Consensus in COPUOS

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Abstract

Consensus is an increasingly selected decision-making procedure in negotiations and institutions. As a more informal mode of negotiating and decision-making without voting, We propose a method of coding and tracking consensus in The Committee on the Peaceful Uses of Outer Space (COPUOS), the foremost global organisation tasked with managing and improving states relations in space, by using its annual reports. By building a dataset of all COPUOS reports from 1990 to 2022, we model the presence and extent of consensus over time in against other quantitative data coded within the reports. We find an increasing number of views expressed over time, with the attainment of consensus mostly attributable to the substantive topic discussed. We also notice that factors related to less frequent attainment of consensus are often also associated with a higher strength of consensus. Non-state actors and developing countries are in some cases associated with increased attainment and strength of consensus.

Word Count: 23,920

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Ad astra

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Chapter 1: Introduction

Space in International Relations

Space is a crucial environment in international relations and global civilisation. The region of space under Earth's gravitational influence hosts an ever-growing array of space objects operating across a range of domains and applications, from communications, Earth observation, navigation, science, reconnaissance, and more. Access to space has only been available for around 70 years, however, since then, humanity has launched approximately 12,000 satellites aboard over 6,600 rocket launches, taking around 600 humans into space (Space Launch Now, n.d.). During and alongside the development of space technologies, states have developed a range of regulatory arrangements regarding the use and exploration of outer space. The first and main international body tasked exclusively with facilitating global cooperation in outer space is the Committee on the Peaceful Uses of Outer Space (COPUOS).

A Brief History of COPUOS

COPUOS was initially established as an *ad hoc* committee by the United Nations General Assembly (UNGA) in 1958 by Resolution 1348 with 18 member states. One year later in 1959, the Committee would be made permanent by the UNGA through Resolution 1472 with 24 states, providing COPUOS with the mandate to: "review, as appropriate, the area of international co-operation, and to study practical and feasible means for giving effect to programmes in the peaceful uses of outer space which could appropriately be undertaken under United Nations auspices" as well as to "study the nature of legal problems which may arise from the exploration of outer space" and to submit to the UNGA reports on its activities (UNGA 1959). COPUOS would hold its first meeting as a permanent body in November 1961, where early discussions centred on its features such as its method of decision-making and the officers of the Committee (Galloway 1979, 5-7). 1962 would see two developments, the establishment of two subcommittees within COPUOS, the Legal Subcommittee (LSC) and the Scientific and Technical Subcommittee (STSC) which held their first meetings in the same year, and the decision announced by the Chair Dr Franz Matsch that "it will be the aim of all members of the Committee and its subcommittees to conduct the Committee's work in such a way that the Committee will be able to reach agreement in its work without need for voting." (Galloway 1979. 7).

As an organisation, COPUOS is a subsidiary organ of the UNGA overseen by the Fourth Committee of the UNGA (Special Political and Decolonization), with the United Nations Office on Outer Space Affairs (UNOOSA), itself a part of the UN Secretariat, acting as its Secretariat (UNOOSA n.d.(b)). Any member of the United Nations may be a member, although not all are. From its original membership, COPUOS has steadily increased its membership over the years (see Figure 1), especially recently, and is currently composed of 102 member states. Non-state actors may also participate in sessions, with other UN bodies, International Organisations (IOs), NGOs, research institutions and think tanks attending. As a subsidiary organ of the UNGA and overseen administratively by UNOOSA, COPUOS has a somewhat unique organisational structure in the UN system (Brisibe 2016, 16-17), and lacks the same level of autonomy present in other IOs, existing primarily as an intergovernmental forum to for member states discuss matters relating to the 'peaceful uses' of outer space.

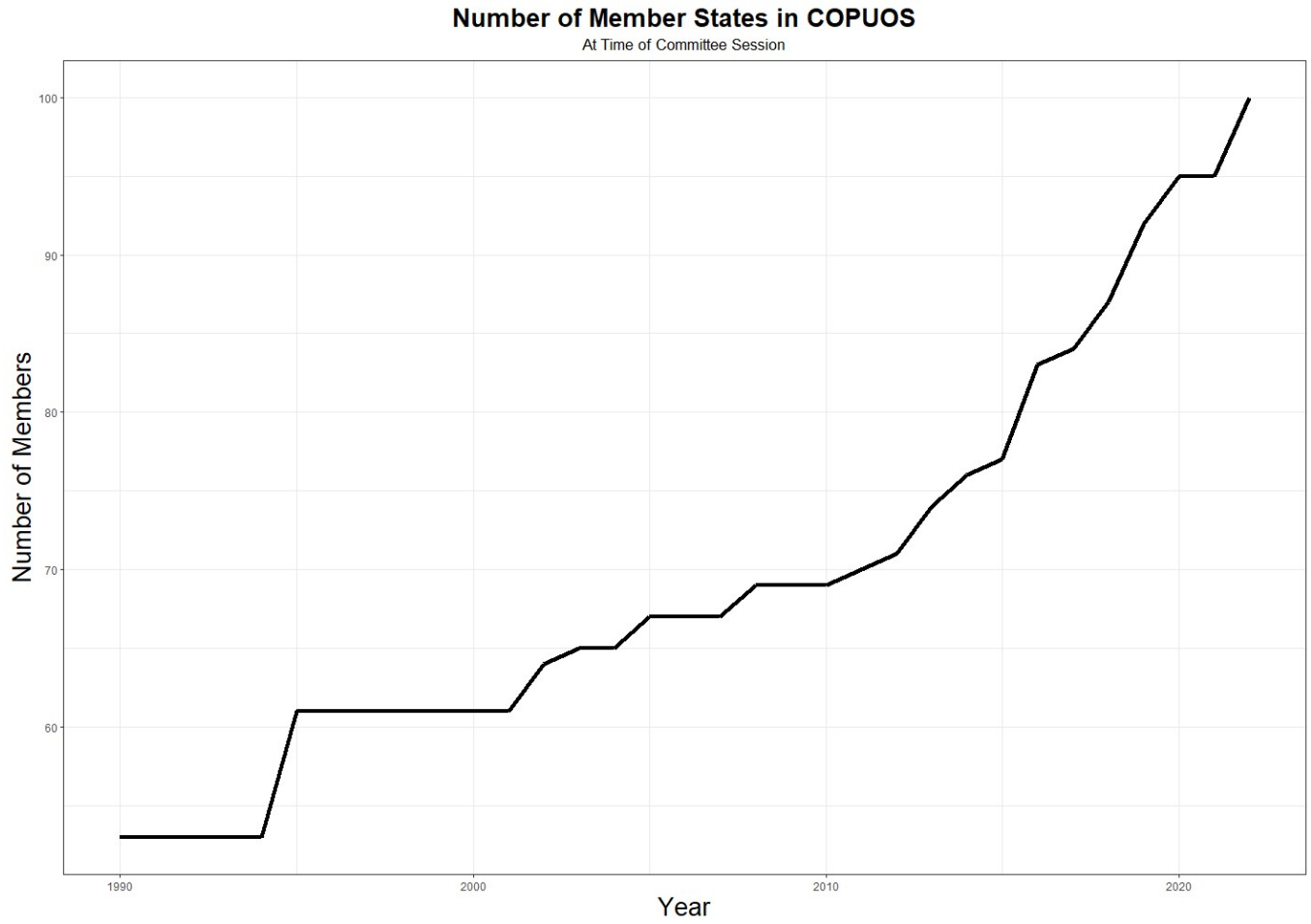


Figure 1: Number of Member States in COPUOS

COPUOS focuses on a range of issues regarding the use of outer space both within the UN systems, such as the United Nations Space Programme, as well as beyond. One long-term substantive issue involves the definition and delimitation of outer space. Whilst discussions within COPUOS are just one aspect of this issue, alongside more technical discussions in the International Telecommunication Union (ITU), it was one of the first substantive issues considered by COPUOS (Freeland 2016, 38-40), with discussions ongoing. Whilst some states believe in a relatively fixed boundary between Earth and space, often around 100-110km above sea level, others believe such a legal demarcation to be unnecessary. Others still, primarily equatorial countries, view geostationary orbit, a thin band above Earth's equator 35,786 km above sea level where satellites can remain in a fixed position above a point on Earth's surface, as either a *sui generis* part of space or not outer space as defined in the OST (Cocca 1988). At the heart of this debate are issues relating to sovereignty and usage rights of natural resources. According to the OST, no state may nationally appropriate space or any celestial body (UNGA 1967, Art II), and so defining space marks the upper limit to states' sovereignty. In the 1976 Bogotá Declaration, a group of equatorial states sought to claim sovereignty over geostationary orbit as a means to deal with what they perceive as other, more advanced states, appropriation of the orbit by placing satellites and allocating the limited radio frequency spectrum exclusively for themselves on a first-come-first-served basis (Cocca 1988; Diederiks-Verschoor and Kopal 2008; 99-100).

COPUOS functions via its annual meetings, held separately by the main committee, the LSC, and STSC over the first half of the year for sessions of around two weeks each, with the main committee meeting last. (Sub)Committee representation reflects their respective profession, with the main committee composed of diplomats, the LSC attended by lawyers and legal experts, with scientists and technical experts from states in the STSC (Hosenball 1979, 96). Meetings are structured by agenda items to be discussed, beginning with a general exchange of views before discussing each item. Decisions are filtered upwards to the subcommittee level, who express the resulting conclusions of discussions, featuring areas of agreement as well as individuals points or opinions within their report. Subcommittee reports are then endorsed with the report of the main committee during its sessions, along with items discussed and agreed during its session. All substantive decisions, and most procedural ones, are made by consensus. The report of the main committee is then submitted to the Forth Committee of the UNGA and then endorsed by the UNGA in the form of a resolution entitled "International Cooperation in the Peaceful Uses of Outer Space". The UNGA has never not approved a report (*email*

correspondence with an expert, May 2023). The reports and subsequent UNGA resolution are not considered to legally bind states, however, do create consequences for the Committee itself (*email correspondence with an expert,* May 2023). For example, expressions adopted by the (sub)Committees regarding their rules of procedure can be seen *ad verbatim* in the "Compendium on rules of procedure", the primary accounting of its rules, meanwhile membership enlargement follows the process of being "recommended" in COPUOS before being officially granted by the UNGA in the annual resolution (COPUOS 2016).

Consensus

In this thesis, we hope to understand, through the context of COPUOS, how states reach consensus. Consensus is the expression of an agreement made, without need for voting, and in the absence of expressed opposition (Buzan 1981, 326; Payton 2010, 3-4). Consensus diverges from unanimity in that where unanimity requires an affirmative vote among all parties to an agreement, consensus demands that no party activity objects to an agreement and is therefore reached without voting. Whilst there is no strict, universally agreed-upon definition of consensus across organisations, (Payton 2010, 3), consensus is an increasingly popular choice in institutional design, particularly as powerful states seek to balance maintaining sovereignty without the difficulties associated with cooperating via unanimity, whilst avoiding majoritarian systems in which they are the minority (Blake and Payton 2015; Payton 2010, 2; Zamora, 1980, 571-588). As we will see, COPUOS represent a particular implementation of consensus. Whereas in other IOs, consensus operates as a means to smooth opposition in the 'shadow of the vote', in COPUOS there is no such formal vote to rely upon. To some, the combination of consensus without the 'shadow of a vote' with intractable issues with high preference heterogeneity among parties should lead to institutional crisis (Ehlermann and Ehring 2005, 68-69), however, while substantive divisions, power discrepancies, and accusations in inefficacy are noted throughout its history (Aftergood 1992; Brisibe 2016; Gaggero 1986), COPUOS has somehow endured and remains the primary global organisation for outer space governance.

What affects how COPUOS reaches consensus?

Overview of the Thesis

This study will attempt to quantify and explain the variations of consensus in COPUOS over time, by the topics it discusses, the level of participation and the balance in participation between developing and developed countries. By using the annual COPUOS reports as our source of data, we hope to disaggregate the annual output of COPUOS, and explore and understand different dynamics related to how it finds consensus, as well as the impact of consensus by measuring the level of commitment or action implied in agreements. In doing so, we offer an original dataset containing all views expressed in the COPUOS reports from 1990-2022, for researchers to build upon and enhance our understanding of consensus and COPUOS (Boeree 2023). We show how different actors are associated with changes in the attainment and expression of consensus over time, and how different substantive topics are related to different levels of consensus. Our findings suggest a more holistic conception of consensus, as composed of its presence and extent, offers a more nuanced and complete understanding of consensus. Meanwhile, our results on actors and substantive issues may have implications for other organisations, and institutional design more broadly. Fundamentally, we view this research as exploring new means of understanding institutional decision-making, which with further refinement could lead to new insights into negotiations and consensus building.

The thesis is structured as follows. In Chapter 2, we explore what it means to express consensus and asses what is perceived to affect the attainment of consensus in negotiations. Chapter 3 provides an overview of how we coded the COPUOS reports and the analysis techniques we will use. The results of our analyses are contained in Chapter 4, which first explores our data before we construct a model to test for significant associations between consensus and our other variables. Chapter 5 attempts to place the results in context, highlighting our findings in relation to our hypotheses, as well as the limits and potential weaknesses in our study. We conclude with Chapter 6, which summarises the thesis, and considers future possibilities for research on consensus and COPUOS.

Chapter 2: Conceptual Framework

In this section, we will explore the main factors that are considered to affect how states reach agreement through negotiations, in particular agreement through consensus, focusing as well on how this is perceived to operate within COPUOS. We first consider what it means to express consensus, in terms of previous analyses of agreements found through consensus. In doing so we conceptualise consensus not just as the attainment of consensus, but also the extent of consensus in how it is expressed. We then present a series of hypotheses to be tested on aspects related to who negotiates and what is negotiated. By whom negotiates, we refer to their numbers, the composition of different negotiators, and states relative power and the impact of developing countries as a coalition. What is negotiated involves different issue areas of negotiations, and how consensus is found within these. The effect of non-state actors in negotiating and decision-making is also explored as affecting institutional performance and decision-making.

Expressing Consensus

This thesis aims at measuring consensus over time and explaining variations based on factors which may affect it. As explained in the introduction, consensus is the expression of an agreement found through lack of opposition. The agreement itself is as relevant as the finding of consensus, and the use of consensus to reach decisions compared to other decision-making procedures plays a role in what kind of agreement is reached (Buzan 1981, 345-7).

Consensus affects the type of outputs produced, as the acceptable outcome between all negotiating parties, rather than just a majority of them, should reflect the variety of positions and interests at stake. As such, agreements conducted via consensus tend to be weaker, as a "lowest common denominator" between parties (Ehlermann and Ehring 2005, 68). In becoming less stringent, expressions of consensus are more ambiguous and open to (contradictory) interpretation by parties, as shown by Jarell in the case of the United Nations Declaration on Human Cloning (2006). States were unable to find reach a binding outcome that could incorporate opposing views on prohibiting therapeutic and/or reproductive cloning, and so the resulting non-binding declaration instead used wording vague enough that both states for and against (certain types of) cloning could interpret it in a way that confirmed their standpoint. Consensus may then represent what states accept rather than what they have been persuaded of (Charnysh et al. 2015). This may still have an overall impact on states' cooperation, however,

allowing flexibility for states has been shown to encourage their initial participation and potentially lead to further implementation (Kucik and Reinhardt 2008).

Measuring consensus raises several difficulties, as it lacks voting tabulation, its attainment is dependent on a range of additional factors, and its presence alone may not be indicative of support among parties (Buzan 1981, 330; Peterson 2018, 123-124). Weingart et al (2004) provide a framework for quantitatively coding negotiations, focusing on extracting the raw discussions and coding expressions that impact the outcome or relationship between negotiators. By aggregating data, and categorising it into distinct negotiating behaviours, one can understand both the strategy and impact of certain negotiating behaviour on reaching agreement. Kacprzyk et al. meanwhile, develop a range of techniques for measuring consensus quantitatively using the testimonies of participants, converting their 'fuzzy' language into an algorithm to measure the extent of agreement vis-à-vis the underlying uncertainty and the ambiguity of participants phrasings (1997). Whilst these do provide valuable insights, they rely on access either to the original negotiations, which in consensus can frequently or predominantly be informal, small groups in back-rooms (Narlikar 2002), or on extensive interviews with a wide range of participants, which makes researching historical negotiations or negotiations over time more problematic.

Instead, one can focus on the outputs of consensus as the shortest causal chain from decisions (Tallberg et al. 2016, 1080), which enable one to connect the states individual interest and positions with solutions to collective problems. While outputs are generally measured by their volume or their bindingness, this proves problematic for IOs which produce explicitly non-binding or regular outputs such as communiques (Sommerer and Tallberg 2016, 32). One potential solution may be to analyse other aspects of the content of these texts through content analysis according to their linguistic features. UNGA resolutions, over three quarters of them being passed via consensus (Peterson 2018, 123), are often the subject of analyses of how the use of language indicates varying degrees of action to be taken, the construction of customary international law, or representations of specific issues. The UNGA itself offers incomplete and minimal indications of the meaning of language in resolutions in its editorial guidelines, providing a list of commonly used action verbs for operative sections, but with the exception of 'notes', 'recalls' and 'reiterates', does not define or differentiate between them (UN DGACM, n.d.). Rafalovitch and Dale, in introducing their multi-lingual corpus of UNGA resolutions, are able to show the most common verbs used in resolutions and how they compare

between the different official languages of the UN (2009). D'Acquisto argues, that although not legally binding, UNGA resolutions do represent "the language of the law" as an authoritative statement, if not "legal language" of one that binds and confers rights and obligations (2017, 13). In doing so, they are able to analyse resolutions through the verbs used, its tense, form, and scope, among other linguistic features, to compare between UNGA and UN Security Council resolutions regarding Palestine, showing a consistency use across time and between the institutions in the ambiguity of resolutions' meaning and consequences (D'Acquisto 2017, 79-80).

The expression of consensus through the use of verbs can be conceived through speech act theory, in particular through locutionary, illocutionary, and perlocutionary speech acts. A locutionary speech act refers to the literal meaning of a sentence and the performance of uttering it, while an illocutionary speech act refers to the intended meaning behind the utterance. A perlocutionary speech act refers to the effect that the utterance has on the listener or the world (Austin 1975, 1–11). To formally express consensus is to more than just describe or identify its existence, it is to achieve something through consensus and its expression (Austin 1975, 1-11; Kurzon 1986). How consensus is expressed matters to states, as its formal expression is intended to give a certain meaning and set of consequences over a different meaning or set of consequences. One example of this is the endorsement process for IPCC reports, which consists of three levels "Acceptance", "Adoption", and "Approval" depending on the type of report and level of government consultation with the scientists who authored it, creating different assessments of the report (IPCC 2013).

In COPUOS, expressions of consensus result in the adoption of treaties, guidelines, recommendations, frameworks and a range of reports. Typically, consensus in COPUOS is evaluated by substantive outputs, such as treaties, sets of principles or guidelines from a legal perspective (see Masson-Zwaan 2023, 12). We hope to provide an alternative, political, perspective that enables the inclusion of a greater scope of discussions and factors that may contribute towards consensus. Consensus, first and foremost, is a decision-making procedure, not a law-making procedure (Ehlermann and Ehring, 2005, 54-55), with law-making requiring an additional step undertaken by states themselves. We hope to chart this decision-making process in an institutional context, with the legal ramifications of substantive outputs by COPUOS already covered from a legal perspective. In doing so, we draw from, and look beyond COPUOS, to the factors that may affect the attainment and expression of consensus in

other consensus-based institutions. As such, we will now explore these factors, constructing our hypotheses to be tested along the way.

Participation

Across decision-making procedures, the number of parties may have some effect on the ability to make decisions, but this effect may be particularly pronounced in consensus, which itself may reinforce this effect by tending towards larger negotiating sizes. Numerically, reaching a single agreement with a higher number of parties with individual positions should become increasingly difficult (Ehlermann and Ehring, 2005, 65). According to original theories of collective action groups which are larger in size and more diverse impose higher costs on finding agreement (Regan, Colyvan, and Markovchick-Nicholls 2006, 167). There are more perspectives, and so it should take more time to reconcile these within some acceptable outcome, and there should be more potential free-riders, and some cases lower individual absolute benefits gained from an outcome (Esteban and Ray 2001, 633; Regan, Colyvan, and Markovchick-Nicholls 2006, 167). There are some diverging perspectives however, and particular properties of consensus decision-making which may exacerbate some aspects, but remedy others. Some assessments of collective action theories have shown that increases in group size need not be associated with increased difficulty in finding agreement. In some specific conditions, which are nevertheless more difficult to meet in larger groups, may not result in increased difficulties of reaching agreement (Chamberlin 1974, 711-716). In particular if the negotiations revolve around 'inclusive' public goods, those that are accessible to all, then in fact larger group sizes should be associated with increased agreement (Chamberlin 1974, 711-716; Esteban and Ray 2001). Constructivists too, would argue that increasing membership need not result in decreased level of agreement. Within an institutional structure, such as an IO, over repeated interactions members socialise with each other constructing shared norms which can then change states preferences (Checkel 1999), to an extent where agreement becomes easier despite increasing group size. Even if one accepts that more powerful states can dominate negotiations, by increasing the group size, power is distributed among more members, gradually weakening a single powerful states influence (Steinberg 2002, 368)

Consensus may exacerbate some of these dynamics but mediate others. Consensus can impact the size of the group, as well as the type of bargaining, and poses a higher threshold for agreement among all parties which makes each additional party disproportionately impactful

relative to majoritarian or weighted systems. First, Consensus tends to be selected based on the framing of the collective action problem as being universalist and requiring broad-as-possible cooperation, thus increasing the number of negotiating parties from the outset (Ehlermann and Ehring; Sohn, 1974). However, because consensus tends to be used in integrative bargaining solutions, which are characterised by lower free-rider problems and less incentive to block agreements (Odell 2013), increases in group size may become less impactful. States, however, still have individual interests, and in IOs not all parties or issues may be amicable to integrative bargaining. Compared to non-sovereign equality systems, states still retain a form of veto in consensus through which they can oppose agreements. More members under such systems means more potential vetoes and a reduction in winning coalitions or pooling (Sommerer et al. 2022, 819; Sommerer and Tallberg 2016, 7). Sommerer and Tallberg do find a connection between decision-making procedure and group size using a dataset of 20 IOs and evaluating them by the volume of policy outputs produced. Increases in both membership and preference heterogeneity among parties are shown as negatively affecting the decision-making capability of IOs, with unanimity systems associated with increased preference heterogeneity when used (2016, 27-31). Although membership increases are in fact more detrimental when majority systems are used, they still negatively affect decision-making under unanimity systems (Sommerer and Tallberg 2016). As such, although the effect of increasing membership does appear to be linked to decreasing agreement, consensus may reduce this association.

Within COPUOS, increases in membership are considered to be connected, if not the main factor, associated with decreasing frequency and strength of consensus. Here, accounts point not just to the perceived mathematical determinism of increasing membership on consensus, but also how this shifts negotiating dynamics in ways that no longer facilitates the negotiation of binding treaties (Brisibe, 2016; Galloway 1979). According to Brisibe, the number of new state members has increased the number of different languages. Negotiations now require interpreters, which slows down interaction and requires the same agreement to be found in more languages, which may have different contextual or cultural understanding of words. The COPUOS reports, originally published only in English, since 1977 are published in the five official UN languages which, although non-binding, are equally authoritative and must be agreed in their entirety (Martinez 2021, 101). The increased membership has also led to increased formality and longer, more structured negotiations, which to Brisibe lead to less consensus (Brisibe 2016). As well, where originally negotiations took place among like-

minded individuals who interacted outside of COPUOS, this is no longer the case, with decreased familiarity among delegates reducing consensus (Kopal 2010).

Hypothesis (Participation 1) *null*
There will be no association between changing levels of state participation and attainment of consensus.
Hypothesis (Participation 1) *alternative*
Increasing levels of state participation will be associated with decreasing attainment of consensus.

Hypothesis (Participation 2) *null*
There will be no association between changing levels of state participation and strength of consensus.
Hypothesis (Participation 2) *alternative*
Increasing levels of state participation will be associated with decreasing strength of consensus.

Composition

Who negotiates through consensus matters. The choice of consensus is typically framed as a compromise between developing states, who should prefer majoritarian systems, and developed states, who should prefer weighted voting systems. Majoritarian systems are far more common than weighted systems (Blake and Payton 2015, 387) and consensus is typically selected in issue areas with initial lower established stakes or higher uncertainty about potential gains (Zamora, 1980). Given that consensus typically operates as a prelude or preclusion of a formal vote more commonly within a majoritarian system, this arrangement should benefit developing countries, who can simply allow votes for which they constitute the majority. Empirical evidence of consensus-based organisations suggests otherwise, with discrepancies of power between developing and developed states manifesting themselves at various stages of negotiations. One example is the World Trade Organisation (WTO), which operates via consensus, but maintains the option for voting based on a majoritarian system if consensus cannot be found (WTO 1995, Article IX(1)). Although developing countries could allow votes within which they constitute the majority, developed countries have an array of tools and strategies to 'invisibly weight' negotiations in their favour. First, the use of consensus prior to, and privileged above majority voting, precludes developing countries from effectively using

their numbers to form winning majorities, as consensus provides developed countries a means to oppose them (Narlikar 2002, 182). Secondly, developed countries can both oppose measures they disagree with more effectively than developing countries, especially if such opposition is held in isolation (Ehlermann and Ehring 2005, 66), meanwhile developed countries can also offer greater incentives, in the form of issue-linkage and side payments, to sway opposing developing countries, effectively weighting decision-making through coercive power (Steinberg 2002, 346-350). Third, is that decision-making in the WTO operates practically through "an elaborate network of informal processes that can beat consensus into shape." (Narlikar 2002, 174). Small 'Green Room' meetings, concurrent meetings, and the requirement to be present to object all place a greater burden on developing countries without the resources to send delegation of requisite size to Geneva for negotiations, especially as many of those technical proficiency as in a range of complex areas as wealthier countries (Narlikar 2002, 174-176). As such, what gets added to the agenda and what eventually gets put to a vote has already been negotiated on the basis of asymmetries of power and expert knowledge but given the appearance of legitimacy by having operated by consensus (Steinberg 2002).

Minority coalitions should gain leverage via consensus, by being able to block motions they disagree with to force agreement within a more acceptable outcome (Odell 2013, 13; Smith 1999, 178). The effect appears particularly pronounced with power discrepancies between a less powerful majority and more powerful minority. The effectiveness of minority groups is even further strengthened where minorities are not characterised by a high degree of preference heterogeneity (Odell 2013, 13). Although often grouped together, developing countries can have as many variety in their positions as between developed and developing countries, which can outweigh the shared recognition that coalescing as blocks can increase their collective bargaining power (Zamora 1980). McRae and Thomas view the major division during the Tokyo Round of the GATT, which operated via consensus, as being between developing and developing countries, however developing countries as a coalition were hardly "monolithic" (1983, 58-59). In counteracting, developing countries should be more effective in formal coalitions than informal ones (Drahos 2003), however some coalitions appear more effective than others (Odell 2013, 13). Over time, the balance may be shifting in developing countries favour as the relative power discrepancies between developed and developing countries decrease, however, unequally between developing countries, which could itself lead fragmentation of developing countries preferences along multiple levels (McArthur and Werker 2016).

The use of developing countries as representing broad, if vague, coalition in COPUOS, as well as the framing of issues as representing specific interests of developing countries is prevalent in COPUOS. Whilst during the Cold War the predominant division in outer space activities and in COPUOS was between the USA and USSR, since there a has been an increase in space actors and inter-bloc cooperation, leading potentially to a multipolar or fragmented international landscape in space (Peter 2016). Developing countries however continue to frame themselves as a combined group with distinct preferences from developed countries and many accounts point to developing and developed countries being the major division in COPUOS (Benko and Schrogl 1995; Cocca 1988; Gaggero, 1986). Here, there are sometimes varying rationales as to what kind of consensus developing countries should seek in COPUOS. Typically, developing countries are seen as pursuing more binding texts that present them with preferential treatment, or distribute gains towards them (Benko and Uwe Schrogl 1995). However, at times, increasing regulation, even if non-binding, is perceived constraining their ability to develop in space, by increasing costs of space activities which disproportionately negatively affect developing countries (Brachet, 2012). Where developed countries, especially the US, tend to maintain a status quo and avoid binding motions in COPUOS, developing countries tend to pursue different types of outcomes more pragmatically, looking to distribute gains in their favour and minimise their own costs at the expense of developed countries (Benko and Uwe Schrogl 1995; Gaggero 1986). Often times, developing countries must take time to collectively reach a common position from which to bargain from (Cocca, 1988).

Developed countries meanwhile, may be willing to placate or allow developing countries preferences in some, limited areas. In the International Telecommunications Union (ITU), consensus is used in decision-making across all three of its ‘sectors’: Radiocommunications, Development, and Standardisation, with different dynamics of consensus in each (Lyall 2015, 37-41). Focusing on Development, consensus manifests typically as larger states not participating, but not wanting to be seen as stalling, largely “aspirational” outputs (Lyall 2015, 38). Given that developing countries as a collective are prominent as a coalition within COPUOS, with distinct preferences to developed countries on form and substance, and account for one of the main divisions between states in COPUOS we would expect increased developing country participation to be associated with lower attainment and weaker consensus. As consensus enables larger states greater capacity to block proposals they disagree with (Ehlermann and Ehring 2005, 66), we would expect them to implement this concurrently to

participation by developing states, allowing consensus only on weaker less impactful forms of agreement.

Hypothesis (Developing Countries 1) *null*
There will be no association between changing levels of participation by developing countries and attainment of consensus
Hypothesis (Developing Countries 1) *alternative*
Increased participation by developing countries will be associated with decreasing attainment of consensus.

Hypothesis (Developing Countries 2) *null*
There will be no association between changing levels of participation by developing countries and strength of consensus
Hypothesis (Developing Countries 2) *alternative*
Increased participation by developing countries will be associated with decreasing strength of consensus.

Scientists as Diplomats

Although the notion of international negotiations is often as one participated in by high-ranking diplomats and government officials, there is a long history since the post-War period of involvement from different actors within negotiations (Melchor 2020, 414-415), with Gottstein attributing the Sputnik shock as catalysing US efforts in connect science to diplomacy (Gottstein 2003). When involved, there is a blending of professional culture, substantive issue, and national interest which makes differentiating the role of the scientist from the scientific issue and the negotiating context difficult in understand how each affects particular outcomes. The involvement of scientists in negotiations and policy making is often in the early stages of policy making, in temporary structures within "less established policy areas and with low legal orientation", and often alongside other actors (Gornitzka and Sverdrup 2011, 144-145). In particular, scientists are utilised in non-majoritarian systems, such as consensus, where the use of objective 'nation-free' knowledge adds legitimacy to proposals (Gornitzka and Sverdrup 2011, 133). Scientists are rarely granted decision-making authority themselves, however, if the problem is of greater technical complexity, decision-makers tend to provide greater autonomy to bureaucrats and experts (Voeten 2019, 151). Scientists and experts can shape the

agendas and even the mandates of IOs, by highlighting certain problems and presenting 'neutral', objective knowledge (Littoz-Monnet 2017), however when, as representing their state rather than acting as neutral experts, scientists communicate as scientists, but bargain as delegates (Strickland 1964, 380-384). The notion of a distinct constant professional culture of scientists, especially those that perceive scientists as embodying objective knowledge untainted from legal or political dimensions is thus highly suspect.

Scientists can be understood as a distinct constant professional culture possessing different skills and communicative strategies, which are able to take advantage and legitimise certain argument in certain policy areas (Gottstein 2003, 4-5; Melchor 2020). 'Intuitive scientists' draw conclusions on "using objective procedures to gather evidence that minimizes bias" with reality as the ultimate reference point, meanwhile supposed 'intuitive lawyers' depart from the aim that a conclusion should confirm prior beliefs and support one's argument. Agreement therefore only becomes possible among 'intuitive scientists' or likeminded 'lawyers' (Regan, Colyvan, and Markovchick-Nicholls 2006, 170). Gottstein follows this line of argument in suggesting that scientists, through undergoing a similar socialisation process to each other, facilitates a more open, accepting, and less formal negotiating environment that leads to "integrative negotiation approaches and forward-looking outcomes" (2003, 5-6, 9). Scientists are mainly constrained in negotiations with each other by their own sides' political oversight, whose skill set and foundation of knowledge revolves around political, and perhaps generally distributive, implications of certain courses of action (Gottstein 2003, 6; Melchor 2020).

Within COPUOS, we see different actors negotiate within distinct settings, with the main committee composed of diplomats, the LSC attended by lawyers and legal experts, with scientists and technical experts from states in the STSC (Hosenball 1979, 96). Although scientists within the STSC still represent their state, this distinction in COPUOS may enable us to distinguish between variations in outcomes from political, legal, and scientific negotiations all else being equal. As accounts of COPUOS highlight the increasing role of the STSC compared to the LSC and the separate operations of the LSC and STSC (Brisibe, 2016), we would expect this to reflect underlying difficulties in finding agreement in the LSC compared to the STSC. We wish to focus on the role of scientists, however, as COPUOS may present a relatively unique opportunity to understand their impact on decision-making, in its rate and what it achieves. Whilst the literature does hint towards scientists negotiating in a more agreeable manner, we believe the extent of this will be constrained by their role as delegates of

their states first and foremost, and so would anticipate only a minor positive association in the strength of consensus they achieve.

Hypothesis (Scientists 1) *null*
There will be no association between items negotiated by scientists and the attainment of consensus.
Hypothesis (Scientists 1) *alternative*
Items negotiated by scientists will be associated with increasing attainment of consensus.

Hypothesis (Scientists 2) *null*
There will be no association between items negotiated by scientists and the strength of consensus.
Hypothesis (Scientists 2) *alternative*
Items negotiated by scientists will be associated with only a minor increase in the strength of consensus.

Issue

Different issues are more amicable to agreement than others. Generally, there is a varying level of institutionalisation into IOs in the first place depending on the issue area. There is less institutionalisation in security related issues than in economic related institutions, as risks of defection are higher, sanctioning more costly, and uncertainty is prevalent and persistent (Lipson 1984; Axelrod and Keohane 1985; 235). States select different decision-making procedures depending on the main issue area of an institution. Blake and Payton offer an analysis of 266 IGOs voting rules, showing a propensity for unanimity decision-making over majoritarian or weighted voted systems when issue areas of the institution revolve around states' 'core interests' such as security or economic matters, as well as when founding membership sizes are smaller (2015). Unfortunately, Blake and Payton do not distinguish in their dataset between unanimity and consensus, and it does not take into account institution which predominantly use consensus, such as the World Trade Organization (WTO), but officially use majoritarian systems. Consensus tends to be selected and utilised in thematically broader institutions (Ehlermann and Ehring 2005, 63) as well as those characterised by lower established stakes, where there is less justification for a weighted voting system (Zamora 1980, 584-586). In broader institutions that cover a range of issues, or a range of issue framings on a

particular area, disaggregating the content of negotiations may be more difficult if the institution covers a range of issues or if framings of issues are contests (Hopmann and Cede 2012).

If reaching consensus requires a result that is acceptable to all participants and frames issues in its selection as collective problems of joint concern, it may be more facilitative of integrative bargaining and problem-solving (Odell 2013, 13). In analysis on the Tokyo Round, Winham notes a difference in negotiations between "negotiation over words" and "negotiation over numbers", as representing integrative and distributive bargaining respectively (Winham 1986, 367), with the former more conducive to negotiation than the latter. This may indicate that even where using consensus may facilitate integrative bargaining, it does not determine it, and may still succumb to distributive issues. As well, in cases where distributive issues are present decision-making procedures which maintain sovereign equality, enable states continual control over the distributive effects of institutions decisions (Blacke and Payton 2015). Fundamentally, whether issues are distributive or integrative is dependent on the perceptions of participants, and the competing strategies in negotiations as selecting between distributive or integrative framing by participants, however some issues do appear more prone to distributive bargaining than others (Irmer and Druckman 2009, 211).

In focusing on the substantive topic under discussion, there does appear to be an overall link between the thematic substance or issue content and the outcome of negotiations. Here, we focus on five broad categories of topics which are associated with a range of diverging implications for institutionalisation, negotiations, and decision-making, that also connected to discussions in COPUOS.

Core Interests

Disputes over identity and security are particularly contentious and are correlated with increased failure of negotiations with a majority of mediated disputes involving issues of security and sovereignty negotiations lead to stalemate or failure (Hopmann and Cede 2012, 242). Sovereignty and security are core, existential interests of states, and held by states at high symbolic value and often invoked as issues of 'high politics' (Blake and Payton 2015, 393). Negotiation issues that are imbued with this high symbolic value and high stakes are often far more difficult to find agreement on, as states perceive them and their value as

indivisible, meaning any concession is seen as yielding completely or at least setting a precedent for future, further concession (Jackson 2008, 194). Sovereignty and security to states are basic underlying properties which enable their continual survival and as such characterised by competition, not cooperation, in a constantly precarious balance of power (Mearsheimer 1994, 10-13). Where security and sovereignty are institutionalised, states may increasingly prefer regional, rather than global arrangement, and based on unanimity rather than consensus (Flemes 2005, 6). As such, in a universalist global organisation operating via consensus, where states cede minimal control in the institutional design, we should expect to this continued through less frequent and weaker forms of consensus on states core issues.

Hypothesis (Core Interests 1) *null*
There will be no association between items relating to states 'core interests' (security and sovereignty), and the attainment of consensus.
Hypothesis (Core Interests 1) *alternative*)
Issues which reflect states 'core interests' (security and sovereignty) will be associated with lower attainment of consensus.

Hypothesis (Core Interests 2) *null*
There will no association between items relating to states 'core interests' (security and sovereignty), and the strength of consensus.
Hypothesis (Core Interests 2) *alternative*
Issues which reflect states 'core interests' (security and sovereignty) will be associated with lower strength of consensus.

Environmental

Environmental issues also contain characteristics which may affect the level of agreement possible. Environmental disputes between states are often technically complex and prone to framing as distributive issues but in which the distribution is over negative instead of positive value (Sjöstedt 2008, 230-235). States disproportionately view losses as of greater value than an equivalent gain, which can harm the capacity to find agreement in these areas (Kahneman and Tversky 1979; Sjöstedt 2008, 230-235). Whilst scientists and experts are often used to provide insight and advice to policy makers within this distinctly scientific area, this may be less effectual than in other areas. Environmental issues are characterised by a high degree of

uncertainty, even within the science, with the extent of a proven association (such as between CFC-levels and ozone depletion) as relevant to policy makers as its existence in forming a response. Negotiations can therefore be slowed down as states seek greater scientific certainty, especially over less future risk compared to immediate crises (Sjöstedt 2008, 236). This is already problematic under consensus, in which perceived slowness of negotiations can compound pre-existing issues (Buzan 1981, 341-342) Two dynamics may counteract this to some degree. States may act out of the precautionary principle, as occurred in the formation of the Montreal Protocol despite the lack of scientific consensus, however, action may be limited to provisional initiation measures, and as compared to other prominent environmental issues such action be an exception rather than the rule (Jacobs 2014). Secondly, by their inherent scientific content, this may enable scientists to contribute more meaningfully to the agenda setting process, enabling a bottom-up approach to influencing decision-makers (Sjöstedt 2008, 242). Whilst this may result in more environmental issues on the agenda, whether it would lead to agreement on these issues remains doubtful.

Hypothesis (Environmental 1) *null*
There will be no association between Environmental issues and the attainment of consensus.
Hypothesis (Environmental 1) *alternative*
Issues regarding Environmental issues will be associated with lower attainment of consensus.

Hypothesis (Environmental 2) *null*
There will be no association between Environmental issues and the strength of consensus.
Hypothesis (Environmental 2) *alternative*
Issues regarding Environmental issues will be associated with lower strength of consensus.

Development

Issues regarding economic development contain competing dynamics which may affect how states reach agreement within them. On the one hand, outcomes should tend to be explicitly distributive, as they aim often for the provision of resources from one party to another, and this should impact consensus negatively (Adelman 2023). On the other hand, issues of development provide a more powerful states important gains to offset this. Development allows more powerful states the opportunity to link-issues or buy support for other areas (Gartzke and Rohner 2010). By participating in development programmes, funding countries hope to

normatively and geo-politically align recipient countries along their interests. Operating via consensus, which is typically done informally with less accounting of states individual interests, serves to facilitate this. Brazys and Panke finds evidence for vote-buying in the UNGA by analysing changes in state's preferences. Less wealthy aid-dependent countries in particular are found to change their positions on interests more frequently on issues outside of their core national interest (2017). Whether development issues themselves lead to more and more extensive consensus, however, is unclear. Within the ITU, although powerful states may not oppose such issues being discussed, this may not necessarily result in consensus occurring or being of any impact (Lyall 2015).

Hypothesis (Development 1) *null*
There will be no association between Development issues and the attainment of consensus.
Hypothesis (Development 1) *alternative*
Issues regarding Development issues will be associated with lower attainment of consensus.

Hypothesis (Development 2) *null*
There will be no association between Development issues and the strength of consensus.
Hypothesis (Development 2) *alternative*
Issues regarding Development issues will be associated with lower strength of consensus.

Organisational Issues

Regarding negotiations over aspects of the institution itself, such as its structure or future direction, whilst centralisation and autonomy are fundament for the organisation to accomplish what states wish it to (Abbott and Snidal 1998), under consensus systems, states are less willing to provide organisations with such autonomy (Zürn, Tokhi, and Binder 2021). On the one hand, administrative decisions should be less contentious than more political topics, which is why we see greater institutionalisation and autonomy ceded to such institutions (Zamora 1980, 575). Within a consensus-based organisation, however, states maintain greater individual control and so changes to the organisation, may be more difficult to reach and less impactful when they require the consent of all parties present. In the context of COPUOS however, which attempts to operates via a notable and deliberate degree of flexibility with a very low degree of autonomy, this may make a greater deal of the desired outcomes reliant on states providing individual permission, expressed through stronger consensus.

Hypothesis (Future Direction 1) *null*

There will be no association between issues regarding the future direction of the organisation and the attainment of consensus.

Hypothesis (Future Direction 1) *alternative*

Issues regarding the future direction of the organisation will be associated with lower attainment of consensus.

Hypothesis (Future Direction 2) *null*

There will be no association between issues regarding the future direction of the organisation and the strength of consensus.

Hypothesis (Future Direction 2) *alternative*

Issues regarding issues regarding the future direction of the organisation will be associated with higher strength of consensus.

Non-State Actors

Non-state actors provide information and expertise, can support implementation of policy, and provide democratic legitimacy to IOs through their presence (Tallberg et al. 2013). While they are usually not able to vote or decide in IOs, they do increasingly participate in IOs since the end of the Cold War, especially in specific forms of IOs, including committees, in issue areas that are more complex and more institutionalised (Tallberg et al. 2013, 236). States on the one hand constrain non-state actor involvement to reduce 'sovereignty costs' of their increasing participation but are also the main determinant of their participation (more so than the supply of non-state actors in a given area) through creating a 'functional demand' for their expertise (Tallberg et al. 2013, 235-243). In doing so, states delegate only certain functions, typically implementation and monitoring, rather than cede control over decision-making. Transnational actors can still positively affect decision-making performance (Vikberg 2023) however only when states forgo their veto in majoritarian or weighted voting system, with no effect found in consensus systems by Sommerer et al. (2022, 836). As any state can essentially veto a measure, non-state actors' contributions in support of the measure will be less effective than in majoritarian or weighted systems (Sommerer et al. 2022, 824).

On the one hand, increasing participation by non-state actors implies an increase in the number of actors, which we consider to be detrimental to reaching consensus. On the other hand, the role of non-state actors is highlighted as enhancing performance in IOs, however, not within consensus-based systems (Sommerer and Tallberg 2016). Although it is likely important the kind of non-state actors participate as well as the potential for decreasing marginal effects on increasing non-state participation (Vikberg 2023, 34), we extend the findings of previous research that finds a positive association between non-state participation and IO performance to hypothesise that increasing participation by non-state actors leads to increases both the attainment of consensus as well as its strength.

Hypothesis (Non-state Actors 1) *null*
There will be no association between levels of non-state actors' participation and the attainment of consensus
Hypothesis (Non-state Actors 1) (*alternative*)
Increased participation by non-state actors will be associated with increasing attainment of consensus.

Hypothesis (Non-state Actors 2) (*null*)
There will be no association between levels of non-state actors' participation and the strength of consensus
Hypothesis (Non-state Actors 2) (*alternative*)
Increased participation by non-state actors will be associated with increasing strength of consensus.

Chapter 3: Methods

Case Selection

We chose to study a single organisation, COPUOS. Comparative studies across multiple IOs have been previously conducted as seen earlier, showing connections between decision-making procedures and aspects of other institutional design, as well as connections between decision-making procedures and outputs, which show how different decision-making procedures lead to different outcomes (Blake and Payton 2015). Nonetheless, they all exhibit similar shortcomings, a failure to distinguish between consensus and unanimity, and for formal and informal modes of consensus within their data, whilst highlighting the limits of measuring outputs for IOs that tend to operate through regular reports of communiques (Sommerer and Tallberg 2016, 31). By focusing on a single IO and disaggregating its regular output into a set of positions with consensus in reference to changing dynamics within the organisation we can explore how these changes over time impact the rate and extent of consensus. In doing so we gain a deep understanding of COPUOS and the factors that affecting consensus within it. By testing various pre-established theories of what affects consensus, we hope to be able to generalise beyond COPUOS, to other IOs that operate via a similar form consensus or other IOs covering similar technical and scientific topics. COPUOS is a particularly rare form of consensus, in that all decisions are made by consensus without an established voting procedure to 'shadow' (Payton, 2010, 3). Whilst this enables us to attribute decisions to within consensus decision-making dynamics, it does limit our generalisability as we cannot fully account for effects that the 'shadow of a vote' may bring.

Data Selection

We analyse the reports because they represent the main, regular substantive output by COPUOS and its subcommittees, which facilitates analysis and comparison across time, issue, and forum. Other outputs by COPUOS, for example guidelines, are rarer, fewer in number, and have been extensively studied by those assessing their drafting, content, purpose, and implementation (see Diederiks-Verschoor and Kopal 2008; Kopal 2010; Masson-Zwaan 2023;). The reports themselves lack extensive systematic study as a text communicating the decision-making of COPUOS over time.

The reports were taken from the public repository on UNOOSA's webpage of which the reports from 1978 to 2022 for the main committee, and 1990 to 2022 from the LSC and STSC were

available. We chose because of this to therefore only analyse the reports between the years 1990 and 2022 to ensure clear consistent comparison across the (sub)committees. Only the English language reports were analysed.

Coding the Reports

The aim of content analysis is "to characterize the meanings in a given body of discourse in a systematic and quantitative fashion" (Franzosi 2004, *quoting Kaplan 1943, 230*). By first selecting a text or a group of texts based on prior assumptions and existing work, one selects a particular characteristic, or set of characteristics, from the text, and reduces the texts by categorising based on a systematic coding scheme (Franzosi 2004). To be amenable to quantitative analysis, the required coding scheme should contain clear differentiable categories which require as little interpretation as possible and are applicable over the whole body of texts (Drisko and Maschi 2015). As well as this interpretive reliability, a code must ensure unitizing reliability, meaning different coders would record data consistently at the same reduced expression (Weingart, Smith, and Olekalns 2004, 448). An underlying assumption here, is that texts can be studied objectively, and that the same use language refers to the same coding category regardless of culture, time, or context with the text (Franzosi 2004). One should capture all relevant data without omitting any, and ensure categories account for all data (Weingart et al., 446-448). The COPUOS reports in this study were hand-coded primarily to account for slight variations in our coding scheme for expressions of consensus and to ensure contextual information was more accurately considered. Because of this, our coding scheme is significantly more time-intensive, but should be more accurate than if done automatically with current technology.

We propose here a multi-level coding scheme for the COPUOS reports, capturing both data of sessions, such as the year, the number of attendees and the names of agenda items, as well as the core outcome of substantive discussions contained within the reports, i.e., whether consensus has been reached and to what extent. In reducing the COPUOS reports down to these elements, we hope to be able to uncover trends in COPUOS over time, topic, and committee as they relate to dynamics of participation and representation. As will be discussed later, by modelling this data we hope to offer explanations for the observed variation (or lack of) in consensus in COPUOS. Our data is limited almost entirely[1] to items within the reports, which

[1] With the exception to how we operationalise developing countries.

means we cannot explain by reference to variables beyond COPUOS, or within COPUOS but not codified within the reports. We do this for practical purposes, as well as to explore the extent of systematic information that can be extracted from such reports and outputs of IOs. We code within the report all items within the main body of the reports, representing the recommendations and decisions of the (sub)committee during each session. We therefore exclude items within the appendixes, such as the reports of Working Groups, proposals by states, and draft and final agreements.

Measuring Consensus

As our output is the expression of consensus, we based our coding scheme around reducing our data to the unit of the expression of consensus. Consensus is measured as the expression of agreement in absence of expressed opposition. We propose here a two-step approach to measuring our dependent variable consensus in the COPUOS reports that measures both the presence of consensus as well as the strength and applicability of consensus when it is reached. We measure consensus depending on the terminology used to express view of delegates and the (sub)Committee. COPUOS and subcommittee reports contain clear, deliberate, and systematic use of terminology to indicate whether views expressed have reached consensus. The schema was introduced by the LSC in 1978 and adopted by both the STSC and main committee in the same year (see COPUOS 1978a §18; and COPUOS 1978b, §82). Through this, COPUOS reports differentiate when a view has been expressed: by just one member state and is not actively shared by others, by multiple members, either when states speak on behalf of groups of states, be them long-term formalised blocks such as the Group of 77 and China, or more ad hoc arrangements centred around specific issues or proposals. When diverging views are offered, this too is indicated in reports under this scheme. As well, when COPUOS finds consensus, this is expressed by the Committee speaking as itself, communicating the agreed upon statement that resulting from bargaining in sessions. We can be confident that this has been used consistently throughout COPUOS reports since as a 2016 Compendium of Rules of Procedure requested by COPUOS and compiled by the Secretariat, repeats and reaffirms this use of language in reports (COPUOS 2016, 5-6). We can therefore create a coding scheme that, by going through the COPUOS reports, extracts views expressed and whether and to what extent these view express consensus. Our unit of coding is therefore the ‘view’, distinct from the paragraph within which views are contained collectively. One paragraph may contain multiple views expressing multiple levels of consensus, and so it must be possible to

differentiate between these. As well, paragraphs may not contain any views. As we are concerned with only views expressed by delegates or the committees themselves, we can ignore purely descriptive content or the actions of other entities, as well as information which does not contain clear distinguishable views. Our coding schema is thus as follows:

Table 1: Coding scheme for presence of consensus

Language	Consensus
"The view was expressed…"	1
"Some delegates expressed the view…"	2
"The (sub)Committee + [action verb]…"	3

For consensus to be coded as '3', we require that the expression must be explicitly by the (sub)Committee and must contain an action verb. The first condition precludes instances where it is uncertain which actor has reached agreement or when, with consensus dependent on all actors agreeing to the extent of not opposing, and having accomplished this during the session being recorded, expressions such as "it was agreed that" are excluded as it is unclear whether the Committee was the one that agreed, and whether agreement was reached during the current session or is being recalled. The second condition, that the expression of consensus contains an action verb, excludes instances where the Committee is not an active actor, but rather a passive recipient. We believe that instances where, for example, "The Committee was informed" do not constitute a meaningful, consensual, form of agreement but merely describe events that occurred to the Committee. Whilst we coded on a 3-part scale on the basis that it is explicitly laid out as such in the Compendium on the Rules of Procedure, for analysis purposes, as we are primarily interested in whether consensus is present or not, we collapse this down into a binary variable[2] and use this within our model. Whilst we lose some resolution of our dependent variable in doing this, we make this adjustment for analysis having extensively read and coded the reports, and noting that a 1 to 3 scale may not accurately represent linearly going from a complete lack of consensus (of singularly held views) to full consensus via partial consensus (of jointly held views). In some cases, a '1' may refer to one opposing position against a proposal that otherwise would have full consensus. As the scale is not continuous nor necessary linear, it is more appropriate and more accurate to interpret between simply views expressed with and without consensus.

[2] 0 = non-Consensus,
1 = Consensus expressed

Consensus Strength

We build on the categories provided by Austin and base our categorisation on the list of operative verbs encountered while coding the reports. In comparing the differences between illocutionary verbs Austin provides five categories: verdictives (which give or declare a verdict), exercitives (which exercise power), commissives (including promises, commitments, intentions), bebabitives (which refer to "social behaviour"), and expositives (which place an act in context of a broader statement) (Austin 1975, 151). In ordering these categories based in the context of an IO, one can scale these based on the level of action, force, or commitment implied by different illocutionary verbs. Exercitives have direct real-world consequences whilst commissives merely pledge or imply, but do not directly induce such consequences. Verdictives can establish something as fact or law, and as such as statement participate in the construction of a social reality. Fundamentally, if the purpose of a text is to express and create consequences through this expression, we can create a schema that orders categories based on the level of intended consequences within their action verbs.

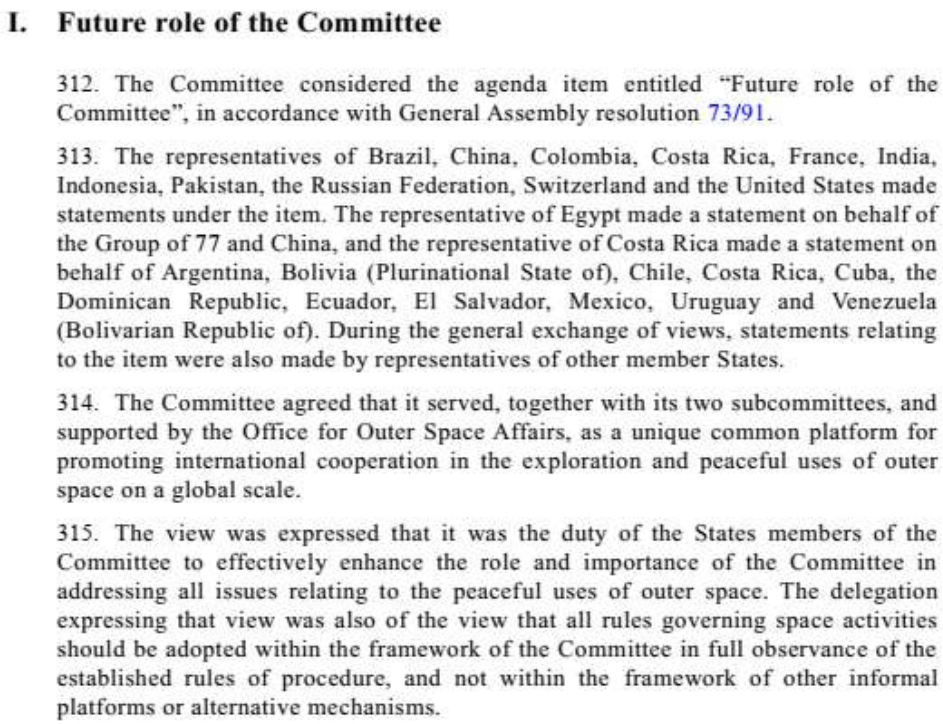
The presence of an action verb then contributes to our second step of measuring consensus, which is measuring its strength. The Committee committing an illocutionary act requires an action verb, as this conveys the actor deciding to take or commit to an action at a specific time, namely during the session in question. We therefore capture initially the action verb used when consensus is expressed. Where two separate action verbs are present in a view (e.g., "The Committee noted […] and requested…"), we count these as two different actions and so two separate expressions of consensus, assuming agreement had to be reached both to note and to request. When action verbs appear as a verb phrase (e.g., "agreed to consider"), we capture this entire phrase, as the entirety will contribute to our classification system. The classification system itself is dependent on the list of unique verb phrases captured, as well as a general understanding of their context gained through hand-coding the reports. In doing so, we reduce our external validity, as classifications are dependent on the context of their use within COPUOS, to strengthen our internal validity. The classification should be categorical and ordinal, so that similar and distinct word meaning are clearly recognisable from the categories, and that we can rank each category as representing stronger or weaker forms of consensus.

Table 2: Catergorisation scheme of operative verbs

Level	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Category description	**Records**	**Records with sentiment**	**Expresses sentiment**	**Continues or initiates discussions**	**Establishes as fact**	**Adopt or endorses**	**Commits or compels to act**
Example verbs	Noted, took note, acknowledged	Noted with appreciation, Noted with concern, Took note with satisfaction	Believed, Emphasized, Expressed with satisfaction	Discussed, Continued to consider, Reconvened	Agreed that, Decided that, Reached agreement	Adopted, Approved, endorsed	agreed to finalize, decided to invite, directed
Number of verbs	8	20	74	57	26	30	46

After collecting all unique instances of operative verb used, we have a list of 264 different verb and verb phrases. Based on the meaning of the verbs and general context of their use in the reports, we constructed a classification system based on 7 categories, ordered on the extent to which they commit the Committee to increasing levels of action with each verb categorised into only one category[3]. 'Weakest' forms of consensus are verbs that record, or express a sentiment, without directly endorsing, deciding, or creating any additional effects. A consensus becomes stronger, verbs are associated with creating such effects, such as signally the Committee has agreed to discuss something. When COPUOS establishes as a fact, states agree on a statement or set of statements, as reflecting their shared view. To adopt or endorse, we consider to be one-level above this, as giving official approval and advocation as a collective. Meanwhile, the highest level of consensus strength commits the committee to some activity, to cease it, or orders another actor.

[3] For the full categorisation scheme, see Appendix 2



I. Future role of the Committee

312. The Committee considered the agenda item entitled "Future role of the Committee", in accordance with General Assembly resolution 73/91.

313. The representatives of Brazil, China, Colombia, Costa Rica, France, India, Indonesia, Pakistan, the Russian Federation, Switzerland and the United States made statements under the item. The representative of Egypt made a statement on behalf of the Group of 77 and China, and the representative of Costa Rica made a statement on behalf of Argentina, Bolivia (Plurinational State of), Chile, Costa Rica, Cuba, the Dominican Republic, Ecuador, El Salvador, Mexico, Uruguay and Venezuela (Bolivarian Republic of). During the general exchange of views, statements relating to the item were also made by representatives of other member States.

314. The Committee agreed that it served, together with its two subcommittees, and supported by the Office for Outer Space Affairs, as a unique common platform for promoting international cooperation in the exploration and peaceful uses of outer space on a global scale.

315. The view was expressed that it was the duty of the States members of the Committee to effectively enhance the role and importance of the Committee in addressing all issues relating to the peaceful uses of outer space. The delegation expressing that view was also of the view that all rules governing space activities should be adopted within the framework of the Committee in full observance of the established rules of procedure, and not within the framework of other informal platforms or alternative mechanisms.

Figure 2: Example Section from COPUOS Report (COPUOS, 2019)

Table 3: Indicative coding of consensus metrics

Committee	Year	Agenda Item	Sub Agenda Item	Simplified Agenda Item	Paragraph	Consensus	Operative verb	Consensus strength
C	2019	Future role of the Committee	0	Future role and work	312	3	considered	4
C	2019	Future role of the Committee	0	Future role and work	314	3	agreed that	5
C	2019	Future role of the Committee	0	Future role and work	315	1		
C	2019	Future role of the Committee	0	Future role and work	315	1		

Participation

Participation is presented in two main levels in the COPUOS reports, the year and the agenda item. Participation at the level of the year is included in the reports through the membership at the time that the session took place[4], the number of attendees who were present at the session, including state and non-state participants, as well we take the number of speakers during the general exchange of views to be representative of annual participation. Whilst we code both the number of members and the number of attendees in our analysis, we prefer to use the number of attendees as a more accurate representation of those present for discussion. We differentiate as well between non-state and state attendees to probe the conjecture that while an increase in the number of state parties should be associated with a decrease in reaching consensus, increasing non-state participation is often associated with increased levels of decision making. At the level of the agenda item from 2005 every agenda item discussed also includes the list of attendees who made statements for this agenda item. This does not necessarily mean that only these attendees participated in discussions at all on the agenda item, but that those are the states that gave an opening statement on the topic. In this regard, the number of states per agenda item could also be taken to indicate the salience given to that topic, with more speakers implying that more states perceive the issue as of enough importance to prepare a statement on it.

Agenda Item

COPUOS has discussed a range of agenda items over its history and has adapted agenda items as aspects are resolved or new ones raised. Adding or removing an item to the agenda in COPUOS requires consensus or instruction by the UNGA. Renaming an agenda item is also subject to the same conditions, and over time agenda items change their titling, for instance by becoming more specific, by highlighting a certain issue within the item, or to acknowledge other actors work on the topic. Agenda items often also contain sub-agenda items, dealing with specific aspects of an agenda item. This is particularly important in the work of the main committee, which annually deals with the agenda items that examine, and endorse, the work of the subcommittees. Within these discussions on the report, items that are not separately discussed in the main committee can then be addressed. It is important that we capture the most accurate agenda item for each view, but also that we can compare between (sub)committees

[4] This lag explains the discrepancy between the dataset and the membership evolution figures provided (UNOOSA n.d.(a))

and across time. We therefore coded for each view expressed the precise agenda item as it appears in the report, along with two levels of sub agenda items within one variable, with the second level separated with a colon[5]. This provided 198 unique agenda items and 456 unique sub agenda items. To enable comparison whilst accounting for changes across time and subcommittee we first extracted a list of the unique combinations of agenda items and sub agenda items together, of which there were 784, and then categorised them depending on the main topic the referred to. We categorised based on the primary substantive item to referred to in the agenda and sub agenda item, interpreting and selecting when necessary, based on understanding of the main topics of debate in COPUOS. In cases where agenda items are considered jointly, we categorised them both within a single entry separated by an '&'. A list of the resulting simplified agenda items is contained in Appendix 1.

Theme

Many, if not all, of the topics themselves relate to a broader geopolitical, technological, or social theme, which as we have seen is considered to affect the capability to resolve negotiations. Security and sovereignty themes are hypothesised as least likely to result in agreement. We measure this by choosing a selection of five themes (Security, Geostationary Orbit, Environment, Development, Future Direction of the Committee) and assigning related agenda item topics to these themes. We chose themes that reflect both broader geopolitical issues, such as security, as well as for fitness within the context of discussions in COPUOS. We use the agenda item topic regarding Geostationary Orbit and the Definition and Delimitation of outer space as our measure of topics related to sovereignty, as the predominant cleavage within these discussions in COPUOS revolves around sovereignty. We recognise however that the generalizability of this metric is limited due to the specific nature of the topic of the geostationary orbit. Security, although not directly discussed within COPUOS's agenda items, is often central to discussions in the agenda item "Ways and means of maintaining outer space for peaceful purposes". We also code and measure themes of Environmental[6] and Development issues based on the relevant agenda items, as well as issues related to the future direction of COPUOS, such as new agenda items and future working methods, to see how the vision of COPUOS itself is subject to contestation among states. Not all agenda items are

[5] Occasionally, there are more than 2 sub agenda items. In these cases, we excluded the least relevant on to comparison.

[6] Environmental here refers to both the space and Earth environment, meaning both agenda items related to climate change and to space debris are included.

represented in these categories, and as such will provide the baseline for our model, however our selection of themes does provide an examination of the theoretically contentious topics geopolitically, some of the most important topics discussed across COPUOS's different committees, as well as over how the institution is controlled in a strategic sense. Agenda items do often relate to multiple themes simultaneously, for example Space Debris, although coded as an Environmental issue, also contains security aspects, such as anti-satellite weapons tests, and security of space assets. We believe that we have coded based on the primary thematic framing of the issue as it appears in COPUOS discussions and beyond, however, readers should bare this in mind.

Developing Countries

The distinction between developing and developed countries is best questionable but remains a useful dichotomy which states themselves sometimes utilise in negotiations to place their interests within broader cleavages. There are no clear undisputable definitions of developing countries. For this study, we use Davis and Bermeo's (2009) operationalisation of developing countries, as those within the low to upper middle categories of income from World Bank data (2023). To account for our time period, we define a developing country as a country who, in the majority of the period studied, is classified as between low to upper middle by the World Bank. From this, we create a reference list of 176 developing countries[7]. We capture the list of speakers during for the general exchange of views as well as for each agenda item, as well as the number of total speakers for both. From this, we use our reference list to search in each agenda and count the total instances of developing countries participation. We then calculate, for each agenda item and for the general exchange of views, the proportion of developing countries who participated in speeches.

Data Analysis

In exploring our data, we first hope to explore connections between our variables and in our variables over time. By doing this, we can understand the distribution of data in our variables and make general broad statement about individual aspects of COPUOS. This will inform our later explanatory panel model, in highlighting skews in our data, and enable us to identify potential trends in COPUOS in consensus, participation, agenda items discussed, and

[7] This list includes non-member states of COPUOS, who may still attend and make speeches. For the full list of developing countries see Appendix 3.

differences in these between the (sub)Committees. This is particularly important as differences between the subcommittee or over time allow us to better interpret our explanatory model and place our results in context of developments and dynamics of COPUOS's subcommittees. To test for significant between two variables, we will primarily use Analysis of Variance (ANOVA) tests, which test the difference between means of more than two groups. Compared to a two-sample t-test, which tests for differences in means between two 'samples' ANOVA enables us to test, for example, whether participation through the number of speakers is on average different between the main committee, LSC, and STSC. To see pair-wise comparisons between each combination of group, we conduct a Tukey Honestly Significant Difference (HSD) test.

We then run a series of panel data models. Panel data methods begins by taking multiple observations of individuals over time, measuring the dependent variable in reference to an individual, a time, and a group, considering both time-dependent and time-constant variables (Petersen 2011, 1-4). Our data is a multi-level time-series panel dataset containing all coded views expressed in the reports of COPUOS and its subcommittees between 1990 and 2022. Multi-level data contains information coded at different scales, in this instance the primary distinction between our levels are variables at the level of the session, such as the attendees, and the level of the agenda item, such as the number of speakers per agenda item. Transforming our data into a panel dataset requires aggregating our data along the correct levels, of which up to three is possible (Individual, Time, and Group). The appropriate individual cross-section is the simplified agenda item, as this is the level most data reduces to. For example, the number of speakers and the proportion of developing country speakers are both coded at this level. We group at the simplified agenda item, rather than the original agenda item, as this makes possible the tracking of consensus across time and subcommittee even where the precise naming of the agenda item changes slightly. The success of this choice, and so our ability to compare consensus across time and group, thus depends on the validity of our categorisation into simplified agenda item.

Observations should be unique, meaning that for every Individual-Time-Grouping, there should be only one observation. As such, from our original dataset, to convert this into a panel dataset for analysis, we aggregate our data values based on the mean for all variables (other than Consensus Strength, for which as an ordinal categorical variable the median is more

appropriate especially with non-normal distribution) within each unique individual-time-group combination[8].

We analyse our panel data to gauge statistically significant associations via a linear panel data model. Our data is unbalanced, meaning that our individuals (the simplified agenda items), do not all have observations at all points in our period, as topics are added or removed. This is common in most panel datasets, but requires foreknowledge in interpreting results (Petersen 2011, 4). Panel data models come in a variety of forms for different purposes and types of data. Fixed and random effects panel data models analyse effects of individual-specific and time-invariant characteristics on the dependent variable respectively. Using a random-effects model enables the estimation of both within-group and between-group variations in the panel data, which helps us to control for unobserved individual-specific characteristics that are constant over time, which can bias the estimates in fixed-effects models (Petersen 2011).

In random effects models, we assume that individual errors, either from measurement errors or unobserved variables, are unrelated to our dependent variables, in other words that we have "strict exogeneity" (Woodbridge 2010, 252-253). If this is not the case, and we have time-invariant omitted variables that are correlated with both the independent variables and the dependent variable, the random effects estimator may be biased and there may be unobserved factors that are correlated with the independent variables. To some extent, due to the scope of our data being limited to the COPUOS report, we must accept the likelihood of additional unobserved factors that may be correlated to the independent and dependent variable, however, a random-effects model offers advantages in terms of capturing unobserved heterogeneity and providing estimates of average effects across agenda items, which enables us to generalise beyond the specific agenda item (Petersen 2011).

As our additional variables are time-varying and tend to change for each agenda item, a random-effects model should be more appropriate. Although we expect a random-effects model to be better suited to our data, we conduct a Durbin–Wu–Hausman test, which compares a fixed and random model and indicates which is more appropriate. Should the results of this

[8] e.g., "Space Resources-2019-C", contains the average values for all variables for discussions on space resources within the main Committee in 2019

test indicate a fixed effects test as more appropriate, we will adapt our model in line with its assumptions.

A one-way random effects model can be expressed as follows:

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 z_i + v_i + e_{it}$$

With additional variables incorporated as:

$$y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 z_i + \sum_{j=1}^{J} \beta_{j+2} w_{itj} + v_i + e_{it}$$

In the above equation, y_{it} represents the outcome variable for individual *i* at time *t*. $\beta_0$is the intercept term, indicating the value of y_{it} when all other variables are equal to 0. $\beta_1$is the coefficient of x_{it}, representing the effect of the variable x_{it} on y_{it}. This shows how a one-unit increase in x_{it} affects the outcome y_{it}, keeping other variables constant. β_2, the coefficient of z_i, represents the effect of the variable $z_i$on y_{it}. This portion captures how a one-unit increase in z_i affects the outcome y_{it}, again keeping other variables constant. $\sum_{j=1}^{J} \beta_{j+2} w_{itj}$ represents a summation term that captures the cumulative effect of a number, *J*, of additional variables added to the model under the same logic of initial independent variables. The individual error term, v_i, represents the individual-specific or unobserved factors that affect agenda item *i*. This tells us the unobserved heterogeneity among the agenda items that is constant over time. Meanwhile e_{it} is the time-specific error or unobserved factors affecting y_{it} at time *t*., showing the variation or fluctuations in y_{it} that are specific to each period.

We will conduct two panel data models, with consensus measured in the first as its attainment and the second as consensus strength. Doing this allows us to understand and compare both the reaching a consensus and its strength against each other, as two components of consensus, alongside the variables that affect each of them individually. As such in model 1, our outcome variable (y_{it}) will be the attainment of consensus as a binary variable and aggregated within our panel data grouping combination. In model 2, y_{it} will be the strength of consensus, aggregated instead by its median with the panel data group, as this is more appropriate measure of central tendency for ordinal categorical variables. In both models, the independent variables are identically selected and aggregated. They are: the year, allowing us to measure consensus

over time, the committee, with the main committee as the reference, the number of annual attendees, number of state observers, number of non-state observers, number of state speakers per agenda item, number of non-state speakers per agenda item, the number of state speakers in the General Exchange of Views, the number of non-state speakers in the General Exchange of Views, the proportion of developing countries as speakers per agenda item, the proportion of developing countries as speaker during the General Exchange of Views, as well as each thematic issue (Security, Geostationary, Environment, Development, and Future Direction of the Committee) separate as a binary variable. We will assign a standard significance level of $p < 0.05$ to all hypotheses.

We will also conduct a series of tests on our models to understand the level of heteroscedasticity and serial correlation in our models. Heteroscedasticity refers to non-constant variance within cross sections or across time. In a random effects model, the error term is assumed to have constant variance (as in is homoscedastic), and so the presence of heteroscedasticity can violate this assumption, resulting in biased standard errors, leading to incorrect or potentially unfounded inferences (Rosopa, Schaffer, and Schroeder 2013). Whilst heteroscedasticity can result from a range of factors, it is important to identify and account for. Should heteroscedasticity be present, we will attempt remedy this by calculating robust standard errors which account for this heteroscedasticity. Serial correlation, meanwhile, is the correlation of an observation with an equivalent observation at a different time (Drukker 2003). In the context of our study, the presence of serial correlation could signify that the propensity to find consensus in one year is correlated with the propensity to have reached consensus in the previous year, or that the number of speakers during one session is correlated with the number of speakers during the next. This is common issue in time-series data, and whilst still a potential problem that can affect our model and the inferences we draw, can too be mitigated by calculating an incorporating into our model robust standard errors.

Chapter 4: Results

Descriptive

Number of Views Expressed.

From 1990 to 2022, we coded a total of 21,371 views expressed within the COPUOS reports across 95 sessions[9]. COPUOS has seen a steady increase in the number of views expressed in its reports since 1990 to the extent that recent years are characterised by almost double the amount of views expressed than those in the early 1990s (see Figure 3) Notable outliers of years far fewer views expressed that normal are 1999, in which the regular COPUOS session were greatly reduced for the UNISPACE II conference, and 2020, in which only the STSC managed to meet in person in February before the Covid-19 pandemic caused the main committee and LSC met jointly online and made decisions by written procedure.

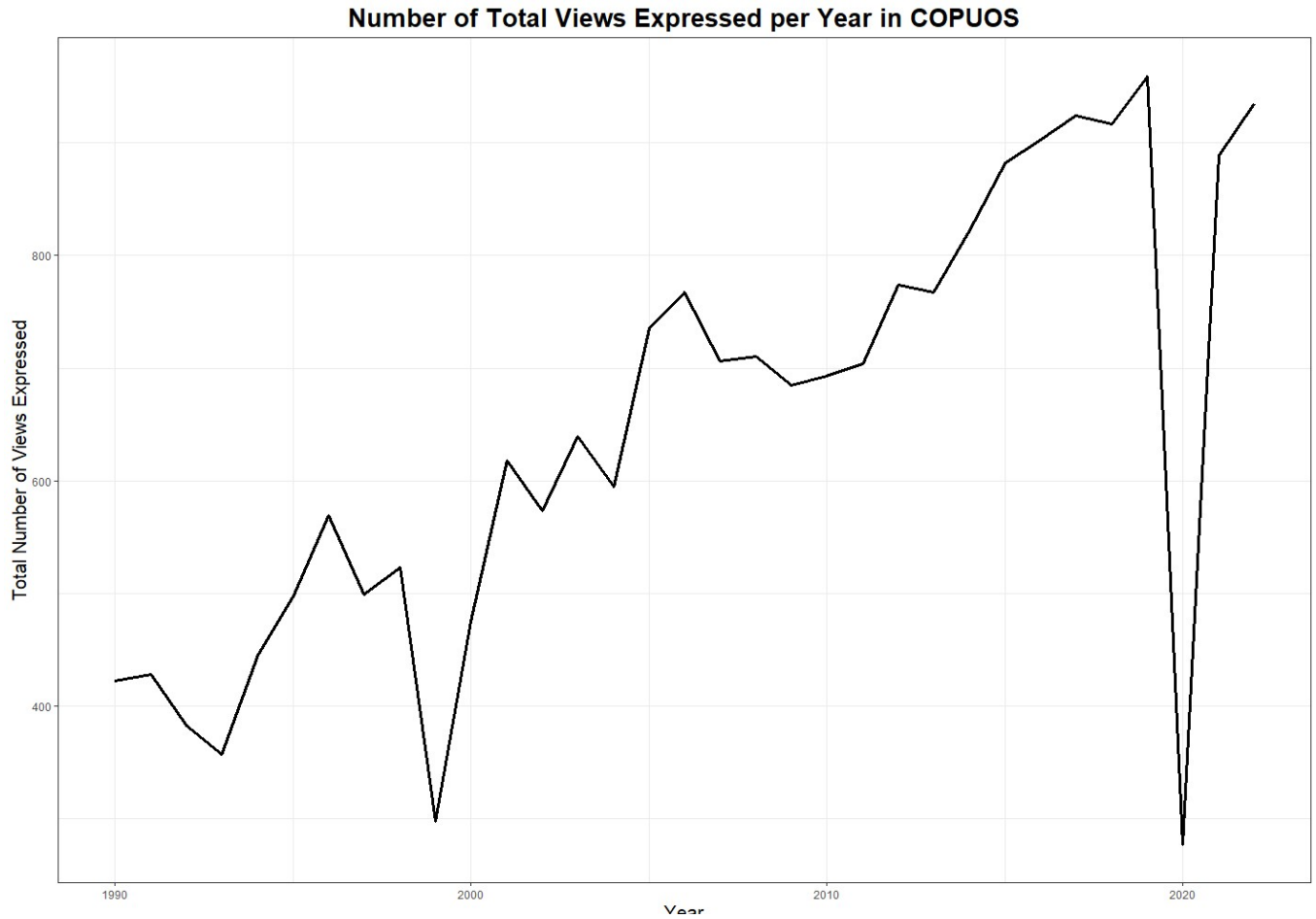


Figure 3: Number of Total Views Expressed per Year in COPUOS

[9] The joint session of the LSC and main committee in 2020 is coded as two separate sessions, demarcated as in the report.

Consensus

Consensus represents the majority (66.9%) of views expressed in the COPUOS reports. Views that are coded as either "1" or "2", representing views expressed by individuals and multiple, but not all, delegates respectively, are more or less equal in their frequencies. Figure 4 shows the number of total views expressed over time by the level of consensus and between the different (sub)committees. Across the committees, increases in the number of total views have expressed are composed of increases in all three levels of consensus, however additional views expressed appear disproportionately composed of non-consensus views. In the LSC within the past five years, a significant increase in the number of individual views can be noted, which could constitute an increasing diversity of individual views, or increasing obstruction of consensus by singular parties. The beginning of the millennium, in which the subcommittees reformed their working methods (McDougall 2000), particularly to enable more and broader discussions in the LSC, appears to have been effective.

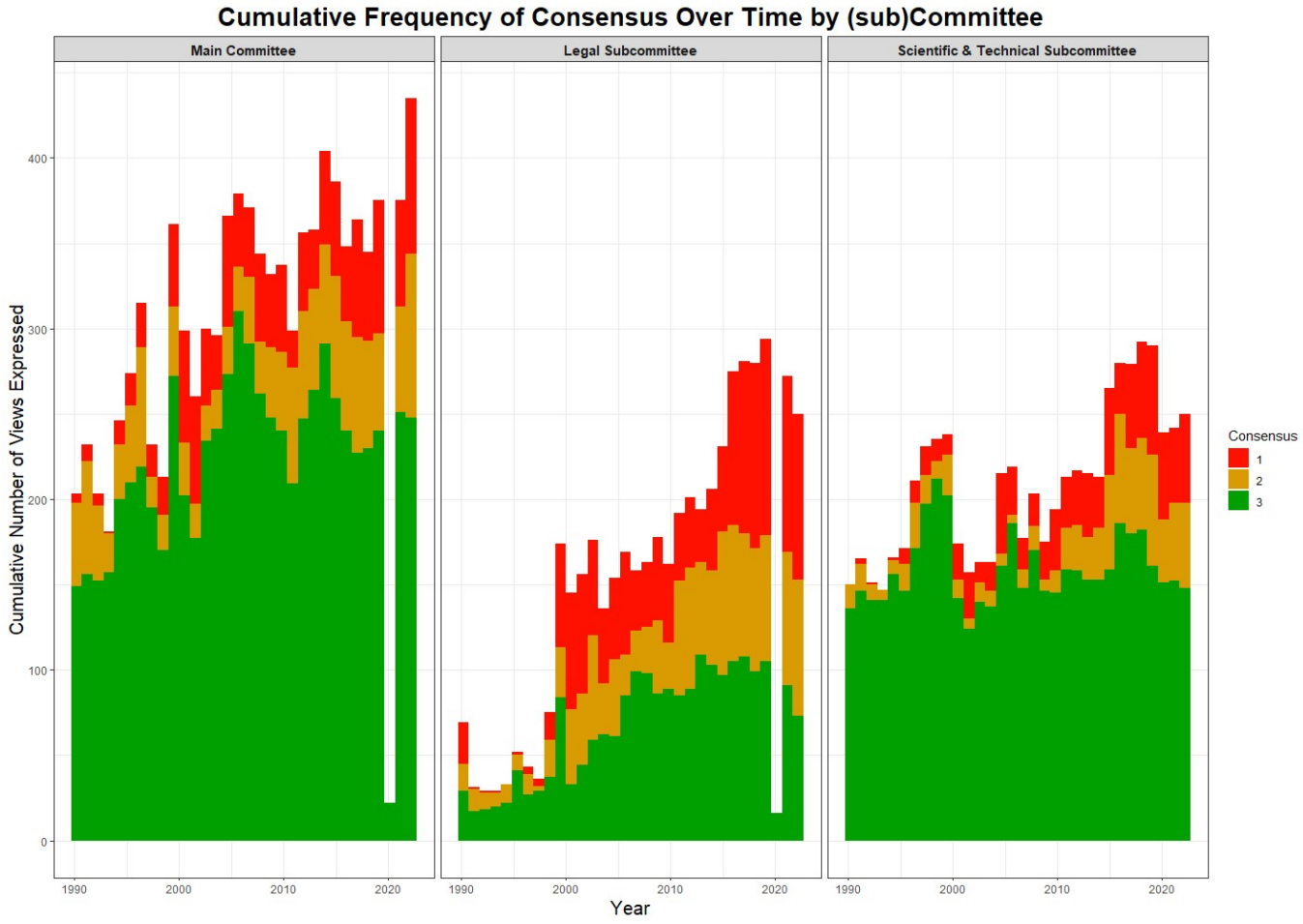


Figure 4: Cumulative Frequency of Consensus Over Time by (sub)Committee

Consensus Strength

Despite being the level with the fewest number of operative verbs (8), verbs which signified the lowest level, those that only express something being recorded, are the most frequent expressions of consensus. 44.2% of observations with consensus belong to this lowest level, of which 82.4% are coded as 'noted' (representing 36.3% of total expressions of consensus). Observations in the highest level of consensus are the least frequent expressions of consensus, with just 328 observations. 95 action verbs are used only once. The use of ten most frequent of our 234 action verbs constitute 80% of all expressions of consensus, indicating a regular use of certain established verbs. Half of the ten most frequent action verbs represent the lowest two levels of consensus, with none from the highest level. The most frequent verb from the highest level (7) is "decided to invite", which is expressed 95 times, often to officially declare offering, typically non-state, external actors the opportunity the address the (sub)committee on a specific relevant issue.

Table 4: The 10 Most Frequently Used Action Verbs in COPUOS Reports

Action Verb	Consensus Strength	Number of observations
Noted	1	5195
Agreed that	5	1129
Noted with satisfaction	2	1040
Took note	1	986
Noted with appreciation	2	714
Endorsed	6	622
Considered	4	516
Welcomed	3	453
Recommended	6	410
Expressed its appreciation	2	379

(Sub)Committee

Out of the 95 total sessions analysed, those in which more than 50% of the views expressed are not of consensus have occurred 18 times, all of them sessions of the LSC. By calculating the proportion of consensus views for each session, we can chart how these changes over time. Figure 5 shows that the LSC reports consistently contain the lowest proportion of consensus views, with the year 2001 recording just 22.8% of views expressed as consensus. All committees show a decreasing trend in the proportion of consensus views over time, especially in the, STSC for which the proportion of consensus views decreased from an average proportion of consensus views from 91.3% for the five-year period between 1990 and 1995 to

61.3% between 2017 and 2022. The main committee appears to vary less in the proportion of consensus views expressed than the subcommittees, and although there is a slight negative trend in the proportion of consensus views, the extent to this is not yet clear. The joint 2020 session of the main committee and the LSC is a clear outlier, where both recorded 100% level of consensus, discussing almost exclusively procedural and administrative items regarding the next session.

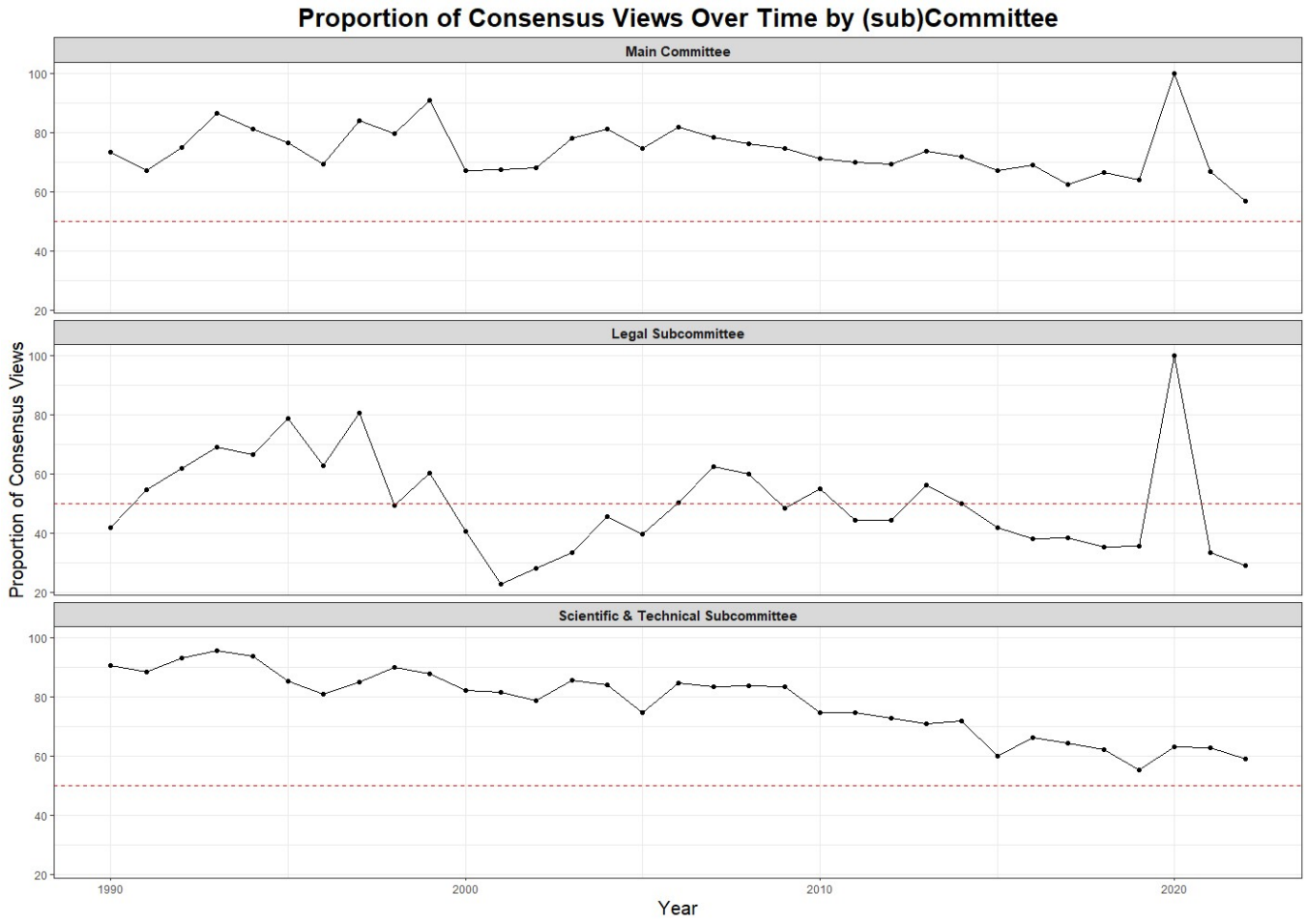


Figure 5: Proportion of Consensus Views Over Time by (sub)Committee

The LSC contains the lowest number of observations in each level of consensus strength, apart from views which express the highest form of consensus, which is rarest in the STSC. The largest discrepancy between the (sub)committees is the far fewer observations of the weakest level of consensus within the LSC compared to both the main committee and the STSC. This creates an interesting contrast with our other observations so far, which have identified a lower frequency of and proportion of consensus views within the LSC, yet as Figure 6 displays, its largest deficiency compared to the other committees is the form of consensus which implies

the least amount of action taken. Both the STSC and main committee see their share proportion of consensus views expressed as the lowest level of consensus. The main committee has a distinctly lower number of observations in the fourth level of consensus strength, which refers to verbs which "initiate or continue discussions and negotiations", meanwhile the STSC notes a dip in the fifth level, referring to verbs which "establish as a fact", which runs counter to our theory that scientists discussing scientific issues would find agreement more frequently on establishing facts than lawyers. Instead, the LSC contains more observations in this category. Overall and between the (sub)committees, we do not see that the number of words in each category corresponds to the number of observations, suggesting most action verbs tend to be used infrequently.

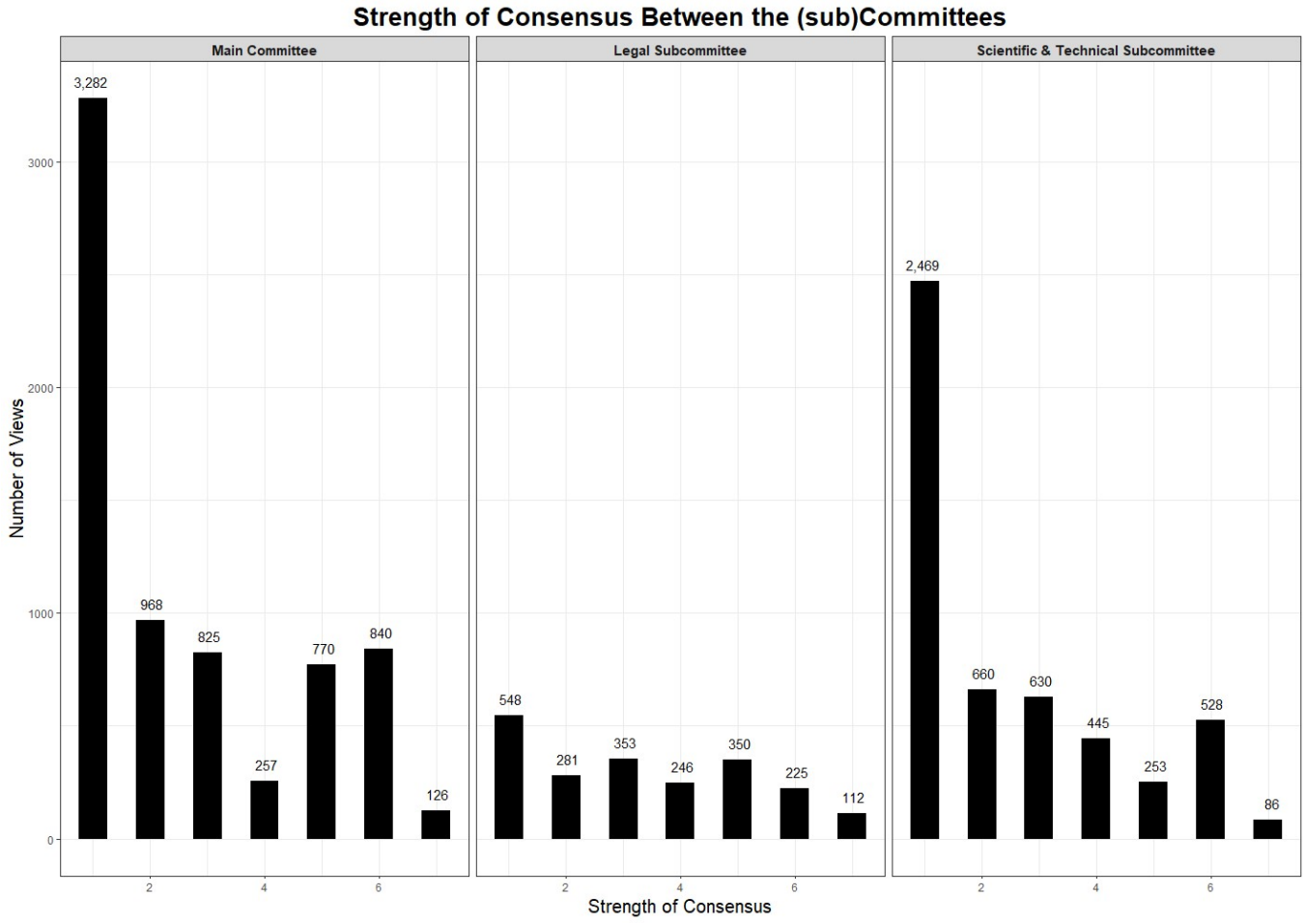


Figure 6: Strength of Consensus Between the (sub)Committees

Membership, Attendance, and Participation

The number of members, attendees, and speakers in the general exchange of views have all increased over the period analysed. Enlargement of the committee membership has increased

in frequency since 2010, with new members accepted in every year with the exception of 2021, which due to the previous year's reduced session saw no new members join. COPUOS in 2022 had 88.7% more full members than it did in 1990, from 53 members to 100 during the 2022 session. Developing countries have composed the majority of members from 1990 to 2022 and have seen their proportional split of the membership increase from 54.7% in 1990 to a high of 75.3% in 2015. In all three committees, the number of attendees in each session has also increased, with similar levels of attendance across the committees. The main committee sees perhaps slightly higher levels of attendance than the subcommittees in general whilst the STSC appear to see slightly higher levels of attendance than the LSC (see Figure 7). To see if there is a statistically significant difference in the average number of attendees in each subcommittee, we conducted an ANOVA test. We do not find a statistically significant difference between the average levels of attendance in of the subcommittees (p=0.11), neither in any pairs of subcommittees using an HSD test.

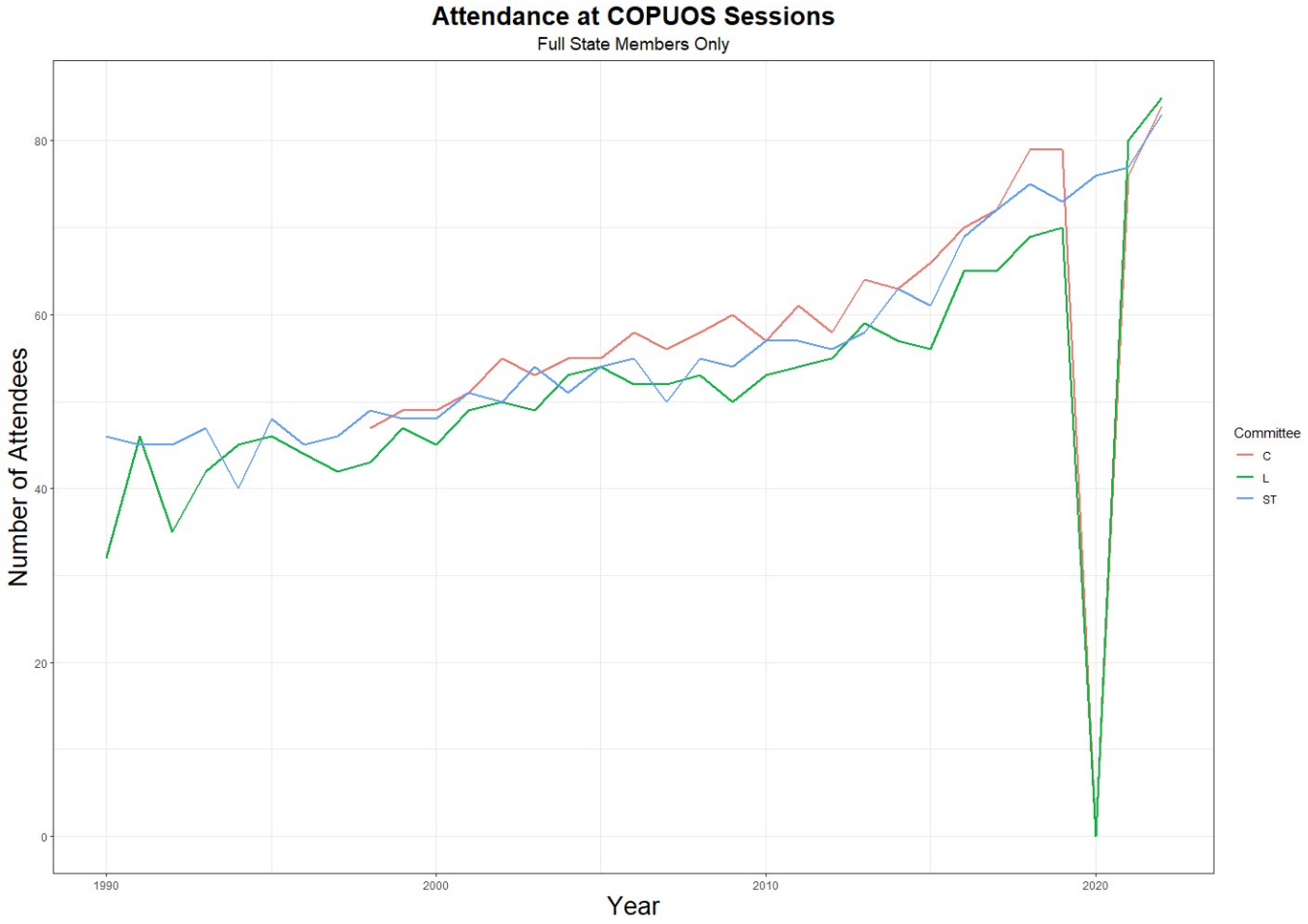


Figure 7: Attendance at COPUOS Sessions

Attendance by non-state actors, comprised of other UN agencies, other IOs, NGOs, think-tanks, and other associations, has seen a dramatic increase, especially after 2005, in all three subcommittees. In particular the STSC appears to see that largest number of non-state observers attending its sessions. An ANOVA tests as well as an HSD pair comparison reveals a statistically significant difference in the average number of non-state observers between subcommittees. Whilst the HSD pair comparison finds no statistically significant difference between average attendance by non-state actors between the STSC and main committee (diff=4.2, p=0.96), we do report a statistically significant difference between the LSC and main committee (diff=-6.2, p=0.007) and a larger difference between the LSC and the STSC (diff=-10.4, p=0.000). The LSC tends to see less non-state observer attendance at its sessions than either other committee, even though it is itself seeing increasing attendance by non-state observers over time.

Participation in the committee's general exchange of views has also increased over time in all three committees, with the main committee also seeing generally higher numbers of speakers than the two subcommittees, who tend to see quite similar number of speakers in their general exchange of views (see Figure 8). We tested overall the difference between the (sub)committees in the average number of speakers in the General Exchange of Views using an ANOVA test. We find a statistically significant difference between the groups (p=0.001) and when tested in pairwise manner using an HSD test we find statistically significant differences between the LSC and Main Committee (diff=-10.49, p=0.001), as well as between the LSC and STSC (diff=-8.48, p=0.01), but not between the STSC and main committee. In both significant instances, the LSC sees less speakers on average during its General Exchange of Views than the other committees.

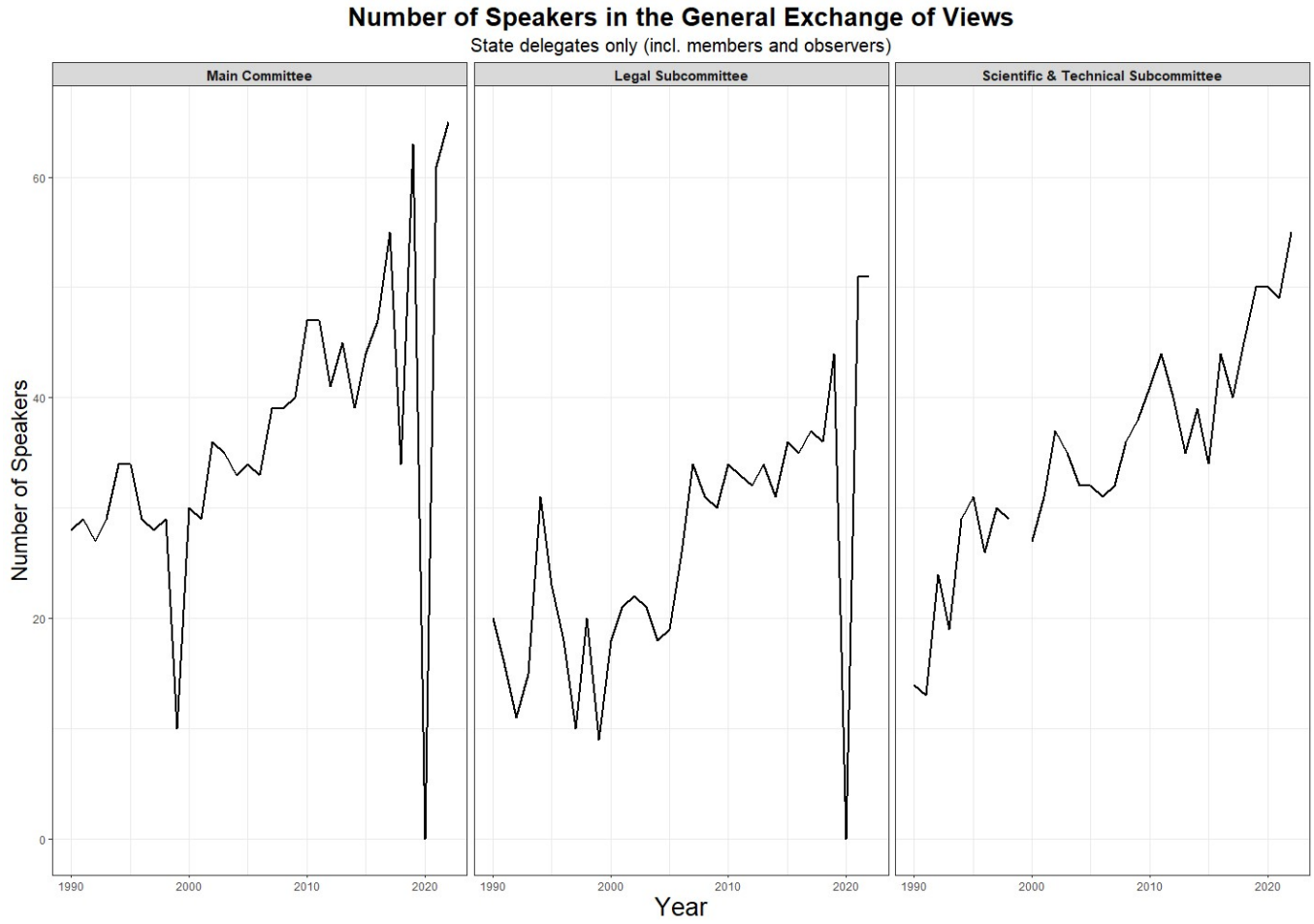


Figure 8: Number of Speakers in the General Exchange of Views

The number of speakers per agenda item is only recorded in the COPUOS reports from 2000 onwards. Most agenda items see less than 20 speakers, with a mean of 14.4 speakers for each agenda item, and many agenda items feature 0 speakers making statements. Over time, although we see increasing participation in some agenda items, characterised by an increasing range between the most participated in agenda items and the rest, across all observations it is difficult to distinguish a trend of increasing speakers per agenda item (see Figure 9). Between the subcommittees, we find a statistically significant difference using an ANOVA test ($p=0.003$), with pairwise comparison showing a difference between the STSC and both the main committee (diff=-3.1, $p=0.005$) and LSC (diff=-2.6, $p=0.04$), meaning the STSC tends to have less speakers per agenda on average than the other committees, however as Figure 9 shows, this trend may not hold in recent years.

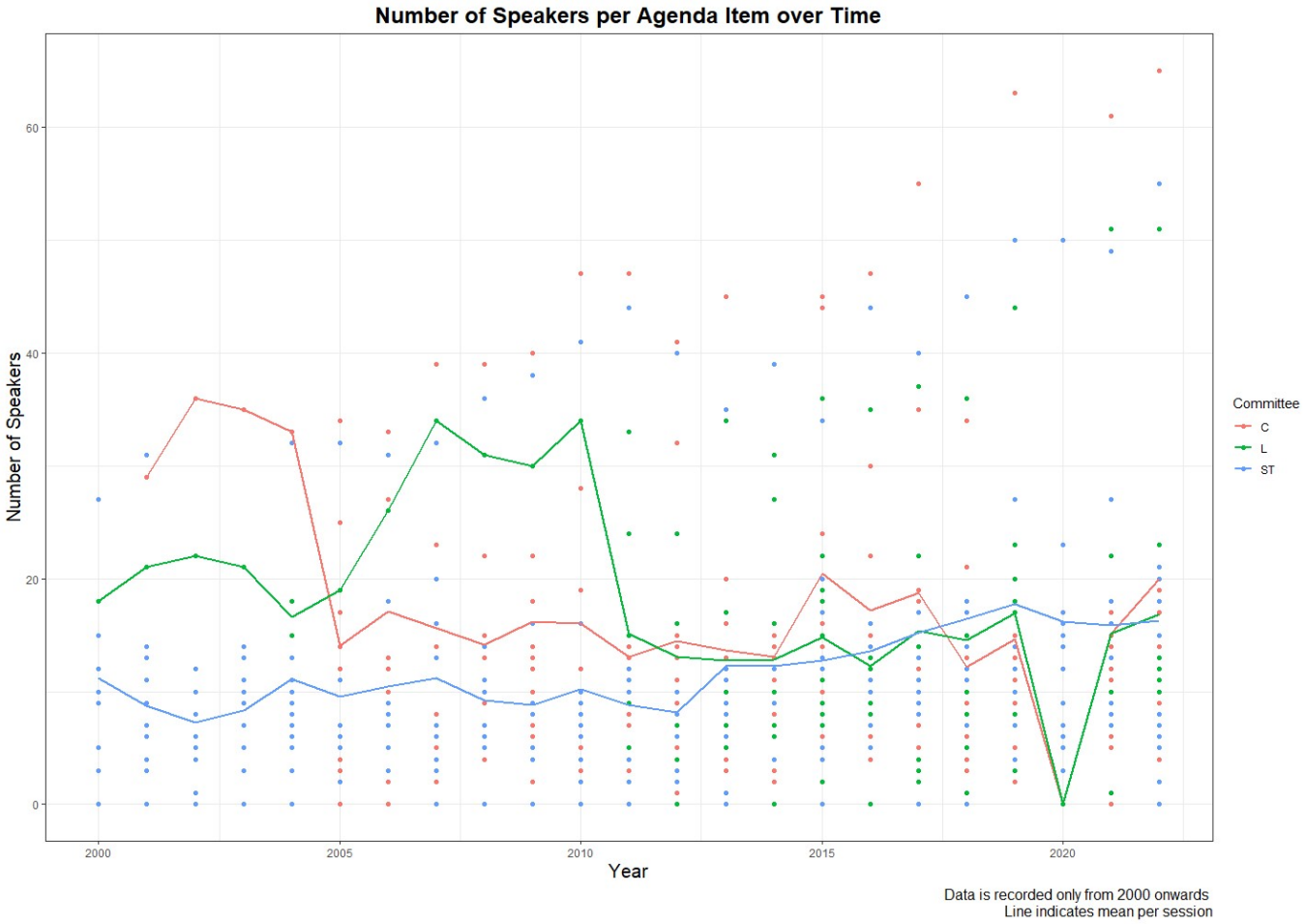


Figure 9: Number of Speakers per Agenda Item over Time

Generally, only up to one non-state speaker participates per agenda item, (1st quartile=0, 3rd quartile=1), although in the General Exchange of Views this can be much more, with a recorded high of 19 during the 2022 session of the STSC. The most recorded non-state speakers on a specific substantive agenda item were on "General exchange of views on the application of international law to small-satellite activities" in 2022, in which there were 12. Whilst the average number of non-state speakers per agenda item does not appear to be increasing over time, the maximum number of non-state speakers does appear to be. Between the subcommittees, on average whilst the main committee and LSC used to have the highest number of non-state speakers, in recent years it appears that the STSC sees slighter greater participation on average (see Figure 10).

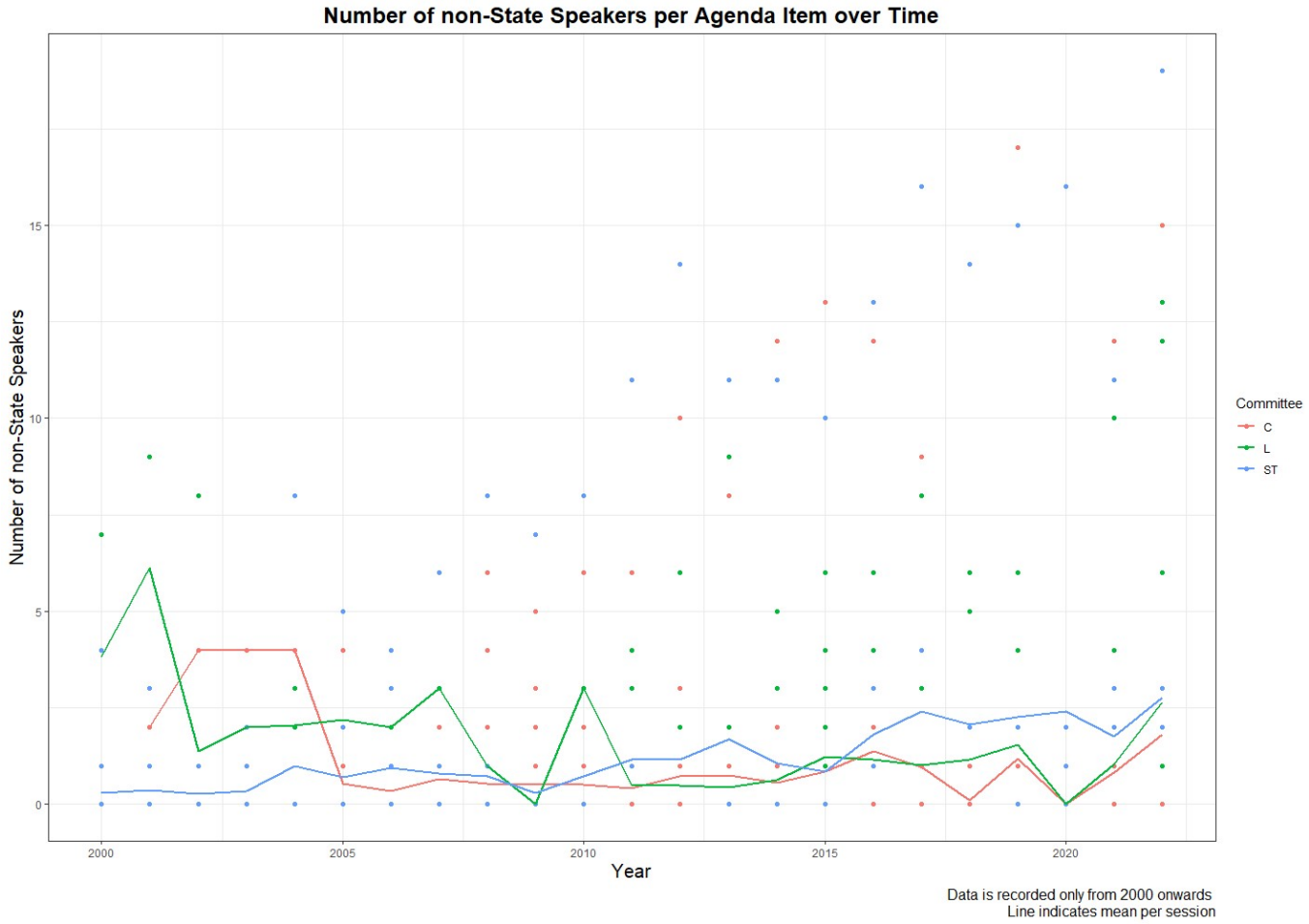


Figure 10: Number of non-State Speakers per Agenda Item over Time

Developing countries consistently constitute the majority of speakers during the General Exchange of Views and tend to constitute the majority during individual agenda items, with an average of 60% of speakers during agenda items being delegates from developing countries (see Figure 11). This is broadly in line with the proportion of the membership composed of developing countries, suggesting they are fairly represented in speeches on agenda items. Over time, particularly in the LSC and main committee, the proportion of developing countries speaking per agenda item appears to be decreasing, whilst in the STSC it is increasing (see Figure 11). We do not note any statistically significant difference between the (sub)committees in the proportion of developing country speakers during the General Exchange of Views ($p=0.18$) nor per agenda items ($p=0.07$).

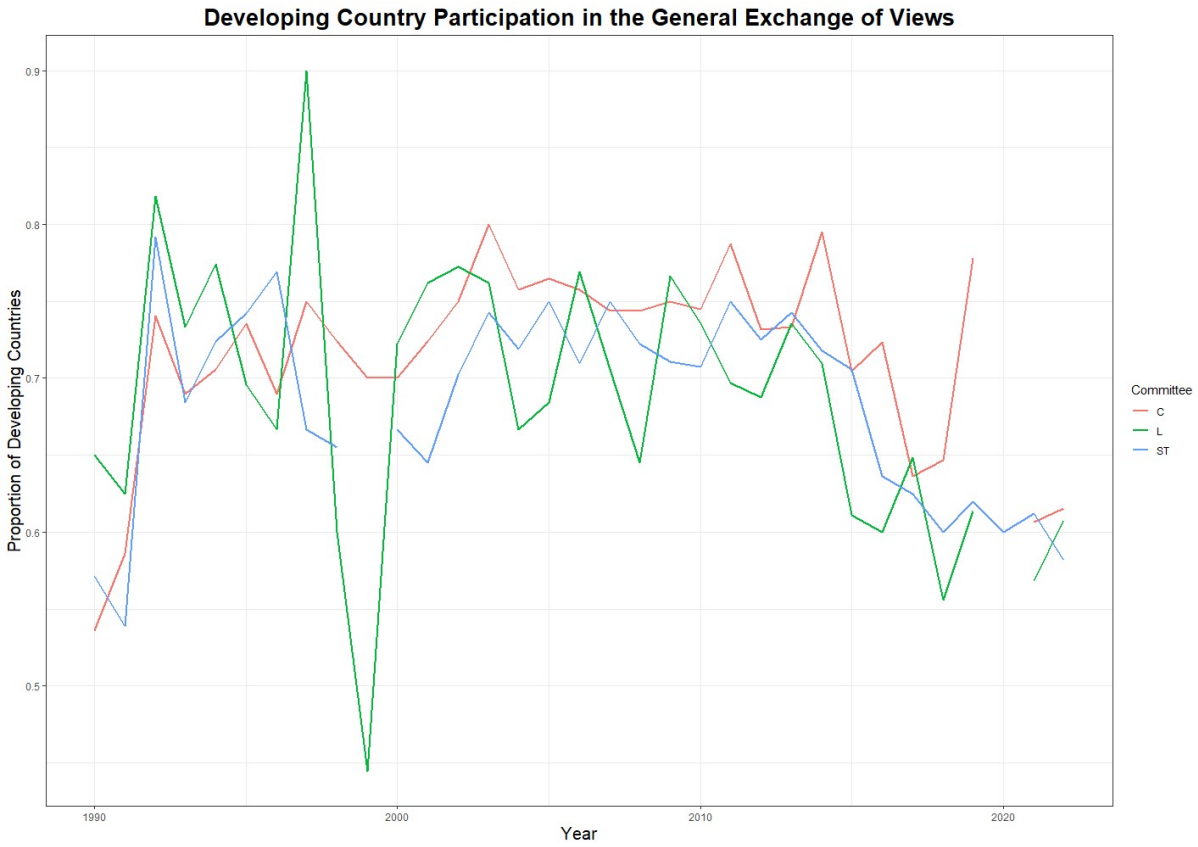


Figure 11: Developing Country Participation in the General Exchange of Views

Agenda items

All three committees have increased the number of agenda items they discuss and in recent years discuss a similar number of agenda items (see Figure 12). The LSC has seen the steepest increase, in particular between 1999 and 2000 which could be related to changes enacted in the working methods of the subcommittee, specifically intended to facilitate the additional and removal of agenda items (McDougall 2000). The change was also implemented in the STSC, however we do not see a concurrent increase in addition to agenda items when taking into account the 1999 STSC session being greatly reduced for the UNISPACE II conference. In every year recorded prior to UNISPACE II the STSC discusses the most agenda items of the sub(committees) and so already likely had a more complete schedule for its sessions.

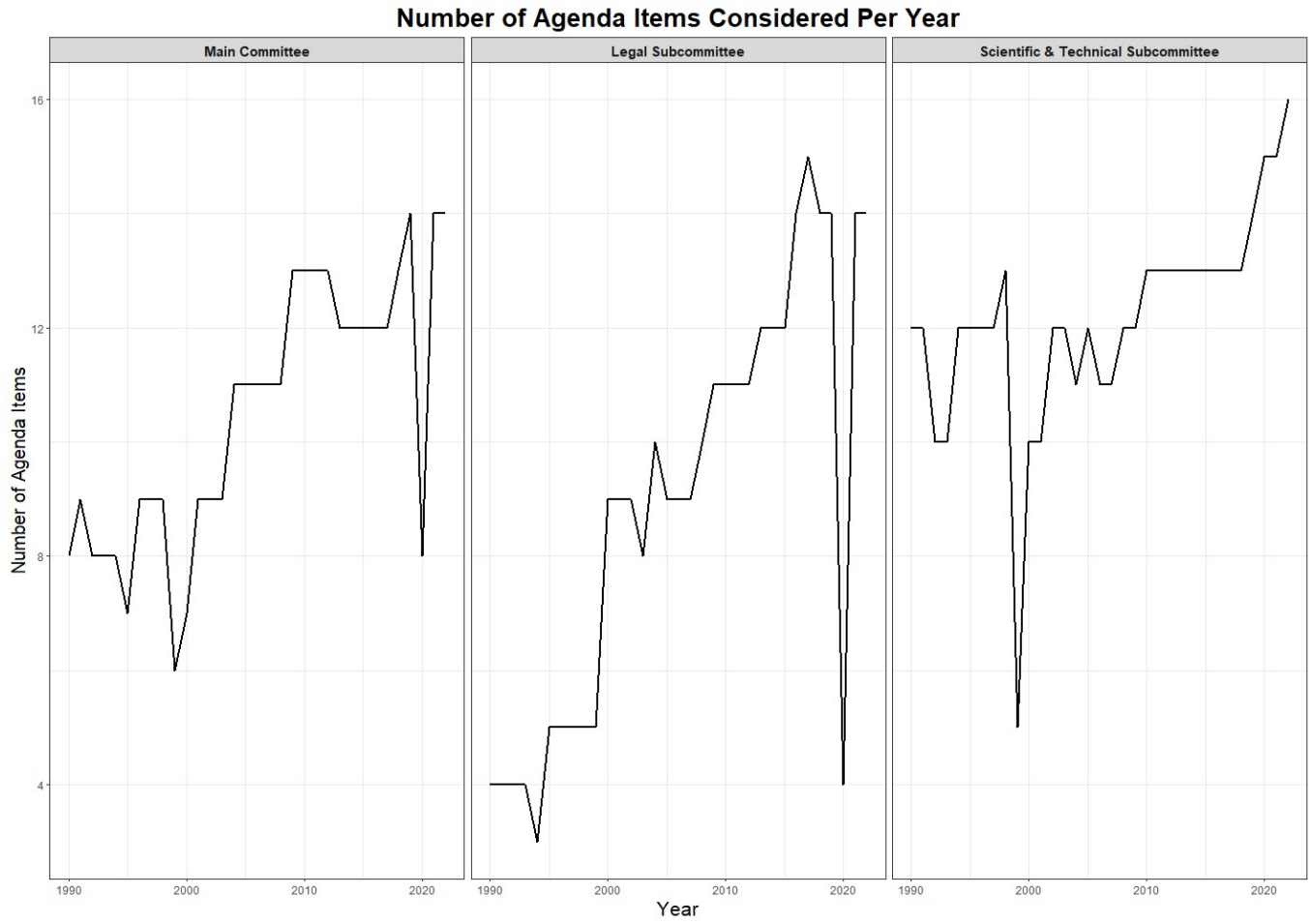


Figure 12: Number of Agenda Items Considered Per Year

When agenda item and sub-agenda item combinations are simplified down to their core substantive issue, by removing references to specific sessions within names, extraneous language, and changes over time in agenda item titling, we find that COPUOS has discussed 116 topics over the time period studied (see Appendix 1). There is high variation in the level to which different topics are discussed, with 7 topics having just 1 total view expressed, and the most discussed topic, the United Nations Programme on Space Applications, having 2,211 views coded, constituting 10.3% of all observations. Topics are discussed on average 184.2 times, however, considering the heavy skew of the data, the median amount of discussion per agenda item of 58.5, and interquartile range of 6.76 to 179.5, better represents the tendency in the level by which COPUOS discusses topics. The top 20 most discussed topics show which substantive and procedural items COPUOS has seen the most views expressed on (see Table 5). Here we see a combination of 'core' and long-discussed regular substantive issues, such as nuclear power sources, more recent but prominent substantive items, such as long-term

sustainability, issues regarding the future role, working methods, and agenda items of COPUOS, programmes overseen by COPUOS/UNOOSA, such as Space-based disaster management, and discussions under the General Exchange of Views.

Table 5: Number of Observations for the 20 Most Discussed Simplified Agenda Items

Simplified Agenda Item	Number of observations
United Nations Programme on Space Applications	2211
Space debris	1724
Nuclear power sources	1239
Definition and delimitation & Geostationary Orbit	1068
General Exchange of Views	966
Five UN treaties	756
Peaceful purposes	716
Space-based disaster management	663
UNISPACE III	642
Long-term sustainability	625
Remote sensing	618
New agenda items	559
Geostationary orbit	501
Draft provisional agenda	496
Global navigation satellite systems	491
Cape Town Convention[10]	490
Future role and work	461
Capacity-building in space law	377
Non-state activities	356
Spin-off benefits	336

In order to better gauge which topics are discussed in which (sub)committee and the level of consensus between topics, we applied a filter to our dataset to only include those topics which have been discussed in 10 or more different years and have 200 or more observations recorded. Although these figures are somewhat arbitrary, with the former accounting for around a third of years analysed and the latter based roughly on the mean number of observations for topics, the remaining data maintains more than half of our observations in 27 agenda topics. Primarily, it enables clearer comparison between the most discussed agenda topics overall and in the number of views expressed. Figure 13 shows which topics are discussed in which (sub)committee and the number of observations in each at different levels of consensus. The

[10] Refers to the Cape Town Convention on International Interests in Mobile Equipment and Space Assets protocol, negotiated primarily through the initiative of UNIDROIT.

United Nations Space Programme is the most discussed, but only within the main committee and STSC, and is characterised by very high levels of consensus. Space debris, the second most discussed agenda topic, is discussed in all three committee, having been introduced into the STSC for the 1994 session and into the LSC in 2009 in the context of a "General exchange of information on national mechanisms" related to space debris following the adoption of the Space Debris Mitigation Guidelines in 2007. It has a markedly lower proportion of consensus views within the LSC. Within the main committee it has never appeared as a separate item, being discussed only in relation to subcommittee reports.

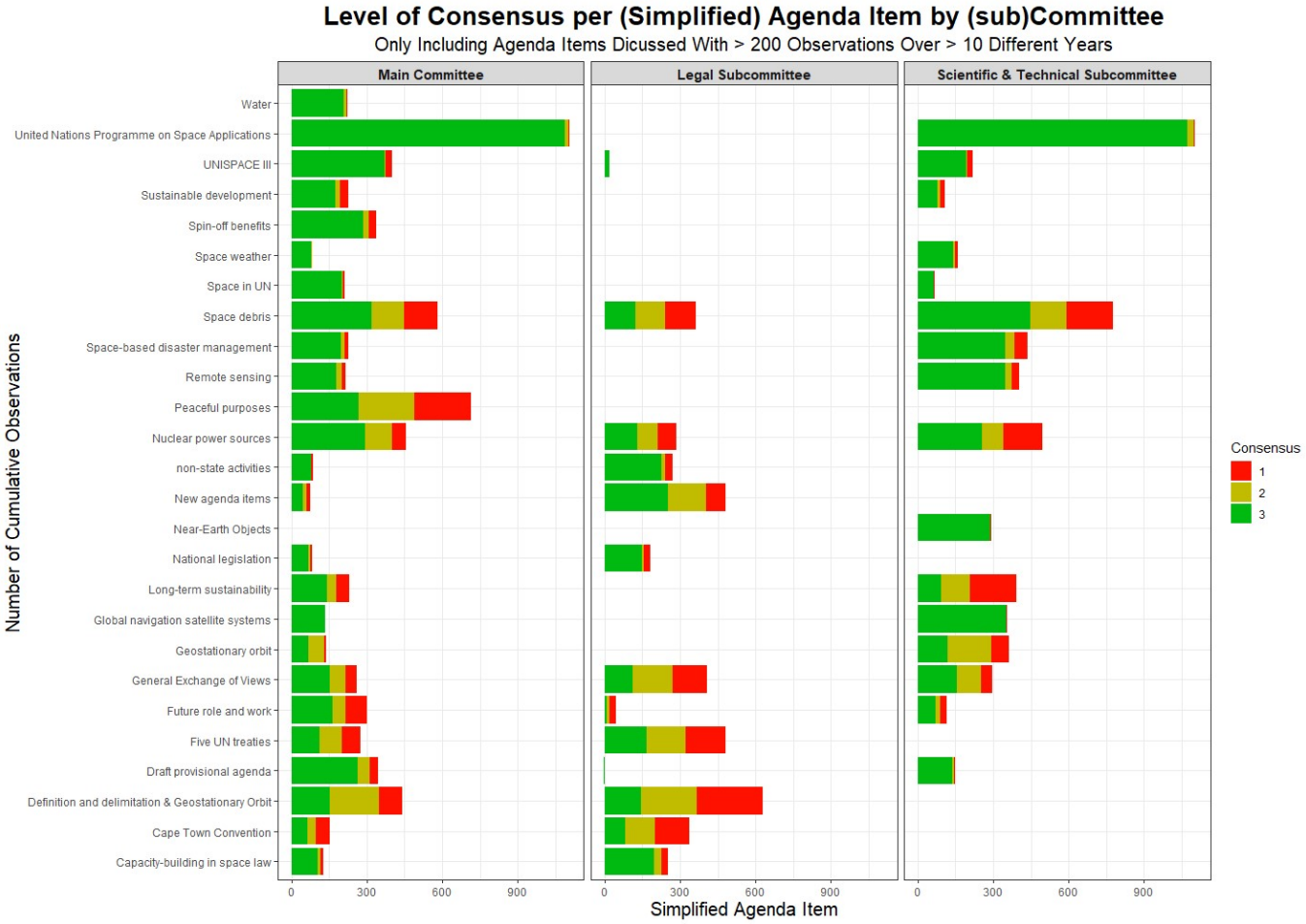


Figure 13: Level of Consensus per (Simplified) Agenda Item by (sub)Committee

Across all simplified agenda items, only 12 are discussed in all (sub)committees, with the majority of these composed of procedural items rather than substantive topics. For some topics this is unsurprising, such as National Legislation, which has no apparent relevance to scientific and technical matters, and Space Weather, which currently holds little legal relevance. For others, the distinctions are less clear, such as for Remote Sensing, which although has had

guidelines agreed through COPUOS in 1986, this has not stopped other topics, such as Nuclear Power Sources maintaining a presence in the LSC. Both subcommittees discuss the geostationary orbit, which is characterised by noticeably low levels of consensus, however the LSC only discusses it jointly with in context with the definition and delimitation of outer space. The lack of overlap in the topics discussed by the subcommittee indicates states may frame issues as either a legal or scientific issues and rarely opt for exploring both perspectives of an issue, at least at the same time as each other. As the main committee by default re-discusses items discussed by the subcommittees during its session, we can be relatively certain that the difference lies between the subcommittees.

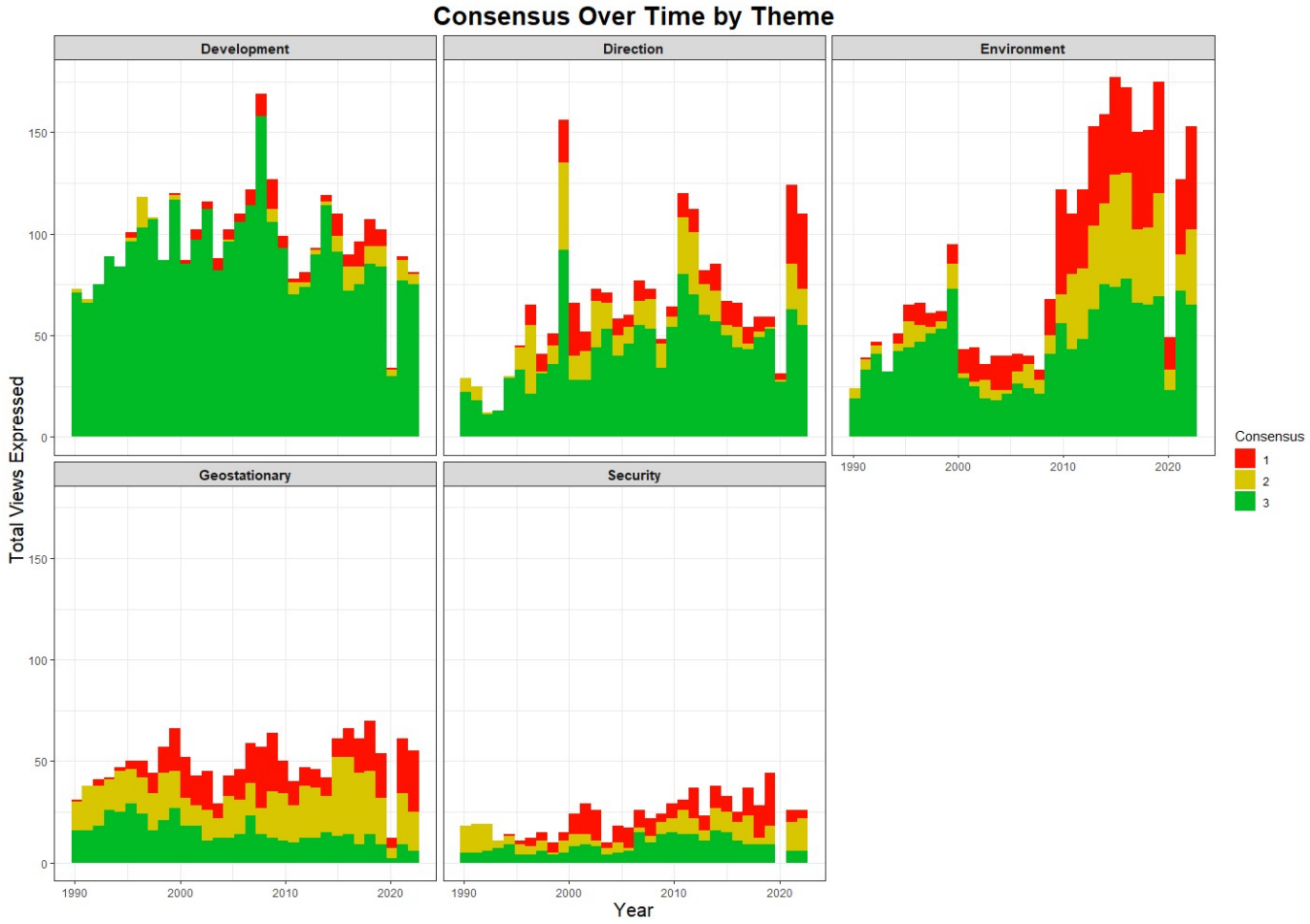


Figure 14 Consensus Over Time by Theme

In exploring our selected themes, we notice different patterns overall between the themes as well as over time between the themes. Items related to developments, although varying year on year, are characterized by generally high levels of discussion as well as high levels of consensus (see Figure 14). Notably, in some years 100% of views expressed related to development are

coded as full consensus. Meanwhile, environmental issues have seen a substantial increase in the number of views expressed within them from around 2009, when Long-term Sustainability was added as an agenda item, with the view of establishing a set of principles. The vast majority of the growth in views expressed on environmental issues however is composed of non-consensus views. This to us indicates that environmental issues have both become more important and more contentious in recent years. Topics related to the geostationary orbits discussed a consistent amount throughout the years despite the lack of notable progress on the matter. This is unsurprising given the very low propensity for consensus on this topic. In running another pairwise comparison ANOVA test we find that topics related to the geostationary orbit have the lowest average consensus (see Table 6). Topics related to the geostationary orbit are only slightly lower in this regard then security related topics, also characterized by very low consensus compared to our other themes but discussed far less over time, although this may be increasing slightly. The theme related to the future direction of the committee although discussed every year, appears to have years in which it is discussed far more suggesting a regular review by COPUOS over its working methods and future direction. The past two years 2021 and 2022 show noticeable increase in the number non consensus views expressed on this theme however it is too early to identify whether this is a trend.

Table 6: Thematic topic ANOVA test

Theme Pair	**diff**	**p=**
Direction-Development	-0.25	0.000
Environment – Development	-0.39	0.000
Environment – Direction	-0.13	0.000
Security – Development	-0.54	0.000
Security – Direction	-0.29	0.000
Security – Environment	-0.15	0.000
Security – Geostationary	0.06	0.008
Geostationary – Development	-0.61	0.000
Geostationary – Direction	-0.36	0.000
Geostationary – Environment	-0.22	0.000

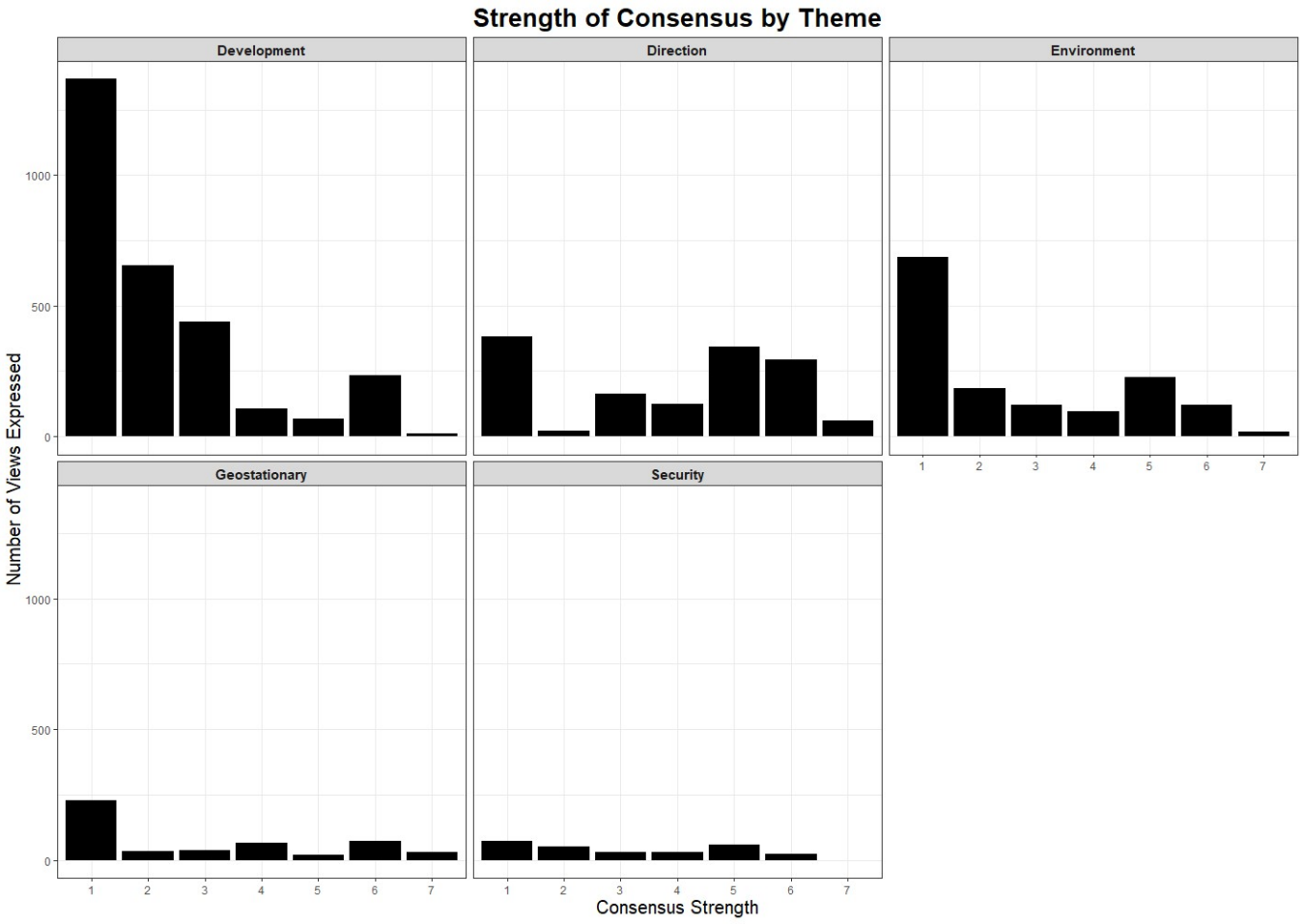


Figure 15: Strength of Consensus by Theme

We also notice differences between our themes in and the strength of consensus when it is reached (see Figure 15). For all themes the most frequent form of consensus is the weakest level. The distribution of consensus strength amongst our themes is most aligned with what we would expect in development and environmental topics, with highest strength consensus levels seeing less frequent expressions, however we do notice that some levels see distinctly more observations in some themes than others. In development there are noticeably more observations in the category of consensus which adopts or endorses, meanwhile in environmental issues the second most frequent level of consensus is that which establishes as a fact. In geostationary topics, whilst we see the most frequent level of consensus being the weakest, we can notice that the second and third most frequent levels are the 4th and 6th, representing an expression of sentiment or opinion, and adopting and endorsing respectively. In topics related to securities we have zero observations in our highest level of consensus. States use different topics for different purposes, which is reflected in the language they use

and the categories that are less represented. Taken together this suggests thematically that there are different patterns in the strength of consensus when it is reached, although states quite consistently find consensus in its weakest form.

Explanatory

We have analysed two models to explain the presence and strength of consensus by yearly and topical dynamics, across the subcommittees and by levels of participation and proportion of developing countries participating. For both models, we conduct both a fixed and random effects model before running a Durbin–Wu–Hausman test (Patrick 2020) which indicated that the random effects model was indeed more appropriate. Upon executing our models, we have also conducted a heteroscedasticity and serial correlation test, which indicates their presence to in both our models. To remedy this, we conduct a robust standard errors calculation, providing us updated coefficient and significance levels. In some cases, these impacts whether an association is statistically significant or not. In interpreting both our models, we will do so based on the robust standard errors' calculation.

The first model looks at the change in the presence of consensus over time between the sub(Committees) considering yearly differences in COPUOS:

Random Effect Model on Consensus in COPUOS

	Dependent variable:	
	Consensus	
	Original Model (1)	Model with Robust SE (2)
Year	-0.001	-0.001
	(0.004)	(0.004)
	t = -0.249	t = -0.240
	p = 0.804	p = 0.811
LSC	-0.218***	-0.218***
	(0.032)	(0.052)
	t = -6.774	t = -4.163
	p = 0.000	p = 0.00004
STSC	-0.043**	-0.043
	(0.022)	(0.030)
	t = -1.962	t = -1.433
	p = 0.050	p = 0.153
Attendees	-0.001	-0.001
	(0.002)	(0.002)
	t = -0.789	t = -0.716
	p = 0.431	p = 0.475
State Observers	-0.002	-0.002
	(0.002)	(0.002)
	t = -1.203	t = -1.304
	p = 0.229	p = 0.193
Non-State Observers	-0.002	-0.002
	(0.002)	(0.002)
	t = -1.149	t = -0.950
	p = 0.251	p = 0.343
State Speakers/Agenda Item	-0.002	-0.002
	(0.001)	(0.001)
	t = -1.561	t = -1.145
	p = 0.119	p = 0.253
non-State Speakers/Agenda Item	0.009***	0.009**
	(0.003)	(0.004)
	t = 2.801	t = 2.434
	p = 0.006	p = 0.016
State Speakers/GEV	0.0003	0.0003
	(0.001)	(0.001)
	t = 0.256	t = 0.251
	p = 0.798	p = 0.802
non-State Speakers/GEV	-0.004	-0.004*
	(0.003)	(0.002)
	t = -1.417	t = -1.870
	p = 0.157	p = 0.062
Developing Countries %/Agenda Item	-0.082**	-0.082*
	(0.039)	(0.049)
	t = -2.082	t = -1.680
	p = 0.038	p = 0.094
Developing Countries %/GEV	0.035	0.035
	(0.139)	(0.139)
	t = 0.253	t = 0.253
	p = 0.800	p = 0.801
Security Topics	-0.220	-0.220
	(0.141)	(0.209)
	t = -1.560	t = -1.049
	p = 0.119	p = 0.295
Geostationary Topics	-0.519***	-0.519***
	(0.123)	(0.036)
	t = -4.238	t = -14.309
	p = 0.00003	p = 0.000
Environment Topics	-0.240***	-0.240***
	(0.087)	(0.065)
	t = -2.752	t = -3.676
	p = 0.006	p = 0.0003
Development Topics	-0.038	-0.038
	(0.079)	(0.069)
	t = -0.477	t = -0.546
	p = 0.634	p = 0.586
Future Direction of Committee	0.007	0.007
	(0.060)	(0.063)
	t = 0.115	t = 0.109
	p = 0.909	p = 0.914
Constant	1.088***	1.088***
	(0.167)	(0.161)
	t = 6.527	t = 6.769
	p = 0.000	p = 0.000
Observations	1,006	
R2	0.316	
Adjusted R2	0.305	
F Statistic	178.357*** (p =)	
Note:		*p<0.1; **p<0.05; ***p<0.01

Our intercept shows that in our reference committee (main), and with all other variables equal to 0, that average value of the proportion of consensus views is 1.088 (p=0.000). This is purely a hypothetical result our model, as there are no plausible circumstances in which consensus could be reached with 0 parties. We do not find a statistically significant association in the average proportion in consensus over time when considering other variables, which means we do not detect a linear association between time and consensus themselves (p = 0.811).

We do find a statistically significant difference when discussions take place in the LSC (p=0.000), which is associated with a 0.218 decrease in the presence of consensus. This represents a substantial difference in tendency for views to express consensus between the LSC and main committee, with the LSC reaching consensus less. We do not find any statistically significant difference between the main committee and the STSC (p=0.153). Although we expected to see scientists discussing scientific and technical aspects of issues, we do not note this, but rather find legal issues characterised in the context of COPUOS, see less attainment of consensus. Therefore, we cannot reject the null of our Scientists 1 hypothesis.

We do not find any statistically significant difference with variables that capture differences in state attendance and participation across years. From this, we are not able to show that only the number of parties present at a negotiation involving a broad set of issues is linearly associated with a decreased proportion in the attainment consensus. Participation in agenda items by states is also not shown to be associated with changes in the proportion of consensus views. We cannot therefore reject the null of our Participation 1 hypothesis.

We do find, however, that increases in the number of non-state speakers in agenda items is positively associated with the attainment of consensus, however to an individually small degree (β=0.009, p=0.016). Given the average number of non-state speakers per agenda item is only one or two, this suggests that non-state speakers tend to have only a very slight impact on the attainment of consensus, however collectively this could become more substantial. The participation by non-state speakers is not shared equally between the subcommittees, with the STSC seeing higher participation on average than the LSC. Whilst we cannot state that the lower number of non-state speakers in the LSC causes lower attainment of consensus, this does present a possible mechanism for future investigation. As we only see statistical significance in some of our measures of non-state participation, we can only partially reject the null of our Non-state Actors 1 hypothesis.

Some thematic discussions are associated with differences in the presence of consensus. Items related to the geostationary orbit, which we interpret as symbolising primarily sovereignty issues, are associated with the average proportion of consensus being obtained more than halving (β=-0.519, p=0.000). Previous accounts of discussions on the geostationary orbit within and beyond COPUOS have focused on how disagreements on the legal understanding and political implications of sovereignty over the geostationary orbit have been particularly fraught (Cocca 1988; Gorove 1979), therefore the negative association itself is not particularly surprising. The extent of its impact, however, suggests it to be an intractable issue with highly entrenched positions. The nature of the geostationary orbit and its properties, as well as the symbolism states attach to issues of theirs and others sovereignty, and how this relates to use of a limited resource in a shared domain, contributes to its contentiousness.

Environmental issues are also negatively associated with the presence of consensus, however, less so than the geostationary orbit (β=-0.240 , p=0.000). There is still a substantial impact of environmental issues on the attainment of consensus, which may relate to discussions over distributive matters, the extent of regulations, or the scientific and technical basis of such matters. Figure 14 suggests to us that this is a particularly recent develop, occurring alongside the discussions of the Long-Term Sustainability guidelines. Whilst the effect of different committees and their different perspectives on these and our other themes is beyond the scope of this study, whether any association exists within and between the individual committees could be a next step in granularity in ascertaining whether different aspects of themes are associated with differences in attaining consensus. Based on our findings, we can reject our Environmental 1 hypothesis in favour of our alternative hypothesis.

We do not know any statistically significant association between topics related to development or security (p=0.295) and the attainment of consensus (p=0.586). In our theory we noted some uncertainty as to whether previous accounts of development issues being faced with less resistance by states would equate with increased consensus, but we are unable to show any relation. Development issues are discussed far more than our other themes, however, which may suggest that developed countries do not block at least discussions on these issues, but when they are discussed, in relation to other agenda items, we do not see a significant change in consensus being attained. We therefore cannot reject the null of our Development 1 hypothesis. Security items are far less discussed, and so we do have few observations within this theme, however it is somewhat surprising that we do not note an association in this area.

Because of the lack of statistical significance in security items, we cannot reject the null of our Core Interests 1 hypothesis, which considers sovereignty and security to be of equal significance to states as a core issue of states.

Finally, we do not note any statistically significant association between levels of consensus and discussions relating to internal strategic directions of the committee itself. Whilst the design and control of an institution is a key aspect to which states pay attention to, in this instance, COPUOS has such little autonomy that perhaps there is at stake and less to control. We therefore cannot reject the null of our Future Direction 1 hypothesis.

Overall, our model is statistically significant below the $p = 0.05$ threshold. The R-squared value is 0.316, which means that the model explains around 32% of the variation in the dependent variable. While this indicates that there is still a significant amount of unexplained variation in the data, an R-squared value of 0.3 or above can be considered quite good in the social sciences, however, with more frequent significance in our independent variables (Ozili 2022). Our robust standard errors correction has resulted in some variables becoming insignificant below our threshold; however, we believe it has improved the accuracy of our model in accounting for the heteroscedasticity and serial correlation present.

Our second model assess the effect of the same variables on the strength of consensus when it is expressed:

Random Effect Model on Strength of Consensus in COPUOS

	Dependent variable:	
	Strength of Consensus	
	panel linear	coefficient test
	(1)	(2)
Year	0.023	0.023***
	(0.029)	(0.004)
	t = 0.782	t = 5.744
	p = 0.435	p = 0.000
LSC	0.524**	0.524***
	(0.237)	(0.052)
	t = 2.214	t = 10.019
	p = 0.027	p = 0.000
STSC	0.480***	0.480***
	(0.152)	(0.030)
	t = 3.154	t = 16.125
	p = 0.002	p = 0.000
Attendees	-0.001	-0.001
	(0.013)	(0.002)
	t = -0.063	t = -0.437
	p = 0.951	p = 0.663
State Observers	0.002	0.002
	(0.013)	(0.002)
	t = 0.175	t = 1.450
	p = 0.861	p = 0.148
Non-State Observers	-0.023	-0.023***
	(0.014)	(0.002)
	t = -1.608	t = -10.136
	p = 0.108	p = 0.000
State Speakers/Agenda Item	0.014**	0.014***
	(0.006)	(0.001)
	t = 2.306	t = 10.409
	p = 0.022	p = 0.000
non-State Speakers/Agenda Item	0.111***	0.111***
	(0.022)	(0.004)
	t = 5.131	t = 29.767
	p = 0.00000	p = 0.000
State Speakers/GEV	-0.007	-0.007***
	(0.008)	(0.001)
	t = -0.810	t = -6.069
	p = 0.419	p = 0.000
non-State Speakers/GEV	-0.011	-0.011***
	(0.021)	(0.002)
	t = -0.517	t = -5.227
	p = 0.606	p = 0.00000
Developing Countries %/Agenda Item	0.420	0.420***
	(0.285)	(0.049)
	t = 1.476	t = 8.634
	p = 0.140	p = 0.000
Developing Countries %/GEV	0.926	0.926***
	(1.060)	(0.139)
	t = 0.873	t = 6.650
	p = 0.383	p = 0.000
Security Topics	0.474	0.474**
	(0.323)	(0.209)
	t = 1.467	t = 2.264
	p = 0.143	p = 0.024
Geostationary Topics	0.441***	0.441***
	(0.170)	(0.036)
	t = 2.601	t = 12.149
	p = 0.010	p = 0.000
Environment Topics	0.050	0.050
	(0.145)	(0.065)
	t = 0.341	t = 0.759
	p = 0.734	p = 0.449
Development Topics	-0.382***	-0.382***
	(0.141)	(0.069)
	t = -2.709	t = -5.512
	p = 0.007	p = 0.00000
Future Direction of Committee	1.745***	1.745***
	(0.132)	(0.063)
	t = 13.240	t = 27.497
	p = 0.000	p = 0.000
Constant	1.201	1.201***
	(1.256)	(0.161)
	t = 0.956	t = 7.472
	p = 0.339	p = 0.000
Observations	1,005	
R2	0.280	
Adjusted R2	0.267	
F Statistic	383.063*** (p =)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

Our consensus strength model provides some interesting insights. First, we see that the strength of consensus has become gradually stronger over time overall. Linearly, each passing year is associated with a 0.023 increase in the strength of consensus (p=0.000) even with the effect of our other variables considered. Over time, this represents a not insignificant tendency to reach stronger consensus in agenda items in COPUOS. We cannot state why this, or any association, has occurred, which may reflect internal or external factors to COPUOS, such as increasing socialisation of delegates leading to increased trust and commitment, increased authority of IOs measured by Zurn, Tokhi, and Binder (2021) despite increasing challenges to multilateralism (Debre and Dijkstra, 2023). A range of other unobserved variables may also be contributing, and while quantifying these would be methodologically challenging, it could be an avenue for further research.

We see a statistically significant difference between the main committee and the subcommittees. Both subcommittees are associated with increases in the median strength of consensus when it is expressed compared to the main committee, with the LSC showing a slightly larger coefficient than the STSC (β=0.524, p=0.000 and β=0.48, p=0.000 respectively). This result, especially in the case of the LSC, should be taken into context. As shown in Figure 6, not only does the LSC reach consensus less often in every level of consensus strength than the other committees, but its primary relative deficiency is in expressions of the weakest level of consensus, which likely pushes its median values higher in our model. In terms of the STSC, while we found no statistically significant difference in its propensity to find consensus, it does reach consensus of a stronger variety than the main committee. Both the STSC and main committee share a similar distribution in the strength of consensus they express overall, so this finding may be a result of aggregating data into agenda item topics, with those topics that the STSC discusses characterised by greater strength of consensus compared to the main committee. We can therefore reject the null of our Scientists 2 hypothesis, with a stronger than expected association, but still relatively weaker than that of the LSC.

As in our first model, we do not find any statistically significant relationship between the number of annual member state attendees or state observers, and the strength of consensus. We do, however, find that annual attendance by non-state observers is negatively associated with the strength of consensus (β=-0.023, p=0.000). Alongside this, we note that non-state speakers are negatively associated with the strength of consensus when participating in the General Exchange of Views (β=-0.011, p=0.000), but positively associated with participating on

individual agenda items (β=0.111, p=0.000). This is a difficult combination to interpret, but one possible explanation may be that when non-state actors participate in the broader aspects of an intergovernmental plenary organ operating by consensus, such as speeches at the beginning of sessions, this result in a slight weaker form of consensus over time. When they participate in more specific items, although they do so in less number, it is where they can offer more targeted expertise, advise, and advocacy, resulting in a more impactful increase in the strength of consensus.

State speakers are also negatively associated with changes in the strength of consensus in the General Exchange of Views (β=0.007, p=0.000).but positively associated, and to a slightly greater degree, when speaking on specific agenda items (β=0.014, p=0.000). This may be related to our finding on non-state participation. States may make different types of speeches during the General Exchange of Views, which are an opportunity, as the name suggests, for states to express without necessarily a specific focus on their broad individual aims. Often states will highlight their recent activities and collaborations, which are typically observed through a weaker strength of consensus such as "expressed its appreciation" for joint endeavours related or adjacent to sessions. Having more participants, and so potentially more such activities to observe, could result in our finding that it tends to decrease the strength of consensus. As we find conflicting associations between levels of our measures of state and non-state participation, we should re-formulate our Participation 2 and Non-state Actors 2 hypotheses to account for these findings before we can reject the null.

Developing speakers are positively associated with increases in the strength of consensus, especially when they represent a higher proportion of speakers during the General Exchange of Views (β=0.926, p=0.000). When developing speakers are the only participants in agenda items, this is associated with an increase in 0.42 levels of consensus strength compared to when they would not participate at all (p=0.000). This runs counter to our expectations, namely, that an increase in the proportion of developing countries could signify either a joint effort to secure gains from developed countries, who should be willing and able to resist, or that an increasing proportion of developing countries could represent a greater diversity of views between developing countries, resulting in weaker consensus. When seen from reverse however, it could instead be that increasing developed countries participation is associated with weaker consensus. Developed states should prefer a status quo, and through consensus should in general be capable of maintaining it. Whilst we cannot prove this in this model, one could use

our dataset measure great power participation to see if Gaggero's observation of great powers aversion to progress in COPUOS holds today (1986, 197). Based on our results, whilst we can reject the Developing Countries 2 null hypothesis, we find the opposite of our alternative hypothesis.

Notably in our topical themes, we find that discussions on the geostationary orbit, despite being characterised by a less frequent attainment of consensus, when attained tends to be nearly half a level stronger (β =0.441, p=0.000). We also see that issues related to security are associated with an even stronger increase in the strength of consensus (β=0.474, p=0.024). One reason for this could be that if in some areas finding agreement is more difficult, but nevertheless desired by states, states may seek to offset or mitigate the higher costs of negotiating with stronger forms of agreement. There is likely a limit to this explanation, however, since states should find agreement more difficult in these areas precisely because they wish to cede less of their sovereignty and autonomy on these issues. Instead, the apparent difference could be that rather than finding stronger expressions of consensus in items related to core issues, states in fact find relatively fewer weaker expressions of consensus in these topics compared to regular topics. This appears to be reflected in our data, such as in Figures 6 and 14, where the difference in the distribution of levels of consensus strength is primarily in the first level. Therefore, whilst we reject the null of our Core Interests 2 hypothesis, we are weary of making generalisations, especially beyond COPUOS.

This discrepancy between different themes distribution of different strengths of consensus may also explain why we see a negative association between development and the strength of consensus and so reject the null of our Development 2 hypothesis (β=0.926, p=0.000). In topics of development, such as in the United Nations Programme on Space Applications, we see a much higher relative number of consensus expressed in its weakest form. Discussions focus less on finding substantive outcome to issues but are more in context of undertakings presented by member states or UNOOSA as a means of information sharing and keeping account and oversight of its activities. Whilst there are plenty of security related undertaking in space, states are less willing to share them in this manner in COPUOS, especially considering its highly restricted mandate on security related topics.

Finally, when states reach consensus on topics related to the future direction of the (sub)Committees, it is associated with a significant and substantial increase in the strength of

consensus, the largest such coefficient, when the theme is associated with a 1.745 increase in the strength of consensus (p=0.000). Although we reject the null of our Future Direction 2 hypothesis in favour of our alternative, here to we express caution. Given the low underlying autonomy of COPUOS, there may be less at stake, and more necessity in deciding stronger individual courses of action on an ad hoc but regular basis. Another potential explanation, which is potentially problematic for our coding scheme of consensus overall, is whether our scheme is consistent across both procedural and substantive discussions, or if views expressed as one of these infer a different meaning of some action verbs. Whilst we have tried to account for this when constructing our coding scheme, we do not code the subject of agreement, and so the potential differences in extent represented in the remaining agreement.

Overall, our second model is statistically significant at the p=0.000 level, with a slightly lower but still acceptable R squared value (0.28). Our robust standard errors correction has resulted in widespread attainment of statistical significance in many of our variables, without altering our coefficients estimates. This is indicating that with improved standard errors calculated to account only for heteroscedasticity or serial correlation, our model finds improved accuracy of estimates for our variables. It does not account for other potential issues in our data, which may produce errors or false significance.

Chapter 5: Discussion

COPUOS has become progressively more active over period studied. Membership has risen as has the number of attendees per year, at around the same rate. COPUOS discusses more agenda items now than it used to and although on average participation in agenda items appears stable, there an increasing range of the number of speakers. An increasing number of views are expressed in session reports, with an increasing diversity of views. COPUOS both agrees, and disagrees, on more than it used to whilst reaching a gradually stronger expression of agreement overtime. The work of COPUOS is quite distinctly demarcated between its subcommittees, with the LSC and STSC tending to discuss different topics, rather than different perspectives on the same topic. We find that the LSC tends to reach consensus less than the main committee, but we do not show that the STSC reaches consensus more or less frequently. Whilst our results regarding the LSC are unsurprising, given the lack of consensus within it is well-documented (Brisibe 2016; Galloway 1979) within COPUOS, with most substantive outputs recently being discussed instead by the STSC we would expect to see this reflected in more frequent and stronger consensus, but we only see the former.

We find that the substance of the topic discussed is most impactful on whether states reach consensus, with themes related to the geostationary orbit and the space and Earth environment both negatively associated with the attainment of consensus. When consensus is reached however, we see that in these more difficult topics, agreement tends to be expressed in a stronger variety. Although we do not find Development topics to be associated with the attainment of consensus, we do note that it results in weaker expressions of consensus. That the geostationary orbit is associated with less consensus is not unexpected. The geostationary orbit is one of the most valuable orbits around Earth, limited in its utilisation, and the most difficult and expensive orbit to reach. Historically, it has been one of the most contentious topics in COPUOS, with a group of equatorial countries signed the Bogotá Declaration, claiming “complete and exclusive sovereignty” over the portion of the orbit fixed above their territory (Diederiks-Verschoor and Kopal 2008, 22). The claims should be understood as largely symbolic. Even the great ‘spacepowers’ of today would struggle to maintain ‘effective control’ over a significant portion of it (Bowen 2022, 307-309, 350-351. As time has gone by, although sovereignty issues have not been fully resolved, some states continue to pursue a *sui generis* legal regime of the geostationary orbit through COPUOS. Underlying needs and interests about accessing a valuable, but limited portion of space which they perceive as being

unfairly divided and appropriated by the most powerful space actors are obscured by these claims of sovereignty, which may lead to the issue continuing to be intractable. Discussions, mainly in the ITU, have made some, small, progress in bringing these concerns to the forefront and attempting to allay them (Bowen 2022, 351), however COPUOS is by its history and structure a more inherently political body than the ITU, which may encourage more symbolic statements over more practical solutions.

We see that environmental topics are more contentious in space as in Earth. Environmental topics are often perceived as distributive topics that require regulation on states activities, in doing so distributing primarily negative value individually. For all space-faring countries, present and future, access to space requires a safe operating environment. The proliferation of space debris, rise of mega-constellations, and lack of an international coordination regime regarding space traffic management all threaten all actors' operations in space. These issues have been the focus of COPUOS, however primarily within the STSC, and while we do not find they affect the strength of consensus, they have resulted in two substantive outputs in the 21st Century. Both are voluntary, and non-binding, and whilst the Space Debris Mitigation Guidelines were adopted over 15 years ago by COPUOS, only 15 countries have since reported implementing them within national policy or legislation (COPUOS 2022). This touches on an overall critique of consensus, that whether the balance between facilitating all parties' interests is worth reducing the meaningfulness of an agreement. Whilst our result provides some nuance to this debate by showing that discussions on more contentious topics, although characterised by less attainment of consensus, some, although not environmental topics, appear to be associated with higher strength of consensus. This higher strength, however, is relative to other items COPUOS discusses, and resulting agreements through consensus may still be weak as compared to outputs of majoritarian or weighted voting systems.

We find conflictual results regarding participation through annual measures and through more granular measures of speakership per agenda item and the attainment of consensus. This suggests a more complex mechanism is at work, which could relate to different forms, or styles of participation during the General Exchange of Views at the opening of COPUOS's sessions, and on specific substantive agenda items. Different types of participation appear to be related to different variations in the strength of consensus, and so measuring participation via membership may not be adequate in understanding increased participations effect on

consensus. Increasing group size alone is not reflected in our model as being associated with decreased attainment of consensus, but rather the type of actors and participate more, and the context they do so within, appears to affect consensus in different ways. While we expected non-state actors to be associated with increased attainment of consensus, we only find this when participating more on agenda item discussions. These opportunities may allow them to provide more targeted and impactful messaging, where speeches during the General Exchange of Views may be perceived as more political. We see this reflected too in our consensus strength model.

Regarding developing countries, whilst we do not find statistically significant association in their increased participation and the attainment of consensus, we do find that that increased participation is associated with increased strength of consensus in both the general exchange of views and on specific agenda items. To us, this suggests that not only to developing countries as a coalition prefer stronger forms of consensus but can obtain these when they participate to a higher degree. There is a limit to how much developing countries can achieve on their own, even as a coalition. Great power interests still likely play a role, and developed countries likely still control the process, with substantive outcomes tending to reflect, or at least not counter, their interests in consensus-based systems (Steinberg 2002).

This thesis has attempted to answer how states reach consensus. We have found issues specific content to be most associated with consensus, but that with those topics in which consensus is found less, when it is achieved it may be more meaningful. Actors and perspectives also matter, with legal issues prone to less, but again stronger consensus than political topics, and with scientific issues associated with increasing strength, but not shown to be associated with increasing attainment, of consensus.

Limitations and Weaknesses

While we have suggested several mechanisms that could explain some of the associations we have found in our data, we must stress that we cannot state to have uncovered any form of causality. Instead, we are limited only to associations and referring to potential processes identified through previous research. Whilst we have tried to offer a range of possible explanations for our association, we are also aware that there are potentially confounding and unobserved variables which may impact the attainment and strength of consensus. We have

limited our analysis to data included within the COPUOS reports, and in doing so, in our analysis we disregard external factors, which may be mistaken. Fundamentally, there are also a multitude of potential other factors which contribute to the success or failure of any negotiation, some may immeasurable, which may make quantification problematic (Buzan, 1981, 330). We also assume that information in the reports is both factually correct and an accurate representation of the extent of agreement reached in COPUOS. The increasing views expressed in our data over time may not reflect an increasing number of views expressed during the sessions, but only those expressed in evolvingly composed reports. Were this to be the case, this would diminish our findings somewhat, but not entirely. What is included in the reports, and how it is included, matters to states. The reports represent the primary accounting of sessions and the reference point for discussions. The phrasing of agreements can create effects on future discussions and the working methods of the Committee, and states must gain consensus on all aspects of the report in all official languages for it to be adopted by the Committee.

There is potentially other information within adjacent to the reports which could be codified and could provide insights into consensus in COPUOS. The impact of the Chair is one such potential factor that impacts consensus (Buzan 1981). Chairs are responsible for identifying and declaring consensus and may play a role in facilitating agreement and providing its initial phrasing (Buzan, 1981, 335). Considering the Chair of COPUOS rotates every two years between individuals nominated by each regional bloc, we did not feel we could capture their effect in our linear model, nor be able to differentiate between the individual and block they represent. As well, COPUOS in the main committee has three such officers, which may have different effects based on their role, while the subcommittee has only one.

The effect of smaller sub-groups, such as Working Groups or expert groups, was perceived as insufficiently communicated within the reports to code their instances, however, may play a role (Narlikar 2002, 174-176). If one could compile when and under what agenda items Working Groups or expert groups operated, this could expand analyses through the dataset to incorporate their role. We have also not tracked the use of speaking on behalf of bloc by developing countries, which is very common in COPUOS. If the use of blocks by developing countries were to be increasing, in our data this could appear more or less the same as a decreasing proportion of developing country participation. Meanwhile, we have explored power discrepancies from the perspective of developing countries combined association with

consensus. One could also look at the association between participation by 'great powers' and the attainment and strength of consensus, or the role of specific developing countries with greater activities in outer space, such as China or India, in how they interact with developing countries impact on consensus.

Whilst we believe the coding of the strength of consensus was done accurately in the context of the verbs usage in COPUOS, this is the potential that errors, misunderstandings, or changes in context or language affect our results. Fundamentally, our scheme and resulting assumes that categories are ordered according to the objective meaning of the contained words unambiguously denoting distinct and equidistant levels of action to be undertaken. Yet, as we have seen, states, especially when operating through consensus, are prone to using deliberately ambiguous language which can be interpreted subjectively. Whilst it has still provided what we consider interesting and valid insights into what language COPUOS uses, its conclusions regarding how this represents the extent of consensus should be taken cautiously, and the method further refined.

Finally, we should be careful about how far we can generalise our finding outside of COPUOS and the specifics of outer space politics. Whilst outer space politics reflect Earth-based politics (Bowen, 2022), they are so under extraordinary circumstances. COPUOS too, is an unusual breed of IO, both central to outer space governance, but operating with little autonomous impact, and through a form of consensus that affixes a higher threshold on agreement by virtue of its lack of voting procedure to 'shadow' discussions. Whilst some of our findings reflect previous research on what affects how states reach consensus, others do not, which may relate both to COPUOS's specific mode of operation and to specific substantive issues COPUOS deals with. As consensus becomes an increasingly used decision-making procedure, but one often used in differing ways by different institutions, it is important to understand the variety of consensus designs and how they impact decisions and decision-making. At the same time, as space actors proliferate in number and type, understanding COPUOS and the broader constellation of the international governance of outer space is an increasingly important area for international relations scholars to focus on. Although the main, regular, substantive output by COPUOS, the reports are but one data source we have drawn on for our analysis, but one in which deeper and extended analyses are possible through our dataset.

Chapter 6: Conclusion

This thesis has presented the Consensus in COPUOS dataset, containing all views expressed in COPUOS and its subcommittee reports from 1990 to 2022 (Boeree 2023). By coding a range of other variables included in the reports, we have attempted to analyse what explains the attainment and strength of consensus in COPUOS. The use of disaggregating regular outputs such as reports and records of meetings into their component agreements represents a novel means of analysing the outputs and performance of IOs. As a proof of concept, we believe we have shown it is an effective means of drawing conclusions about IOs, however will require refining, both in general and towards the specific institutional context of future uses. Further research could look deeper into COPUOS, potentially utilising the transcripts and recordings of sessions to obtain individual states positions, and chart how and why they coalesce into consensus as expressed in reports. Alternatively, one could look at other IOs utilising consensus, or where voting data is not present, or outputs are regular communications rather than discreet policies or agreements.

In an era in which international cooperation is facing sustained and serious challenges, understanding how states can still find consensus and in what form becomes increasingly important, and potentially valuable in designing cooperative structures to enable this. Importantly, however, an increasing diversity of views should not be discouraged, or seen as a form of institutional deficiency. How states manage their differences and find common ground and collective good is the ultimate goal of international relations, in which a means of honest discussion is a foundational aspect. Whilst consensus may lead to weaker outcomes, it may facilitate a better process of dialogue. COPUOS must find a balance between being able to find some substantive agreement, making some impact, while accounting for the broad spectrum of needs, interests, and capabilities of its members.

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Appendix

Appendix 1: List of Simplified Agenda Items

"Space2030"

ad hoc meeting of the First and Fourth committees of the General Assembly

Adoption of Committee report

Adoption of the agenda

Astronomy

Attendance

Capacity building in space science and technology applications

Capacity-building in space law

Chair

Climate change

Colloquium

Commemorations

Composition of the bureaux

COSPAS-SARSAT

Dark and quiet skies

Definition and delimitation & Geostationary Orbit

Direct television broadcasting

Draft provisional agenda

Election

Exhibition

Five UN treaties

Fourth Space Conference of the Americas

Future role and work

Geosphere-Biosphere programme

Geosphere-Biosphere programme & Planetary exploration & Astronomy

Geostationary orbit

General Exchange of Views

Global navigation satellite systems

Government and private activities to promote education in space science and engineering

Human spaceflight

International Astronautical Congress

International Heliophysical Year

International Space Year

International treaties

Introduction

Launch systems

Launching state

Life sciences

Long-term sustainability

Meetings of subcommittees

Membership

Moon Treaty

National legislation

National reports

Near-Earth Objects

New agenda items

New projects

Nomination of officers

non-binding UN instruments

non-state activities

Nuclear power sources

Observer status

Opening of the session

Organization of work

Organizational matters

Other matters

Other reports

Panel

Participation in Committee work

Peaceful purposes

Appendix 2: Consensus Strength Table

1	2	3	4	5	6	7
acknowledged	acknowledged with appreciation	believed	agreed to	agreed	adopted	agreed [.] to suspend
agreed to annex	further noted with appreciation	advised	agreed to begin consideration	agreed [.] that	agreed to [.] request	agreed not to
noted in particular	noted with appreciation	commemorated	agreed to consider	agreed it could	agreed to adopt	agreed not to amend
noted	noted with approval	commended	agreed to continue examining	agreed on	agreed to endorse	agreed not to schedule
reiterated its acknowledgement	noted with concern	congratulated	agreed to continue its consideration	agreed that	agreed to recommend	agreed to apply to
recognized	noted with gratitude	considered [.] useful	agreed to continue reviewing	admitted	agreed to request	agreed to cancel
took note	noted with great appreciation	considered it essential	asked	agreed upon	appealed	agreed to conclude
took particular note	noted with great satisfaction	conveyed its condolences	analysed	agreed with	appealed to	agreed to continue applying
	noted with interest	drew attention	began consideration	concluded	approved	agreed to continue contributing
	noted with particular satisfaction	emphasized	began its consideration	decided	approved retroactively	agreed to establish
	noted with regret	expressed	began its review	decided	called for	agreed to extend
	noted with satisfaction	expressed [.] condolences	carried out	decided that	called on	agreed to finalize
	took note with appreciation	expressed appreciation	commenced the consideration	and agreed	called upon	agreed to have [.] distributed
	took note with concern	expressed concern	conducted	concluded that	decided [.] to adopt	agreed to include
	took note with great interest	expressed deep gratitude	agreed [.] to continue	continued to play an important role	decided to recommend	agreed to invite
	took note with interest	expressed its appreciation	agreed [.] to reconvene	found [.] had help	decided to request	agreed to make
	took note with satisfaction	expressed its concern	agreed to continue	found [.] helpful	declared its support for	agreed to postpone
	was equally gratified to note	expressed its condolences	agreed to hold	found that [.] had helped to enable	endorsed	agreed to proceed
	was gratified to note	expressed its congratulations	agreed to reconvene	had a fundamental role to play	formally adopted	agreed to rename
	was pleased to note	expressed its gratitude	convened	had an important role to play	decided not to recommend	agreed to retain
		expressed its hope	conducted a joint consideration	had responsibilities	further called upon	agreed to revise

		expressed its hopes	conducted extensive consultations	identified	made the following recommendations	agreed to schedule
		expressed its profound gratitude	considered	reached agreement	reaffirmed its recommendation	agreed to submit
		expressed its satisfaction	considered [.] jointly	reached consensus	recommended	agreed to suspend
		expressed its sincere appreciation	considered in general terms	reaffirmed	reiterated the request	agreed to the establishment
		expressed its sincere congratulations	considered jointly	reiterated	requested	agreed to use
		expressed its solidarity	considered that	was able to reach consensus	strongly endorsed	decided [.] to establish
		expressed its sorrow	considered together		strongly recommended	decided not to re-establish
		expressed its sympathy	continued		urged	decided to admit
		expressed its sympathy and solidarity	continued consideration		suggested	decided to conclude
		expressed its thanks	decided to consider		encouraged	decided to establish
		expressed its views	agreed to focus			decided to extend
		paid special attention to	discussed			decided to grant
		expressed satisfaction	examined			decided to include
		expressed the hope	focused its attention			decided to invite
		expressed the importance	focused its discussion			decided to reduce
		expressed the view	focused			decided to set up
		expressed the wish	agreed to continue to consider			decided to submit
		expressed with appreciation	agreed to develop			directed
		extended its gratitude	agreed to review			accepted the application [.] granted
		felt that	continued its consideration			elected
		expressed its continued concern	continued to conduct			established
		expressed its deep appreciation	continued to consider			finalized
		expressed its deepest appreciation	continued to examine			agreed to provisionally suspend
		expressed its encouragement	contributed to			agreed to discontinue
		continued to express its concern	entrusted			Invited

		continued to stress	held			re-established
		expressed its full support	organized			
		greatly appreciated	organized its work			
		held the view	pointed out			
		highlighted	reconvened			
		indicated	refined			
		observed	addressed			
		observed a minute of silence	resumed its consideration			
		offered its congratulations	reviewed			
		offered its thanks	took up consideration			
		paid tribute	agreed to			
		recalled				
		recalled that				
		reiterated its view				
		shared the appreciation				
		shared the satisfaction expressed				
		stressed				
		thanked				
		underlined				
		underscored				
		warmly welcomed				
		was gratified				
		was honoured with the presence of				
		was of the opinion				
		was of the view				
		welcomed				
		welcomed with appreciation				
		welcomed with satisfaction				

Appendix 3: Developing Country List

Albania,
Algeria,
American Samoa,
Angola,
Antigua and Barbuda,
Argentina,
Armenia,
Aruba,
Azerbaijan,
Bahrain,
Bangladesh,
Barbados,
Belarus,
Belize,
Benin,
Bhutan,
Bolivia,
Bosnia and Herzegovina,
Botswana,
Brazil,
Bulgaria,
Burkina Faso,
Burundi,
Cabo Verde,
Cambodia,
Cameroon,
Central African Republic,
Chad,
Chile,
China,
Colombia,
Comoros,
Congo,
Costa Rica,
Côte d'Ivoire,
Croatia,
Cuba,
Czech Republic,
Democratic Republic of the Congo,
Djibouti,
Dominica,
Dominican Republic,
Ecuador,
Egypt,
El Salvador,
Equatorial Guinea,
Eritrea,
Estonia,
Eswatini,
Ethiopia,
Fiji,
Gabon,
Gambia,
Georgia,
Ghana,
Gibraltar,
Greece,
Grenada,
Guam,
Guatemala,
Guinea,
Guinea-Bissau,
Guyana,
Haiti,
Honduras,
Hungary,
India,
Indonesia,
Iran,
Iraq,
Isle of Man,
Jamaica,
Jordan,
Kazakhstan,
Kenya,
Kiribati,
Korea,
Kosovo,
Kyrgyz Republic,
Kyrgyzstan,
Lao PDR,
Latvia,
Lebanon,
Lesotho,
Liberia,
Libya,
Libyan Arab Republic,
Lithuania,
Macao SAR, China,
Madagascar,
Malawi,
Malaysia,
Maldives,
Mali,
Malta,
Marshall Islands,
Mauritania,
Mauritius,

Mexico,
Micronesia,
Moldova,
Mongolia,
Montenegro,
Morocco,
Mozambique,
Myanmar,
Namibia,
Nauru,
Nepal,
New Caledonia,
Nicaragua,
Niger,
Nigeria,
North Macedonia,
Macedonia,
Northern Mariana Islands,
Oman,
Pakistan,
Palau,
Panama,
Papua New Guinea,
Paraguay,
Peru,
Philippines,
Poland,
Portugal,
Puerto Rico,
Romania,
Russian Federation,
Russia,
Rwanda,
Samoa,
São Tomé and Príncipe,
Saudi Arabia,
Senegal,
Serbia,
Seychelles,
Sierra Leone,
Slovak Republic,
Slovakia,
Slovenia,
Solomon Islands,
Somalia,
South Africa,
South Sudan,
Sri Lanka,
St. Kitts and Nevis,
St. Lucia,
St. Vincent and the Grenadines,
Sudan,
Suriname,
Syrian Arab Republic,
Syria,
Tajikistan,
Tanzania,
Thailand,
Timor-Leste,
Togo,
Tonga,
Trinidad and Tobago,
Tunisia,
Türkiye,
Turkey,
Turkmenistan,
Tuvalu,
Uganda,
Ukraine,
Uruguay,
Uzbekistan,
Vanuatu,
Venezuela,
Vietnam,
West Bank and Gaza,
Yemen,
Zambia,
Zimbabwe