Speaking Presidentially

Computationally Identifying Metaphors in the Speeches of Presidential Candidates

by Vladimir Myers

Abstract

Renowned Cognitive Linguist, George Lakoff, posited a theory about the metaphorical basis of political ideology in his book *Moral Politics* (1998/2002). Lakoff noted that cognitive linguistics has established that people tend to think in metaphors. Lakoff noticed that liberals and conservatives use very different metaphors when describing government and politics. While both sides tend to view politics through the Nation as a Family metaphor, liberals and conservatives differ on what that ideal family (and by extension, government) should look like. This then translates into different conceptual metaphors, observed through the speaking styles of politicians and ideologues of both sides. While a compelling theory, Lakoff admits that he did not base it off of any rigorous experimental or analytical design and this is mostly confirmed through observation and experience. This paper takes an unprecedented approach by seeking to test this political theory empirically by using a computer algorithm to analyze what metaphors are used in speeches given by the candidates running for nomination to be President in the 2016 election cycle. First, an algorithm was devised to find the political metaphors identified by Lakoff in the candidates' speeches. The algorithm was tested on human-identified metaphors and had a substantial improvement over the baseline but still leaves accuracy to be desired. The algorithm was then used on the full set of presidential candidate speeches and results showed that Republicans used Strict Father metaphors more than Democrats as expected, but the difference was slight and the accuracy of the metaphor-identification algorithm may have played a factor. More research is needed in this field, and in Conceptual Metaphor Identification in general, to confirm or reject Lakoff's theory.

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Introduction

Theories abound as to what differentiates liberals from conservatives. Political scientists will point to positions on the issues, sociologists point to demographic data, economists explain it with rational choice theory, and ideologues will portray the other side as stupid and/or corrupt.

George Lakoff, cognitive linguist at University of California at Berkeley, however, takes a novel approach. He thought it was interesting why certain beliefs tended to congregate together. Why is it that people who are in favor of military intervention as a foreign policy also tend to be against labor laws? Why is it that those who advocate for social programs to help the poor also tend to be in favor of allowing abortions? To answer these types of questions, he looked to see if he could find any unifying concepts in the realm of metaphors.

Lakoff noticed that across the aisle, people tend to think of government as a parent and think of citizens as the children. Using this a framework, people evaluate policies in terms of how it would work in a household. Conservatives tend to value discipline-based approaches to families, as opposed to liberals who value empathy-based approaches, as seen by parenting guides aimed at both groups. These parental preferences translate into political ideologies.

Lakoff notices these themes in ideologues talking about their ideology and party, but he admitted that he did not use a rigorous empirical approach to verify his theory. I present in this paper a methodology for using a computer algorithm to empirically test Lakoff's theory. A computational approach would provide an algorithm to extensively and reproducibly find metaphors in political speech, without the inherent subjectivity of human-based approaches.

Background Information

Conceptual Metaphors

A conceptual metaphor is when we understand a domain in terms of another domain. For example, one conceptual metaphor in English is the MONEY IS A LIQUID metaphor. When using this metaphor, we think of money and financial instruments as behaving similar to liquids, which is exemplified by the term *liquidity*, a term relating to how easily money can circulate. Indeed such terminology is so embedded in the language that it can be difficult to spot such metaphors. Some other terms and phrases that come out of this metaphor are:

- The government *froze* my assets (frozen money like frozen liquid cannot move).
- The mortgage is *underwater* (the house is drowning in the debt like a person underwater).

George Lakoff Model of Politics

In his book, Moral Politics, George Lakoff lays out a theory of how the differences in liberals and conservatives is dependent on what they view is the ideal family structure, and this can be seen based on what metaphors they use.

Lakoff starts with the observation that people tend to view the politics through the conceptual metaphor NATION IS A FAMILY. In this metaphor, government is seen as the parent, and the citizens its children. When viewed from this framework, it makes sense that the government should protect its citizens, like a parent protects their children (Lakoff 155).

Strict Father Model

The Strict Father model believes that a strong authority father figure needs to enforce morality by punishing bad behavior and rewarding good behavior. One example of Strict Father metaphor is MORAL AUTHORITY IS PARENTAL AUTHORITY. This metaphor entails the belief that it is the right and responsibility of those in authority positions to exercise that power on those who don't know any better (Lakoff 78).

This gets translated into conservative ideology by insisting that the government needs to be a strong authority and strictly enforce the law. This conservative view can be seen with the Republican tendency to favor the enforcement of their morality through the legal system (abortion, gay marriage, etc.), their support of police even in the face of police brutality scandals, and their endorsement of minimum-sentencing, death penalty, and other “tough on crime” measures.

Nurturant Parent

The Nurturant Parent model believes that the role of parents is to provide guidance and support so that the child can grow into responsible adults. One prominent metaphor is PEOPLE NEEDING HELP ARE CHILDREN NEEDING NURTURANCE. This metaphor entails that it is morally good to take care of people that need assistance (Lakoff 118).

This gets translated into liberal ideology by insisting that the government should care for those that are struggling. This liberal view can be seen with the Democrat tendency of insisting that the government provide assistance to the poor and using affirmative action to help disadvantaged groups.

Empirical Studies (and lack thereof)

By Lakoff's own admission, this theory seems true by inspecting the way that people talk about

politics, but it is difficult to empirically validate on a large scale. I could only find one such study, which was done in 2005 by Alan Cienki.

Cienki's paper describes one approach of empirically testing Lakoff's theory. The paper uses hand-picked metaphors that were used in a single presidential debate series. The author read transcripts of the televised debates between George W. Bush and Al Gore and coded any metaphorical references to morality. The author and a trained analyst coded the metaphors until they reached reliable agreement on 20% of the data (20 pages out of 100 pages of transcript). The author found only 48 direct expressions of the Strict Father or Nurturant Parent model, such as when Gore said that government needs to give parents "the tools to protect against cultural pollution" which is the metaphor IMMORALITY AS IMPURITY. The author then looked for entailments, which are indirect expressions of the Strict Father or Nurturant Parent model by saying something that is not a metaphor but clearly had the intention behind the metaphor, such as when Bush said "this is a society that — of ours that's got to do a better job of teaching children right from wrong," which supports the intent behind the Strict Father metaphor MORAL BEHAVIOR IS SETTING STANDARDS AND ENFORCING THEM (Cienki 5).

Literature Review of Conceptual Metaphor Identification

Conceptual Metaphor Identification (CMI) is a relatively small field within Computer Science that focuses on computational methods of identifying metaphors. There are many challenges in developing an algorithm for metaphor identification. For one, there is human ambiguity on what even constitutes a metaphor. Studies in CMI must use human reviewers to validate metaphor identifications, and these human reviewers often disagree with each other and attempts are made to reconcile the differences of opinion. Another issue is that there are few linguistic clues for metaphors. Conceptual metaphors are, by definition, dependent on the context they are used, so some form of semantic analysis or analyzing the content of the surrounding words is required.

Baumer et al. describes an approach to CMI, which finds pairs of words where each word is from a different corpus. For example, the phrases "the money *poured* into his bank account," "they *froze* my assets," and "capital freely *flowed* from investors" contain words related to *liquid* from the Laboratory corpus and contains words related to *money* from the Finance corpus, so these phrases lead to the metaphor MONEY IS LIQUID. To begin analysis, the researcher creates corpora (the authors used Wikipedia) related to a source domain and a corpora related to the target domain, to treat as the corpora and then the software finds sentences where the source domain exists, but its normal domain of use is being violated – for example in the sentence "the car

drank the gasoline” inanimate objects generally aren't associated with drinking, so this phrase would be flagged for human review. The paper stresses that human interpreters of the metaphor are necessary and that the primary purpose of CMI is to locate potential metaphors to ease the discovery process for the researcher. The authors tested the approach on political blogs using the source domain Scientist and the target domain Candidate. They were able to find novel metaphors not previously considered, such as “Obama is tested” just as a “theory is tested” (Baumer 27).

Shutova et al describe an approach that is able to discover new metaphors only using a small set of human-inputed knowledge. It expands the metaphor set by using already-known metaphors and uses clustering algorithms to find syntactically similar nouns and verbs, discovering potential new metaphors.

Shaikh et al note the limitations of the previous methods discussed. On the Baumer et al. method they note that “they self-report their work to be an initial exploration and hence, inconclusive” (Shaikh 211). On the Shutova et al article, they say “Their method relies on annotated training data, which is difficult to produce in large quantities and may not be easily generated in different languages” (Shaikh 211). Shaikh et al laid out the groundwork for “building a conceptual space for each sufficiently evidenced source domain so that linguistic metaphors can be accurately classified as instances of appropriate conceptual metaphors.” (Shaikh 211). They start by building source domains using seed words, and growing that conceptual space by noting words that co-occur with those seed words (Shaikh 213). Once the source domains are found and expanded, it is possible to find when a sentence contains words in close proximity from two different domains.

Zachary Mason describes CorMet, which is a system that uses dynamically mined corpora to discover conventional metaphors. To build the domain corpora, it performs a Google query and processes no more than 3000 of the webpages returned (Mason 25). It then uses selectional-preference-learning to weight the clustering using WordNet to find the categories (Mason 26). The result of the system is that “it can sometimes identify metaphoric language, if it manifests as a common selectional-preference gradient between domains, but is far from being able to recognize metaphoric language in general” (Mason 43).

Algorithm to Determine if a Given Metaphor is in a Given Sentence

Third-Party Modules:

WordNet was used in this project to look up information on words and do comparison between words, a crucial step in identifying metaphors. WordNet is provided for research usage from Princeton University (Princeton). WordNet also provides synset information. Because words can have multiple meanings, each word also has a number of synsets associated with it. A synset is a way to reference a specific usage of the word. In the current implementation, the algorithm always uses the first synset for a word when doing comparisons, but a more advanced algorithm would attempt to determine which synset is most appropriate depending on the context.

The Natural Language Toolkit, abbreviated NLTK, was used to provide generic text processing tools, such as provided stop words that were used to remove semantically irrelevant words, also known as stop words. This toolkit also provided a convenient binding for using WordNet. NLTK is an open-source project (Bird).

Input

1. The Metaphor Domains: A conceptual metaphor is given in the form of two words (domains) that are metaphorically comparable. For example, in the metaphor “Morality is Growth” the domains Morality and Growth are used and converted to synsets.

2. The Sentence: A string of characters representing a sentence such as “We need to move in the right direction to grow as a nation.” While the input need not necessarily be a sentence (it will easily accept a few words to a whole paragraph) a sentence is a natural unit for finding metaphors within.

Output

1. Word-Domain Pairs: For both of the input metaphor domains, return the 2 words in the sentence that are most similar to the domains. With the metaphor domains Morality and Growth and with the sentence “We need to move in the right direction to grow as a nation.” the resulting word-domain pairs are (Morality, right) and (Growth, grow) because Right and Grow are most similar to Morality and Growth, respectively.

2. Similarities: The Word-Domain Pairs show which words were most similar to the domain, and the algorithm also returns the quantified similarity of those words. If the similarity value for either word is below the threshold of 2.0 then it is not considered a metaphor and returns None.

Steps in Algorithm

1. Split the sentence into words: the words were found by performing a regular expression search with the string “\w+” which matches on any consecutive series of alpha-numeric characters, also including underscores and asterisks.

2. Remove the stop words: Stop words are words that are common enough that they don't lend any special meaning to the sentence, such as “the” “a.” The stop words are a standard set provided by NLTK. I also included two stop words in addition to the standard set, “applause” and “laughter” because the transcribed speeches I used contained these words to indicate audience responses, which are not related to the content of the candidate's speech.

3. Process the words: Use WordNet to find the Synset information for the words.

4. For each word: Compare the word to the metaphor domains using LCH-similarity algorithm and mark the similarity scores

5. Identify the word-domain pairs with the highest similarities. If the similarity scores for both exceed the threshold, then return the word-domain pairs with the similarities.

Research Process for Testing algorithm

1. Gather 100 random sentences: I wrote a script that delineates all of the sentences in the corpus and randomly chooses 100 of them and outputs them to a csv file.

2. Choose a subset of 5 metaphors to look for. The chosen metaphors were:

- PERSON IS AN OBJECT – A person, like an object, has inherent properties that generally do not change.
- MORALITY IS INTEGRITY – Morality requires having integrity (such as structural integrity) to remain strong.
- MORALITY IS PURITY – Someone that is moral is pure (free from corrupting factors). An impure element can affect the purity of those around it.
- MORALITY IS NURTURANCE – To be moral is to nurture and help something grow.
- MORAL ORDER IS NATURAL ORDER (shortened to Moral is Natural) – Something that occurs in nature is moral. Something that is “unnatural” is immoral.

These metaphors were chosen because they were the most common metaphors found in a preliminary analysis, in which the metaphor identification algorithm was run without verification.

3. Gather an independent reviewer: You and the reviewer both independently determine which of the 5 metaphors are present in each of the 100 sentences.

4. Resolve differences in the two reviewers by discussing why certain metaphors were identified for the sentence. If a consensus is not reached, then mark metaphors from both reviewers in the sentence.

5. For each sentence:

a) Run the metaphor algorithm for each of the 5 metaphors

b) Tally the result (1-5) as follows:

(1) The algorithm marked a metaphor when the humans marked none [False Alarm]

(2) The algorithm marked no metaphor when the humans marked at least one [False Negative]

(3) The algorithm marked no metaphor when the humans also marked none (True Negative

(4) The algorithm marked a metaphor that the humans also marked (Correct Metaphor)

(5) The algorithm marked a metaphor but not one that the humans marked (Incorrect Metaphor)

3. Gather results and compare the number correct versus the number wrong and the reasons for being wrong.

Findings from Testing the Algorithm

Working with an independent reviewer, I identified the metaphor (out of the subset of 5) in each of the 100 random sentences. After reconciling differences between our metaphor identifications, we ended up with 95% agreement.

The algorithm was used to identify one of the 5 metaphors on the same 100 sentences. The algorithm's choices were compared with the human judgments. The overall accuracy was 56%.

Mark	Mistake name	Count
1	False Alarm	6
2	False Negative	33
3	True Negative	48
4	Correct Metaphor	8
5	Incorrect Metaphor	8

Figure 1. Results from testing metaphor identification algorithm against human judgments.

Because there were 5 metaphors that were being identified, along with no metaphor, randomly choosing the correct metaphor (or absence of metaphor) is 1 out of 6 or 17%. When compared with this baseline, the 56% accuracy of the algorithm is a substantial improvement.

I have determined that this algorithm is sufficiently accurate to use to test the hypothesis, with the caveat that more research is needed to improve the accuracy of metaphor identification.

Also, the true positives, false positives, true negatives, false negatives, precision, and recall were calculated for each chosen metaphor.

metaphor	True Positive	False Positive	True Negative	False Negative	Precision	Recall
Person is Object	4	7	83	10	0.364	0.286
Morality is Integrity	0	7	79	18	0	0
Morality is Purity	1	3	92	8	0.25	0.111
Morality is Nurturance	3	3	81	17	0.5	0.15
Morality is Natural	0	2	92	10	0	0

Figure 2. Calculating identification rates for the metaphor identification algorithm against human judgments.

The relatively lower recall than precision, in particular not finding any true positives for MORALITY IS INTEGRITY or MORALITY IS NATURAL, suggests that the algorithm needs to be more sensitive to finding metaphors.

Research Process for Testing Hypothesis

Once it has been established that the algorithm is reliable for determining if there is a metaphor in a given sentence, one can use it to test whether the Lakoff theory is correct. The hypothesis is that more liberal (i.e. Democrat) politicians will use more Nurturant Parent metaphors than Strict Father metaphors and vice-versa for conservative (i.e. Republicans). Using the metaphor identification algorithm, one can quantify the ratio of Strict Father to Nurturant Parent metaphors in a given text. Using the algorithm to analyze political speeches given by Republican and Democratic presidential candidates should yield a higher Strict Father to Nurturant Parent ratio for Republicans than Democrats.

1. Gather Speeches: Speeches were downloaded from the American Presidency Project, a project of the University of California, Santa Barbara (Gerhard). The project stores select transcripts of speeches by candidates running for the presidential nomination of the Republican or Democratic party. All available speeches from 21 candidates (The APA did not have any speeches for Republican candidate Jim Gilmore) were copied into a single file for each candidate. It should be noted that the project is not exhaustive, and certain candidates had far more transcribed speeches available than other candidates.

2. For each candidate:

a) Split into sentences: The Natural Language Toolkit is a module that contains a sentence parser that was used to find all the sentences in all speeches from a given candidate.

b) Identify the metaphors: For all of the Lakoff metaphors, use the algorithm to determine if that metaphor is in each sentence.

c) Track Metaphors: Keep a count of the metaphors found for each candidate.

d) Calculate the ratio of Strict Father to Nurturant Parent metaphors.

Findings from Testing the Hypothesis

Democratic Candidates

party average: 3.970031256

candidate	SF:NP ratio
Chafee	4.7666666667
Clinton	3.6915544676
O'Malley	3.0616740088
Sanders	4.1397849462
Webb	4.1904761905

Republican Candidates

party average: 4.3252482522

candidate	SF:NP ratio
Bush	3.4272727273
Carson	3.2
Christie	3.6470588235
Cruz	7.1428571429
Fiorina	2
Graham	3.962962963
Huckabee	3.5263157895
Jindal	3

candidate	SF:NP ratio
Kasich	5.6923076923
Pataki	6
Paul	6.5454545455
Perry	4.6
Rubio	4.3148148148
Santorum	5.5416666667
Trump	3.125
Walker	3.4782608696

Figure 3. The ratio of Strict Father metaphor usage to Nurturant Parent metaphor usage for each candidate running for the 2016 presidential nomination of the Democratic of Republican party, divided by party.

The average SF:NP ratio is higher for Republicans than Democrats (4.32 vs 3.97), however this difference is not statistically significant according to the t-test (p=0.6067). A much larger sample size than 21 may lead to more significant results.

Contradicting the hypothesis, there are a number of Republican candidates with substantially lower SF:NP ratios than the Democratic average. Most notably, Donald Trump has a ratio of 3.125, even though he has won the Republican nomination. It is curious this happened despite Trump being seen and portrayed as a “tough guy” and his most notable quotes are very Strict Father in nature. For example, his stance that illegal immigrants from Mexico are largely “rapists and criminals” is the epitome of the PERSON IS AN OBJECT metaphor because it is believed that Mexican migrants have inherent properties. One explanation for Trump's low SF:NP ratio is that his most memorable quotes are only said once in a speech and their repetitions in the news cycle

do not count towards the SF:NP ratio. Also, Trump is known to boast about himself and this may skew him towards the NP metaphors when talking about himself or how good he will be for the country. Also, the American Presidency Project, at the time of access, only had Trump's speech announcing his candidacy and no other speeches. Perhaps an analysis including some of his later speeches would yield a different answer.

Conversely, Bernie Sanders, widely considered the most liberal senator in the country and describes himself as a “democratic socialist”, had an above-average SF:NP ratio for the Democratic party. The American Presidency Project had 17 speeches for him at time of access so this ratio is not skewed by a small sample size.

It also seems odd that Democrats still use SF metaphors roughly 4 times for every 1 NP metaphor. The Lakoff theory would expect Democrats to use more NP metaphors than SF metaphors. Such a high SF metaphor count may be due to over-counting. From testing the algorithm, it was shown that the PERSON IS AN OBJECT and MORALITY IS INTEGRITY metaphors have high false positive rates. In what is perhaps not a coincidence, those two metaphors are also the top two metaphors counted (see Appendix 1). Especially with PERSON IS AN OBJECT, it is likely that many words are considered similar to *object*, which would explain why it is by far the most common metaphor found.

Supporting the hypothesis, Ted Cruz, widely considered the most conservative candidate running for the Republican nomination, has the highest SF:NP ratio of all candidates, something predicted by the Lakoff model.

Conclusion

This study aimed to empirically test George Lakoff's theory of political ideology presented in *Moral Politics*. Unlike Lakoff's theoretical verification, this study developed an empirical method to test his theory, and unlike Alan Cienki's hand-coded approach, this study used an automated computer program to identify the metaphors. This computational approach improves upon Cienki's approach by eliminating the possibility of human subjectivity from the analysis and also allows searching a much larger corpus.

The algorithm was verified by the researcher, along with an independent reviewer, selecting a random 100 sentences in the corpus and identifying among 5 of the Lakoff metaphors. The algorithm was run on these 100 sentences and were compared with the human judgments, achieving a 56% accuracy which is substantially better than the random selection baseline of 16% (1 out of 6, including no metaphor identified). However, the precision and recall results for the individual metaphors suggest that more could be done to improve the algorithm.

The algorithm was run on the rest of the corpus and for each presidential candidate, the

algorithm tracked the ratio of the number Strict Father metaphors used by the candidate compared to the number of Nurturant Parent metaphors. As expected, Republican candidates used Strict Father metaphors at a higher ratio than Democratic candidates, however the difference was slight, and disconcertingly the Republican presumptive nominee, Donald Trump, has a SF:NP ratio lower than the average Democratic candidate.

The empirical test of Lakoff's model in *Moral Politics* was not supported by this study. The challenges of Conceptual Metaphor Identification regarding metaphor ambiguity and inaccuracy affect this project. More research needs to be done into refining the algorithm for a more nuanced approach to finding metaphors than the approach currently used. In particular, the high rate of false positives suggests that a more context-dependent approach will help improve precision.

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Appendix 1: Total Counts of Specific Metaphors

metaphor	N	type
person is object	2408	SF
morality is integrity	1022	SF
morality is purity	945	SF
morality is nurturance	823	NP
action is nurturance	787	Both
community is family	732	Both
subject is a child	566	SF
morality is strength	429	Both
kernel is substance	414	SF
moral is natural	361	SF
right is way	316	SF
immorality is degeneration	263	SF
moral is obedience	223	SF
morality is height	182	Both
morality is empathy	179	NP
evil is a force	173	Both
morality is self-improvement	158	NP
sociable is child	134	NP
evil is falling	126	SF
morality is happiness	92	NP
dependent is child	91	NP
wellbeing is wealth	76	Both
immorality is impurity	72	SF
morality is health	65	SF
immorality is disease	62	SF
morality is carnival*	54	NP
moral is sociable	49	NP
good is upright	36	Both
moral is enforced	35	SF
moral is growth	29	NP
bad is low	29	Both
moral is parent	22	Both
authority is parent	17	SF

*It seems the WordNet got confused between fair an