Deciphering Multilateral Climate Negotiations with Language Models

Anonymous ACL submission

Abstract

Multilateral negotiations are crucial for effective climate actions. These negotiations follow complex, multi-step procedures involving representatives from 198 different countries. Negotiators representing the interests of financially constrained countries are at a serious disadvantage: (i) they face language barriers, (ii) have limited experience, and (iii) operate in smaller teams. In this work, we outline several ways in which large language models (LLM) can alleviate these hurdles. We formalize the negotiation problem using recent advances in LLM agency and propose several modules based on interviews with climate youth negotiators conducted at the COP28 in Dubai. We argue that LLMs could represent a "chess moment" for negotiations and hope our work can convince more NLP researchers to contribute to climate negotiation research.

1 Introduction

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According to the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6), the world's most authoritative scientific body on climate change, human-induced global warming of 1.1 degrees C has spurred changes to the Earth's climate that are unprecedented in recent human history (IPCC, 2021). Climate impacts on people and ecosystems are more widespread and severe than expected and future risks will escalate rapidly with every fraction of a degree of warming. At present, between 3.3 and 3.6 billion people are living in places "highly vulnerable" to climate change (IPCC, 2022a). Urgent, global, systemwide transformations are needed to secure a netzero, climate-resilient future. Climate change and our collective efforts to adapt to and mitigate it will exacerbate inequity should we fail to ensure a just transition (IPCC, 2022b). Hence, multilateral negotiations are crucial for effective climate action because they facilitate global cooperation, ensure equitable distribution of responsibilities, and

enable the pooling of resources and knowledge 043 to address the multilayered complex, and transboundary nature of climate change. Negotiations 045 at the United Nations Framework Convention on Climate Change (UNFCCC) are complex and long 047 processes involving 198 parties grouped in a multitude of blocks, each with diverse interests and pri-049 orities. These negotiations are conducted through a consensus-based approach, where all parties must 051 agree on the final terms of any decision. Countries typically negotiate in blocks, such as the G77 and China, the European Union, the Alliance of Small 054 Island States (AOSIS), and the Least Developed 055 Countries (LDCs), each representing different interests, economic statuses, and vulnerabilities to 057 adverse effects of climate change (see Figure 2 in the Appendix). This block-based approach aims to streamline negotiations and amplify the voices of 060 smaller or less influential nations. However, achiev-061 ing consensus is challenging due to conflicting in-062 terests; for instance, developed nations may priori-063 tize economic growth and technological solutions, 064 while developing nations often emphasize financial 065 support and equitable burden-sharing for climate 066 mitigation and adaptation. The requirement for 067 consensus ensures that all countries' views are con-068 sidered, promoting fairness and justice. Nonethe-069 less, this same requirement can lead to protracted 070 negotiations and diluted agreements, as the need for 071 unanimous consent often results in compromises 072 that may not fully address the urgency or scope 073 of climate action required. Thus, while consensus 074 negotiations at the UNFCCC are vital for ensuring 075 equitable participation, they inherently face difficulties reconciling its diverse member states' varied 077 and sometimes opposing interests. To understand the potential of large language models (LLMs) in 079 the context of climate negotiations, it's helpful to draw a parallel with the integration of computer aids into the game of chess. The game of chess was first introduced around the beginning of the sev-

enth century (Contributors to Wikimedia projects, 084 2024). Although chess was originally meant to simulate war tactics by the nobility, it gradually 086 became known as the ultimate game of strategy. Because chess is a two-player game, players historically required the presence of other skilled players to practice and improve. Enthusiasts would gather 090 in chess cafes or clubs to play and study puzzles or reports of famous games. This started changing around the 1970s with the introduction of chess computers. Suddenly, players had found a tireless sparring partner that could be tuned to their desired level of difficulty (Campitelli, 2013). The effect has been extraordinary: over the past three decades, there has been a steep rise in the average global chess skill level (Regan and Haworth, 2011), making the once elitist game accessible to people 100 from all walks of life. We believe that negotiations 101 are at the precipice of a similar revolution. As 102 with chess, the main avenue to improve negotia-103 tion skills today comes in the form of debate clubs, 104 coaches, and static training materials. Unlike chess, negotiations generally do not have a finite action space: there are countless ways players can craft 107 sentences to persuade their opponents. The level 108 of difficulty is further exacerbated in the case of highly specialized topics - like climate negotia-110 tions - that require participants to be aware of vast 111 amounts of background information and special-112 ized jargon. Indeed, until recently, the idea of ma-113 chines with sufficient natural language understand-114 ing to perform free-text negotiations was regarded 115 as futuristic. Yet, with the advent of LLMs, there 116 has been an increasing body of research showcas-117 ing LLMs negotiating capabilities (Davidson et al., 118 2024; Bianchi et al., 2024; Salvi et al., 2024). Si-119 multaneously, there has been significant progress 120 in retrieval-augmented-generative model strategies 121 (RAG) aimed at ensuring the relevance and factu-122 ality of LLM-generated text (Lewis et al., 2020). 123 In combination with rapidly falling costs and in-124 creasing availability, LLMs seem primed to act 125 as tireless negotiation-sparring partners. In what follows, we will argue how such "negotiation assis-127 tants" can be realized and used to level the playing 128 field for climate negotiators. Our contributions are: 129 (1) defining the bottlenecks of multilateral climate 130 131 negotiations as problems for the ACL climate community supported through empirical interviews, (2) 132 a mathematical framework to run negotiations hy-133 pothesis space, and (3) a set of initial applications of LLMs to support multilateral negotiations. 135

2 Mathematical Framework

As the Introduction describes, UN climate negotiations generally have two phases. Below, we propose simplifying assumptions to make such negotiations tractable for LLMs. 136

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Phase 1. Firstly, all n = 198 countries enter a "prenegotiation" phase, seeking to find coalitions based on shared interests. At the end of phase 1, $B \ll n$ blocks have been formed. Crucially, a country can be part of multiple blocks. For each block b_i , we represent their mutually agreed-upon positions as payoff tables containing the range of negotiation values and the payoff amount each value provides per issue. Furthermore, each payoff table comes with so-called "red lines", representing the minimum or maximum negotiation values beyond which no agreement can be reached. In addition to the block-level payoff tables, each country has a private payoff table. A country's private payoff table generally does not perfectly align with the payoff tables of the blocks it is a member of. That said, we will assume that a country's payoff table does not contain red lines that conflict with the block's red lines.

Phase 2. In the second phase, the final negotiations commence at some physical location. Typically, a location is divided into M topical rooms. Each room is responsible for reaching an agreement on their assigned issues ¹. For discussion's sake, we will assume that issues do not overlap, i.e., an issue discussed in room A cannot influence the payoffs of an issue discussed in room B. For each issue, the "agreement space" of all possible negotiation values can then be defined as lying between the red lines of all participating blocks. In our case, we will assume that agreement spaces are non-empty (While undesired, in reality, such agreement space may be empty). Note that countries face a dual optimization problem: they try to maximize their private payoffs for each issue, constrained by their commitment to maximize their blocks' payoffs. Countries can influence the outcomes of negotiations through their agents. All things equal, the more agents a country has present in a room, the bet-

¹For completeness, during real-world negotiations, each block typically selects a representative country to negotiate on behalf of all member countries. Additionally, a significant role is played by the 'presidency' a chosen country committed to remaining neutral and not pursuing its own payoff table. This country has the authority to aggregate input from each room and propose changes to the main document, ensuring a cohesive and representative negotiation process

ter the chances are a preferred outcome is reached. 180 This presents a natural tension point, as countries 181 with more agents have an advantage over countries with fewer agents. Furthermore, different agents exhibit varying levels of effectiveness, e.g., due to a difference in experience level. We will discuss 185 this matter in detail in the next section. Finally, fi-186 nancially constrained countries rarely have enough agents to represent their interests in each room. If we discretize our negotiation period into R rounds, 189 countries thus have to choose where to place their agents during each round. 191

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Issues. Following the negotiation framework described by (Davidson et al., 2024), we distinguish between distributive issues, where agents with opposing interests must divide a fixed amount of payoff, and compatible issues, where agents' interests are aligned. Finally, we also allow agents to assign different overall importance to issues, resulting in integrative issues. For example, block A might care more about reducing greenhouse emissions while block B might feel more strongly about finance for adaptation. In this case, block A can "trade" emission rights with block B for increased financing.

3 LLMs as Negotiation Assistants

To understand the determinants and needs of an individual agent's effectiveness, we conducted interviews with climate youth negotiators from six countries: Liberia, Paraguay, Peru, Nigeria, Lebanon, and Indonesia. These interviews took place prior to the UNFCCC Conference (COP28) in Dubai. A consolidated summary of the interviews is available in the appendix. Our analysis identified three primary barriers to effectiveness: (a) language barriers, (b) tedious information retrieval, and (c) a lack of customized training. In this section, we first describe each barrier in detail. Next, we argue that LLMs provide promising opportunities to tackle each challenge. Lastly, we introduce Polly, a negotiation assistant that we deployed during COP28, demonstrating a real-world use case of LLM-assisted negotiations.

222Language Barrier.Negotiators from multiple223countries highlighted difficulties stemming from224English not being their first language. This is partic-225ularly challenging when dealing with the technical226language and jargon used in the UNFCCC docu-227ments. For instance, negotiators from Liberia and228Paraguay noted the challenge of navigating the spe-229cialized vocabulary used in these contexts. More-

over, participants from Peru and Nigeria reported challenges in communicating complex topics to senior negotiators, which hindered their ability to advocate for their positions effectively. Existing tools like Google Translate are often insufficient to solve these problems because they struggle with the technical jargon and nuanced language specific to climate negotiations. These tools may provide literal translations that lack the contextual understanding necessary for accurate and effective communication in such specialized settings. LLMs are uniquely suited due to their ability to provide context-specific language assistance. For example, by carefully translating between multilingual styles and jargon, LLMs can directly enhance a negotiator's effectiveness in a discussion.

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Linking Topics. Another primary barrier faced by negotiators is the labor-intensive nature of information retrieval and topic linkage. Negotiations, at conferences like COP28, require access to a vast amount of information, including historical data, policy documents, scientific reports, and real-time updates. The time and effort required to locate, retrieve, and process this information can be overwhelming and detract from a negotiator's ability to focus on strategic discussions and decision-making. Negotiators from multiple countries noted the complexity and time-consuming nature of navigating the UNFCCC website, which serves as the main source of information. For example, negotiators from Paraguay reported insufficient time to process crucial information, which impeded their ability to prepare effectively for negotiations (see Appendix 4). Negotiators from Lebanon mentioned a lack of historical knowledge about past negotiations, further complicating their ability to engage effectively (see Appendix 4). Additionally, the reliance on internal communications and networks for information dissemination was highlighted by several countries, leading to inconsistent access to necessary data. A further complication arises from some countries not having enough agents to attend all the negotiation rooms simultaneously. This is particularly problematic for developing countries that often lack the resources to deploy a sufficient number of representatives. When a country cannot send an agent to a particular room, it risks missing out on crucial discussions and updates, making it even more challenging to catch up in subsequent rounds. This absence forces the few available agents to spend more time retrieving and processing missed

Youth Negotiators Assistant	UNFCCC Acronyms 6 messages
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O Browse Assistants	An NDC stands for Nationally Determined Controlution. It is a key component of the Paris Agreement within the United Nations Pranework Convention on Climate Change (UVECC), NDCs are commitments that countries make to reduce their greenouse gas emissions, adapt to the impacts of climate change, or both. Each country determines its own NDC based on its national circumstances, canabilities, and environities to the ament to be arrohitom: transmission and the arrow involution to the the and the stand of the and the stand of the stand
Paris Agreement	UNFCCC to outline their climate action plans.
2 messages 20/05/2024, 16:41:27	
UNFCCC Acronyms	
6 messages 25/03/2024, 15:31:37	summarizer Please summarize the document. Your task as a Summarizer is to condense it into a brief overview, focusing on key points and conclusions. For example, 'Can you provide a summary of the key out
Outcome of the first global s	Past Document Comparer I want you to compare the current document with a past version III provide. As a Past Document Comparer, identify any changes, additions, or omissions. For example, 'Hern's the previous version
2 messages 15/02/2024, 15:35:07	Redline Checker Your role will be a Redline Checker. I will provide a specific redline or non-neoptiable point, and you need to check if it's part of the document. Ready/?
UNFCCC Acronyms 18 messages 20/05/2024, 16:41:09	Intervention Writer I need you to be an Intervention Writer. Based on our past conversation, Write an intervention for the UN Climate Change Conference. This should include creating an action plan or proposing solut
Guidance to the Global Envir	Action Plan Strategy I need you to be an Intervention Helper. Based on our past conversation, develop a basis for an intervention. This should include creating an action plan or proposing solutions. For example, 'Based
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Mitigation ambition and im 6 messages 05/12/2023, 11:57:54	Mental Health Adviser I want you to act as a mental health adviser. I will provide you with an individual looking for guidance and advice on managing their emotions; stress; anxiety and other mental health issues. You sh
Climate Change Negotiation	Motivational Ceach I want you to act as a motivational coach. I will provide you with some information about someone's goals and challenges, and it will be your job to come up with strategies that can help this person
6 messages 05/12/2023, 11:56:02	Empty Prompt Empty Prompt Content
⊙ ⊙ New Chat	▼ Send

Figure 1: The web interface of Polly, an LLM-based youth negotiator assistant deployed to over 70 climate negotiators during UN COP28 in Dubai. Polly was co-designed with negotiators to meet their needs effectively.

information, exacerbating the problem and putting them at a strategic disadvantage. We argue that LLMs, enhanced through a RAG setup, are wellsuited to assist negotiators in quickly retrieving and linking important information and improving their effectiveness.

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Training. Currently, young negotiators interested 287 in improving their climate negotiation skills primarily rely on the following resources: (i) static training materials, e.g., case studies designed by 290 291 the United Nations Institute for Training and Research (UNITAR) and Harvard Kennedy School; (ii) organized online or in-person discussion sessions (Harvard Kennedy School, 2024); and (iii) live negotiation practice followed by tailored feed-296 back, e.g., as organized by the Youth Negotiators Academy (2024). Unfortunately, (i) and (ii) are 297 generally not freely available, while (iii) is strongly capacity-constrained, thus severely limiting to-be 299 negotiators of crucial practice. Using the framework outlined in Section 2, LLMs could make a 301 clear difference here. Starting from simple one-onone negotiations to simulate a negotiation between 303 304 two blocks, one can gradually increase the number of issues, stakeholders, and block memberships. In 305 each case, one can design a scenario and assign payoff tables for applicable issues to the different 307 countries and blocks. Each country can further be assigned a varying number of agents. LLMs can then simulate the position of negotiating agents by 310 interacting with each other and the human negotia-311 tor. Crucially, the payoff tables of LLM agents that do not share block membership with the human 313

negotiator are hidden during the training. Upon concluding a negotiation, humans using such a system to train can analyze each interaction as the "true" payoff tables of all participating agents are known. One can even simulate the case of multiple rooms by simulating multiple concurrent negotiations in parallel. By having an impartial LLM keep track of the ongoing "agreement state" a negotiator can decide which negotiation requires most of its attention. This level of customized explainability presents a potentially transformative user experience that could level the playing field for negotiators from underrepresented countries. 314

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Use Case. During COP28 in Dubai, we deployed Polly, an LLM-based negotiation assistant designed to address (1) language barriers and (2) topic linkage. Negotiators accessed Polly through a web interface (see Figure 1) and utilized features such as documentation summaries, red line identification, and intervention drafting. Additionally, we conducted capacity-building workshops to educate negotiators about LLM limitations, including hallucinations and data security. Future work will update Polly to also provide (3) customized training.

4 Conclusion

We believe computer linguists need to look into support for improving multilateral climate negotiations as a direct impact on tackling climate change. Potentially, LLMs could be a chess moment for climate negotiations, capable of leveling the playing field by empowering financially constrained climate negotiators.

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Appendix A: Consolidated Summary	394
Document for Climate Youth Negotiator	395
Interviews	396
Background and Demographics	397
We interviewed negotiators from 6 different coun-	398
tries on challenges they face and how technology	399
such as Large Language Models (LLMs) can assist	400
their work.	401
Total number of interviewees: 6	402
Countries represented: Liberia, Paraguay, Peru.	403
Nigeria, Lebanon, Indonesia	404
Average years of experience in climate negoti-	405
ations: Varied, with some negotiators new to the	406
process.	407
Key Chellenges and Dain Daints	400
Key Chanenges and I am I onits	400
Most commonly used tools and resources.	409
• Grammarly: Used for writing assistance	410
(Paraguay).	411
• Google Drive: For document collaboration	412
(Paraguay).	413
• No use of translation tools: Difficult lan-	414
guage to translate (Paraguay).	415
Wished-for tools and resources.	416
• Language tools: More sophisticated lan-	417
guage and grammar tools for UNFCCC texts	418
(Paraguay, Liberia).	419
Ouick information retrieval: Platforms for	420
efficient document scanning and key informa-	421
tion extraction (Lebanon, Nigeria).	422
• Customized training: Tailored learning re-	423
sources are needed (Liberia).	424
Communication Challenges.	425
• Expressing complex ideas: Difficulties with	426
fast and accurate expression in English (Mul-	420
tiple Countries).	428
• Language proficiency: Varied levels of En-	429
glish proficiency create barriers (Indonesia).	430
Information Processing and Decision Making	431
Methods to Stay Updated.	432
• Networks and collaboration: Through col	/100
leagues and shared resources (Multiple Course	403
reagues and shared resources (multiple Coull-	434

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tries).

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	G77 & Chin	a								E	U Applicant	s	Annex I	Umbrella	European Union		
AOSIS	Bahamas Barbados Belize	Jamaica Sa Maldives Si Marshall Islands Si	amoa ingap urinar	ore me	AILAC Chile Honduras		Argentina Azerbaijan Brunei Darussalam			B N M	Bosnia & Herz. N. Macedonia Montenegro		Türkiye EITs		European Union		
Cook Islands Niue	Dominican Republic Fiji	Micronesia To Nauru Tr	onga rinidad	d & Tobago	Costa Rica	Cuolinitia rainantia Mongolia Costa Rica Paruguaye Philippines D.P.R. of Korea Thalland Turkmenistan Uruguay Basel Tajikistan Uruguay Basel Tajikistan		A Paraguay Philippines		Philippines		S	Serbia			Ukraine	1
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LDCs							Iran		Sri Lanka Viet Nam	Ш			Annex II	Australia	Austria Ireland		
Tuvalu	Haiti Kiribati				Bangladesh			1		Ш	EIG		, unico in	Canada Iceland	Belgium Italy Denmark Luxembourg		
	Timor-Leste			Arab	Group	Jordan Syrian A.R.	Iraq Kuwait Saudi Arabia							Japan New Zealand Norway	Finland Netherlands France Portugal Germany Spain		
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Cabo Verde Mauritius Seychelles	Guinea-Bissau São Tomé & Princip	e		Comoros	Djibouti Mauritania	Morocco Tunisia	Libya	South Africa	Botswana Cameroon	ľ	Georgia		Liechtenstein Monaco				
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Figure 2: Overview of blocks in the UNFCCC by Haller (2024)

Language Challenge	Details
Language barriers	Difficulties with English not being a first language (Multiple Countries)
Technical language	Navigating the jargon of the UNFCCC (Liberia, Paraguay)
Knowledge transfer	Gaps in technical knowledge and sharing of information (Multiple Countries)
Historical knowledge	Lack of historical negotiations awareness (Lebanon)
Complex topic communication	Challenges in conversing with senior negotiators (Peru, Nigeria)
Understanding party positions	Quick adaptation to negotiation dynamics is tough (Multiple Countries)

Table 1: Overall Challenges in the Role of Climate Youth Negotiator

Env. Challenge	Details
COP experiences	Initial COP experiences were daunting due to unpreparedness (Paraguay, Peru)
Public speaking	High-stakes environments make articulating complex topics challenging (Multiple Countries)

Table 2: Challenging S	Situations Faced	by	Negotiators
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Information Challenges	Details
UNFCCC website navigation	The main source of information is complex (Multiple Countries)
Time constraints	Insufficient time to process crucial information (Paraguay)
Information dissemination	Reliance on internal communications and networks (Multiple Countries)

Table 3: Information Gathering and Processing Challenges

• News and updates: Newsletters and online	unfamiliar topics (Multiple Countries).	442
platforms (Liberia, Lebanon).	Collaboration Insights.	443
Approach to Complex Information.	• Inclusive communities: Supportive environ-	444
• Collaboration: Teamwork and leveraging ex-	ments among negotiators are fostered (Peru,	445
pertise for complex problems (Peru).	Nigeria).	446
• Research: Conducting thorough research on	• Language learning: Initiatives to improve	447

448	language skills (Indonesia).
449	Ideation and Solutions
450	Desired Improvements in the Climate Negotia-
451	tion Process.
450	A according the Circulification of official door
452 453	• Accessionity: Simplification of official docu- ments for inclusivity (Lebanon, Nigeria).
454	Repetitive Tasks and Desired Efficiencies.
455	• Historical data retrieval: Automation for
456	historical negotiation details (Lebanon).
457	Future Vision.
159	• Technological support: AI and digital tools
450	are seen as potential aids in negotiations (Mul-
460	tiple Countries).
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461	Overall Recommendations and Suggestions
462	To develop tools for UNFCCC technical language
463	translation, create AI-assisted platforms for his-
464	torical data analysis, and establish technologically
465	empowered environments for young negotiators to
466	contribute effectively.
467	Appendix B: Abbreviated outline Climate
468	Youth Negotiator Programme (CYNP)
469	Fundamental Training
470	The fundamental training covers: Introduction To
471	Climate Science. Multilateral Climate Processes
472	and UNFCCC, Science Of Climate Change - Why
473	Are We Here, History Of International Climate
474	Decision-Making - How Did It Start?, Introduction
475	To UNFCCC - How To Make Sense Of UNFCCC
476	Complexity?, How Do Decisions Get Made In The
477	UNFCCC Context?, Bigger Picture And Architec-
478	ture And Agents Of Change.

Potential Benefits	Details
Translation and summarization	Overcoming language barriers and condensing information (Multiple Countries)
Document analysis	Streamlining synthesis from extensive documents (Multiple Countries)

Table 4: Potential Benefits of LLM Integration

Concerns	Details
Over-reliance risks	Dependency on technology could diminish critical research skills (Liberia, Paraguay)

Table 5: Challenges or Reservations about LLM Integration