean absolute pitch slope were determined for each segment (Table 2).

Table 2. Results for segmental analysis of speeches by Kennedy, King and Reagan. Segments with memorable phrases¹ highlighted.

<u>Work</u>	<u>%Monosyllabic</u>	<u>% Words Used Once</u>	<u>Spread</u>	<u>Pitch Slope</u>
JFK1	26.32%	47.37%	-21.05%	168.62
JFK2	60.78%	37.25%	23.53%	270.37
JFK3	75.93%	18.01%	57.91%	214.03
JFK4	60.53%	18.42%	42.11%	361.52
JFK5	71.34%	27.12%	44.21%	278.08
JFK6	68.91%	34.38%	34.54%	249.32
JFK7	66.83%	22.73%	44.11%	284.71
JFK8	71.50%	23.83%	47.67%	248.49
JFK9	70.93%	18.60%	52.33%	320.58
JFK10	81.25%	0.00%	81.25%	333.71
JFK11	78.38%	21.62%	56.76%	312.22
Reagan1	60.00%	23.33%	36.67%	839.61
Reagan2	64.95%	18.56%	46.39%	650.32
Reagan3	65.61%	19.11%	46.50%	701.62
Reagan4	62.01%	17.16%	44.85%	660.90
Reagan5	55.79%	23.48%	32.32%	643.21
Reagan6	56.79%	23.60%	33.19%	562.39
Reagan7	66.94%	10.74%	56.20%	697.51
Reagan8	64.05%	21.49%	42.56%	542.50
Reagan9	60.79%	22.91%	37.89%	547.92
Reagan10	52.17%	19.57%	32.61%	543.80
Reagan11	66.26%	17.70%	48.56%	646.44
Reagan12	65.57%	13.11%	52.46%	663.92
Reagan13	69.60%	18.32%	51.28%	549.95
Reagan14	62.00%	23.33%	38.67%	457.30
Reagan15	71.94%	14.39%	57.55%	562.02
MLK1	70.86%	17.71%	53.14%	380.08
MLK2	70.86%	17.71%	53.14%	395.93
MLK3	75.00%	24.04%	50.96%	552.54
MLK4	62.73%	30.00%	32.73%	594.42
MLK5	69.19%	24.86%	44.32%	536.22
MLK6	65.85%	18.29%	47.56%	560.55
MLK7	75.00%	20.45%	54.55%	523.74
MLK8	77.27%	16.08%	61.19%	638.49
MLK9	73.27%	13.84%	59.43%	760.67

In virtually all speeches, the portions with the memorable phrases were associated with high use of monosyllabic words and mean absolute pitch slope and low use of words used once in the speech.

F. Orbital Decomposition Analysis

Orbital decomposition is a technique utilizing symbolic dynamics to explore nominally coded time series data [14]. We utilized ORBDE, a software program that allows determination of topological entropy and fractal dimension from such nominally coded data and applied it to the time-series coded for the number of monosyllabic words and words used once in the work (Table 3).

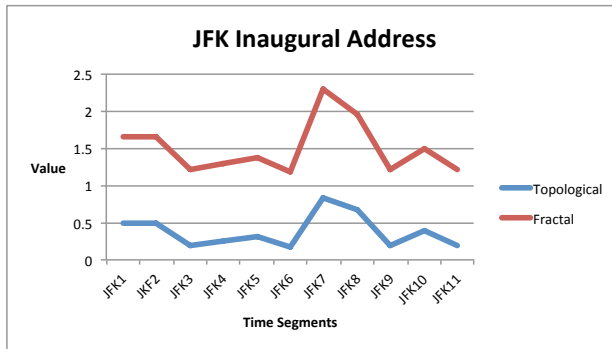
¹ JFK4: “...pay any price”; JFK10: “ask not what your country”; JFK11: “...God’s work must be our own”; Reagan7: “...tear down this wall”; MLK8: “...I have a dream”; MLK9: “...free at last”.

Table 3. Orbital Decomposition showing Topological Entropy and Fractal Dimension. Segments of speeches with memorable phrases in bold.

Work	Topological	Fractal
Wanna Hold Your Hand	0.062	1.063
Almost Like Being in Love	0.129	1.138
My Heart Goes On	0.2	1.221
JFK11	0.2	1.221
Road Not Traveled--Frost	0.25	1.284
Getty	0.25	1.284
JFK4	0.25	1.286
MLK9	0.287	1.33
MLK8	0.387	1.473
Do Not Go Gentle-Thomas	0.396	1.486
JFK10	0.401	1.493
Reagan7	0.936	2.549
Cronkite	1.057	2.877
Fire and Ice--Frost	1.161	3.193

Disappointingly, attempts to employ this tool to understand the time-series as a whole seemed to have limited utility. All the works showed positive Largest Lyapunov Exponents demonstrating sensitive dependence to initial condition but that was expected. With the exception of the speech by Reagan, the memorable phrases all occurred in segments with topological entropy between 0.2 and 0.401 and fractal dimensions between 1.221 and 1.493 (Pink or 1/f Noise). This is in the range of Self Organized Criticality [15]. All of the songs had lower or equal values, but the other works were scattered. No clear pattern of progression within the works themselves was apparent (Fig. 9). It is possible that a different coding system could have revealed other results.

Fig. 9. Analysis of Kennedy’s Inaugural Address with Orbital Decomposition



4 Discussion

Clark has described political speech as a form of poetry, and related the construction of political speech to the oral-formulaic concept of Parry [16, 17]. However, Clark envisioned this poetic formula as one primarily based upon words—syntax, semantics and aesthetics. Our pilot study suggests that although that may indeed be the case, there is another acoustic component layered on top of this. Mean absolute pitch slope and the relationship between the use of monosyllabic words and words used only once appear to be strongly associated with the memorable segments of political speeches. In this regard, and in those moments, political speech may be more like song performance than poetry reading.

Certainly, the phrase “Ask not what your country can do for you—ask what you can do for your country” is noteworthy from its syntax, semantics and aesthetics. However, the influence of mean absolute pitch slope associated with this phrase may likewise be significant. It is common experience that it is easier to remember the words to a song than a similar string of words without the associated pitch element. Likewise, television shows and products, at least in the past, were associated with jingles and theme songs. Who can forget:

*Just sit right back and you'll hear a tale,
A tale of a fateful trip
That started from this tropic port
Aboard this tiny ship* [18].

The Ballad of Gilligan's Island stays with us decades later, bringing back elements that otherwise would be long forgotten. Havelock had approached this idea when he stated, “The correspondence in Homeric narrative must be explained not on visual but acoustic principles. They are not patterns, in short, but echoes” [19]. Writing in 1982, he did not have the benefit of computerized pitch analysis to bolster this observation.

There are possible physiologic mechanisms that undergird this association of words with pitch. Stephen Porges has written extensively on the influence of the “Polyvagal Theory” on social engagement [20]. Music in the frequencies of the human voice is a potent conveyor of emotion and is useful in music therapy [21]. We hypothesize that speech with high mean absolute pitch slope combined with increased use in monosyllabic words and repeated words may allow the content to pass the limbic portal and enter into the decision-making prefrontal cortex. As Kahnemann and others have pointed out, decision-making is a strongly emotional process [22].

Rhythmic components of speech have been shown to produce alignment of neural activity in the human auditory cortex [23]. Successful communication is enhanced through speaker-listener neural coupling. Sometimes neural activity in the listener actually *precedes* the speaker's enunciation [24]. It is as yet unclear as to the influence of mean absolute pitch slope, use of monosyllabic words and repeated words may have

upon this neural coupling, but it is an intriguing subject for further research, especially in light of the apparent association of 1/f noise with cognition [25].

Eric Havelock described his experience listening to a radio address by Adolf Hitler in October 1939:

The strident, vehement staccato sentences clanged out and reverberated and chased each other along, series after series, flooding over us, battering us, half drowning us, and yet kept us rooted there listening to a foreign tongue which we somehow could nevertheless imagine that we understood. This oral spell had been transmitted in the twinkling of an eye, across thousands of miles, had been automatically picked up and amplified and poured over us. [26]

At that moment, perhaps Havelock found himself not only marveling, but understanding how the prosodic elements of a speech could, by themselves, add a whole other dimension to communication. Additional studies are needed, but we may be closer to understanding why the people only marveled when Cicero spoke but marched after hearing Caesar. Perhaps Cicero could expertly communicate the logical and complicated, but Caesar had also mastered the emotional and complex. When the two are skillfully mixed, tremendous potential (for good as well as evil) can be released.

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