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The Transition from Quantitative to Computational Methods in Foreign Policy Analysis

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Abstract

Computational methods have been increasingly used in Foreign Policy Analysis (FPA). Text analysis, geospatial analysis, and network analysis are among the most used computational methods. This article examines the FPA literature that utilizes computational methods and discusses their theoretical and empirical implications for future research. I argue that while these methods are not without their criticisms, the integration of computational tools enables FPA researchers to create and use big data sets, improve sampling, and collect and analyze data. Computational methods in FPA enable theory-driven analysis of big data, providing both theoretical and empirical insights, and allowing testing of micro-level foundations of FPA theories. However, challenges such as the validity of measures and selection bias should be taken into account. While computational methods present significant opportunities for advancing FPA, these challenges need consideration.

Keywords: Foreign Policy Decision-Making, Text Analysis, Geospatial Analysis, Network Analysis, Computational Social Science

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Introduction

Computational methods have become increasingly applied in International Relations (IR). The advancements in computing reduced the costs and increased the efficiency of collecting and analyzing data (Alvarez 2016). The advancements in computing and the diffusion of data science into political science through training and method classes enabled the proliferation of research utilizing computational tools. Historically, scholars have used various software programs for their research. The novel use of computational tools and methods enables the collection and pre-processing of large-scale data in a faster and more granular form (Kim and Ng 2022). This article reviews the current state of research on Foreign Policy Analysis (FPA) utilizing computational methods. It also provides examples from existing research covering different areas of foreign policy for the potential use of computational methods for researchers and discusses the theoretical and empirical implications of computational tools for FPA. To address these purposes, the article reviews the literature on text analysis, geospatial analysis,

and network analysis, showcasing the use of computational methods in foreign policy analysis. In short, this article addresses the following questions: What computational methods are utilized in FPA? What are the primary issues for which computational methods are applied? What are the implications of employing computational tools in FPA?

Computational methods refer to various computer-based approaches, including machine learning algorithms and natural language processing (Alvarez 2016; Salganik 2019). While computational methods often involve using computers to apply statistical and mathematical models for data analysis, they also encompass processes for collecting, generating, and visualizing data. Specifically, computational methods in FPA apply various computer science, data science, and statistical techniques and models to collect and analyze data for theory-driven questions about foreign policy. Computational tools and methods have been applied to a vast range of topics about foreign policy, including foreign aid (Van Weezel 2015), elite hawkishness (Jost et al. 2024), geopolitical threats (Trubowtiz and Watanabe 2021), economic sanctions (Elshehawy 2023), public diplomacy (Spry 2019), and social media use of diplomatic missions (Lin 2024).

FPA has a long history of using various computational tools, such as event data developed in the 1960s for quantifying foreign policy behavior and the Verbs in Context System (VICS), to measure foreign policy behavior and leadership profiling in the late 1990s (Potter 2010). While scholars have often used computational tools and quantitative data and methods together, computational methods should not be confused with quantitative methods. Quantitative methods refer to statistics and mathematics as tools for analyzing data, which can be employed by hand or calculator. Computational methods refer to using a computer to employ statistics and mathematics for big data analysis, but they extend to collecting, creating, and displaying data. Also, the data may be either quantitative or qualitative observations. Computational methods can offer a "third way" methodological approach (Ünver 2019: 160). The insights gained from traditional qualitative and quantitative methods can be further enriched by computational methods. Computational methods such as natural language processing are increasingly used in FPA research and can offer a path forward for the FPA field.

I argue that computational methods not only enable theory-driven analysis of big data that can have theoretical and empirical implications for FPA but also make it possible to test the micro-level foundations of FPA theories. By applying novel methods, scholars can gain new insights and refine currently existing middle-range FPA theories. Empirically, computational tools enable the collection of large-scale (e.g., texts) and new data sources (e.g., social media posts) that can contribute to our substantive knowledge of foreign policy. Also, the accumulation of data can increase the accuracy of analysis as the sample size gets bigger, thanks to computational tools. The application of computational methods in FPA offers a robust toolkit for modeling complex systems, integrating empirical data, validating findings, and exploring alternative scenarios. By leveraging computational methods, researchers can develop deeper insights into international dynamics, improve predictive capabilities, and provide well-informed policy recommendations.

Yet, computational methods might also present various challenges, including the validity of measures and selection bias. Scholars must be aware of the challenges to mitigate these concerns. In other words, while computational methods provide a significant opportunity for FPA to accumulate knowledge by using new data sources, testing and generating theories, and applying cutting-edge methods in a fast and replicable way, the challenges they bring need to be considered seriously.

The next section provides the historical evolution of computational tools and methods in FPA. The literature shows a diverse range of issues and tools that can be useful in understanding the current state of computational approaches in the field. I will first provide a history of computational tools and methods. Then I will examine text analysis, geospatial analysis, and network analysis.

History of Computational Tools and Methods in Foreign Policy Analysis

Event data is among the major and earliest uses of computational tools in FPA. The event data set was created to chart the states' foreign policy behaviors and patterns. The data is collected from newspapers, and each state interaction is coded numerically or categorically. For example, "if two countries sign a trade agreement, that interaction might be assigned a numerical score of +5, whereas if the two countries broke off diplomatic relations, that would be assigned a numerical score of -8. When these reports are averaged over time, they provide a rough indication of the level of cooperation and conflict between the two states" (Schrodt et al. 1995: 146).

The first notable example of an event dataset is the World Events Interaction Survey (WEIS) designed by Charles McClelland (1976). Events are collected from newspapers like Reuters and automatically coded by a computer program. Conflict and Peace Databank (COPDAB) is another early dataset that includes events that occurred between 1948 and 1978 (Azar 1980). Event data research received significant funding from governmental agencies to provide information for policymakers. Later, numerous quantitative event datasets appeared, and these computerized tools aimed to set up early crisis warning systems such as the Early Warning and Monitoring System (EAMS) and Computer-Aided Systems for Handling Information on Local Conflicts (CASCON) (see Hudson 2005). In the context of machine-coded events, the Kansas Event Data System (KEDS) constitutes a significant step. KEDS provides a computer program named Text Analysis by Augmenting Replacement Instructions (TABARI) that helps users generate event datasets.[1] This dataset reduces the cost of research and saves time for event data research.

Table 1 shows a sample of hand-coded event data for the Iraq-Kuwait Crisis. Researchers collected news titles and lead sentences as in the following example from a Reuters news agency report dated July 17, 1990. The title is "Resurgent Iraq Sends Shock Waves Through Gulf Arab States," and the lead sentence is "Iraq President Saddam Hussein launched an attack

1 See the KEDS datasets at https://eventdata.parusanalytics.com/software.html.

on Kuwait and the United Arab Emirates (UAE) Tuesday, charging they had conspired with the United States to depress world oil prices through overproduction" (see Schrodt 1995 for details). In the first sentence, Iraq is the source and Kuwait is the target. According to the WEIS coding scheme, the event and type of action are coded.

Table 1. WEIS Code for Reuter News (Schrodt 1995)

Date	Source	Target	WEIS Code	Type of Action
900717	IRQ	KUW	121	CHARGE
900717	IRQ	UAE	121	CHARGE
900723	IRQ	KUW	122	DENOUNCE

Leadership analysis is another research program in FPA in which scholars utilize computerized tools. FPA scholars use leaders-at-a-distance tools to analyze leaders' personality traits, beliefs, and different cognitive aspects that are thought to influence their decision-making. At-a-distance techniques are used to analyze leadership traits and belief systems without directly interviewing or using psychological tools in a lab environment. Operational code analysis (OCA) and leadership trait analysis (LTA) are among the most common types of leadership analysis. OCA was introduced by Nathan Leites (1953) to investigate the Soviet Politburo's decision-making. Similarly, the Verbs in Context System (VICS) content analysis scheme was developed to code leaders' speeches. The VICS scheme utilizes verb-based attributes because verbs are viewed as a leader's linguistic representation of perceived power relationships. Verbs show beliefs about self and others in the context of cooperative and conflictual attributes in the political universe. VICS focuses on transitives in public statements, encodes them relying on the verbs' direction, and scales them in line with their intensity. Earlier studies utilizing the VICS constructed hand-coded verbs (Crichlow 1998).

The following example from Schafer and Walker's (2006) book helps to illustrate how the VICS scheme is utilized. The following quote is taken from United States (US) President Jimmy Carter's address to the nation on January 4, 1980: "Massive Soviet military forces have invaded the small, nonaligned, sovereign nation of Afghanistan…" (Schafer and Walker 2006: 41). In this instance, the entire phrase constitutes a single verb-based utterance. The verb phrase identified here is "have invaded." The directional nature of the verb is conflictual (-), and it represents an action or deed. In this context, conflict-related actions are classified as -3.

The subject of the verb is "Massive Soviet military forces." It is important to note that Jimmy Carter, as the speaker, does not refer to himself or any of his in-groups, which leads to the classification of the subject as "other". Depending on the research question, additional contextual information may be pertinent. This might include noting that the subject area pertains to the Cold War, U.S.–Soviet relations, or Afghanistan. Alternatively, one could specify that the subject is a nondemocracy or that the domain relates to "foreign". The complete data line for this utterance would appear as follows, based on the selection of contextual variables: -3 "other foreign nondemocracy" (Schafer and Walker 2006: 41).

This shows a hand-coded example of Jimmy Carter's speech based on the VICS scheme. The verbs are coded based on various factors such as direction and intensity (Schafer and Walker 2006: 41). Both event data and VICS data evolved from hand-coded, quantitative data sets to machine-coded data sets, in which computers not only tabulate statistics but also use software dictionaries and grammatical parsers to retrieve data and construct indices.

More recently, Social Science Automation developed software that facilitates leadership trait analysis as well. ProfilerPlus software was developed to computerize the VICS procedure. The software codes political leaders' statements and produces quantitative indices of their psychological aspects. This automated content analysis offers high reliability and saves time. It compares leaders with the norming groups of world leaders. Operational code analysis has been applied to various leaders, countries, and themes, such as leaders' nuclear proliferation decisions (O'Reilly 2014). The studies include analyses of American leaders like Donald Trump, Hillary Clinton from the US (Walker, Schafer and Smith 2018), leaders of the European far-right, such as Marine Le Pen of France and Geert Wilders of the Netherlands (Özdamar and Ceydilek 2020), Dutch Prime Minister Rutte (Willigen and Bakker 2021), German leaders (Malici 2006), Chinese leaders like Mao Zedong (Feng 2005, 2007), leaders from Latin America (Thiers 2025) and Middle Eastern leaders (Canbolat 2025; Özdamar 2017).

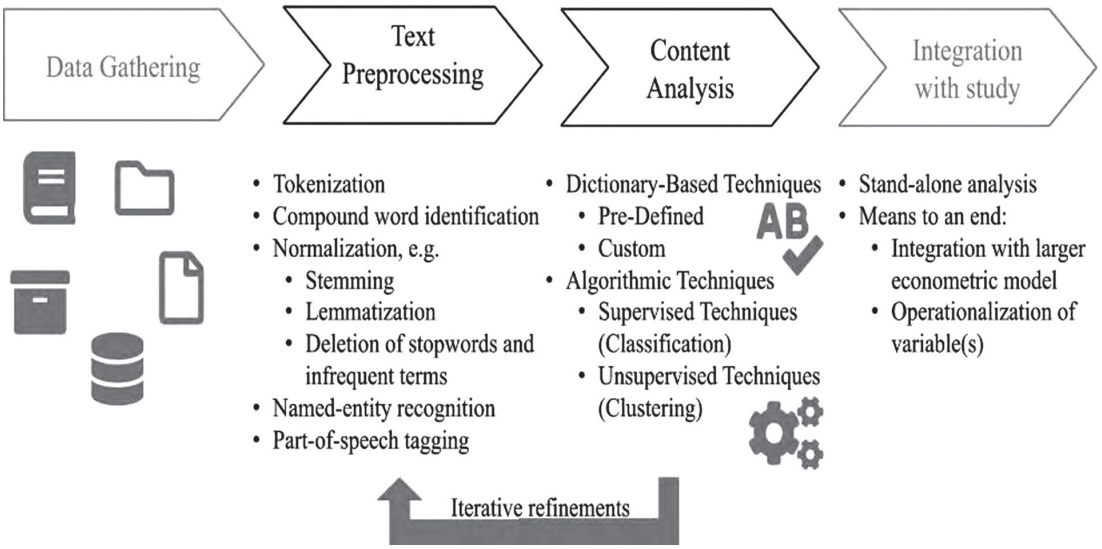
ProfilerPlus is also used in leadership trait analysis (LTA). LTA was developed by Margaret G. Hermann (1980) and is used to analyze the personality of leaders based on their verbal utterances. The personality traits of leaders, which include self-confidence, need for power, and control over events, are examined to make inferences about leaders' personalities and decisions. Leadership trait analysis is used in Western and non-Western contexts and offers quantitative indices that can be compared to a norming group of world leaders. The automated content analysis of leadership traits has been used to examine Latin American (Thiers and Wehner 2022), Middle Eastern (Çuhadar et al. 2021), British (Rohrer 2014), American (Özdamar, Halistoprak and Young 2023), and populist leaders (Fouquet and Brummer 2023).

Contemporary use of computational tools is mainly based on programs like R and Python. With the advancement of computing, new packages developed for programs like R offer fast, reliable analysis of various data and issues. In addition, the relevant computational courses in doctoral programs have become a norm, especially in the West, and help students of political science combine their area-specific knowledge with computational tools and can offer a "third way" methodological approach (Ünver 2019: 160). The insights of traditional qualitative and quantitative methods can be enriched further by computational methods. Computational methods not only make use of computers to employ statistics and mathematics for data analysis, but, as noted above, they make it easier to collect, create, and display certain types of data. Notably, the data may be either quantitative or qualitative. Computational models often allow for model complexity to improve predictive performance, making it less likely for FPA scholars to be constrained only by specific theoretical models.

Text Analysis

Computational text analysis offers novel ways of analyzing foreign policy-related issues based on massive datasets with theoretical and empirical implications. A large number of texts are publicly available for analysis. "Text as Data" approach refers to existing unstructured texts that are "transformed into more structured, summary, and quantitative data to make it amenable to the familiar tools of data analysis" (Benoit 2020: 463). The process involves text mining or collection and text preprocessing, which includes removing stop words, lemmatization, tokenization, and quantifying the cleaned textual data to make statistical inferences about politics (Figure 1).

Figure 1. Roadmap of Text Analysis (Antons et al. 2020: 331)[2]



Natural Language Processing (NLP) is another important method that has become popular with advancements in computing and digital data storage capabilities. Computer programs like R and Phyton offer replicable text analysis using NLP techniques. These programs provide different packages like *Quanteda* and *Tidytext* in R and libraries like Gensim and NLTK in Phyton. The programs also include visualization tools to chart the collected, pre-processed, and analyzed textual data.

Textual data provides a useful tool to extract information from news, policy documents, speeches, archival data, and various other similar documents. O'Connor et al. (2013) used unsupervised machine learning methods to extract event data from the news. While various militarized conflicts and foreign policy attitudes can be examined by applying similar methods, collaboration with other disciplines, such as Computer Science, can produce fruitful results for mining data, building models, and inferring results from data.

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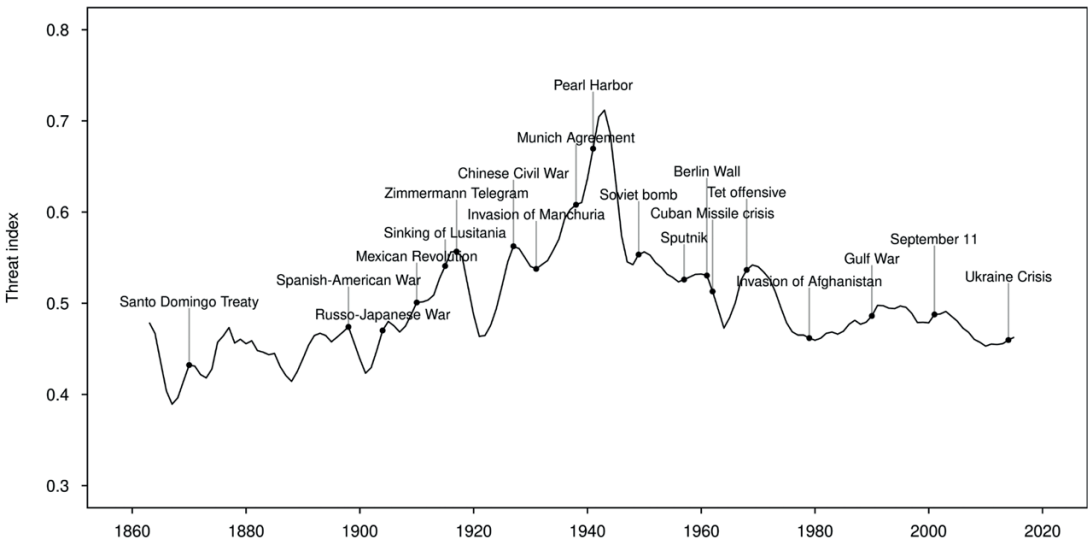
Trubowitz and Watanabe (2021) used a text-as-data approach and created a geopolitical threat index. Their approach enabled charting leaders to assess international threats by using publicly available text data from newspapers. Using semi-supervised machine learning models, they showed the variation in the US threat perception and validated the results from the conventional indicators of interstate behavior and material capabilities. Figure 2 below shows the threats to the US stemming from Russia and China over more than a century.

Figure 2. Threats to US interests by country: China and Russia (Soviet Union), 1861–2017 (Trubowitz and Watanebe 2021: 10)[3]



These scholars created a quantitative threat index that is easy for regression and other statistical analyses. In addition, the index enables the visualization of threats and tracks the trajectory of the dangers for a nation over time. This research departs from other approaches that consider arms race dynamics and economic factors when measuring threats, as it provides an alternative way of analyzing and including the variable of geopolitical threats in the analyses based on textual data.

Another example of how computational methods enable using different and large datasets is Mochtak and Turcsanyi's (2021) study on Chinese foreign policy discourse. Mochtak and Turcsanyi (2021) collected Chinese Ministry of Foreign Affairs press conferences and created a corpus. The study presents a useful resource for mapping and analyzing China's foreign policy discourse. The collected data covers almost 20 years and shows that the most negative sentiment in the official discourse regarding the US occurred during Xi Jinping's leadership (Mochtak and Turcsanyi 2021: 752). The study finds that while Hu Jintao's presidency was marked by economic cooperation, Xi's presidency has been characterized by more conflictual issues (Mochtak and Turcsanyi 2021: 753). The study offers a new path to study foreign affairs press releases as foreign policy data, combining the advantage of large data and less time needed to collect and analyze.

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Moreover, Elshehawy and her colleagues (2023) used the NLP method to collect economic sanctions-related government documents and built a textual dataset, SASCAT. They applied this method to the US case and revealed insights about partisanship, inter-branch delegation, and policy priorities. Similarly, Turcsanyi, Liškutin, and Mochtak (2023) examined the Chinese foreign policy influence based on the United Nations General Assembly voting and speech data. They utilized NLP techniques to estimate and quantify foreign policy positions of the Central and Eastern European countries and examined whether their positions aligned with China.

Public diplomacy and social media are other fields in which text analysis has been applied. Spry (2019) examined Facebook posts of foreign affairs ministries of Asian countries, including India and Japan, to analyze their public diplomacy from 2017–2018. Spry (2019) found that (1) smaller and less wealthy nations pay more attention to the Facebook posts of publisher countries, and (2) while institutional factors determine the content of the posts, audience-related factors play a decisive factor in engagement level. This study has become an important example of a cross-national examination of new public diplomacy by computational text analysis techniques and was followed by others in the field. For example, Ng and Carley's (2023) examination of the "balloon incident", involving a Chinese balloon in US airspace, examined "the bots as agents of information maneuvers," influencing social networks and narratives. They found that whereas bots geotagged to the US focused on balloon location, bots geotagged to China focused on escalating the issue.

Finally, populism has increasingly been one of the recent focus centers of scholars using computational tools and methods in the field. In their recent study, Dai and Kustov (2022) examined why presidential candidates adopt populist rhetoric. They coded a subset of speech data by hand and applied machine-learning techniques such as a random forest classifier "that learns the rules from the initial hand-coded sample in the first step to predict the (non-) populist document class as close as possible to the human coder" (Dai and Kustov 2022: 390). They found that those candidates who have an electoral disadvantage are more likely to resort to populist rhetoric. Future studies can be applied to how foreign policy issues influence populists' foreign policy rhetoric.

Geospatial Analysis

Various programs like ArcGIS, R, and Phyton are utilized to create and analyze geospatial data. Spatial locations are defined by a certain set of coordinates, including latitude and longitude. Geographic information can be coded as vector data or raster data. Vector data includes spatial features like a point, line, or polygon that can have values for other factors to be examined. Raster data, however, utilizes pixels, three-dimensional imageries, and predefined equal-size units (Branch 2016). Geospatial analysis enables examining spatial relationships by using statistical analysis and creating visualizations.

In IR, there has been an interest in the creation of multiple spatial datasets over the past few years. The GeoEPR[4] dataset is among the prominent datasets that code the location of ethnic groups and measure ethnic fractionalization, and it has been used by ethnic conflict scholars. ACLED[5] provides a dataset for armed conflict that can be beneficial for FPA scholars to examine violent events with their locations. Also, the AidData[6] dataset records development funding across the globe and the geolocation of the aid projects.

One of the main areas geospatial analyses are used is foreign aid. The literature generally utilizes observational and experimental approaches to study the effects of foreign aid. Yet, foreign aid offers fertile ground for utilizing computational methods with more granular data. The effects of aid, diffusion, and local dynamics can be analyzed using spatial tools. A good example of this type of research was recently carried out by Blair, Marty, and Roessler (2022). By examining foreign aid as a soft power instrument, Blair et al. (2022) examined whether aid leads to affinity for donor countries and the values they promote. The study examined 38 African countries and compared these states' views toward China and the US in relation to the aid these countries provided to the region. Furthermore, the authors used AidData and the Aid Information Management Systems of African finance and planning ministries to access spatial data and isolate the effects of different donors. Their findings suggest that while the Chinese aid does not increase support for China, the US aid increases the support for liberal democratic values.

Another study, by Van Weezel (2015), examined whether foreign aid decreased conflict in three African countries from 1999 to 2008. Unlike similar studies using country-year as the unit of analysis, Van Weezel (2015) used subnational administrative divisions by looking at geocoded local aid data. The study revealed that aid was usually distributed to areas close to the capital city, which was far from the conflict occurring in peripheral areas. It also showed there was little support for positive or negative effects.

Vecci and Zelinski (2017) analyzed the impact of foreign aid on civic capacity in Nigeria and Uganda. By using the Spatial Durbin Model, they showed that whereas civil society aid projects were correlated with low levels of participation at community meetings in Nigeria, they had a positive impact on the level of satisfaction with democracy in both Nigeria and Uganda.

In a different study, Goemans and Schultz (2017) examined border disputes among African states using geospatial data. The research shed light on the causes of territorial disputes with reference to ethnic identities and colonial legacies. Territorial and border disputes as foreign policy disputes by using geospatial data and analysis provide an exciting ground area for research in FPA. Although FPA scholars have so far paid more attention to text analysis-based computational models, geospatial analysis-based computational models can yield fruitful results for testing the spatial dimensions of FPA theories.

4 See the GeoEPR datasets at https://icr.ethz.ch/data/epr/geoepr/beta.html.

5 See the ACLED datasets at https://acleddata.com.

6 See the AidData datasets at https://www.aiddata.org/datasets.

Network Analysis

Scholars of IR have increasingly used network analysis (Maoz 2012). Network analysis examines "how material, social, and ideational relationships create structures among actors through dynamic processes" (Hafner-Burton, Kahler, and Montogomery 2009: 560) and focuses on the relationships among nodes (agents, individuals, states, etc.). By utilizing various programs to analyze and visualize data like UCINET, R, Python, and Gephi, network analysis also helps collect and analyze data with replicable codes. These programs rely on different packages and libraries that are updated for model-specific or comprehensive analysis of networks.

Scholars utilize network analysis models to explain interactions among states and classical themes focused on rivalries, alliances, cooperation, and conflict dynamics. For example, Kinne (2014) analyzed the politics of diplomatic recognition to address two trends in diplomatic practice: the use of diplomatic relations to signal approval or disapproval of a regime, relying on signs from diplomatic channels, and the use of official diplomatic missions to obtain prestige in the international system. Kinne (2014) found that these two trends were in fact the outcome of network effects, mainly because states do not possess enough resources, and they need to choose state allies and partners well. Yet, states do not have full information about the advantages and disadvantages of recognizing states diplomatically. Kinne (2014) argued that states' decision to extend recognition depended on the decision of recognition by other states.

More recently, Choi (2023) examined the influence of broker positions in diplomatic networks on a state's tendency to initiate interstate conflict and argued that diplomatic networks could influence the outbreak of militarized disputes. By using diplomatic network data spanning over 200 years, Choi (2023) found that broker states can leverage their position and influence other states' policies. In an earlier study, Maoz et al. (2007) examined relations among states based on the concepts of friendship and enmity. These scholars examined direct ("my enemy") and indirect ("the enemy of my enemy") foreign relations between states. By using social network analysis, they found that foreign relations over the 186 years their research covered demonstrated relational imbalances. According to them, states that had common enemies were inclined to forge alliances with each other; however, indirect enemies were prone to fight each other. Their findings supported what they call a "simple" version of realist theory.

Corradi, McMillan, and Dietrich (2022) used network analysis in their examination of interstate hostility. By applying temporal exponential random graph models, they argued that pairs of states with a direct past of adversarial actions were more likely to have militarized disputes. Mochtak and Diviak's (2019) research analyzed relations among the members of the Czech Parliament. By again using network analysis, they examined the membership in groups of friendships forming official ties among Czech parliamentarians and foreign assemblies and found that interparliamentary groups constituted an autonomous organization for parliamentary diplomacy that can considerably differ from the official position of the government.

Computational social science, which "refers to the application of computational methods to explore and test scientific … theories" (Hox 2017: 3), integrates new sources of data into

different modes of analysis by providing fine-grained measures (Kitts and Quintane 2020: 85). One of the novel uses of network analysis utilizes digital data to map relations between agents, including those in the context of social media. Zeitzoff, Kelly, and Lotan (2015) examined how foreign policy issues about Israel and Iran were discussed in different languages on X (formerly known as Twitter). By using social network analysis, they found that while some foreign policy networks mirrored the foreign policy positions and cleavages correctly, other languages did not.

Figure 3. Semantic Network Analysis of China-Related Bills at the US Congress (Zhang and Wang 2023:5)[7]

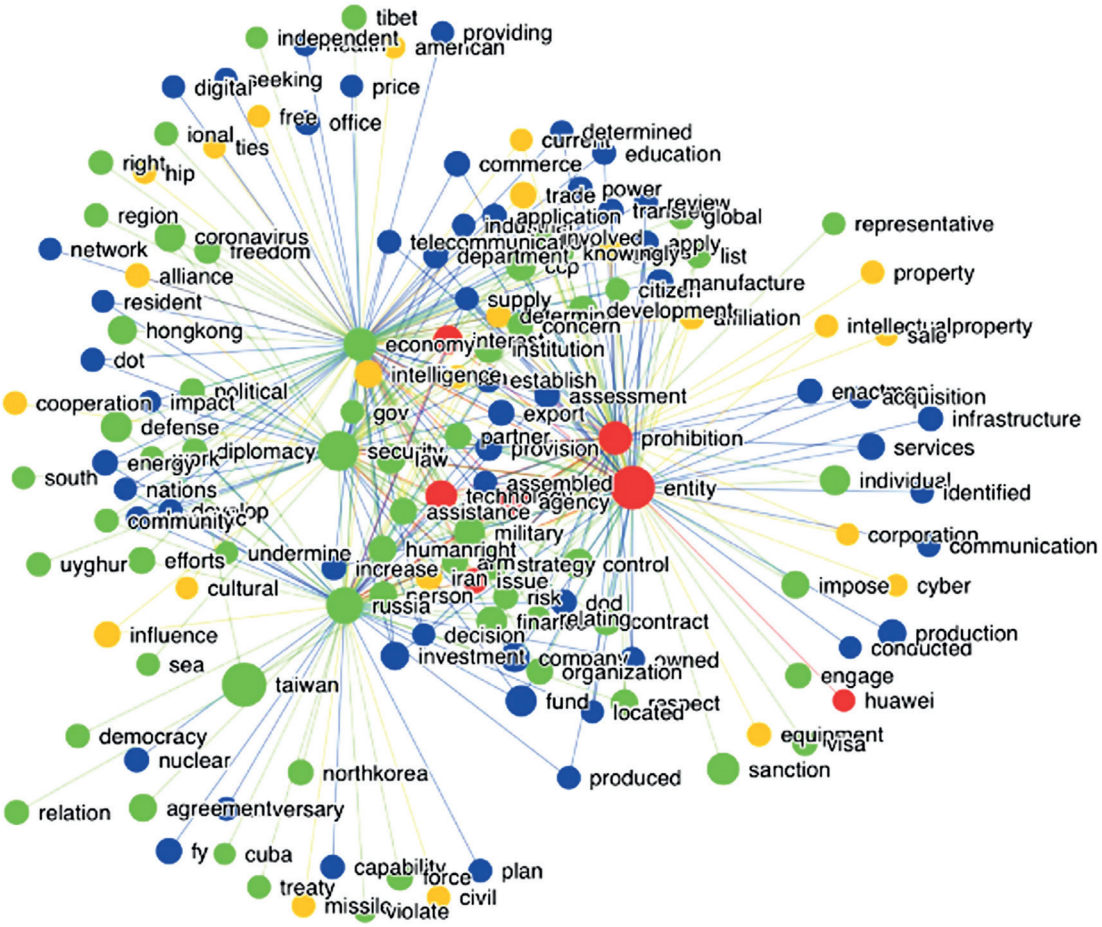

Figure 3 shows a network analysis of China-related Bills at US Congress speeches. Zhang and Wang (2023) analyze the US Congress bills to examine US foreign policy toward China from the 115th–117th Congresses (Jan. 3, 2017–Jan. 3, 2023). It helps understand the foreign policy narratives about China and demonstrates a way of studying foreign policymaking based on network analysis.

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Lin (2024) scrutinized public diplomacy by analyzing the US and Iranian embassies' social media accounts on a Chinese social media platform called Sina Weibo. Lin's (2024) network analysis revealed both countries' public diplomacy styles on social media. The nodes in the analysis were coded based on clusters as detected by the Louvain algorithm by using Gephi software. These studies by Zeitzoff, Kelly, and Lotan (2015) and Lin (2024) present interesting examples of how foreign policy can be studied using social media data and network analysis. Indeed, the accumulation of social media data presents an opportunity for FPA scholars to study foreign policy using different perspectives and techniques.

Discussion and Implications for Future Research

Computational methods refer to different computer-based methods, such as machine learning algorithms and natural language processing (Alvarez 2016). They can offer a "third way" methodological approach (Ünver 2019: 160). The insights of traditional qualitative and quantitative methods can be enriched further by computational methods. In addition to allowing researchers to employ statistics and mathematics to analyze data, computational methods help collect, create, and display data. In particular, scholars have used computational methods in FPA to collect and analyze data for theory-driven questions about foreign policy actions.

Computational methods offer theoretical and empirical implications for FPA. Theoretically, scholars can test micro-foundations of theories by using more granular data that computational tools now enable us to collect (Hox 2017). They can help test assumptions of the theories, produce new arguments, and modify existing ones. Moreover, computational models can advance the field, making theoretical approaches more robust by allowing answering old questions with new data and techniques. Using computational models may pave the way for linking macro-level theories to micro-level theories (Edelman et al. 2020).

Another important theoretical contribution of computational methods is its focus on the micro-macro linkage, which underlines the fact that understanding individual behaviors and decisions is fundamental to understanding how these decisions get aggregated into broader systemic outcomes. In other words, FPA bridges the individual choice of leaders, the choice to use force, for example, and the international phenomena arising as a result of such decisions. This perspective is holistic, allowing scholars to see how micro-level actions cascade into macro-level dynamics in the international arena.

Regarding specific methods, text analysis can contribute to FPA with its techniques like sentiment analysis and topic modeling, as it permits systematic analysis of large amounts of textual data from different sources, including but not limited to social media posts of elites and diplomatic missions, as examples above show. The easy access to granular and rich data enables FPA scholars to offer novel insights regarding the discourse, beliefs, and attitudes of foreign policy decision-makers. Another important component of computational methods that can be applied for FPA purposes is network analysis. Through propaganda toward a system of

social interaction structured around alliances, trade, or diplomatic networks, it identifies key actors and observes the flow of information and influence within the network. This analytic approach provides insight into how changes in network structures intersect with changes in international relations.

Network analysis underlines how social and material factors form structures between actors (Ward, Stovel, and Sacks 2011). In this sense, network analysis offers a rich ground for researching actor-based approaches to foreign policy analysis. Elites in foreign policy have received renewed attention recently (Saunders 2022), and bureaucrats, leaders, and other potentially influential individuals in foreign policymaking can be examined based on their networks, the intensity of their ties with each other, and clusters of elites. For both theory-building and theory-testing purposes, network analysis offers pathways for FPA. Geospatial analysis enhances the study of FPA by utilizing increasing amounts of high-resolution spatial data that can help examine novel theoretical ideas in the field. Spatial data collection and analysis can be used to gain a more granular and detailed understanding of geographic factors impacting foreign policy decision-making.

Besides, computational methods emphasize validating their models and providing proof of robustness to ensure that the insights from the models can be reliable (Boero 2015). FPA researchers can also employ computational methods in testing their models against alternative assumptions and parameters, thus offering increasing credibility and applicability to their findings. This emphasis on rigor is key to ensuring faith in the conclusions drawn and to standing the test of scrutiny. Computational methods are also an intrinsically data-driven pursuit based on the use of extensive datasets for the specification and validation of models (Boero 2015). FPA scholars could benefit from this fact by analyzing big data, including digital trace data, satellite data, social media posts, news articles, and international trade data, to give new insights into the dynamics of foreign policy and public opinion on international relations.

Furthermore, computational tools can help bridge domestic politics and international relations (Kaarbo 2015). The substantive, theoretical, and methodological toolbox of FPA can be enhanced by adding computational tools and methods. Theory-building efforts can be facilitated with the opportunity of big data. Computational tools and methods also enable reproducibility. The codes are increasingly becoming available in journal data repositories, which can contribute to the replication and use of other researchers. In other words, computational tools can increase the empirical scope of FPA and pave the way for examining large datasets by using Structured Query Language (SQL) and Application Programming Interface (API) (Akbaritabar 2024). Additionally, online surveys can be conducted using social media advertisements to recruit respondents. Online experiments can be another way of gathering and analyzing data. Computational tools not only enable data gathering but also data cleaning and pre-processing for analysis. This is also important as the digital trace data might require a significant amount of time to prepare for the main analysis.

Figure 4. Advisor Model Data Construction by Using Computational Methods (Jost et al. 2024: 12)[8]

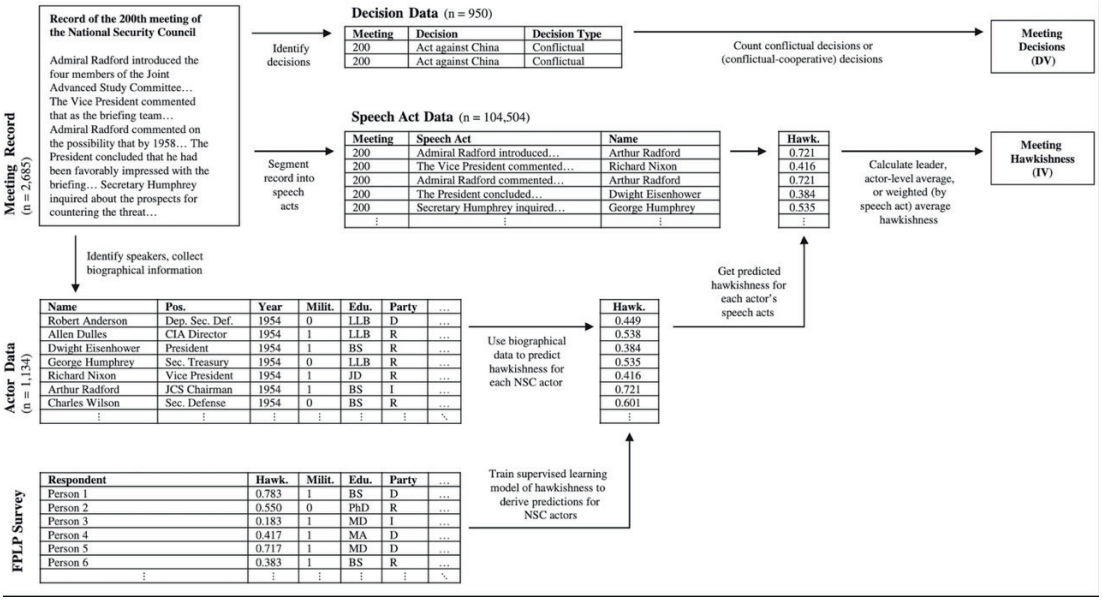

Figure 4 describes the data construction process based on archival records of foreign policy meetings in the US from 1947 to 1988 in a recent example of the use of computational tools and methods (Jost et al. 2024). The study used optical recognition software to turn official meeting record photographs into digitized text and utilized machine learning to measure the hawkishness of 1,134 people identified in the meeting records to test their advisor model. The study exemplifies how computational tools and methods can enhance our ability to use at-a-distance techniques to analyze elites' decision-making processes and test assumptions in novel ways.

Computational methods also enable exciting opportunities for interdisciplinary collaboration. A collaboration with data scientists, computer scientists, and machine learning engineers in FPA would lead to more technical and computational support for theory formation in the field. It can also pave the way for FPA-related research to inform research in other disciplines, including Communications, Sociology, and Data Science.

Yet, computational methods are not without limitations. Similar to any other empirical social scientific method, they present various challenges related to validity, reliability, and bias. In geospatial analysis, for example, measurement validity can be limited when actors, institutions, or behaviors are not described accurately in geospatial data. Selection bias might occur "when the focus on spatial entities or ideas prejudices unit selection, removing nonspatial units from the analysis" (Branch 2016: 846-847). One potential solution to address the measurement validity challenge is to ensure that the researchers' choice of the theoretically appropriate level of analysis and the appropriate spatial form, like point and polygon, of the

8 This figure is used from an open-access article, licensed by Creative Commons Attribution 4.0 License, see https://creativecommons.org/licenses/by/4.0/.

units that are examined, are well matched with each other. Branch (2016: 863) suggests the following steps: "using multiple coding methods to combine nonspatial and spatial units and variables, defining units analytically rather than empirically, and focusing research questions on those units and processes that are not being selected out."

Causal inference is a matter of interest in all empirical social science fields and seeks to increase the present understanding of causes and effects (Hofman et al. 2021). Through network analysis, we often observe associations or correlations among different network parameters, such as centrality, and various types of outcomes; these associations do not always lend themselves to clear causation. One of the major lines of criticism that has sometimes been directed at the field is the issue of selection bias. For example, friendships might form based on common interests, characteristics, etc., and it might be these commonalities that lead to similar outcomes independent of friendship itself (Alvarez 2016: 131).

In text analysis, for example, the association established between marginalized political groups and their languages entails that much of the information about them relies upon Western sources, which may also bear the bias of Western cultures (Windsor 2022). For instance, while researching event data, such as possible protests or violence, many sources have overlooked the Arab Spring due to their use of English-language news. They could thereby have overlooked some key developments, while local news sources would capture most of these developments (Windsor 2022). The vast amount of available text in English presents an opportunity to analyze. However, this can lead to selection bias in text analysis. The available corpus of speeches in English might limit the generalizability and interpretation of the research (Windsor 2022) as well. Furthermore, the translated speeches from another language might require further attention depending on the purpose of the research.

To advance the internationalization of IR research around computational text analysis, Windsor (2022) suggests that there are several courses of action scholars might pursue. The first is to build collaborations with local scholars fluent in target languages and who will widen their repercussions on the field. Second, scholars can utilize language-agnostic methodologies such as topic modeling to analyze non-English documents. As Nelson (2017) notes, the combination of computers for sorting and humans for interpretation can bridge quantitative and qualitative scholarship. These approaches can together enhance IR and FPA studies. Such cooperation is essential for the reason that language structures perception and much may be lost in translation (Windsor 2022). To compensate for selection bias entrenched in the IR text-as-data corpora, formulation of working groups, creation of central repositories, and organization of text-as-data courses and workshops can be carried out.

Another additional challenge is that computational methods might require the use of digital trace data, which is increasingly controversial in terms of data privacy (Lazer et al. 2009). Finally, various social media companies restrict the use of their data, making it difficult to access digital trace data (Lazer et al. 2020). Scholars might need to be attentive to open science principles and protecting human subjects without violating confidentiality.

Conclusion

Overall, the implementation of computational methods in FPA can offer a solid toolset for modeling complex systems, enriching empirical data, validating findings, and discovering alternative pathways. Through computational methods and tools, the researchers can get better insights into international dynamics, enabling them to better predict accompanying policy recommendations without ignoring potential limits and biases, as is the case in other methods.

In conclusion, computational methods such as text analysis, geospatial analysis, and network analysis enable the collection and analysis of large-scale and more granular data. They enable FPA scholars to link new data sources, including the digitization of historical archives, empirically examine some of the most enduring questions in the field in different ways, and ask new questions and test novel theories. Future research should utilize these computational methods not only to enhance rigor in FPA but also to connect research in the field with IR and other fields of study.

References

Akbaritabar, Aliakbar. 2024. Thinking Spatially in Computational Social Science. *EPJ Data Science* 13 (1): 1–12.

Alvarez, R. Michael, ed. 2016. *Computational Social Science*. Cambridge University Press.

Antons, David, Eduard Grünwald, Patrick Cichy, and Torsten Oliver Salge. 2020. The Application of Text Mining Methods in Innovation Research: Current State, Evolution Patterns, and Development Priorities. *R&D Management* 50, 3: 329-351.

Azar, Edward E. 1980. The Conflict and Peace Data Bank (COPDAB) Project. *Journal of Conflict Resolution* 24, 1: 143–152.

Benoit, Kenneth. 2020. Text as Data: An Overview. In *The SAGE Handbook of Research Methods in Political Science and International Relations*, eds. Luigi Curini and Robert Franzese. New York, SAGE: 461-497.

Blair, Robert A., Robert Marty, and Philip Roessler. 2022. Foreign Aid and Soft Power: Great Power Competition in Africa in the Early Twenty-First Century. *British Journal of Political Science* 52, 3: 1355–1376.

Boero, Riccardo. 2015. *Behavioral Computational Social Science*. New York, John Wiley & Sons.

Branch, Jordan. 2016. Geographic Information Systems (GIS) in International Relations. *International Organization* 70, 4: 845–869.

Canbolat, Sercan. Have Middle Eastern Leaders Learned from the Arab Uprisings? An Arabic Operational Code Approach, Uluslararası İlişkiler, Advanced Online Publication, 24 April 2025, pp. 1–21.

Choi, Seulah. 2023. Where You Sit Matters: The Power of Brokers in Diplomatic Networks & Interstate Conflict. *International Interactions* 49, 5: 669–695.

Corradi, Andrea, Cassie McMillan, and Nick Dietrich. 2022. A Hostile Reputation: A Social Network Approach to Interstate Hostility. *Social Networks* 71:61–69.

Crichlow, Scott. 1998. Idealism or Pragmatism? An Operational Code Analysis of Yitzhak Rabin and Shimon Peres. *Political Psychology* 19, 4: 683-706.

Çuhadar, Ç. Esra, Juliet Kaarbo, Barış Kesgin, and Binnur Özkeçeci-Taner. 2021. Turkish Leaders and Their Foreign Policy Decision-Making Style: A Comparative and Multi-Method Perspective. *Turkish Studies* 22, 1: 1–27.

Dai, Yaoyao, and Alexander Kustov. 2022. When Do Politicians Use Populist Rhetoric? Populism as a Campaign Gamble. *Political Communication* 39, 3: 383–404.

Edelmann, Achim, Tom Wolff, Danielle Montagne, and Christopher A. Bail. 2020. Computational Social Science and Sociology. *Annual Review of Sociology* 46: 61–81.

Elshehawy, Ashrakat, Nikolay Marinov, Federico Nanni, and Jordan Tama. 2023. SASCAT: Natural Language Processing Approach to the Study of Economic Sanctions. *Journal of Peace Research* 60, 5: 877–885.

Feng, Huiyun. 2005. The Operational Code of Mao Zedong: Defensive or Offensive Realist? *Security Studies* 14, 4: 637–662.

Feng, Huiyun. 2007. *Chinese Strategic Culture and Foreign Policy Decision-Making: Confucianism, Leadership and War*. London, Routledge.

Fouquet, Stephan, and Klaus Brummer. 2023. Profiling the Personality of Populist Foreign Policy Makers: A Leadership Trait Analysis. *Journal of International Relations and Development* 26, 1: 1–29.

Goemans, Hein E., and Kenneth A. Schultz. 2017. The Politics of Territorial Claims: A Geospatial Approach Applied to Africa. *International Organization* 71, 1: 31–64.

Hafner-Burton, Emilie M., Miles Kahler, and Alexander H. Montgomery. 2009. Network Analysis for International Relations. *International Organization* 63, 3: 559–92.Hofman, Jake M., Duncan J. Watts, Susan Athey, Filiz Garip, Thomas L. Griffiths, Jon Kleinberg, Helen Margetts et al. 2021. Integrating Explanation and Prediction in Computational Social Science. *Nature* 595 7866: 181-188.

Hox, Joop J. 2017. Computational Social Science Methodology, Anyone? *Methodology* 13, 1: 3–12.

Hudson, Valerie M. 2005. Foreign Policy Analysis: Actor-Specific Theory and the Ground of International Relations. *Foreign Policy Analysis* 1, 1: 1–30.

Jost, Tyler, Joshua D. Kertzer, Eric Min, and Robert Schub. 2024. Advisers and Aggregation in Foreign Policy Decision Making. *International Organization* 78, 1: 1–37.

Kaarbo, Juliet. 2015. A Foreign Policy Analysis Perspective on the Domestic Politics Turn in IR Theory. *International Studies Review* 17, 2: 189-216.

Kim, Jae Yeon, and Yee Man Margaret Ng. 2022. Teaching Computational Social Science for All. *PS: Political Science & Politics* 55, 3: 605–609.

Kinne, Brandon J. 2014. Dependent Diplomacy: Signaling, Strategy, and Prestige in the Diplomatic Network. *International Studies Quarterly* 58, 2: 247–259.

Kitts, James A., and Eric Quintane. 2020. Rethinking Social Networks in the Era of Computational Social Science. In *The Oxford Handbook of Social Networks*, eds. Ryan Light and James Moody. Oxford, Oxford University Press: 70–97.

Lazer, David, Alex Pentland, Lada Adamic, Sinan Aral, Albert-László Barabási, Devon Brewer, Nicholas Christakis, et al. 2009. Computational Social Science. *Science* 323, 5915: 721–723.

Lazer, David M. J., Alex Pentland, Duncan J. Watts, Sinan Aral, Susan Athey, Noshir Contractor, Deen Freelon, et al. 2020. Computational Social Science: Obstacles and Opportunities. *Science* 369, 6507: 1060–1062.

Leites, Nathan Constantin. 1953. *A Study of Bolshevism*. Glencoe, The Free Press.

Lin, Zhi. 2024. A Virtual Battlefield for Embassies: Longitudinal Network Analysis of Competing Mediated Public Diplomacy on Social Media. *Political Communication*: 1–29.

Malici, Akan. 2006. Germans as Venutians: The Culture of German Foreign Policy Behavior. *Foreign Policy Analysis* 2, 1: 37–62.

Maoz, Zeev, Lesley G. Terris, Ranan D. Kuperman, and Ilan Talmud. 2007. What Is the Enemy of My Enemy? Causes and Consequences of Imbalanced International Relations, 1816–2001. *The Journal of Politics* 69, 1: 100–115.

Maoz, Zeev. 2012. How Network Analysis Can Inform the Study of International Relations. *Conflict Management and Peace Science* 29, 3: 247–256.

McClelland, Charles A. 1976. World Event/Interaction Survey Codebook. ICPSR Ann Arbor.

Mochtak, Michal, and Tomas Diviak. 2019. Looking Eastward: Network Analysis of Czech Deputies and Their Foreign Policy Groups. *Problems of Post-Communism* 66, 6: 418–433.

Mochtak, Michal, and Richard Q. Turcsanyi. 2021. Studying Chinese Foreign Policy Narratives: Introducing the Ministry of Foreign Affairs Press Conferences Corpus. *Journal of Chinese Political Science* 26, 4: 743–761.

Nelson, Laura K. Computational Grounded Theory: A Methodological Framework. *Sociological Methods & Research* 49, 1: 3-42.

Ng, Lynnette Hui Xian, and Kathleen M. Carley. 2023. Deflating the Chinese Balloon: Types of Twitter Bots in US-China Balloon Incident. *EPJ Data Science* 12, 1: 1–28.

O'Connor, Brendan, Brandon M. Stewart, and Noah A. Smith. 2013. Learning to Extract International Relations from Political Context. In *Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, eds. Hinrich Schuetze, Pascale Fung, and Massimo Poesio. Sofia, Association for Computational Linguistics: 1094–1104.

O'Reilly, Kelly. 2014. *Nuclear Proliferation and the Psychology of Political Leadership: Beliefs, Motivations and Perceptions*. London, Routledge.

Özdamar, Özgür. 2017. Leadership Analysis at a 'Great Distance': Using the Operational Code Construct to Analyse Islamist Leaders. *Global Society* 31, 2: 167–198.

Özdamar, Özgür, and Erdem Ceydilek. 2020. European Populist Radical Right Leaders' Foreign Policy Beliefs: An Operational Code Analysis. *European Journal of International Relations* 26, 1: 137–162.

Özdamar, Özgür, Burak Toygar Halistoprak, and Michael Young. 2023. Do Campaign Speeches Predict Foreign Policy? An Operational Code and Leadership Trait Analysis of Donald Trump's MENA Policies. *Uluslararası İlişkiler* 20, 80: 73–91.

Rohrer, Samuel R. 2014. What Makes a Prime Minister Great?: A Leadership Trait Analysis of the Effectiveness of British Prime Ministers from 1902 to 2004. *Research & Politics* 1, 3.

Salganik, Matthew J. 2019. *Bit by Bit: Social Research in the Digital Age*. New Jersey, Princeton University Press.

Saunders, Elizabeth N. 2022. Elites in the Making and Breaking of Foreign Policy. *Annual Review of Political Science* 25, 1: 219-240.

Schafer, Mark, and Stephen G. Walker. 2006. Operational Code Analysis at a Distance: The Verbs in Context System of Content Analysis. In *Beliefs and Leadership in World Politics: Methods and Applications of Operational Code Analysis,* eds. Mark Schafer and Stephen G. Walker. New York, Palgrave Macmillan US: 25-51.

Schrodt, Philip A. 1995. Event Data in Foreign Policy Analysis. In *Foreign Policy Analysis: Continuity and Change in Its Second Generation*, eds. Laura Neack et al. Englewood Cliffs, NJ, Prentice Hall: 145-166.

Spry, Damien. 2019. From Delhi to Dili: Facebook Diplomacy by Ministries of Foreign Affairs in the Asia-Pacific. *The Hague Journal of Diplomacy* 15, 1–2: 93–125.

Thiers, Consuelo. Political Leaders' Role in Latin American Foreign Policy: A Systematic Review, Uluslararası İlişkiler, Advanced Online Publication, 15 April 2025, pp. 1–17.

Thiers, Consuelo, and Leslie E. Wehner. 2022. The Personality Traits of Populist Leaders and Their Foreign Policies: Hugo Chávez and Donald Trump. *International Studies Quarterly* 66, 1: sqab083.

Trubowitz, Peter, and Kohei Watanabe. 2021. The Geopolitical Threat Index: A Text-Based Computational Approach to Identifying Foreign Threats. *International Studies Quarterly* 65, 3: 852–865.

Turcsanyi, Richard Q., Kamil Liškutin, and Michal Mochtak. 2023. Diffusion of Influence? Detecting China's Footprint in Foreign Policies of Other Countries. *Chinese Political Science Review* 8, 3: 461–486.

Ünver, H. Akın. 2019. Computational International Relations What Can Programming, Coding and Internet Research Do for the Discipline? *All Azimuth: A Journal of Foreign Policy and Peace* 8, 2: 157–182.

Van Weezel, Stijn. 2015. A Spatial Analysis of the Effect of Foreign Aid in Conflict Areas. *AidData Working Paper #8.* Williamsburg, VA, AidData. Accessed at: https://docs.aiddata.org/ad4/pdfs/wps8_a_spatial_analysis_of_the_effect_of_foreign_aid_in_conflict_areas.pdf.

Vecci, Joseph, and Tomas Zelinsky. 2017. A Spatial Analysis of Foreign Aid and Civil Society. https://gupea.ub.gu.se/handle/2077/51440.

Walker, Stephen G., Mark Schafer, and Gary E. Smith. 2018. The Operational Codes of Donald Trump and Hillary Clinton. In *The Oxford Handbook of Behavioral Political Science*, eds. Alex Mintz and Lesley Terris. Oxford, Oxford University Press: 1-24.

Ward, Michael D., Katherine Stovel, and Audrey Sacks. 2011. Network Analysis and Political Science. *Annual Review of Political Science* 14, 1: 245–264.

Willigen, Niels van, and Femke E. Bakker. 2021. Trauma and Belief Systems; an Operational Code Analysis of Dutch Prime Minister Rutte and the Downing of Flight MH17. *Risk, Hazards & Crisis in Public Policy* 12, 2: 215-233.

Windsor, Leah C. 2022. Bias in Text Analysis for International Relations Research. *Global Studies Quarterly* 2, 3: ksac021.

Zeitzoff, Thomas, John Kelly, and Gilad Lotan. 2015. Using Social Media to Measure Foreign Policy Dynamics: An Empirical Analysis of the Iranian–Israeli Confrontation (2012–13). *Journal of Peace Research* 52, 3: 368-383.