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MODELING LANGUAGE CHARACTERISTICS OF
LEADERS IN AUTHORITARIAN REGIMES OVER
DECADES

by

Nia Dowell

A Thesis

Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Science

Major: Psychology

The University of Memphis

May, 2014

ACKNOWLEDGMENTS

The current thesis thanks the research colleagues in the Languages Across Cultures Lab and at the University of Memphis (<https://sites.google.com/site/graesserart/projects/language-across-cultures>). Special thanks to Caitlin Mills, John Meyers, Mae-Lynn Germany, and Lisa Mintz for assistance.

This research was supported by the National Science Foundation (BCS 0904909, DRK-12-0918409), and U.S. Department of Homeland Security (Z934002/UTAA08-063). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of these funding agencies.

Abstract

Dowell, Nia Marcia Maria. M.S. The University of Memphis. May/2014. Modeling Language Characteristics of Leaders in Authoritarian Regimes over Decades. Major Professor: Dr. Arthur C. Graesser

The present research investigated the linguistic patterns in the discourse of three prominent autocratic political leaders whose reigns lasted for multiple decades. The texts of Fidel Castro, Zedong Mao, and Hosni Mubarak were analyzed using computational linguistic methodologies and nonlinear modeling techniques to explore the temporal trajectory of formality over time. Specifically, this metric of formality increases with abstractness of words, syntactic complexity, cohesion (referential and deep), and the informational genre (as opposed to narrative). At the other end of the continuum, informal discourse tends to have concrete words, simple syntax, low cohesion and high narrativity. The findings are aligned with theoretically grounded hypotheses of aging and persuasion in hopes of identifying which most appropriately explains the formality of leaders' political texts.

Keywords: political discourse, social disequilibrium, computational linguistics, Coh-Metrix, cognitive decline, common ground

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Introduction

Leader cognitive functioning and the quality of the leader-follower relationship are central to the leadership process (Antes & Mumford, 2012; Bluedorn & Jaussi, 2008; Mumford, Friedrich, Caughron, & Byrne, 2007). Political leaders need to make high stakes decisions and ensure political stability. How do they exert such control? Scholars have widely acknowledged the leadership process as being inextricably bound to language, discourse, and communication (Bligh & Hess, 2007; Bligh, Kohles, & Meindl, 2004; Grimmer & Stewart, 2013; Pennebaker & Lay, 2002), which is the focus of the present research, in addition to other factors in the spectrum of politics.

Social science researchers have identified how the language of political leaders can reveal psychological states, cognitive functioning, and more macro-level social dynamics and strategies of influence (Abe, 2011; Bligh et al., 2004; Ferrari, 2007; Guerini & Stock, 2010; Matsumoto & Hwang, 2012; Pennebaker & Lay, 2002; Pennebaker & Stone, 2003). These findings are compatible with previous research in other areas where language and discourse have proven useful in detecting psychological and social phenomena, such as personality, psychological functioning, social tension, success of group interaction, ideological positions on war, deception and emotion (Abe, 2012; Agarwal & Rambow, 2010; D'Mello, Dowell, & Graesser, 2009; D'Mello & Graesser, 2012; Mairesse & Walker, 2010; Newman, Pennebaker, Berry, & Richards, 2003; Rude, Gortner, & Pennebaker, 2004; Scholand, Tausczik, & Pennebaker, 2010). If political leadership is manifested in language and discourse in a fashion that reflects cognitive functioning and leader-follower relationship

characteristics, then it is worthwhile to conduct systemic investigations of the linguistic and discourse patterns of the language of leaders (Bligh et al., 2004; Cobb & Kuklinski, 1997; Grimmer & Stewart, 2013; Mutz, Sniderman, & Brody, 1996; Pennebaker & Lay, 2002). The present research uses automated linguistic analyses to explore the speeches of three long-tenured autocratic leaders and evaluate competing hypotheses of cognitive decline and social interaction.

There is considerable variation among the different approaches to investigating political discourse, but researchers have been increasingly incorporating corpus linguistics and computational techniques (Baker et al., 2008; Hancock et al., 2010; Hart & Childers, 2005). Revolutionary advances in computational linguistics (e.g., Coh-Metrix and LIWC, as discussed later) provide a new framework for analyzing and identifying linguistic and psychological strategies in political discourse. Among the many benefits of these tools is their ability to be applied systematically and also provide the capacity to analyze substantial amounts of information that may span many years (Brier & Hopp, 2011; Graesser, Dowell, & Moldovan, 2011; Grimmer & Stewart, 2013).

These developments in computational linguistics methods combined with advanced statistical modeling allow researchers to track the linguistics and discourse structures of political leaders over time and in the context of socially significant events. The applications of such approaches in the political science and leadership areas open a world of possibilities that help address gaps in the leadership literature such as leadership over time and in the situational contexts (Kark & Shamir, 2002; Ployhart, Holtz, & Bliese, 2002; Shamir, 2011; Yukl, 2002a).

As one example, a robust linguistic construct is linguistic complexity or formality (Biber, 1988; Crystal, 1987; Heylighen & Dewaele, 2002; Heylighen, 1999; Labov, 1972). Formal discourse is the language of print or sometimes pre-planned oratory when there is a need to be precise, coherent, articulate, and convincing to an educated audience. Informal discourse, on the other hand, has a solid foundation in oral conversation and narrative, with a reliance on common background knowledge to inferentially fill in information gaps. The degree of formality or informality in discourse has been shown to play an important role in signaling socially significant meaning, such as authority, persuasion, politeness, solidarity, interpersonal relationships, closeness, and leader-people relations (Bello, 2000; Brennan & Clark, 1996; P. Brown & Levinson, 1978; R. Brown & Gilman, 1960; Dijk, 1998; Graesser et al., in press; Lederman, 1980; Morand, 1995; Pearce, 2005). Relevant to the current investigation, previous work has shown political leaders discourse increased in formality increased during times of crisis, namely armed conflict (Dowell, Windsor, & Graesser, under review). Given the important psychosocial significance of this linguistic formality construct, it is surprising that little research has investigated the potential dynamic or adaptive qualities with regard to political leadership.

Overview of Present Research and Contribution

The present research addresses this issue by using computational linguistic methodologies and nonlinear modeling techniques to analyze the temporal trajectory of formality over time within the leaders' years of power. The mixed-effect modeling approach adopted in the current analyses has many benefits, one of which is the ability to assess the influence of the fixed effects after accounting for any random

effects, which based on the previous findings would be armed conflict. The findings are aligned with theoretically grounded hypotheses of social interaction and aging in hopes of identifying which theories most appropriately explain the phenomena. Specially, we explore the linguistic patterns of formality in the discourse of three prominent autocratic political leaders, Fidel Castro, Zedong Mao, and Hosni Mubarak, whose reigns lasted for multiple decades. Changes in linguistic formality have important implications for social interaction and aging.

The present research makes two primary contributions to the literature. First, we examine the temporal dynamics of leadership in order to advance current understandings of how leadership unfolds over time (Avolio, Gardner, Walumbwa, Luthans, & May, 2004; McCauley, Drath, Palus, O'Connor, & Baker, 2006; Ployhart et al., 2002; Shamir, 2011; Yukl, 2002a). Doing so allows for a critical evaluation of competing hypotheses concerning leader cognitive functioning and the quality of leader-follower relationships. Second, we add to the limited body of research that has investigated leadership phenomena outside the boundaries of western political leaders (Bligh & Robinson, 2010; Masters & 't Hart, 2012; Robinson & Topping, 2012).

Theoretical Frameworks that Predict Formality Over Time

Theoretical bases exist for two contrasting explanations regarding the linguistic changes in formality over time in political discourse. First, according to the *common ground* hypothesis, political leaders' discourse becomes more informal over time as a consequence of an increased mutual understanding, beliefs, and assumptions. Second, according to the *cognitive–aging* hypothesis, the discourse of political leaders becomes more informal over time as a product of age-related cognitive decline.

Common Ground Hypothesis

Within the realm of social interaction, the common ground perspective is a widely accepted theoretical framework of communication (Knapp & Daly, 2002). Common ground refers to the knowledge and beliefs communicators assume each other share. In the conversational context, this shared knowledge includes information that captures group membership, co-present physical location, and previous shared interactions (Brennan & Clark, 1996; Clark & Brennan, 1991; Knapp & Daly, 2002). For example, individuals in a conversation are able to infer that they share several types of knowledge on the bases of both being in a particular town, or observing a particular event at the same time, or maintaining a record of what has been previously discussed. According to Clark and Brennan's framework, common ground plays a central role in determining many aspects of the interaction between individuals, including the communication style (Clark & Clark, 1977; Clark & Wilkes-Gibbs, 1986; Clark, 1992, 1996; Horton & Gerrig, 2005; Schober & Brennan, 2003).

Two critical elements of this communication framework that are relevant to political discourse over time are the principal of accumulation and the principal of

least effort. The principal of accumulation refers to the building of common ground between people, wherein common ground is built incrementally on the history between communicators (Clark & Brennan, 1991). Individuals are motivated to achieve and increase common ground because it makes them feel more socially connected (Clark & Kashima, 2007) and feel better about themselves (Wittenbaum & Park, 2001). During the course of a conversation, as the interaction advances, individuals keep track of the common ground and update it moment to moment, thereby increasing shared information (Hanna, Tanenhaus, & Trueswell, 2003). This can be extended to longer run social interactions, such as those found between friends, married couples and beyond a dyad level to small groups and culture (Fast, Heath, & Wu, 2009; Klein, Clark, & Lyons, 2010; Pasupathi, Carstensen, Levenson, & Gottman, 1999). Taken together, this research illustrates the dynamic and adaptive qualities of common ground with respect to time.

A second aspect of this communication framework is that achieving and maintaining common ground is an effortful activity for discourse participants, who have a propensity to minimize this effort. Specifically, the least effort principal maintains that individuals use the least amount of cognitive or linguistic effort needed to successfully communicate their message (Brennan & Clark, 1996; Clark & Krych, 2004; Clark & Wilkes-Gibbs, 1986). In these studies, effort is not an all-or-nothing process, but operates in different degrees. How much effort is needed to accomplish and maintain common ground in a given situation is defined by the grounding criterion (Brennan & Clark, 1996; Clark & Brennan, 1991), i.e., the degree of grounding shared referents that is sufficient for the immediate purposes. The

grounding criterion can be influenced by the degree of accumulated common ground between individuals. This claim is supported by research showing that communication becomes more efficient over time, namely with the accumulation of common ground (Clark & Wilkes-Gibbs, 1986; Horton & Keysar, 1996). For example, suppose two previously unacquainted individuals discuss their political views. The interaction likely demands more effort to be properly grounded, i.e., reconciled with the existing common ground. In contrast, it would be much easier and require fewer resources to convey the same information in a conversation between a 30-year married couple who has accumulated considerable common ground.

Building on these findings, we posit the common ground hypothesis of a leader – follower relationship. For long-tenured authoritarian political leaders, relevant principles of the common ground theory would apply, namely the concept of least effort and dynamic accumulation of common ground in the communication process. From this perspective, the leaders' shifts towards more informal language can be understood as an adaptive response to increased common ground with their constituents. Thus, the common ground hypothesis is an especially plausible explanation considering the lengthy tenure of many authoritarian leaders.

The two potential temporal trajectories that would be indicative of the common ground hypothesis are presented in Figure 1. As shown in the figure, a simple linear trajectory over time may indicate the accumulation of common ground between leaders and citizens, which is manifested in a more gradual fashion over the years. Similarly, exponentially decreasing change trajectory, characterized by a *negative*

linear effect plus a weaker *positive* quadratic trend, could also approximate the theoretical trajectory consistent with common ground. More specifically, the first hypothesized linear trajectory would be indicative of a gradual accumulation of common ground between leaders and followers over time. However, the second trajectory depicts more rapid initial accumulation of common ground, followed by a leveling out that might represent a baseline line level for the leader “maintaining” common ground over the years.

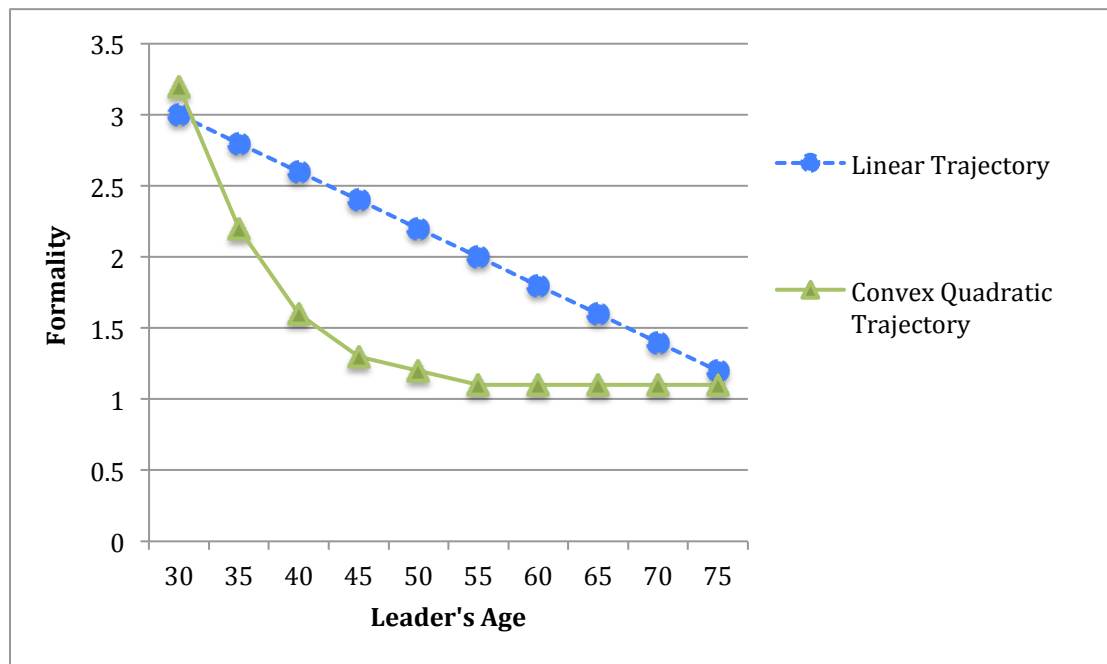


Figure 1. Common Ground Hypothesis Trajectories

Cognitive–Aging Hypothesis

There is considerable evidence that age-related changes in cognitive, motor and perceptual functioning may affect speech in several ways (Bopp & Verhaeghen, 2005; Hofer & Alwin, 2008; Noh & Stine-Morrow, 2009; Radvansky & Dijkstra, 2007). Most of the research is based on self-reports and non-linguistic task

performance (Bortfeld, Leon, Bloom, Schober, & Brennan, 2001; Burke, MacKay, Worthley, & Wade, 1991; Rastle & Burke, 1996), but there is a substantial body of research that has investigated specific linguistic indicators of cognitive changes in adulthood (Kemper, Rash, Kynette, & Norman, 1990; Kemper & Sumner, 2001; Pennebaker & Stone, 2003). Perhaps the most interesting findings show the mechanisms involved in producing formal or complicated language might deteriorate over time. This work suggests age-related declines might occur in several linguistic areas, such as narrative structure (Ardila & Rosselli, 1996; Juncos-Rabadán, 1996; Kemper et al., 1990), linguistic density and complexity (Kemper & Sumner, 2001), and cohesion (Cohen, 1979; Juncos-Rabadán, 1996). For instance, Kemper has found large declines in linguistic complexity with age, namely idea density and syntactic complexity (Kemper & Sumner, 2001).

From the cognitive psychology perspective, age differences in linguistic formality are expected in most extant theories of cognitive aging. Processing resource theory (aging depletes the cognitive resources available for processing) (Belleville, Rouleau, & Caza, 1998) and the speed theory of cognitive aging (Salthouse, 1996) provide theoretical reasons for these observed changes in linguistic production over time. Collectively, this research suggests linguistic changes in formality of authoritarian leaders observed over their tenure might be a product of their normal or clinical age related declines. According to this perspective, changes in formality would show an accelerated curvilinear function toward later years (Figure 2). More specifically, a large *negative* linear component plus a *negative* quadratic trend would reflect the expected cognitive decline. That is, there is an initial small decrease, followed by a

dramatic drop in the later years. Therefore, the hypothesis is that increasing age is associated with a decline in formality. This decline has critical implications for the nature of cognitive processes affected in aging political leaders.

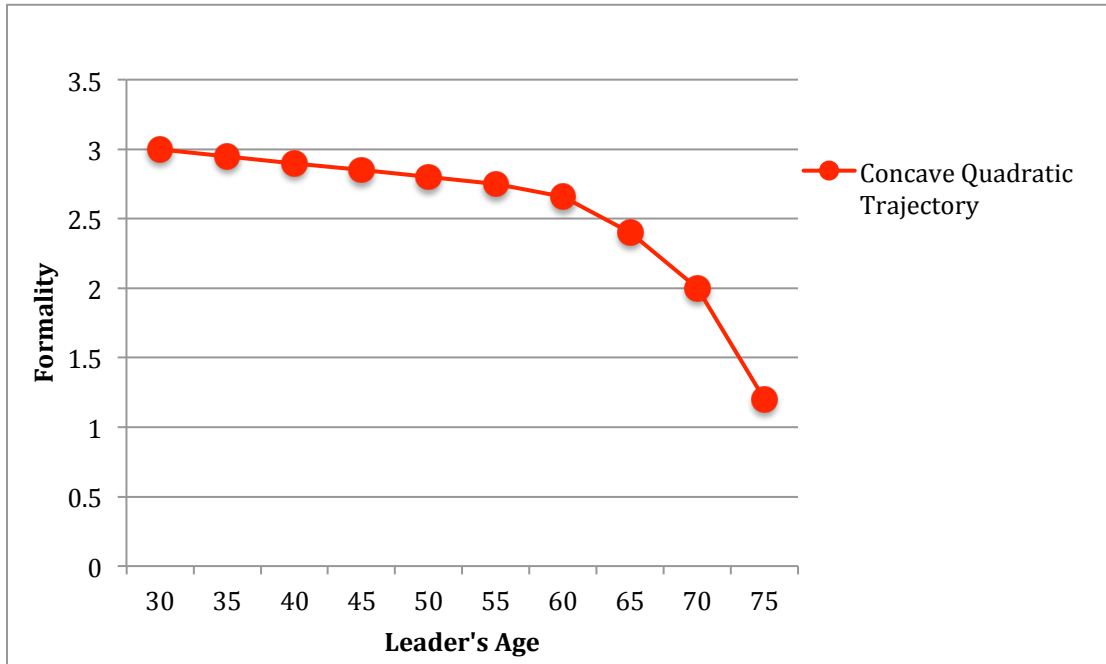


Figure 2. Cognitive-Aging Hypothesis Trajectory

Methods

Authoritarian Leader Corpora

Commander Fidel Castro. Commander Fidel Castro's corpus consisted of 1,172 English-translated texts delivered between 1959 and 2008. The texts were obtained using the Castro Speech Database maintained by the Latin American Information Center at the University of Texas at Austin, as well as *Discursos e Intervenciones de Fidel Castro* ("Castro Speech Database - LANIC," 2010, "Discursos e Intervenciones del Comandante en Jefe Fidel Castro Ruz," 2010).

Chairman Zedong Mao. Chairman Zedong Mao's corpus consisted of 365 English translated texts delivered between 1926 and 1970. The speeches from 1926-1957 were collected from the "Selected Works of Zedong Mao" published by Foreign Languages Press (Tse-Tung, 2001), while the speeches ranging from 1958-1970 were collected from the "Selected Works of Zedong Mao" published by Kranti Publications (Tse-Tung, 1990).

President Hosni Mubarak. President Hosni Mubarak's corpus consisted of 307 English translated texts delivered between the years of 1996 and 2011. The texts were obtained using the Egypt State Information Service site ("Egypt State Information Service," 2011).

The genres of texts includes speeches, statements on major issues, and addresses in which the leader was the sole speaker. Basic descriptive statistics for the autocratic leader corpora are presented in Table 1. Information that is not a part of the actual discourse (e.g., audience reactions, editor comments) was removed in a rigorous cleaning process. Each speech was then labeled by date and put into a text

file format and analyzed using a computational linguistic facility. Finally, each speech was given a unique increasing number that varied from 0 to 1 according to the following formula using month as the unit of analysis:

$$T_x = \frac{[Y_x * 12 + M_x] - [Y_{min} * 12 + M_{min}]}{[Y_{max} * 12 + M_{max}] - [Y_{min} * 12 + M_{min}]} \quad (1)$$

Where the relative time of speech (T_x) was modeled as a function of the year the speech was given (Y_x), the number of months in a year (12), the month speech was given (M_x), the year first speech was given (Y_{min}), the month first speech was given (M_{min}), the year last speech was given (Y_{max}), and the month last speech was given (M_{max}). This standardized metric for time was used because the intervals between speeches were not homogeneous and for each leader time is relative to his career duration.

Table 1
Descriptive Statistics for Autocratic Leader Corpora

Measure	Mean	SD	Median
Commander Fidel Castro			
Number of Words	4934.38	4817.66	3324.50
Number of Sentences	248.67	253.04	147.50
Chairman Zedong Mao			
Number of Words	2342.52	3041.33	1237.00
Number of Sentences	112.35	148.00	53.00
President Hosni Mubarak			
Number of Words	1673.80	1158.13	1395.00
Number of Sentences	63.77	43.90	52.00

Crisis Data

The crises data for Cuba, Egypt and China were derived from two popular political science datasets: the Armed Conflict Location and Event Dataset–ACLED (Raleigh, Linke, Hegre, & Karlsen, 2010), and Correlates of War Dataset (Sarkees &

Wayman, 2010). There is considerable overlap between these datasets, namely that they provide exact locations, dates, and additional characteristics of individual events. However, both were needed to cover the entirety of tenure for all autocratic leaders. Specifically, both datasets cover civil and international conflict events, but the Correlates of War Dataset v4 covers 1816-2007 (Sarkees & Wayman, 2010), while the Armed Conflict Location and Event Dataset covers 1960-present (Raleigh et al., 2010) and allowed for the inclusion of the most recent Egypt events.

To merge each country's conflict data with each respective autocratic leader's linguistic data, we used the start/end dates provided in the conflict data and coded the leaders' speeches that had a date within that range. It is important to note that there are instances where multiple conflicts occur in the same time period, thus the conflict measure is a continuous measure reflecting the number of conflicts that were underway when a particular speech was given. Descriptive statistics indicated the average number of crises per speech varies among leaders, namely Mubarak ($M = 1.27$, $SD = 2.57$), followed by Mao ($M = .80$, $SD = 1.18$) and lastly Fidel ($M = .65$, $SD = 1.13$).

Computational Linguistic Tool

Coh-Metrix is an automated linguistics facility that analyzes higher-level features of language and discourse (Graesser, McNamara, Louwerse, & Cai, 2004; McNamara, Graesser, McCarthy, & Cai, 2014). Coh-Metrix includes sophisticated methods of natural language processing, such as syntactic parsing and cohesion computation, to capture deeper language characteristics (Graesser, McNamara, & Kulikowich, 2011). Coh-Metrix provides hundreds of measures at multiple levels,

including genre, cohesion, syntax, words, as well as other characteristics of language and discourse (Graesser, McNamara, et al., 2011). Recently, a principal component analysis (PCA) was conducted that revealed eight orthogonal dimensions which accounted for 67% of the variance in text variability in a large corpus of over 37,000 texts (TASA). Additionally, these Coh-Metrix dimensions align with multilevel theoretical frameworks of language and discourse (Graesser & McNamara, 2011; Kintsch, 1998; Snow, 2002). These frameworks distinguish representations of meaning, structures, strategies, and cognitive processes at different levels of language and discourse. The five major dimensions of Coh-Metrix are listed and succinctly defined below, starting with the most global level (genre) and ending with a dimension of words.

1. **Narrativity.** Narrative texts tell a story with characters and events, which are closely affiliated with everyday oral conversation.
2. **Deep cohesion.** The extent to which the ideas in a text are connected with causal, intentional, or temporal connectives at the deeper situation model level.
3. **Referential cohesion.** The extent to which discourse contains explicit words and ideas that overlap across sentences and the entire text.
4. **Syntactic ease.** Sentences with fewer words and simple, less embedded syntactic structures are easier to process and understand.
5. **Word concreteness.** The extent to which words evoke mental images and are more meaningful to the reader than abstract words.

For the purposes of the current investigation, the following five Coh-Metrix dimensions were used to compute one composite measure of formality (below).

Formula 2 computes the formality measure.

$$\text{Formality} = [(\text{Expository} + \text{Deep Cohesion} + \text{Referential Cohesion} + \text{Syntactic Complexity} + \text{Word Abstractness}) / 5] \quad (2)$$

Specifically, this metric of formality increases with abstractness of words, syntactic complexity, cohesion (referential and deep), and the informational genre (as opposed to narrative). At the other end of the continuum, informal discourse tends to have concrete words, simple syntax, low cohesion (because knowledge based inferences can fill the gaps), and high narrativity. We therefore computed a composite score of formality that integrated the five major dimensions of Coh-Metrix, wherein five dimensions were weighted equally (Li, Cai, & Graesser, 2013). Descriptive statistics indicated the average formality per speech for all leaders was similar, namely Mubarak ($M = .18, SD = .19$), followed by Fidel with ($M = .17, SD = .22$) and Mao ($M = .11, SD = .29$).

Results

A mixed-effects modeling approach was used for all analyses because of the repeated measures design of speeches over time and the unbalanced distribution of the leaders' speech data. Mixed-effect modeling has become increasingly popular because of the flexibility offered in handling this type of data (Pinheiro & Bates, 2000), and its suitability for exploring longitudinal leadership phenomena (Ployhart et al., 2002). Mixed-effects models include a combination of fixed and random effects and can be used to assess the influence of the fixed effects on dependent variables after accounting for any extraneous random effects. In line with this, mixed-effects regression allows for a parsimonious analysis of the more subtle features of the longitudinal processes, results in more accurate estimates of parameters, and offers improved tests of hypotheses (Weiss, 2005).

As discussed in the Introduction, specific temporal trajectories are associated with the theoretical hypotheses. For each autocratic leader, two main mixed models (Linear and Quadratic) were constructed to evaluate the evidence for the common ground hypothesis or cognitive-aging hypothesis. The linear and quadratic formality slopes were specified to further inform the functional shape of formality change in proximity to time, as depicted in Equation 3. Formality for a given leader (i) at a given time (t) was modeled as a function of that leader's initial formality base line (B_{0i} : the intercept), plus their average individual rate of formality change per speech (B_{1i} : the linear slope parameter), plus the acceleration or deceleration for each linear growth trajectory (B_{2i} : the quadratic slope parameter), plus a random within-leader error term (r) representing prediction error of holding intercept and slope constant.

$$\begin{aligned} Formality_{ti} = & B_{0i} + B_{1i} \times (\text{time of speech}_{ti}) \\ & + B_{2i} \times (\text{time of speech}_{ti}^2) + r_{ti} \end{aligned} \quad (3)$$

More specifically, the linear mixed-effect models consisted of *formality* as the dependent variable and *time* as the independent fixed effect variable. Additionally, quadratic models with *formality* as the dependent variable and *time* plus *time*² as the independent fixed effect variables were constructed. The random effect in both models was *armed conflict count*. Armed conflict was chosen as a random variable based on the findings from previous work where we found formality increased during times of crisis (Dowell, Windsor, & Graesser, in preparation). Therefore, this analysis procedure yields a very stringent test on the effect of time on formality because it partials out the variance associated with armed conflict.

It is important to mention one additional detail pertaining to these mixed effects regression models. In addition to constructing the model with *time* (linear models) and *time* plus *time*² (quadratic models) as fixed effects, *null models* with the random effects (*armed conflict*) but no fixed effects were also constructed. A comparison of the null models with the linear and quadratic models allows us to determine whether time or any potential time variations significantly predicts the functional shape of formality over time above and beyond the random effect of armed crisis periods. This approach allowed us to differentiate temporal patterns of formality (common ground hypothesis or cognitive-aging hypothesis) while accounting for armed crisis influence characteristics.

Table 2 - 4 summarizes the results of the analyses. Akaike Information Criterion (AIC), Log Likelihood (LL) and a likelihood ratio test were used to determine the best fitting and most parsimonious model. For Fidel Castro, Zedong Mao, and Hosni Mubarak, the likelihood ratio tests indicated that the linear model yielded a significantly better fit than the null model, $\chi^2(1) = 246.22$, $\chi^2(1) = 105.23$, $\chi^2(1) = 14.57$, respectively. More specifically, the linear model revealed that formality significantly decreased over time for Fidel Castro, Zedong Mao, and Hosni Mubarak.

Table 2

Fidel Castro Mixed Effect Model Comparison, Linear Model vs. Quadratic Model

Model	Parameters	LL	AIC	ES	SE
Linear Model					
	4	-517.99	-509.98		
Time				-.32**	.02
Quadratic Model					
	5	-520.59	-510.59		
Time				-.33**	.02
Time ²				-.11	.07

Note. * $p < .05$; ** $p < .001$. Akaike information criterion (AIC), log likelihood (LL), fixed effect estimate (ES), standard error (SE).

Table 3

Zedong Mao Mixed Effect Model Comparison, Linear Model vs. Quadratic Model

Model	Parameters	LL	AIC	ES	SE
Linear Model					
	4	14.61	18.61		
Time				-.67**	.06
Quadratic Model					
	5	8.93	12.93		
Time				-.72**	.06
Time ²				-.72*	.07

Note. * $p < .05$; ** $p < .001$. Akaike information criterion (AIC), log likelihood (LL), fixed effect estimate (ES), standard error (SE).

Table 4
Hosni Mubarak Linear Mixed Effect Model Comparison, Linear Model vs. Quadratic Model

Model	Parameters	LL	AIC	ES	SE
Linear Model					
	4	-180.87	-172.87		
Time				-.17**	.04
Quadratic Model					
	5	-184.78	-174.78		
Time				-.22**	.05
Time ²				-.33*	.16

Note. * $p < .05$; ** $p < .001$. Akaike information criterion (AIC), log likelihood (LL), fixed effect estimate (ES), standard error (SE).

After determining a significant linear relationship between formality and time, the next step was to assess the fit of the quadratic model for each autocratic leader. The likelihood ratio tests indicated the quadratic model yielded a significantly better fit than the linear model for Zedong Mao, $\chi^2(1) = 5.68$ and Hosni Mubarak $\chi^2(1) = 3.91$, but not for Fidel Castro $\chi^2(1) = 2.59$. These results are illustrated in Figures 3-5, which show the raw and model predicted formality values for Mubarak Hosni and Zedong Mao's quadratic model, and Fidel Castro's linear model.

The magnitude (in relation to the linear parameter) and curvature of the quadratic parameter was of particular interest in discerning the most appropriate theoretical explanation for the political leader's formality over time. For instance, if the quadratic parameter is positive, the overall trend is convex (apex at the bottom, curve opens up); if the quadratic parameter is negative, the overall trend is concave (apex at the top, curve opens down). Similarly, the magnitude of the quadratic parameter adds to the understanding of the data and evaluation of theoretical claims.

Specifically, the strength of these terms (taken together) can also indicate the location of the curve, namely if it is an early peaking curve or late peaking curve (Petscher, Schatschneider, & Compton, 2013).

The patterns depicted in these figures have important theoretical implications. Specifically, we observed a steady linear decay pattern for Fidel Castro that is in line with common ground hypothesis. However, Zedong Mao and Hosni Mubarak's quadratic formality trajectory tells a different story. The functional shape depicted in Figure 4 and Figure 5 highlights an overall concave trend (apex at the top, curve opens down) that is late peaking around age 61 for Zedong Mao and around 74 for Hosni Mubarak. This suggests that the accelerated decrease in formality for Zedong Mao and Hosni Mubarak might be reflecting age-related cognitive impairments.

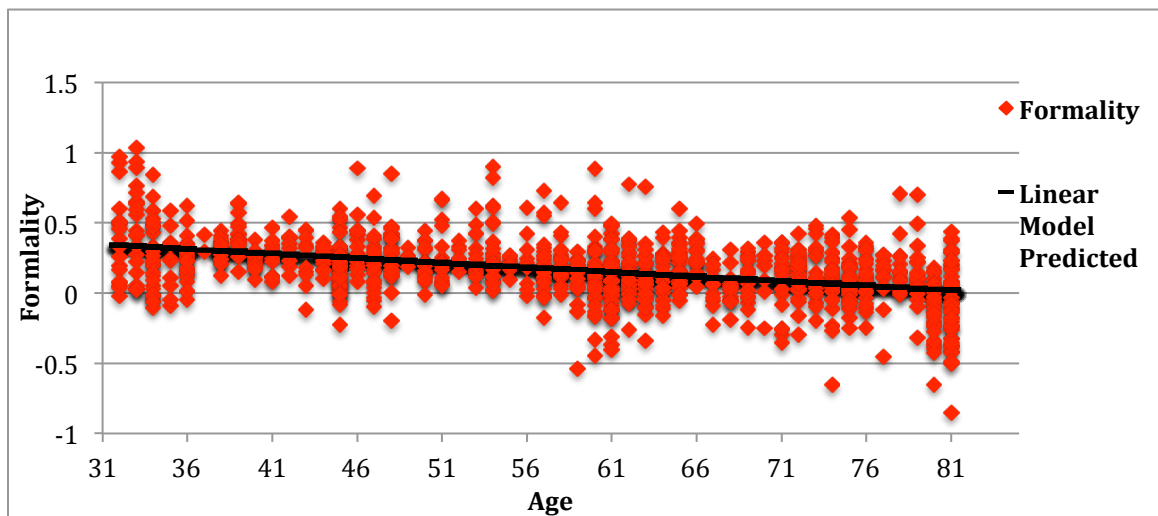


Figure 3. Raw and model predicted formality scores for Fidel Castro over his career. This figure illustrates the formality of Fidel Castro's discourse followed a temporal trajectory consistent with accumulating Common Ground.

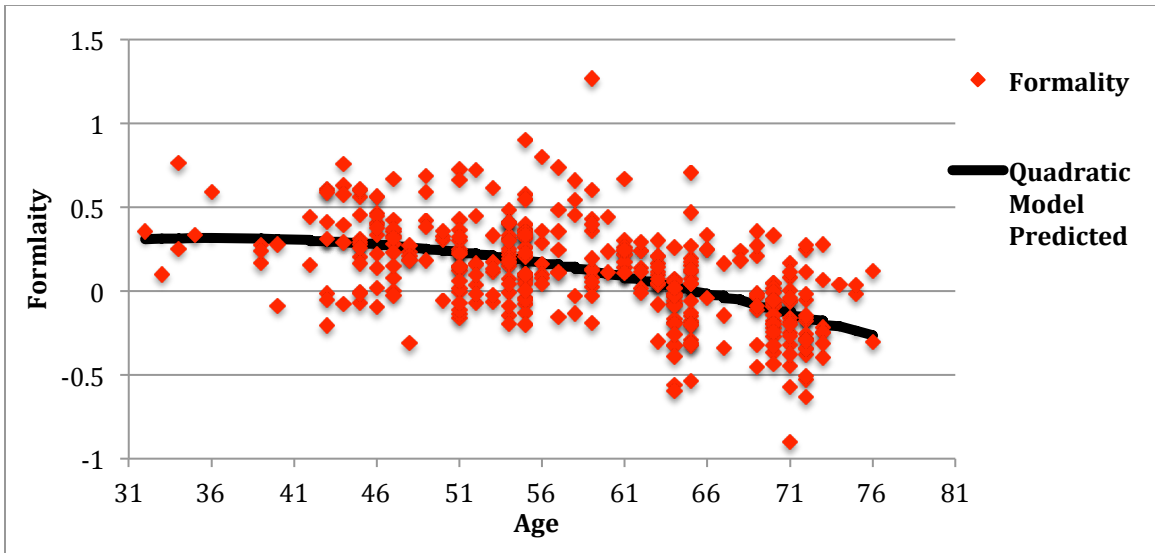


Figure 4. Raw and model predicted formality scores for Zedong Mao over his Career. This figure illustrates the formality of Zedong Mao’s discourse followed a temporal trajectory consistent with Cognitive Decline.

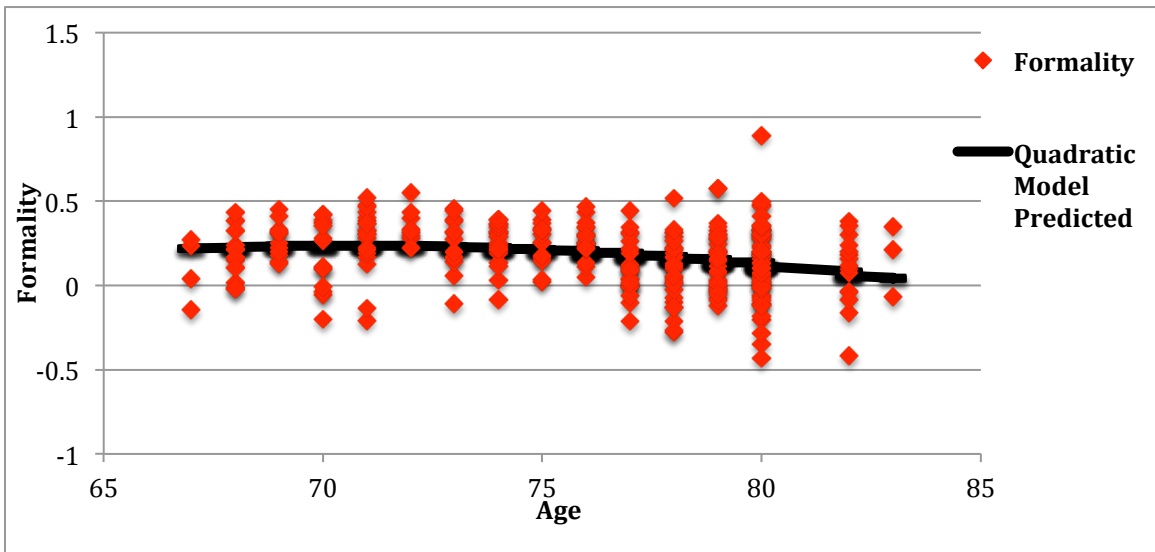


Figure 5. Raw and model predicted formality scores for Hosni Mubarak over his career. This figure illustrates the formality of Hosni Mubarak’s discourse followed a temporal trajectory consistent with accumulating Common Ground.

Discussion

Time is an under-explored dimension in leadership studies that has the potential to provide significant insights into the adaptive characteristics of leadership processes. This may be particularly relevant for autocratic leaders whose regimes last multiple decades. In this study, we explored the language and discourse patterns of autocratic political leaders over their career and aligned those patterns with theoretical hypotheses of social interaction and cognitive aging. The findings provide insights into how these leaders form leader-follower relationships and the quality of their cognitive functioning.

The results indicated that the leader's language initially reflects stilted discourse that is informational, cohesive, syntactically complex and abstract – the essence of formal discourse. Interestingly, this formality of discourse decreases over time, as the leaders get older. For Fidel Castro we observed a functional form for formality that would be consistent with accumulating common ground with their constituents. The steady linear decrease in formality illustrates the accumulation of common ground between leaders and citizens, which is manifested in a gradual fashion over the years. The other change trajectory that would be indicative of the common ground hypothesis was the exponentially decreasing change trajectory; however, we did not find evidence to support this pattern. These findings suggest that the relationship processes between leaders and followers might follow more gradual, steady accumulation rather than a rapid initial accumulation. For Zedong Mao and Hosni Mubarak, we observed a formality trajectory in line with what would be expected from normal age related cognitive decline. That is, there is an initial small

decrease in linguistic formality, followed by a dramatic drop in Zedong Mao's and Hosni Mubarak's later years. Collectively, these findings are an especially important contribution to the literature by providing insights into the dynamics concerning leader-follower relationships and the nature of cognitive processes affected in aging political leaders.

The computational methodology employed in the current study is one of the many possible methods to examine political language and discourse. For instance, the majority of past research in this area has utilized one contemporary approach called Critical Discourse Analysis (CDA) (Prentice, 2010). This approach has the advantage of providing an in-depth description of the discursive construction and language uses, but is based on qualitative interpretations (Suzuki, 2009). There are obvious concerns with regard to its subjectivity, namely arbitrary text selection, as well as its generalizability, reliability and representativeness due to a tendency to focus analyses on a small number of texts (Prentice, 2010; Wodak & Meyer, 2009). Computational linguistic techniques do not afford the particular type of in-depth analysis found in CDA studies. However, the questions of interest in the current research required techniques that lend themselves nicely to objective comparisons and also to provide the capacity to collect and analyze massive amounts of information that span many years (Brier & Hopp, 2011; Hancock et al., 2010; Hart & Childers, 2005).

A primary contribution of this research is to demonstrate a novel methodological approach to the study of leadership that allows researchers to address some of the noted non-trivial gaps in leadership and organizational research. Specifically, the two reoccurring criticisms about conceptualizing leadership is that

they are a-temporal and context-independent, despite the obvious dependency of many aspects of leadership on time and social context (Lichtenstein et al., 2006; Mumford et al., 2007; Shamir, 2011). In line with this, investigating the behavior of autocratic leaders extends our understanding of the international system, especially given that much existing research has focused on democratic leaders in light of the limited availability of data for this category of leadership. The speeches and texts that autocratic leaders produce are a particularly important artifact because autocracies typically tend to be much less transparent than democracies.

Our investigation of the linguistic patterns of autocratic leaders over the course of their careers may provide predictive patterns of behavior that will help scholars, policymakers, and the security community to better understand autocracies and political leaders in general. Given that autocratic societies are subject to the whims of their leaders, as they are often less constrained by rules and institutions than their democratic counterparts, using computational linguistic techniques like Coh-Metrix (McNamara et al., 2014), can reveal individual-level patterns of behavior that provide additional clarity, even in an anarchic system (Wendt, 1992). Because of their tremendous exclusionary power and influence over country policies, autocratic leaders and their linguistic patterns merit future study.

An inherent limitation to all leadership discourse studies is the difficulty discerning the influence of speechwriters. Given that leaders are responsible for any repercussions, it seems plausible to assume they play a critical role in the final decisions regarding the content of the speech. However, the involvement of leaders in the actual speech writing process is likely to vary. From this perspective, the weight

of speechwriters' influence on individual leaders' language remains an empirical question (Bligh et al., 2004; Emrich, Brower, Feldman, & Garland, 2001; Winter, 1995). In order to fully understand the impact of speechwriters on political discourse, additional research is needed that quantitatively identifies any potential differences in the linguistic patterns between political leaders' public and private communication.

Another limitation is that this work was conducted on translated English texts of these autocratic leaders. We used the translated versions because we can measure more linguistic constructs that allow use to adequately measure our theoretical hypotheses. However, we have examined the cohesion of these speeches in the original language and findings were on par with those obtained in the translated versions. Therefore, we have confidence that these translated versions reflect what would be found in the original texts.

This research presents a novel approach to the study of political leadership that allows researchers to address some of the neglected links in leadership and organizational research, namely conceptualizing leadership as a-temporal and context-independent. As a consequence, some of the most interesting questions in the leadership field are overlooked because we fail to systematically observe and describe the evolution of leadership over time and in the context of critical events (McCauley, 2006; Shamir, 2011; Yukl, 2002b). From this perspective, we feel this research serves as an example of the many promising applications afforded by the inclusion of computational methodologies in leadership research.

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