Geopolitical Forecasting Analysis of the Russia-Ukraine War Using the Expert's Survey, Predictioneer's Game and GPT-3 *

Kirill Kalinin†

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†Researcher at the Hoover Institution, Stanford University (E-mail: kkalinin@stanford.edu)

Abstract

The Russia-Ukraine war that began on February 24th has resulted in significant geopolitical upheaval, sending shockwaves that reverberated around the globe. This extended and highly destructive war continues to rage on without any apparent resolution in sight. This paper attempts to use the famous *Predictioneer's Game*, developed by Bruce Bueno de Mesquita, to forecast future developments of the war along three issue dimensions: Russia's control over Ukraine's territory, feasibility of utilizing tactical nuclear weapons by Russia, and the post-war evolution of the Russian political regime. The *Predictioneer's game* is built on two types of inputs: expert-based data and AI-generated data (GPT-3). My findings provide valuable insights into potential outcomes of the Russia-Ukraine war and can inform policy decisions and diplomatic efforts aimed at resolving the conflict. The paper highlights the limitations of using GPT-3-generated inputs and the importance of considering expert knowledge to generate accurate policy outcomes.

Keywords: Russia-Ukraine war, Predictioneer's Game, geopolitical forecasting, GPT-3, large language model.

Introduction

The ongoing military conflict between Ukraine and Russia, which began in February 2014, has caused significant geopolitical upheaval and poses a threat to global stability. The Western sanctions imposed on Russia have cut the country off from large parts of the global economy, leading to Russia's political and economic isolation. Despite this, the Kremlin has not shown any signs of cracking, and attempts to stifle potential social protests through repression and social spending may not prove to be efficient.

The conflict between Russia and Ukraine is rooted in Russia's challenge to the prevailing international norms and the contemporary world order, as well as Vladimir Putin's desire to expand Russian territory. The geopolitical significance of Ukraine for Russia is rooted in its strategic location, political influence, and potential impact on Russia's imperial ambitions. The ongoing crisis reflects deep-seated tensions and competing interests of these two countries and has far-reaching implications for regional stability and global security.

Predicting the future developments of the Russia-Ukraine war is a difficult task, as it involves a high degree of uncertainty regarding the conflict itself and the participating countries. This paper builds on the information accumulated by the expert community over the year of conflict. Here I propose an empirical strategy that leverages the expertise of experts in Russian studies, along with advances in natural language processing and formal modeling. Specifically, in this paper, all involved sides are considered rational players who behave strategically to maximize their respective utilities. To model these relationships, I utilize (Bueno de Mesquita 2011)'s *Predictioneer's Game*, which uses data collected from selected experts in February 2023, exactly a year after the war started, and a large language model (GPT-3). The obtained forecasting results based on different inputs are then compared with game-free predictions provided by the experts and generated by GPT-3, thus helping to assess the variability of different forecasts and enhance our understanding of the conflict's possible outcomes.

This paper focuses on three issue dimensions of the conflict: the *territorial* dimension,

which pertains to Russia's control over Ukraine's territory; the *nuclear threat* dimension, which is focused on the feasibility of utilizing tactical nuclear weapons during the current military conflict; and the *regime's future* dimension, which emphasizes the post-war evolution of the Russian political regime.

All three issue dimensions encompass a vast spectrum of potential outcomes. For instance, control over Ukraine's territory issue dimension includes outcomes ranging from the complete restoration of Ukraine's territorial integrity within its 1991 borders, along with the restoration of its full foreign policy autonomy, to the scenario where Russia gains control over the entirety of Ukraine, and Ukraine loses its foreign policy independence. The nuclear issue dimension considers the possibility of the utilization of tactical nuclear weapons as a result of its defeat in a conventional war and/or the subsequent inability to defend the annexed regions and considers the positions of various players in terms of support for this action. Finally, the domestic policy dimension of post-war Russia encompasses a diverse range of possibilities, ranging from a scenario where voters are allowed to freely and fairly elect their leaders, even if this results in the victory of the opposition, to a scenario in which Putin stays in power, and the regime evolves into a mature dictatorship.

The paper is structured as follows. Section 1 provides a brief description of the current geopolitical conflict between Russia and Ukraine. Section 2 outlines the methodological framework, which includes a brief overview of the *Predictioneer's Game* model and general information about GPT-3's *Davinci* model. Section 3 describes the empirical strategy used in this study, which involves data collection through a small expert survey and GPT-3. Section 4 presents the key findings of this paper. Finally, the last section draws conclusions and examines potential directions for further research.

Geopolitical Context

The onset of the conflict in Ukraine on February 24 has resulted in significant geopolitical upheaval, sending shockwaves that reverberated around the globe. This extended and highly destructive event continues to rage on without any apparent resolution in sight. Western sanctions on Russia extended to the freezing of Russia's dollar and Euro reserves, banning oil and gas imports, and effectively cutting the country off from large parts of the global economy. The crisis not only posed a threat to European security, but also led to a surge of refugees and placed additional stress on the global economy, which was still recovering from the COVID-19 pandemic. The conflict highlighted and reinforced the contradictions between democracies and autocracies and underscored the importance of military alliances that offer security guarantees or promises of military assistance.

The United States and its allies have taken steps to bolster Ukraine and hold Russia accountable for the ongoing war. Specifically, they have implemented unprecedented economic sanctions on Russia in an effort to reduce Russia's ability to finance the war, impose costs on Russian policymakers and elites, and inflict damage on the Russian economy. Furthermore, the United States has led the way in providing arms and military supplies to enhance Ukraine's ability to defend itself against a larger Russian military force, with support from several European and Asian allies (Smeltz et al. 2022).

Despite the fact that sanctions have not yet provoked cracks within the Kremlin system, a declining or stagnant economy, increasing fiscal inefficiencies, and rising inflation have eventually contributed to growing social discontent. As a result, it can become more difficult for the regime to sustain the status quo in the future. The Kremlin's attempts to suppress potential social protests through a combination of repression and social spending may not prove to be efficient. A deteriorating economy and rising unpopularity of the war in Ukraine could potentially lead to domestic threats to the regime, and possible regime change(Snegovaya et al. 2023). According to the online forecasting platform, Metaculus, it is projected that Putin will step down from the presidency in the spring of 2023 (Metaculus

2023*a*). The platform also indicates that there is only a 7% probability of a regime change or coup taking place in Russia, and only 18% of participants believe that Russia will undergo significant democratization within the next five years (Metaculus 2023*d*,*c*).

The range of potential post-war scenarios for the Russian political regime is broad, ranging from complete democratization with fully free and fair elections to Putin handing off all power to several trusted associates, to Putin handing off power to at least one associate, or Putin remaining in power and the regime evolving into a mature dictatorship (Golosov 2022). The potential range of scenarios in the event of Russia's military defeat can be determined by a variety of factors, including the society's broad reaction and the level of discontent among elites who may seek to escape the sanctions trap and hope for a better future.

The current crisis between Russia and the West can be attributed to Russia's active challenge to the prevailing international norms and the contemporary world order, as well as Vladimir Putin's desire to secure his place in history as a leader who oversaw the expansion of Russian territory. This ambition is consistent with Russia's longstanding tradition of territorial expansionism and is reflected in the ideology of *neo-Eurasianism*, which entails some form of repressive rule at home and imperial expansion into other territories. Alexander Dugin, a leading proponent of neo-Eurasianism, has argued that the successful resolution of the Ukrainian question is critical to the success of the entire Eurasian project. According to Dugin, Ukraine poses significant geopolitical risks to Russia's imperial ambitions due to its political ambivalence as a country located in the *cordon sanitaire*, its large territory and population, its control over the Black Sea coast, and its willingness to join NATO(Dugin 1997; Kalinin 2019).

The geopolitical significance of Ukraine for Russia is beyond doubt. However, according to Robert and McFaul (2022), what is equally crucial to note is that Ukrainian democracy poses a significant threat not only to Putin's geopolitical ambitions but also to his autocratic regime: Putin perceives democracies, particularly those situated in the post-Soviet region, as the primary threat to his regime's stability and longevity. Therefore, the endangerment

of Ukrainian democracy is not only a matter of geopolitical significance but also a potential threat to Putin's authoritarian rule. Moreover, as we will see in the analysis, Putin has inadvertently placed his regime in jeopardy. His absolute rule in Russia is now irreversibly conditional on his victory in the Russia-Ukraine war. A potential outcome of a defeat in the conflict is an increased risk of regime change, as this paper's analysis suggests. However, the preferred means for such a change would likely be a compromise or elite pact rather than violent and radical methods.

The range of potential scenarios for the Russia-Ukraine war is wide, starting from a scenario in which there is a complete restoration of Ukraine's territorial integrity within the 1991 borders and full foreign policy autonomy, to Russia retaining control over Crimea and/or other occupied territories, to Russia gaining control over all of Ukraine, resulting in Ukraine losing its foreign policy autonomy. According to a survey conducted one year after the Russian invasion of Ukraine, 75% of the participants believe that Russia will have control over territories that were previously part of Ukraine, with the exception of LNR, DNR, or Crimea, by January 1, 2024 (Metaculus 2023*b*). This observation suggests that there is a high likelihood of the scenario in which Russia retains all of the occupied territories in 2023 and beyond.

This conflict is characterized by an escalation spiral that perpetuates itself, wherein both sides intensify their actions in response to perceived threats. While Ukraine and the West find the *Kosovo scenario* unacceptable, Russia views the *Vietnam scenario* as equally intolerable (Tegmark 2022). According to Tegmark, Russia can no longer compete with the West in terms of quantitative escalation and is thus attempting to avoid the *Vietnam outcome* by escalating qualitatively, with the use of nuclear weapons being its last resort, with a probability of occurrence estimated at 30%. However, an alternative estimate from the Metaculus prediction community suggests a lower probability of nuclear use in 2022, fluctuating between 5% and 11%, with an overall risk of a full-scale nuclear war beginning in 2022 of 0.35%, similar to the annual risk of nuclear war during the Cold War (Metaculus

2022). Putin's statements regarding the possible use of nuclear weapons reflect Russia's desire to assert itself as a great power capable of winning wars, expanding its territory, and projecting force in its neighborhood (Grozovski 2022). Putin's readiness to use nuclear weapons, given Russia's failure to win in conventional war, has made the use of nuclear weapons tempting for Russia. However, some scholars argue that it is not in Russia's interest to use nuclear weapons offensively, particularly if Putin is a rational player who is not likely to die within the next few months (Mironov 2022). The use of nuclear weapons by Russia would make the West more reluctant to negotiate the terms of the end of the war, and it would also upset India and China, who use nuclear weapons for nuclear deterrence (Mironov 2022). Therefore, the risk of the use of nuclear weapons by Russia is expected to be minimal.

The rational choice theory portrays individuals, states and organizations as rational agents who make decisions based on a careful analysis of the costs and benefits of their actions, ultimately selecting the option that maximizes their own self-interest. It assumes that individuals have precise information about the outcomes of their choices, possess the cognitive ability to weigh each option against all others, and are aware of all available choices. The application of this approach to the Russia-Ukraine situation may raise questions about its validity, as some of Putin's actions and his surrounding may seem irrational. However, the *madman theory* argues that the simulation of madness can be a rational strategy. For example, in 2015, Martin Hellman stated that "nuclear weapons are the card that Putin has up his sleeve, and he's using it to get the world to realize that Russia is a superpower, not just a regional power"(Braw 2015).

While this paper is intended to be primarily exploratory, based on the contextual analysis of the ongoing war, I have formulated three distinct forecasting expectations for each of the aforementioned issue dimensions.

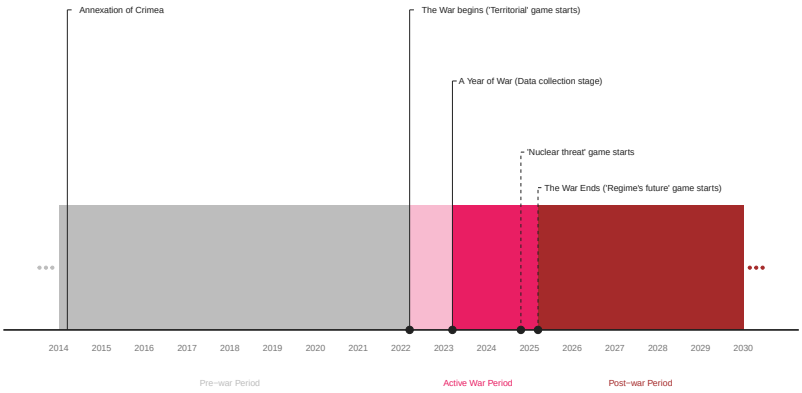
My **first expectation** is that if Russia loses the war, its control over the occupied territories would be most likely lost. This implies that Russia's current territorial gains in Ukraine will not be sustainable, and its annexation of Crimea will be in jeopardy. The

outcome of this scenario will depend on the future degree of control of the occupied territories by Russia and Ukraine's resources to retake these territories.

The **second expectation** is that in the event of a conventional military defeat, Russia's use of tactical nuclear weapons would be minimal due to the severe repercussions that would follow. This implies that Russia is unlikely to employ nuclear weapons as a response to a conventional military defeat. However, this assumption presupposes that Russia is a rational actor and will act in its best interest to avoid further escalation and the catastrophic consequences of nuclear warfare.

The **third expectation** is that in the event of Russia's potential defeat in the war, the end of the conflict is likely to result in Putin weakening his grip on power, which may create opportunities for various transitional scenarios. The realization of this outcome will depend on how Putin is perceived by the Russian elites, whether as a successful or failed leader, and how the general public in Russia views this development.

Figure 1: Timeline



Based on the three expectations outlined, the author proposes three *Predictioneer's Game* models that are related to different aspects of the ongoing Russia-Ukraine war. The first game will focus on the extent of Russia's control over Ukrainian territory during the war period, with the aim of predicting how the war will end in terms of territorial control. The

second game will explore the potential use of tactical nuclear weapons by Russia as a last resort in the event of a lost conventional war. The third game will focus on the future of the post-war Russian political regime, but limited to the scenario of Russia's defeat in the war. This scenario is expected to have a greater impact on the political regime compared to a scenario where Russia emerges victorious. The proposed timeline for proposed games reflects the pre-war, active war, and post-war periods and is presented visually in Figure 1.

Methodological Framework

I propose an empirical strategy that leverages the expert knowledge with the advances in natural language processing and formal modeling. This approach aims to combine the opinions of experts, analytical capabilities of natural language processing and formal modeling techniques. The ultimate goal of this study is to provide a more comprehensive and nuanced understanding of the dynamics of the Russia-Ukraine war.

The *Predictioneer's Game* Model

The *Predictioneer's Game* model developed by Bruce Bueno De Mesquita is one of the influential models in political forecasting literature. Since its first publication, the model has undergone several changes and revisions. Unlike past versions of the model based on expected utility theory, its current version used in this research is grounded in formal modeling and solved for Bayesian Perfect Equilibria(Bueno de Mesquita 1984, 1997, 2011). The model evaluates decision-making of multiple players through a series of proposals and influence tactics, leading to coalition building and issue resolution. It can be applied by political scientists and policy makers to anticipate and reshape outcomes to align with their own interests and can be used to analyze decisions in any domain, including the Russia-Ukraine war. It has demonstrated its efficacy in predicting a variety of political events. By utilizing limited data inputs, the model generated forecasts that were remarkably precise in actual

forecasting scenarios, with an accuracy rate of approximately 90% in over 1,700 cases, as evaluated by Feder (Feder 1995, 2002).

The original forecasting model referred to as the expected utility model focuses on the application of Black (1948)'s median voter theorem and Banks (1990)'s theorem on the monotonicity. The median voter theorem states that a majority rule voting system will select the outcome most preferred by the median voter, meaning that in each round of negotiations, the player whose position is closest to the median voter position is the winner. In the model the players are considered as endowed with bounded rationality, i.e. being able to see only one move ahead of their current choice. The players engage in negotiations, during which they calculate their payoffs from challenging each other. After receiving the offers, each player selects the one that maximizes their own payoff. This can lead to changes in the positions and power of some of the players, as well as a shift in the median voter position. The game continues in this manner until it reaches an equilibrium, at which point all players are satisfied with their positions given the positions of the other players, and no offers can result in a positive payoff for any player. At this point, the game ends and the median voter position in this round is the winning position.

According to Bueno de Mesquita (2011), the new model's structure is more complex than the expected utility model. In the game, nature makes moves that assign types to each player along two dimensions of uncertainty, resulting in sixteen possible combinations of beliefs about the mix of player types. In the game, each player knows the capabilities and policy position of each player on each issue, as well as the salience each player associates with those issues. However, players do not know how much others value alternative outcomes or what perceptions others have about their risks and opportunities. The game is repeated over multiple rounds, with payoffs at the terminal nodes changing from round to round. The game ends when either (1) the sum of player payoffs in the current round is expected to be greater than the projected sum of payoffs in the next round, or (2) the total utility for the average player is expected to be greater in the current round than in the next round.

These conditions indicate that the average player's welfare, as measured by either accumulated payoffs or total utility, is expected to decline in the next round. The model assumes two constraints to facilitate prediction: first, that issues are unidimensional, meaning that preferences can be represented on a line segment, and second, that preferences for potential outcomes diminish steadily the farther in Euclidean distance a possible settlement is from one's preferred outcome.

Generation of Synthetic Data with GPT-3

In this study, I propose the use of a large language model, specifically the GPT-3 model, as an information retrieval tool for generating responses that are supported by both the model and its trained data. The GPT-3 model, developed by OpenAI (2022), is an advanced language model consisting of 175 billion parameters and is trained on a massive corpus of text totaling 570 gigabytes. This corpus includes text from various datasets such as *Common Crawl*, *WebText2*, *Books1*, *Books2*, and *Wikipedia*. Because of its pre-training on diverse and vast text sources, the GPT-3 model can perform various natural language processing tasks with few-shot learning or even one-shot learning without additional fine-tuning.

Earlier attempts to predict real-world events by generating responses to Metaculus binary questions using the GPT-3 were largely unsuccessful, yielding results that one would expect if guessing completely at random (Bonde 2022). However, it should be noted that the lack of success with the model can be attributed to the use of an earlier version of the model, namely the *davinci-002* model, which is known to perform less effectively than the newer *davinci-003* model. Another use of GPT-3 is in generating scenarios for future developments in Ukraine, checking them for internal consistency, and calculating probability estimates for each scenario. Even though GPT-3 did not predict the war, it is capable of generating plausible and coherent scenarios for further research, as noted by (Jungwirth and Haluza 2023) in their study.

The model's performance and ability to generate coherent and accurate responses is

contingent upon the quality and quantity of training data. It is crucial to ensure that the model is trained on a diverse and comprehensive data set in order to minimize variations in its responses and improve overall performance. In instances where the data set is limited or inadequate, the model may exhibit a higher degree of variability in generated responses.

Due to its probabilistic foundation, the GPT-3 model can generate different responses for the same input, depending on the parameters set for the model. The study proposes using the GPT-3 model to generate responses to questions related to the Russian-Ukrainian conflict, either directly or indirectly, by gathering data as inputs for the *Predictioneer's Game* model. It is feasible to integrate probabilistic data generation relying on the GPT-3 model with formal modeling based on the *Predictioneer's Game* model. Given that the GPT-3 model cannot generate data manifesting intricate behavioral patterns such as strategic behavior, this approach helps to address such limitations.

One method of generating responses using the GPT-3 model involves producing letter-graded responses for multiple-choice questions and utilizing their log probabilities or probabilities for subsequent analysis (Kalinin 2023). Alternatively, another method employed in this study is to directly query numeric predictions from the model for specific issues or parameters used in the *Predictioneer's Game* model. The drawback of the latter approach is that the interval scale must be divided into categories. Furthermore, since the GPT-3 model is an autoregressive model, it is advisable to utilize autoregressive generation by conditioning the generation of specific parameter values on previously generated parameter values. However, for the sake of simplicity, the current version of the paper generates parameter values independently. In other words, the responses to each question are not influenced or influenced by the responses to previously asked questions, as expected in a regular survey.

Another critical consideration is that the GPT-3 model was trained solely on the data available up until June 2021. As a result, when asked questions about the war, the model will provide responses based on pre-war knowledge, conceivably resulting in counterfactual biased responses. Nonetheless, this approach constitutes an intriguing experiment in generating

probability responses about the state of the world that the model has not directly encountered. To address this limitation, all prompts are contextualized with the statement: "On February 24, 2022, Vladimir Putin authorized a 'special military operation' against Ukraine, starting a war between Russia and Ukraine." This preface is intended to contextualize all questions and produce responses based on pre-2022 data for the event that the model never observed. It is noteworthy that OpenAI restricts the fine-tuning of its *davinci-003* model, but allows for the fine-tuning of smaller models such as *Curie* and *Babbage*. Regrettably, these smaller models are not capable of effectively understanding multiple-choice questions.

My *fourth expectation* is that, despite lacking direct knowledge of the current state of the war, GPT-3 can infer about future developments of the ongoing military conflict by being exposed to the data from wars and conflicts of the past. This suggests that GPT-3 has the potential to serve as an AI-based geopolitical expert, even though it may not have the same level of exposure to current developments as human experts do.

Empirical Strategy

Collecting Expert Data

To generate geopolitical forecasts using *Predictioneer's Game*, it is essential to include all relevant players, such as individuals, organizations, demographic groups, and nations that may influence the issue at hand. The model operates within a one-dimensional issue spectrum, where players interact solely within a single issue space. This assumption is quite strong, as players' strategies may depend on multiple issues simultaneously when engaging with other players (Karimi et al. 2022). For example, Putin is most likely linking the potential defeat in the war with his future and the future of his political regime. Nevertheless, nearly all political issues can be adopted to a one-dimensional policy spectrum.

In this research, I propose three distinct games related to (1) the extent of Russia's control over Ukrainian territory, (2) the potential use of tactical nuclear weapons in the

ongoing military conflict, and (3) the future of the Russian political regime following the war.

For the *territorial* issue dimension, I use natural scales, i.e., a percentage of territory to be agreed upon in a settlement. I build on Urlacher (2022)'s approach.[1] However, his proposed scale actually consists of several issue scales. For instance, Russia retaining control over the Russian-speaking area of Ukraine but losing influence over the rest of Ukraine (position 50) does not preclude the remaining part of Ukraine from, for instance, joining NATO or the EU, which are separate issue dimensions. The revised issue scale is presented in Table 1. In my opinion, the following list of players are directly or indirectly involved in the game: Russia, Ukraine, Belarus, Kazakhstan, Turkey, United States, China, European Union, and NATO.

Table 1: Issue Scale "Control over Ukrainian territory"

Score	Description
	On February 24, 2022, Vladimir Putin authorized a "special military operation" against Ukraine, starting a war between Russia and Ukraine. Please provide a numerical score, on a scale of 0 to 100, that represents Position of a country or organization on an issue scale "Control over Ukrainian territory."
0	Complete restoration of Ukraine's territorial integrity within the 1991 borders and full foreign policy autonomy.
15	Russia retains control over Crimea. Other occupied territories (Luhansk, Donetsk, Kherson, Zaporizhzhia) are integrated into Ukraine.
25	Russia retains control over Crimea, two "republics" in the east (Luhansk, Donetsk), but two "republics" in the south (Kherson, Zaporizhzhia) are integrated into Ukraine.
50	Russia retains control over annexed regions (Crimea, Luhansk, Donetsk, Kherson, Zaporizhzhia) but loses influence over the rest of Ukraine.

To be continued

[1] 100 – Russia gets all of Ukraine; 85 – Russia gets the Russian areas and retains influence over the rest of Ukraine; 65 – Russia retains influence over a territorially stable Ukraine; 50 – Russia gets the Russian areas but loses influence over Ukraine; 30 – Ukraine gains full foreign policy autonomy; 10 – Ukraine joins EU; 0 – Ukraine becomes a full member of NATO.

Table 1: (*continued*)

Score	Description
65	Russia retains control over annexed regions (Crimea, Luhansk, Donetsk, Kherson, Zaporizhzhia) and maintains influence over the rest of Ukraine.
85	Russia retains control over half of Ukraine and maintains influence over the rest of Ukraine.
100	Russia gains control over all of Ukraine, Ukraine loses its foreign policy autonomy.

The *nuclear threat* issue dimension demonstrates a selected country's/organization's position on the use of tactical nuclear weapons by Russia as a consequence of Russia's defeat in a conventional war and its inability to defend the annexed regions of Crimea, Luhansk, Donetsk, Kherson, and Zaporizhzhia. This issue continuum comprises a range of positions, from strong opposition to strong support of the nuclear threat, and is referred to as "beauty contests"(Bueno de Mesquita 2022). The players involved in this game are the same as those in the previous game, namely Russia, Ukraine, Belarus, Kazakhstan, Turkey, the United States, China, the European Union, and NATO. This issue scale is provided in Table 2.

Table 2: Issue scale "Nuclear Threat"

Score	Description
	On February 24, 2022, Vladimir Putin authorized a "special military operation" against Ukraine, starting a war between Russia and Ukraine. Please provide a numerical score on a scale from 0 to 100, that represents Position of a country/organization on the "Nuclear Threat" issue scale.
0	Strongly against
25	Against
50	Neutral/undecided
75	Support
100	Strongly support

The third issue dimension pertains to a post-war regime change and can be constructed along the continuum of the size of the winning coalition, as described in the selectorate theory by Bueno de Mesquita et al. (2004). This theory asserts that the level of support or loyalty for the incumbent leader depends on the size of the winning coalition relative to the selectorate, where the selectorate is a group of individuals who have the power to determine whether the current leader remains in power, while the winning coalition is a subset of the selectorate upon which the leader relies for support. The proposed scale ranges from a scenario in which Russia conducts free and fair elections with a broad winning coalition to a scenario of a dictatorship in which the winning coalition is small. The players for this issue dimension include Vladimir Putin, security services (e.g., FSB, FSO, GRU), Russian military (Ministry of Defense), federal bureaucracy, regional bureaucracy, nationalists (e.g., Igor Strelkov, Alexander Dugin), systemic liberals (e.g., Alexei Kudrin, Herman Gref), private armies (e.g., Yevgeny Prigozhin, Ramzan Kadyrov), business elites in private business and state-owned enterprises. This issue scale can be found in Table 3.

Table 3: Issue scale "Russian political regime in the postwar era"

	Description
	On February 24, 2022, Vladimir Putin authorized a "special military operation" against Ukraine, starting a war between Russia and Ukraine. Please provide a numerical score on a scale from 0 to 100, that represents Position of a player in the "Russian political regime in the postwar era" issue dimension.
0	Voters decide in fully free and fair elections, even if this allows a true opposition figure to win.
20	Putin resigns, formation of a national salvation government, gradual democratization.
50	Putin resigns, formation of a national salvation government without democratization.
60	Putin hands off all power to several trusted associates, having carefully balanced them against each other.

To be continued

Table 3: (*continued*)

	Description
80	Putin hands off all power to a trusted successor from "siloviki".
90	Putin hands off some power to at least one associate, but keeps some power for himself well into the future.
95	Putin keeps all power in his own hands despite leaving the presidency.
100	Putin stays in power, regime evolves into mature dictatorship.

Both the AI and experts are required to provide assessments of the *Position*, *Influence*, *Salience*, *Flexibility*, and *Veto-power* of each player involved in the *Predictioneer's Game*. In the game, *Position* provides a numeric value for the outcome on the issue scale ranging from 0 to 100 that each player currently advocates or supports. *Influence* represents the relative potential ability of each player to persuade other players to adjust their approach to the issue in line with their perspective, it ranges from 1 to 100. *Salience* reflects the importance each player attaches to the issue, with values ranging from 1 to 99, and *Flexibility* measures an player's resolve or flexibility, with values between 0 and 100 (including the possibility of a value of 0 or 100, but normally ranging from 0 to 35). *Veto-power* refers to a player who possesses the formal authority to reject a mutually accepted outcome (1), if a player has no such authority (0).

It is important to note that, when experts were requested to enter a score on a scale, e.g., from 0 to 100, they were expected to provide any numerical score that falls within the specified range, and not just those labeled as preferred outcomes. Since numbers in reality may not always be divisible by 5 or 10, the presence of focal points on the scale can lead to the introduction of measurement error resulting from rounding. To mitigate these errors, experts were requested to provide scores that are preferably unassociated with the proposed list of labels assigned to each issue continuum.

In addition to questions regarding the *Predictioneer's Game*, auxiliary direct questions were asked to elicit experts' predictions about the dimensions of territorial and regime tran-

sitions, along with their assessments of the duration of the war and possible timing of a post-war regime change.

Collecting GPT-3 Data

This section provides examples of three prompts that were used to generate specific issue positions of country-players with the GPT-3 (*davinci-003*)[2].

Table 4: Generation of values for Policy parameters using GPT-3

Score	Description
Issue 1	*On February 24, 2022, Vladimir Putin authorized a 'special military operation' against Ukraine, starting a war between Russia and Ukraine. Give a numerical score to [PLACEHOLDER]'s position from 0 to 100 on an issue 'control over Ukrainian territory', where 0(Complete restoration of Ukraine's territorial integrity within the 1991 borders and full foreign policy autonomy), 15(Russia retains control over Crimea and other occupied territories, i.e. Luhansk, Donetsk, Kherson, Zaporizhzhia are integrated into Ukraine), 25(Russia retains control over Crimea, two 'republics' in the east, i.e. Luhansk, Donetsk, but two 'republics' in the south, i.e. Kherson, Zaporizhzhia are integrated into Ukraine), 50(Russia retains control over annexed regions, i.e. Crimea, Luhansk, Donetsk, Kherson, Zaporizhzhia but loses influence over the rest of Ukraine), 65(Russia retains control over annexed regions, i.e. Crimea, Luhansk, Donetsk, Kherson, Zaporizhzhia, and maintains influence over the rest of Ukraine), 85(Russia retains control over half of Ukraine and maintains influence over the rest of Ukraine), 100(Russia gains control over all of Ukraine, Ukraine loses its foreign policy autonomy).*

To be continued

[2]The code for GPT-3 simulation https://github.com/kkalininMI/Geopolitical-Forecasting-with-GPT-3.git

Table 4: (*continued*)

Score	Description
Issue 2	*On February 24, 2022, Vladimir Putin authorized a 'special military operation' against Ukraine, starting a war between Russia and Ukraine. Give [PLACEHOLDER] a numerical score, on a scale of 0 to 100, that represents [PLACEHOLDER]'s position on an issue scale 'the use of tactical nuclear weapons by Russia as a consequence of Russia's defeat in a conventional war and/or the subsequent inability to defend the annexed regions of Crimea, Luhansk, Donetsk, Kherson, and Zaporizhzhia,' where 0([PLACEHOLDER] is strongly against the use of tactical nuclear weapons by Russia), 25([PLACEHOLDER] is against the use of tactical nuclear weapons by Russia), 50([PLACEHOLDER] is neutral or undecided about the use of tactical nuclear weapons by Russia), 75([PLACEHOLDER] supports the use of tactical nuclear weapons by Russia), 100([PLACEHOLDER] strongly supports the use of tactical nuclear weapons by Russia).*
Issue 3	*On February 24, 2022, Vladimir Putin authorized a 'special military operation' against Ukraine, starting a war between Russia and Ukraine. Give a numerical score to [PLACEHOLDER]'s position from 0 to 100 on an issue 'the future of Russian political regime after the Russia-Ukraine war', where 0(Voters decide in fully free and fair elections, even if this allows a true opposition figure to win), 20(Putin resigns, formation of a national salvation government, gradual democratization), 50(Putin resigns, formation of a national salvation government without democratization), 60(Putin hands off all power to several trusted associates, having carefully balanced them against each other), 80(Putin hands off all power to a trusted successor from 'siloviki'), 90(Putin hands off some power to at least one associate, but keeps some power for himself well into the future), 95(Putin keeps all power in his own hands despite leaving the presidency), 100(Putin stays in power, regime evolves into mature dictatorship).*

GPT-3 simulated data are presented in Tables A1 and A2 of the Appendix. Comparison of the expert-based and GPT-based data yields significant discrepancies that contradict our initial expectation about their relative similarity. Notably, while the policy scores for *territorial* issue dimension are consistent between experts and GPT-3, policy scores for other issue dimensions display notable discrepancies.

Moreover, the values for other parameters of interest are observed to be substantially different, indicating that GPT-3 may encounter difficulties in matching expert beliefs concerning more complex parameters such as *Influence*, *Salience*, *Flexibility*. These disparities

are expected to have a significant impact on the analysis of the *Predictioneer's Game*. Further discussion of the observed discrepancies will be provided in the subsequent section.

Hence, based on the collected data, we can derive four forecasting quantities: 1) assessments based on the expectations of experts regarding the future developments of the conflict; 2) estimates provided by the *Predictioneer's Game* model using expert knowledge; 3) assessments generated by the GPT-3 language model concerning future developments of the conflict; and 4) estimates provided by the *Predictioneer's Game* model using GPT-3's inferences about the war (Karimi et al. 2022).

Findings

Let's start with description of the initial distribution of power among the players before running the *Predictioneer's game* model. The distribution of power in each game provides valuable insights and sets our expectations regarding the outcome of the game. To determine the percentage of power held by each player, each player's *Influence* is multiplied by its *Salience*, and normalized by the total amount of power held by all players.

My analysis of Figure 2 for *territorial* issue dimension, as shown in graphs (a) and (d), demonstrates that the positions of "Complete restoration of Ukraine's territorial integrity" and "Russia retains control over Crimea while other occupied territories are integrated into Ukraine" are supported by the most cumulative amount of power. Interestingly, both expert-based surveys and GPT-3 analyses highlight the large distance in the power position of Russia ("Russia retains control over half of Ukraine and maintains influence over the rest of Ukraine") compared to the other players involved.

The *nuclear threat* issue continuum, as depicted in graphs (b) and (e), reveals a stark contrast between the expert-based graph (b) and GPT-3's assessments. The expert-based graph (b) indicates that all players, except Russia, support a non-nuclear solution to the crisis, while the GPT-3 model based on pre-war data, shown in graph (e), suggests that all

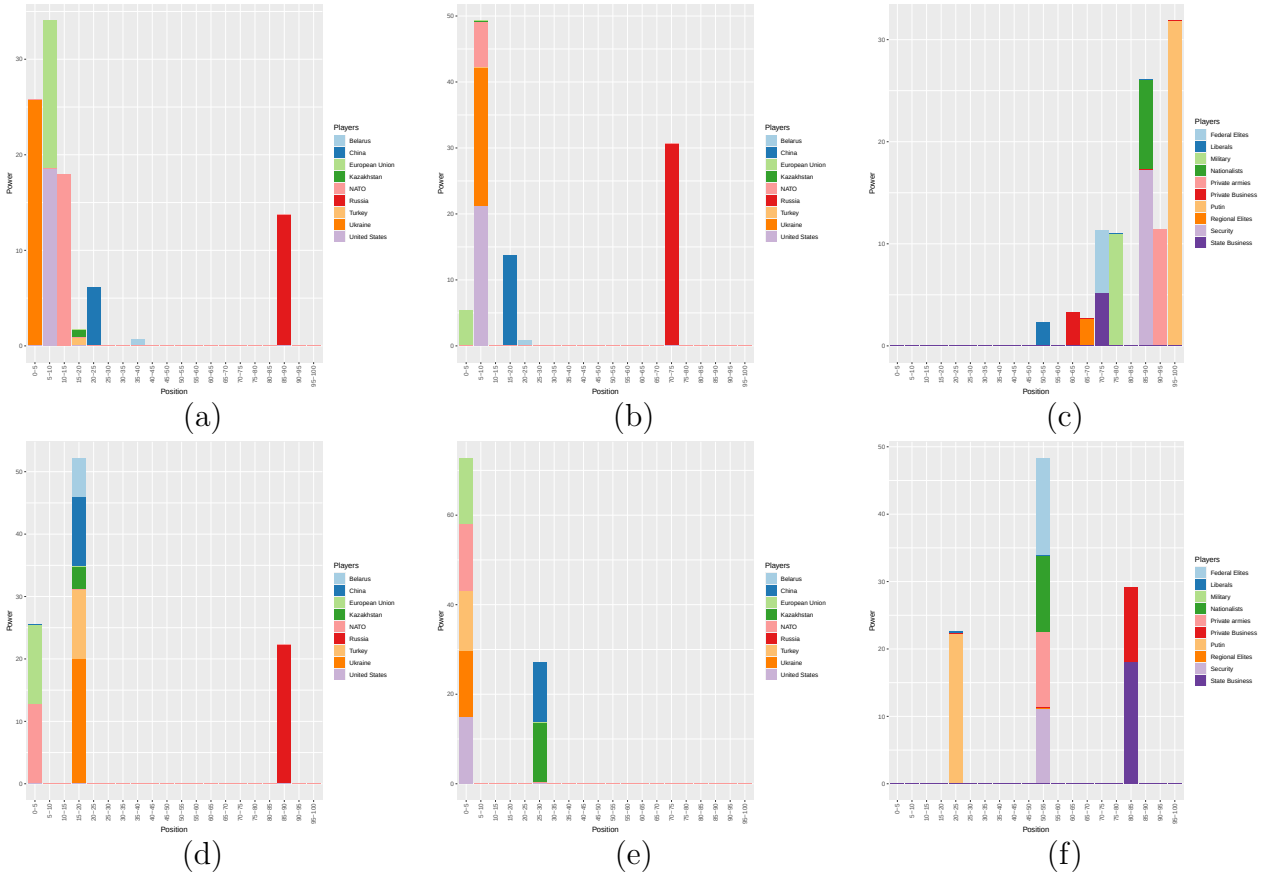
players, including Russia, are against the use of nuclear weapons.

Regarding the *regime's future* issue dimension, there appears to be a discrepancy between the results obtained from graphs (c) and (f). Specifically, while the expert-based graph demonstrates that the majority of power is concentrated in support of the existing regime, with some minor variations, the GPT-3 model generates a result in which the position advocating for "Putin resigns, formation of a national salvation government without democratization" is supported by the majority of players. Interestingly, GPT-3's analysis suggests that Putin himself would support a position that entails his resignation, the formation of a national salvation government, and a gradual democratization process. However, it is important to note that this may reflect the model's wishful thinking and inherent biases, particularly if it was trained mostly on the Western data.

The general forecasting results from the *Predictioneer's game* are presented in Table 5. Based on the Table, the mean position of 23.3 among the experts indicates that Russia is likely to maintain control over Crimea and the two "republics" in the east (Luhansk and Donetsk), while the two "republics" in the south (Kherson and Zaporizhzhia) will be integrated into Ukraine. A direct inquiry to the GPT-3 model yielded an identical outcome. This prediction is supported by the *Predictioneer's Game* calculations utilizing both expert-based and GPT-3-based inputs, resulting in calculated issue positions of 21.7 and 19.7, respectively. Hence, my **first expectation** regarding Russia's defeat in the war resulting in its loss of control over the occupied territories is partially supported by the analysis, which suggests that Russia will most likely retain control over Crimea and two "republics" in the east (Luhansk, Donetsk), but there is a possibility that the two "republics" in the south (Kherson, Zaporizhzhia) could be integrated into Ukraine.

If the expert-based forecast indicates that the war will last for at least two years, the game using the "end rule" criterion predicts a considerably shorter timeframe of at least six rounds, which perhaps may fall within a period of at least 6-8 months. The "end rule" criterion implies the round in which participants choose to end bargaining as their utility

Figure 2: Initial Static Forecasts



Notes: (a) *territorial* issue dimension (experts); (b) *nuclear threat* issue dimension (experts); (c) *regime's future* issue dimension (experts); (d) *territorial* issue dimension (GPT-3); (e) *nuclear threat* issue dimension (GPT-3); (f) *regime's future* issue dimension (GPT-3).

will decline in future rounds. In other words, the net utility from all negotiations among all players is expected to be less in the next round than it is in the current round. If the "end rule" is ignored and the players continue playing, the winning position along this dimension is projected to be in Russia's favor towards the end of a three-year period, reaching 31.7 for expert-based inputs in the *Predictioneer's Game* and approximately 50 for GPT-3-based inputs. In other words, the analysis reveals that time is working in Russia's favor, thereby increasing the probability of the outcome in which Russia maintains control over the annexed regions while losing influence over the remainder of Ukraine.

Based on the Table 5, the probability of Russia employing tactical nuclear weapons in

Table 5: General Forecasting Results

Issues		end rule				36 months		
		Experts	Experts PG	GPT-3	GPT-3 PG	GPT-3 PG	Experts PG	GPT-3
territorial	position	23.3	21.7	25.0	19.7	48.9	31.7	50.0
	time	24.0+	6.0	-	3.0	-	-	-
nuclear threat	position	26.7	16.8	0.00	6.4	25.0	8.6	0.00
	time	-	3.0	-	1.0	-	-	-
regime's future	position	60.0	84.7	50.0	56.7	53.6	67.6	50.0
	time	18.0+	1.0	-	9.0	-	-	-

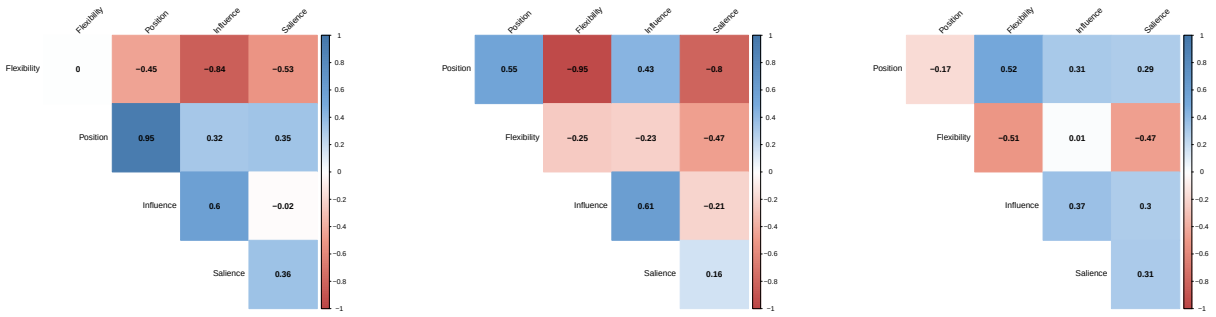
Notes: "PG" are the *Predictioneer's Game* estimates; *time* in months.

the aftermath of a defeat in conventional warfare is small, with estimates ranging from 8.6 to 26.7. The duration of this game is short, often concluding in only 1-3 rounds. Even if the confrontation were to persist for an extended period, the position along this dimension remains relatively consistent. Therefore, this analysis supports my **second expectation**, which posits that Russia is unlikely to resort to the use of its nuclear weapons as a response to a conventional military defeat, and that the nuclear threat rhetoric is likely linked to a strategy based on the "madman theory".

The analysis of the *regime's future* game is complicated. The expert-based assessments indicate a position of 60, suggesting that one possible outcome for Putin would be to relinquish power to a few trusted associates while carefully balancing them against each other, with the regime change occurring in at least 18 rounds/months. In contrast, the *Predictioneer's Game* based on the expert's data favors a scenario in which Putin hands over all power to a trusted successor from the "siloviki", with a score of 84.7, and the game ends in just one round. When directly prompted, the GPT-3-based analysis predicts a position of 50, which entails Putin's resignation and the formation of a national salvation government without democratization, with *Predictioneer's Game* yielding a slightly higher estimate of 56.7. At the end of a three-year period, the *Predictioneer's Game* using expert-derived data produces an estimate of 67.6, indicating support for a scenario where Putin transfers all power to a trusted successor from the "siloviki". The estimates generated by the GPT-3-based

Predictioneer's Game are notably similar, with a value of 53.6. Therefore, the calculations conducted in this study provide confirmation for the **third expectation**, which postulates that a significant loss in the war would lead to a decrease in Putin's control over power and create possibilities for various regime transition scenarios related to power transfer to a trusted successor or a few trusted associates.

Figure 3: Correlation Graphs for Expert-based and GPT-3-based Inputs



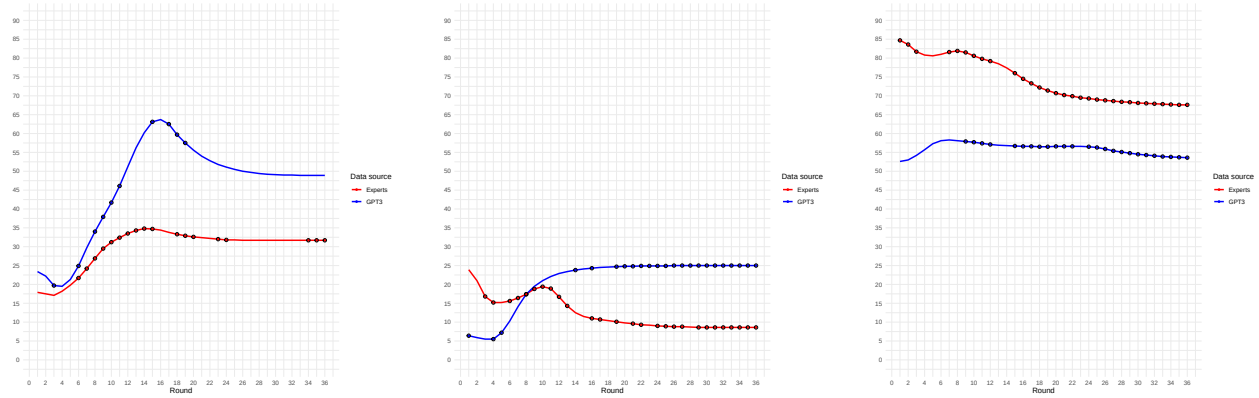
(a) (b) (c)

Notes:(a) *territorial* issue dimension (experts); (b) *nuclear threat* issue dimension (experts); (c) *regime's future* issue dimension (experts).

The differences in forecasts observed between experts and GPT-3 raise questions regarding the discrepancies in the inputs provided by the experts and those generated by the language model. These issues were briefly mentioned in the preceding section of this paper. The correlation matrices presented in Figure 3 illustrate prevalence of positive Pearson's correlations between input parameters for the *territorial* and *regime's future* issue dimensions, with the exception of the *Flexibility* parameter, whereas the *regime's future* issue dimension exhibits a weakly negative correlation coefficient. If the experts' data is treated as the ground truth, this result suggests that GPT-3 failed to generate relevant input parameters for the *regime's future* dimension, while the generated estimates for the other two dimensions were relatively similar to the input parameters based on expert data. Therefore, my **fourth expectation** is only partially supported by data analysis. It appears that GPT-3 is good at capturing the semantic information and generating relevant responses for questions related

to the *Position* of particular players, while questions pertaining to *Salience* and *Flexibility* present more significant difficulties. This difficulty can be attributed, at least in part, to the model's lack of knowledge about the current state of the world, as well as the absence of autoregressive data generation that would allow for conditioning of responses on different parameters generated by the GPT-3.

Figure 4: Smoothed Means for Policy Position



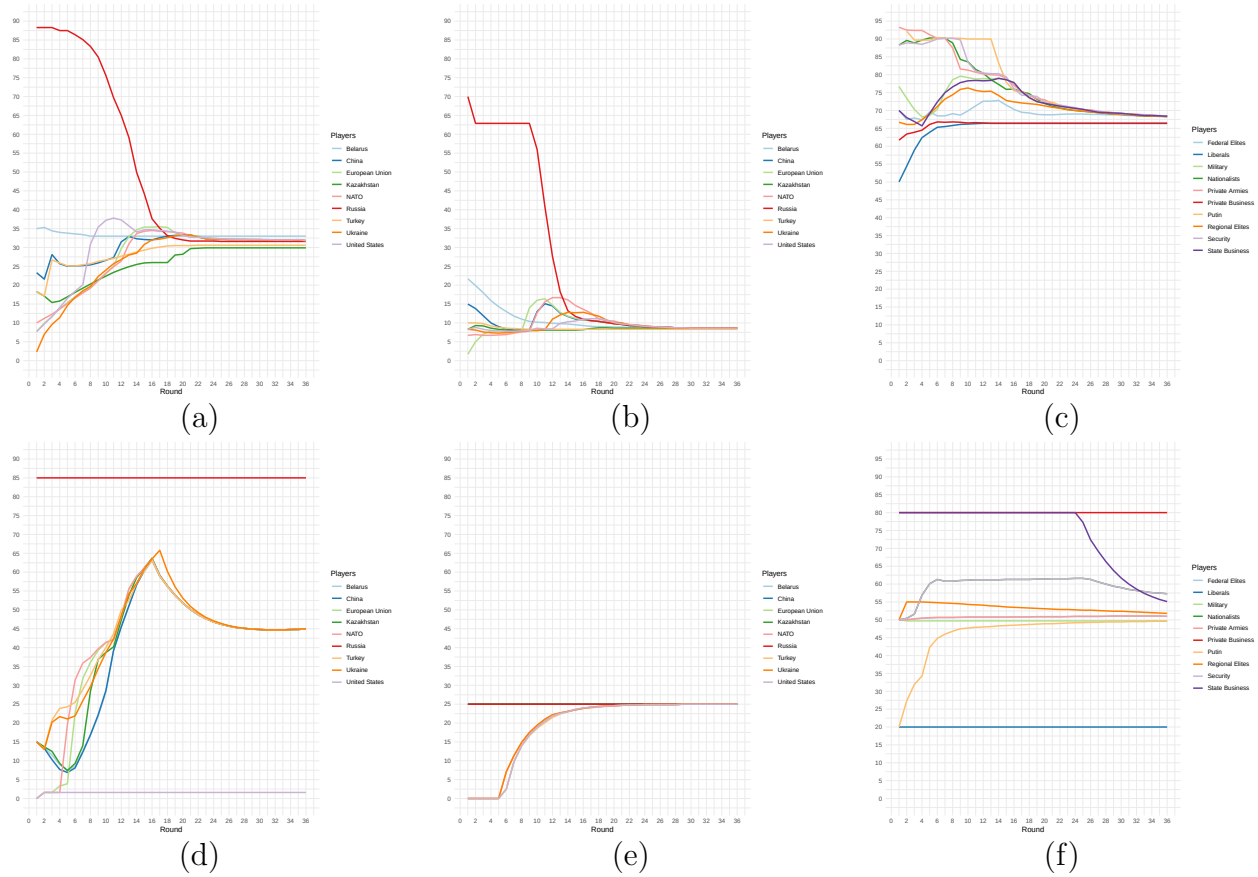
(a) (b) (c)

Notes: (a) *territorial* issue dimension (experts); (b) *nuclear threat* issue dimension (experts); (c) *regime's future* issue dimension (experts).

The dynamic forecasts depicted in Figure 4 illustrate the development of policy predictions over time utilizing smoothed means, based on inputs from both experts and GPT-3. During the initial rounds, substantial and frequent fluctuations in policy trends are observed. However, as the game progresses, the trends become more stable, indicating a more uniform and predictable pattern of policy predictions. The trend based on expert analysis demonstrates a less varied range of policy change when compared to the trend derived from the GPT-3 data. Both trends are identified by circular markers which represent the "end rule" criterion. In the *territorial* dimension, the "end rule" values for expert-based trends range from a minimum of 21.7 to a maximum of 34.7, while for GPT-3, they range from 19.7 to 63.1, respectively. In the *regime's future* issue dimension, a gradual "anti-authoritarian" tide is observed in both the expert-based trend (from 84.7 to 67.6) and the GPT-3 trend (from 57.9 to 53.6), as shown in Figure 4(c).

The detailed information regarding trends and the corresponding "end rule" values can be found in Table A3 of the Appendix. This table serves a critical purpose in demonstrating which policy positions are conducive to mutually beneficial negotiations, wherein all parties prefer to conclude the game rather than to continue it. As we see all three game have multiple rounds opening the possibilities for negotiations among the players.

Figure 5: Dynamic Forecasts for Policy Position



Notes: (a) *territorial* issue dimension (experts); (b) *nuclear threat* issue dimension (experts); (c) *regime's future* issue dimension (experts); (d) *territorial* issue dimension (GPT-3); (e) *nuclear threat* issue dimension (GPT-3); (f) *regime's future* issue dimension (GPT-3).

Figure 5 displays the evolution of policy positions over time with graphs (a-c) based on expert data and (d-f) based on GPT-3 data. Graph (a) illustrates that the expert-based trend reveals a distinctive stance taken by Russia in terms of territory control, which contrasts with the positions of other players. Over time, however, Russia's policy gradually aligns with the

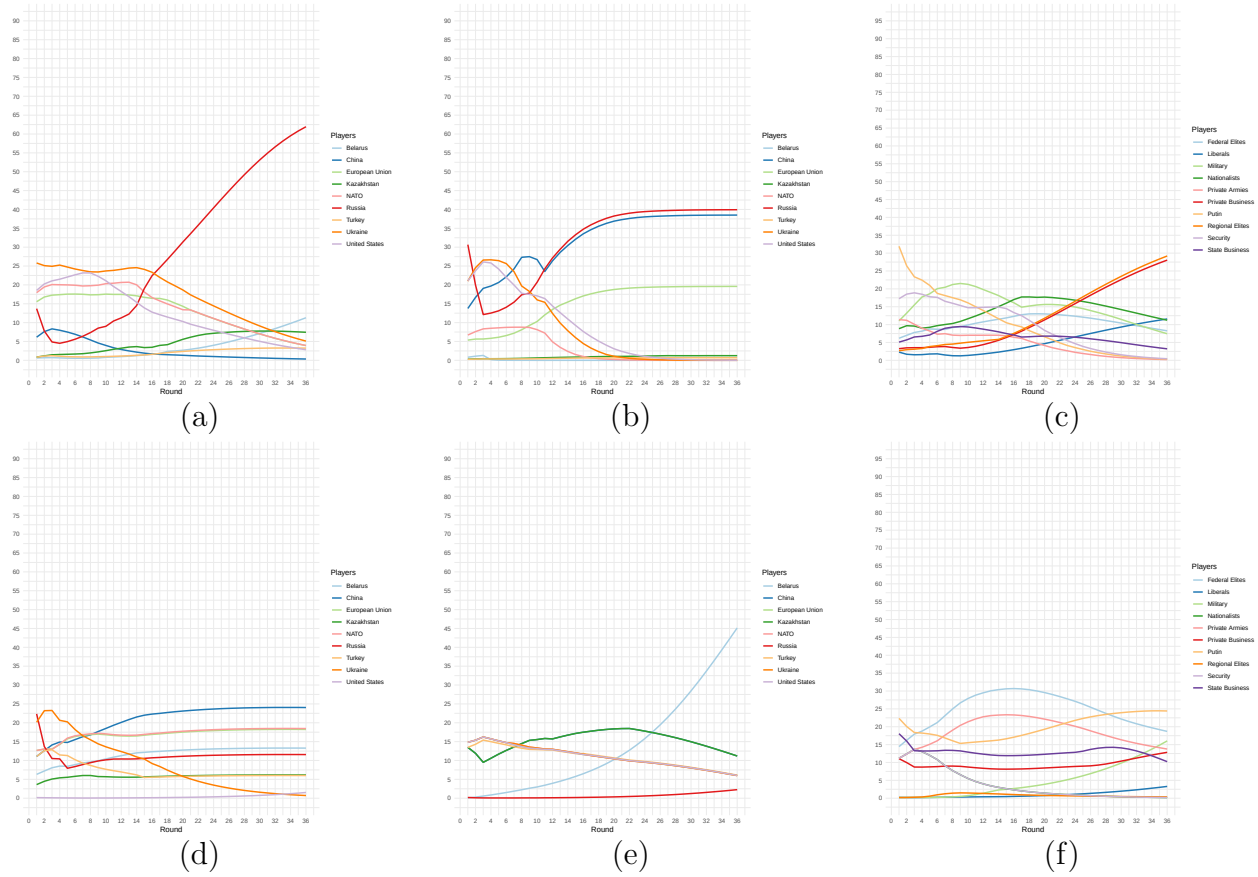
positions of other players. In contrast to the expert-based trend shown in graph (a), where players change their positions over time and eventually converge to the winning position of 31.7, the GPT-3-generated data in graph (d) indicates that Russia's position on territory control (85) will remain unchanged and run parallel to the positions of other players, who eventually converge to position 45.

Graphs (b, e) illustrate the temporal evolution of policy positions in the *nuclear threat* issue dimension. The expert-based trend showcases significant shifts in Russia's stance on nuclear threats, moving towards renunciation of the use of tactical nuclear weapons after a potential defeat in a conventional war. The analysis reveals a plateau lasting for eight rounds/months, with Russia's position on the nuclear threat at 62.9, followed by a rapid drop in the position leading to convergence with the positions of other country-players at the winning position of 8.6. In contrast, GPT-3's analysis in graph (e) suggests that all countries, including Russia, consistently lean towards being against the use of nuclear weapons in a crisis situation (25).

The policy evolution portrayed in graphs (c, f) of Figure 5 concerns *regime's future* issue dimension following the war. Graph (c) shows that the expert-based trend triggers the "end rule" in the first round, ending the game at Putin's position at 92.2. Putin maintains this position until round 14, after which he undergoes a significant shift towards supporting a larger winning coalition. Other players follow suit, and by round 36, Putin and the other players converge at a position of 68, which is close to a labeled issue position where Putin relinquishes all power to several trusted associates. In contrast, the GPT-3 model depicted in graph (f) supports more significant changes by predicting Putin's resignation, the formation of a national salvation government, and gradual democratization. The model forecasts that the majority of players in the game adjust their positions over the rounds until they converge at a position close to the winning position of 50. It is noteworthy that, in this game, negotiations do not have any impact on the positions of private business and liberals.

Figure 6 provides a detailed analysis of power dynamics among the players over time,

Figure 6: Dynamic Forecasts for Power

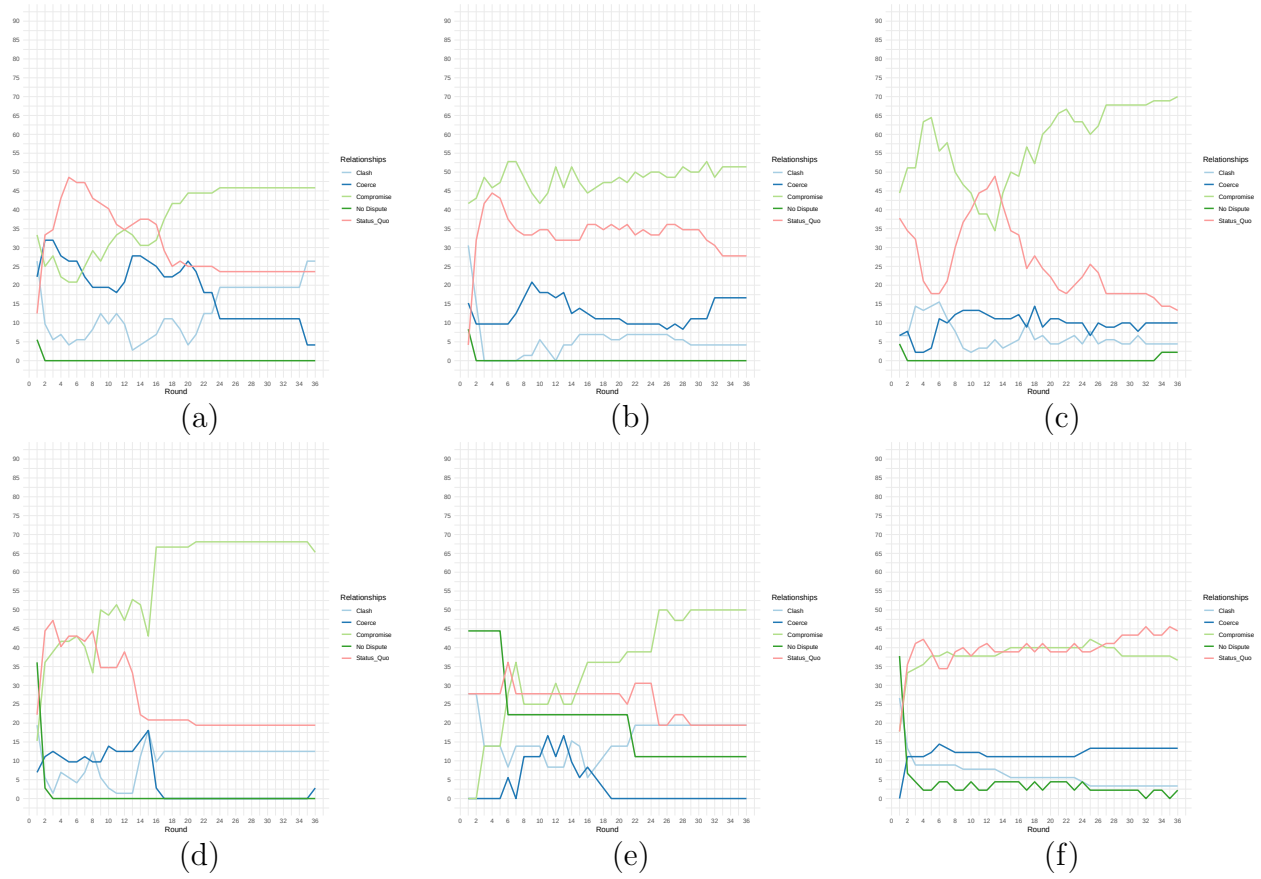


Notes: (a) *territorial* issue dimension (experts); (b) *nuclear threat* issue dimension (experts); (c) *regime's future* issue dimension (experts); (d) *territorial* issue dimension (GPT-3); (e) *nuclear threat* issue dimension (GPT-3); (f) *regime's future* issue dimension (GPT-3).

which adds a temporal dimension to the initial static forecast based on the distribution of power among policy positions. The results offer valuable insights into the evolving power dynamics of each player over time. Specifically, graph (a) indicates that Russia's power will gradually increase in the *territorial* issue dimension; graph (b) demonstrates that China and Russia exhibit growing levels of power compared to the EU and other players in the *nuclear threat* issue dimension; finally, graph (c) shows that the power of regional elites and private businesses in Russia will increase over time, while the power of security services and Putin will decrease in the *regime's future* dimension. Furthermore, the data generated by GPT-3 in graph (d) predicts that China will gain more power compared to other players over the

rounds. In contrast, Belarus emerges as the player with the most power in graph (e), while others experience a decline, which may be too far-fetched from reality. Lastly, graph (f) depicts relatively indistinguishable power dynamics, with Putin gaining a small power lead in the end.

Figure 7: Dynamic Forecasts for Relationships



Notes: (a) *territorial* issue dimension (experts); (b) *nuclear threat* issue dimension (experts); (c) *regime's future* issue dimension (experts); (d) *territorial* issue dimension (GPT-3); (e) *nuclear threat* issue dimension (GPT-3); (f) *regime's future* issue dimension (GPT-3).

Figure 7 presents the structure of player relationships over time, as classified into five types: "no dispute", "status quo", "compromise", "coerce", and "clash" Bueno de Mesquita (2011).[3]

[3]According to Bueno de Mesquita (2022), "no dispute" reports the percentage of pairs of players who share the same position; "status quo" is the percentage of players whose relationship with each other is to leave each other alone; "compromise" refers to the percentage of player interactions in the round that

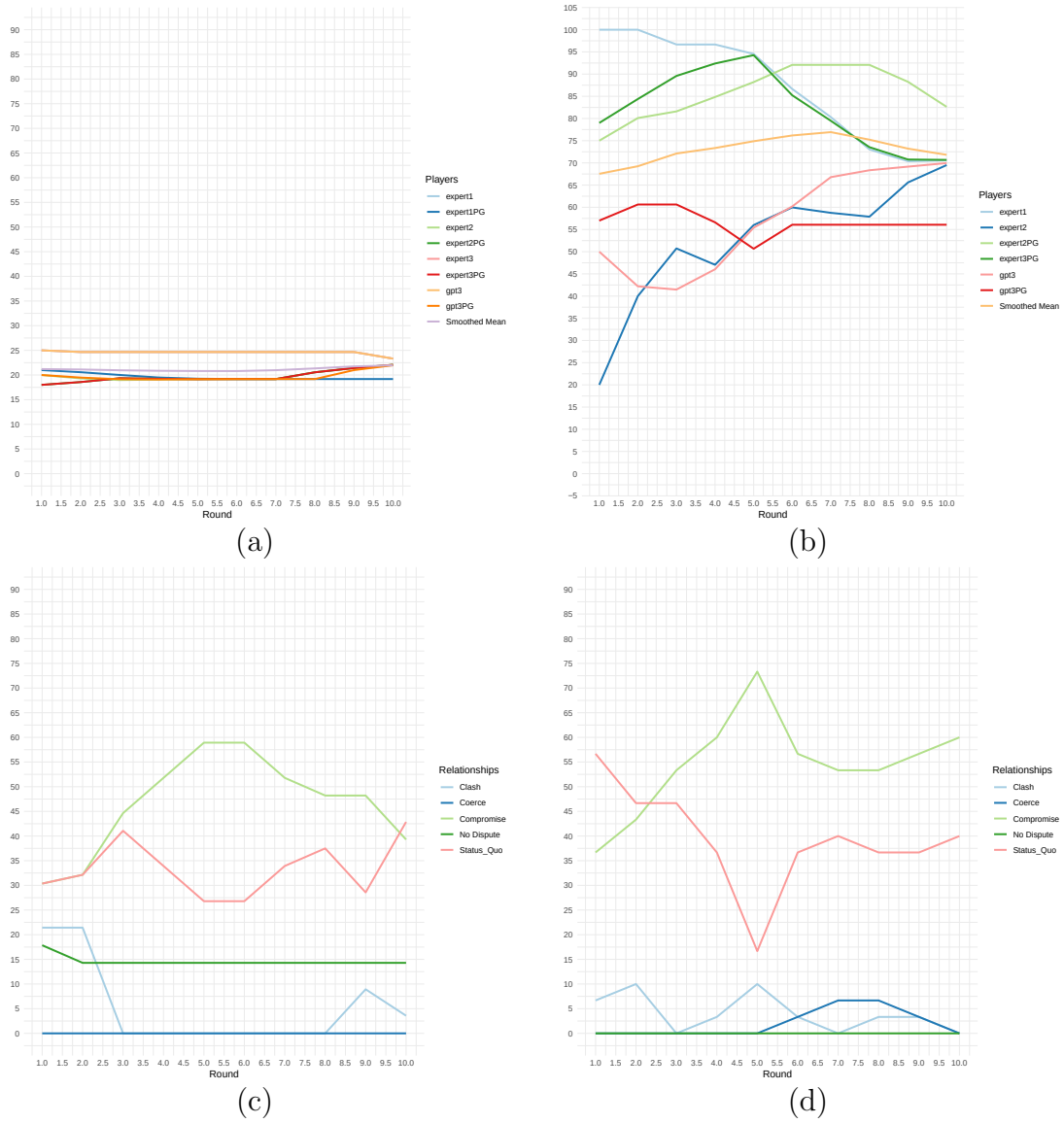
Figure 7 demonstrates a gradual increase in the prevalence of "compromise" relationships in the later rounds, indicating a shift towards cooperation. The "status quo" relationship is the second most prevalent, but it tends to decrease in the later rounds. Notably, the "clash" relationships observed in the *territorial* issue dimension, as depicted in graphs (a) and (b), are particularly strong in rounds from 18 to 36. However, they are almost always dominated by "compromise" or "status quo" strategies, implying the possibility of a negotiated settlement or inaction due to a lack of interest in bargaining. Across all rounds in both the *nuclear* issue dimension (graphs b and e) and the *regime's future* issue dimension (graphs c and f), the dominant relationship strategies were "compromise" and "status quo". The gradual increase in the percentage of "compromise" relationships over rounds in the *regime's future* dimension suggests a negotiated regime transition in Russia, rather than a transition based on violence.

The forecasting results can be difficult to combine due to the presence of multiple and sometimes conflicting forecasts built on different data sources, as shown in Table 5. To address this issue, I conducted an experiment using the *Predictioneer's game* to simulate bargaining between experts, allowing them to adjust their positions and those of other experts. This approach serves as a robustness check for the overall prediction results and facilitates the integration of different estimates, as it utilizes disaggregated expert data.

The simulation study presented here focuses on the *territorial* and *regime's future* issue dimensions. Each game includes raw predictions by both human experts and GPT-3, as well as expert-level predictions generated by the *Predictioneer's game*. The human experts are assigned the highest score on the *Influence* scale, while GPT-3 receives a slightly lower score (details can be found in the Appendix, see Tables A4, A5). All experts, including GPT-3, are assigned the maximum score of 99 on the *Salience* scale and a *Flexibility* score of 20. Only human experts are permitted to serve as veto-players.

are predicted to involve their compromising on an intermediate position somewhere between their current stances; "coerce" refers to the unilateral imposition of costs by one player on another who then gives in rather than resist; "clash" refers to relationships in which each player in a pair imposes costs on the other.

Figure 8: Results of the *Predictioneer's Game* for the Human Experts and AI Expert (GPT-3)



Notes: (a) Changes in experts' policy positions on the *territorial* issue dimension; (b) Changes in experts' policy positions on the *regime's future* issue dimension; (c) Changes in experts' relationships on the *territorial* issue dimension (GPT-3); (d) Changes in experts' relationships on the *regime's future* issue dimension (GPT-3).

The results, presented in Figure 8, demonstrated that policy positions on the *territorial* issue dimension are remarkably close, with positions converging to 22 after 10 rounds of negotiation. In contrast, for the *regime's future* issue dimension, there is a broad variation of issue positions, with the majority of positions converging to 72 after 10 rounds of negotiation.

These results are remarkably consistent with the estimates presented in Table 5, where an estimate of 20 is predicted for the *territorial* dimension (see the "end rule" part), and around 80 for the future of Russian regime.

Overall, the *Predictioneer's game* can serve as a valuable tool for simulating interactions between human experts and GPT-3 in the context of policy prediction. It enables artificial "experts" to interact in the bargaining rounds, treating AI as a separate player. Further research, however, is needed to explore the applicability of this approach in other policy domains.

Conclusion

The current study makes significant contributions to the forecasting of potential outcomes of the ongoing conflict between Russia and Ukraine. The findings indicate that Russia is likely to maintain control over Crimea and the eastern "republics", while the southern "republics" may become integrated into Ukraine. Notably, the analysis predicts a shorter timeframe for the end of the war than expected, with the game-based approach suggesting a timeframe of approximately six rounds if all players act rationally. However, if one of the players continues playing regardless of the outcomes, the timeframe can effectively become longer.

The prolongation of the game could potentially benefit Russia, as indicated by GPT-3's predicted score of 65, which implies that Russia would maintain control over the annexed regions (Crimea, Luhansk, Donetsk, Kherson, Zaporizhzhia) and hold influence over the rest of Ukraine. On the other hand, a predicted score of 35 suggests that Russia would retain control over Crimea and the two "republics" in the east (Luhansk, Donetsk), while the status of the two "republics" in the south (Kherson, Zaporizhzhia) would be ambiguous, with neither Russia nor Ukraine able to claim them as their territory. These results indicate that Russia's power may continue to grow over the course of 36 rounds, while Ukraine's power would likely diminish, suggesting that, all other things being equal, Russia would

hold the upper hand in any future peace settlement negotiations. It is important to note that while the dominance of the "compromise" strategy in relationships persists, the use of clash strategies increases over time, potentially leading to an intensification of the conflict if the game is played through all 36 rounds. The distribution of "end game" points, assuming all players are interested in ending the game, suggests that there are opportunities to bring the game to a close sooner rather than later.

The analysis of Russia's political regime in the aftermath of the war reveals various potential scenarios. Based on the results of the *Predictioneer's Game* utilizing expert data, the most likely scenario involves Putin relinquishing power to a trusted successor from the "siloviki" group, and the game ending after only one round. If the game continues, it is predicted that Putin will hand over power to a few trusted associates, with regime change occurring 18 rounds after the end of the war. GPT-3 simulations propose alternative scenarios in which Putin distributes power among various trusted associates, carefully balancing their influence against each other. However, further delays would force Putin to resign, leading to the formation of a national salvation government without democratization. The *Predictioneer's Game* based on expert data suggests that an earlier resignation and game ending would secure Putin's control over the transition of power, while delays would result in him losing power. The game's findings suggest that Russia's defeat would gradually diminish Putin's power over all 36 rounds, while other groups such as regional elites and private businesses gain more power. Therefore, regime collapse due to war defeat would lead to decentralization and redistribution of power among the regions and private players. The regime's collapse would also result in the downfall of associated groups such as state-owned businesses, security apparatus, and federal elites. It is worth noting that according to the game the predicted regime transition is based on compromise, i.e., an elite pact rather than violence.

Finally, based on the analysis, it can be concluded that the probability of Russia using tactical nuclear weapons after a defeat in a conventional war is low. Typically, the game ends

within a short period of 1-3 rounds, and even if it continues, the position of Russia along the *nuclear threat* issue dimension remains relatively unchanged. Therefore, it is unlikely for Russia to use nuclear weapons in response to a conventional defeat. However, it is possible for Putin to use the perception of using nuclear weapons as a strategy to strengthen Russia's position in negotiations, a concept explained by the *madman theory*. For instance, some experts argue that Putin may be using the threat of nuclear weapons to demonstrate Russia's power and status as a superpower, rather than as a realistic option in a military conflict.

The predictions derived from the analysis of the *Predictioneer's Game* and GPT-3 can have practical implications for policymakers and diplomats who seek to resolve the conflict. For example, the prediction that the game is likely to end sooner than expected can prompt policymakers to increase their diplomatic efforts to find a peaceful solution before the conflict escalates further.

It is crucial to acknowledge that the accuracy of the predictions generated in this study is contingent on the quality of the input data. Although the quality of the expert data is relatively high, the sample size is small and needs to be increased in future studies. Furthermore, the results indicate that GPT-3 was unable to generate relevant input parameters for the *regime's future*, while the estimates generated for the other two dimensions were relatively similar to the input parameters based on expert data. This highlights the limitations of relying solely on machine learning algorithms for generating input data for complex forecasting analyses.

There is a significant scope for future research to address the limitations associated with the use of either machine learning algorithms or expert assessments independently. One promising avenue for bridging this gap is by simulating the interactions between human experts and AI for policy prediction. In this regard, the paper has suggested utilizing the *Predictioneer's game*, which could potentially be a valuable approach for simulating such interactions.

By leveraging the strengths of human expert assessments and GPT-3-based "experts", the *Predictioneer's game* has the potential to offer a robust and flexible framework for generating more accurate and comprehensive predictions. This approach could be applied across a broad range of policy domains and has the potential to help overcome some of the challenges associated with using either human expert assessments or machine learning algorithms alone.

It is important to recognize that the predictions presented in this paper are based on a set of assumptions and input data. As such, they should be treated as one possible scenario rather than a definitive outcome. The outcomes of the conflict are likely to be influenced by a range of factors, including future geopolitical developments, economic conditions, and social dynamics.

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A Appendix. Supplementary Tables and Figures

Table A1: Values of Input Parameters for *Territorial* and *Nuclear threat* Issue Dimensions

		Territory Control					Nuclear Threat				
Player	Source	Position	Influence	Salience	Flexibility	Veto	Position	Influence	Salience	Flexibility	Veto
Russia	expert	88	25	80	17	1	70	53	77	18	1
	gpt	85	100	100	0	0	25	90	0	0	0
Ukraine	expert	2	38	98	8	1	8	30	93	8	0
	gpt	15	90	100	30	0	0	70	100	30	0
Belarus	expert	35	5	18	43	0	22	3	33	23	0
	gpt	15	40	70	10	0	25	40	0	25	0
Kazakhstan	expert	18	8	15	47	0	8	2	25	23	0
	gpt	15	40	40	25	0	25	70	90	25	0
Turkey	expert	18	7	18	40	0	10	2	22	25	0
	gpt	15	70	70	25	0	0	70	90	25	0
United States	expert	8	42	65	34	1	8	37	77	8	1
	gpt	0	70	0	25	0	0	70	100	25	0
China	expert	23	28	32	43	0	15	37	50	20	1
	gpt	15	70	70	10	0	25	70	90	25	0
European Union	expert	8	32	72	34	1	2	10	72	8	0
	gpt	0	70	80	25	0	0	70	100	25	0
NATO	expert	10	38	68	34	1	7	12	77	8	1
	gpt	0	70	80	30	0	0	70	100	30	0

Table A2: Values of Input Parameters for *Regime's future* Issue Dimension

Player	Source	Position	Influence	Salience	Flexibility	Veto
Vladimir Putin	expert	97	93	100	3	1
	gpt	20	100	100	25	0
Security services	expert	88	52	97	10	1
	gpt	50	50	100	40	0
Russian military	expert	77	40	80	17	0
	gpt	50	90	0	30	0
Federal bureaucracy	expert	70	23	77	27	0
	gpt	50	80	80	0	0
Regional bureaucracy	expert	67	12	67	28	0
	gpt	50	80	0	25	0
Nationalists	expert	88	35	73	10	0
	gpt	50	50	100	40	0
Systemic liberals	expert	50	10	67	23	0
	gpt	20	0	100	0	0
Private armies	expert	93	37	90	10	1
	gpt	50	50	100	0	0
Private business	expert	62	17	57	22	1
	gpt	80	70	70	0	0
State-owned enterprises	expert	70	23	63	25	0
	gpt	80	100	80	0	0

Table A3: Smoothed means and End Rule Across Rounds

	Territorial		*Nuclear*		*Regime's future*	
	Smoothed Mean	"End Game"	Smoothed Mean	"End Game"	Smoothed Mean	"End Game"
Rd 1	17.88	0	23.90	0	84.72	1
Rd 2	17.51	0	21.04	0	83.60	1
Rd 3	17.09	0	16.78	1	81.71	1
Rd 4	18.16	0	15.15	1	80.76	0
Rd 5	19.84	0	15.20	0	80.55	0
Rd 6	21.73	1	15.62	1	81.03	0
Rd 7	24.18	1	16.42	1	81.64	1
Rd 8	26.92	1	17.37	1	81.93	1
Rd 9	29.53	1	18.80	1	81.45	1
Rd 10	31.24	1	19.42	1	80.55	1
Rd 11	32.43	1	18.90	1	79.77	1
Rd 12	33.54	1	16.70	1	79.21	1
Rd 13	34.27	1	14.31	1	78.50	0
Rd 14	34.81	1	12.49	0	77.37	0
Rd 15	34.70	1	11.48	0	75.96	1
Rd 16	34.43	0	10.98	1	74.49	1
Rd 17	33.80	0	10.68	1	73.27	1
Rd 18	33.33	1	10.40	0	72.22	1
Rd 19	32.92	1	10.11	1	71.42	1
Rd 20	32.61	1	9.82	0	70.74	1
Rd 21	32.36	0	9.55	1	70.24	1
Rd 22	32.16	0	9.34	1	69.85	1
Rd 23	31.97	1	9.16	0	69.53	1
Rd 24	31.84	1	9.02	1	69.26	1
Rd 25	31.77	0	8.90	1	69.01	1
Rd 26	31.73	0	8.82	1	68.77	1
Rd 27	31.70	0	8.75	1	68.57	1
Rd 28	31.68	0	8.69	0	68.40	1
Rd 29	31.66	0	8.64	1	68.25	1
Rd 30	31.65	0	8.61	1	68.13	1
Rd 31	31.65	0	8.59	1	68.00	1
Rd 32	31.65	0	8.58	1	67.89	1
Rd 33	31.65	0	8.58	1	67.79	1
Rd 34	31.66	1	8.58	1	67.70	1
Rd 35	31.66	1	8.58	1	67.62	1
Rd 36	31.66	1	8.58	1	67.59	1

Table A4: The *Predictioneer's Game* Inputs for the Human Experts and AI Expert (territorial dimension)

	Group	Player	Position	Influence	Salience	Flexibility	Veto
1	1	expert N1	25	100	99	20	1
2	1	expert N1 PG	21	100	99	20	0
3	2	expert N2	20	100	99	20	1
4	2	expert N2 PG	18	100	99	20	0
5	3	expert N3	25	100	99	20	1
6	3	expert N3 PG	18	100	99	20	0
7	4	gpt-3	25	50	99	20	0
8	4	gpt-3 PG	20	80	99	20	0

Notes: "PG" stands for the *Predictioneer's Game* estimates.

Table A5: The *Predictioneer's Game* Inputs for the Human Experts and AI Expert (*regime's future* dimension)

	Group	Player	Position	Influence	Salience	Flexibility	Veto
1	1	expert N1	100	100	99	20	1
2	2	expert N2	20	100	99	20	1
3	2	expert N2 PG	75	100	99	20	0
4	3	expert N3 PG	79	100	99	20	0
5	4	gpt-3	50	50	99	20	0
6	4	gpt-3 PG	57	80	99	20	0

Notes: "PG" stands for the *Predictioneer's Game* estimates.