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International Public Administrations on Twitter: A Comparison of Digital Authority in Global Climate Policy

Alexandra Goritz^{ab*}, Johannes Schuster^{ab}, Helge Jörgens^c and Nina Kolleck^{ab}

^a Department of Social Sciences, Leipzig University, Germany

^b Department of Education and Psychology, Freie Universität Berlin, Germany

^c Department of Political Science and Public Policy, Iscte – Instituto Universitário de Lisboa, Portugal

** Corresponding author's email address: alexandra.goritz@fu-berlin.de*

Alexandra Goritz is a research associate at Leipzig University and a doctoral student at the Freie Universität Berlin. Her research focuses on global climate politics, international public administrations, climate education, and social network analysis. She holds an MSc in Environment and Development from the London School of Economics (LSE) and a BA in Politics and Public Administration from the University of Konstanz.

Johannes Schuster is a research associate at Leipzig University and a doctoral student at Freie Universität Berlin. He holds a BA in Educational Science from the University of Jena and an MA in Educational Research from Freie Universität Berlin. His research focuses on the implementation of the UN Convention on the Rights of Persons with Disabilities and inclusive education, the diffusion of innovation, and social network analysis.

Helge Jörgens is Assistant Professor at Iscte – Instituto Universitário de Lisboa and Senior Researcher at CIES-IUL – Centro de Investigação e Estudos de Sociologia in Lisbon, Portugal. He holds a PhD in political science from Freie Universität Berlin and his research focuses on environmental and climate policy analysis, the diffusion of policies, and the influence of international public administrations.

Nina Kolleck is full professor of Political and Education Science at Leipzig University (Institute of Political Science) and heads a research group of Education Science and Social Systems at Freie Universität Berlin. She holds qualifications in political and education sciences and her research focuses on public and education policy, civic and citizenship education, and social network analysis.

International Public Administrations on Twitter: A Comparison of Digital Authority in Global Climate Policy

International organizations and their secretariats, called international public administrations (IPAs), have been found to hold considerable authority in world politics. In this study, we conceptualize and measure IPA authority in the digital sphere. We propose the concept of digital authority to measure authority of actors in online social networks (OSN), such as Twitter. Applying exponential random graph models (ERGMs) based on Twitter data during climate change negotiations we compare the authority of IPAs to that of other actors. Our findings show that IPAs are attributed as much authority as state actors in global climate communication networks on Twitter.

Keywords: international public administrations, authority, global climate policy, Twitter, comparative analysis, exponential random graph models (ERGMs).

Introduction

The landscape of world politics has become increasingly fragmented. Issues such as human rights, labor standards, or climate change are not governed by nation states alone anymore but rather by a variety of state and non-state actors on multiple levels. This growing complexity raises questions of who holds authority in global governance and how authority can be conceptualized and measured.

Within the global governance literature, the secretariats of international organizations (IOs), referred to as international public administrations (IPAs), have received increasing scholarly attention. IPAs are “bodies with a certain degree of autonomy, staffed by professional and appointed civil servants who are responsible for specific tasks and who work together following the rules and norms of the IO in question” (Bauer, Knill, and Eckhard 2017: 2). Traditionally in the International Relations literature, IPAs were considered servants of nation states with little autonomy of their own. However, within the last two decades, scholars have argued that IPAs are more than that – they are “actors in their own right” (Jinnah 2014: 21) that possess agency and can act strategically (see e.g., Heinkelmann-Wild and Jankauskas in this issue; see also Bayerlein et al. in this issue). Hence, a growing number of scholars recognizes that IPAs have autonomous influence on global governance processes (Barnett and Finnemore 2004; Biermann and Siebenhüner 2009; Bauer and Weinlich 2011; Eckhard and Ege 2016; Bauer, Knill, and Eckhard 2017).

One main factor for the influence of IPAs is their authority (Busch and Liese 2017). Authority is described as an asymmetrical social relationship based on recognition which enables actors to exert influence (Simmerl and Zürn 2016). This concept is also central to the global governance literature. According to Zürn “patterns of authority are the key to the understanding of any political system” (2018: 37). Different sources of authority have been identified for IPAs (Barnett and Finnemore 2004: 20–24). Most commonly, authority is ascribed to their expertise

and knowledge (expert authority or *de facto* authority) as well as to their impartial and apolitical appearance (legal-rational authority or *de jure* authority). Besides, their moral standing and senior leadership skills have been identified as crucial sources of authority. A vast literature has emerged that aims at conceptualizing and measuring authority of IPAs (Barnett and Finnemore 2004; Ecker-Ehrhardt 2012; Hooghe and Marks 2015; Busch and Liese 2017; Hooghe et al. 2017; Zürn 2018).¹

This study aims to add to this literature by providing a conceptualization of authority that allows to measure and compare IPA authority vis-à-vis other actors. We argue that the increasing use of online social networks (OSN) as means of communication offers a vast potential to observe interaction patterns that allow to draw conclusions about authority structures. We refer to this kind of authority as *digital authority*. Rather than presenting a completely new concept, we define digital authority as *de facto* authority within the digital sphere.²

For this study, we use data from the OSN Twitter. Particularly for political content, Twitter has become an important communication tool (Dubois and Gaffney 2014; Williams et al. 2015; Jungherr 2016) due to the opportunity to follow political events such as UN negotiations or elections, online in real-time. Most IOs and heads of government have a Twitter account (Burson Cohn & Wolfe 2018). Twitter users also include citizens, representatives of civil society organizations as well as businesses. For IPAs, Twitter presents an opportunity to reach stakeholders that are not usually involved in multilateral negotiations. By providing policy-specific information to a wider audience, IPAs can build transnational support to bring multilateral negotiations to a successful end (Jørgens et al. 2017). Moreover, by shining light on their activities, they can use Twitter as a form of self-legitimation (Duncombe 2017). However, not only the activity of users provides information about them, but also the extent to

¹ For an excellent overview of the literature on IPA authority, see Busch and colleagues in this issue.

² By “digital sphere” we refer in this study to online social networks, such as Twitter. We acknowledge that there are many other possibilities to conceptualize “digital spheres” as, for example, online blogs or e-mails.

which other users interact with them. We argue that being an addressee of interaction on Twitter (through a mention, reply, or retweet) allows us to measure their *de facto* authority.

As a case study, we use the climate policy domain. Similar to other policy areas, governance patterns in the area of climate change have become more complex (Keohane and Victor 2011; Abbott 2012). Due to the slow and limited progress of multilateral negotiations in an issue area that requires immediate action, transnational climate governance (TCG) initiatives and schemes have seen a considerable growth (Andonova, Betsill, and Bulkeley 2009; Bulkeley et al. 2012; Roger, Hale, and Andonova 2017). Hence, authors argue that authority in global climate governance has partially shifted from multilateral actors to transnational ones, or at least has become more fragmented (Hoffmann 2011; Bäckstrand et al. 2017; Hickmann 2017). In this context, the role of IPAs within the complex climate governance networks has been discussed by an increasing number of scholars (Jørgens, Kolleck, and Saerbeck 2016; Kolleck et al. 2017; Hickmann et al. 2019; Saerbeck et al. 2020). Global climate policy presents thus an interesting case to examine the authority of IPAs in comparison to other actors within the digital sphere.

We use Twitter data gathered during climate change negotiations of five consecutive years (2013-2017) to measure the digital authority of key actors. Since the concept of authority is understood as a social relation, we apply social network analysis (SNA), which offers ideal techniques due to its emphasis on social relations between actors. In particular, we apply an inferential SNA technique, called exponential random graph models (ERGMs) that allows to make inferences about the network topology (Robins et al. 2007). Hence, we aim to introduce SNA to the study of IPA authority. Combining communication data from Twitter with SNA enables us to infer digital authority of IPAs in comparison to other actors in global climate communication networks.

This article is organized as follows: In the first section, we describe why authority structures in world politics have changed and discuss the forms of authority that can be attributed to IPAs.

Next, we explain the measure of digital authority that is proposed in this study. Thereafter, the case of global climate policy is presented. In the fourth section, we describe our data set, methodological approach, and model specification. Subsequently, we present the results of our pooled ERGM. In a concluding section, we discuss our findings, limitations, and present prospects for future research.

Changes in global authority structures

Authority structures in world politics are no longer represented by national borders (Rosenau 2003). Businesses and civil society organizations operating from the global to the local level as well as sub-national units, such as regional governments and cities, are becoming increasingly active in global governance processes. Two main explanations for this development have been brought forward (Green 2013; Roger and Dauvergne 2016). The first is a functional explanation. State-led governance activities are often not sufficiently successful in certain policy areas and therefore private actors start to engage. The second explanation emphasizes the structural shifts that have occurred during the last decades, that are technological developments and globalization processes in general, which enable private actors to communicate and organize more easily (Bennett and Segerberg 2012). Hence, a wide variety of private and public actors at different levels have emerged within the global governance space.

To account for the activities of these types of actors, the concept of TNG emerged and since has attracted a lot of scholarly interest (Hall and Biersteker 2002; Prakash and Potoski 2006; Abbott and Snidal 2009; Andonova, Betsill, and Bulkeley 2009; Green 2013; Ruggie 2014; Roger and Dauvergne 2016). TNG is defined as a process in which at least two non-state or sub-state actors, located in different nation states, follow a common set of rules aimed at steering their behavior towards a public goal (Andonova, Betsill, and Bulkeley 2009; Roger, Hale, and Andonova 2017). Nation states and international organizations can also be part of

these processes (Abbott and Snidal 2009). This collection of various actors cooperating across multiple levels in combination with the multilateral processes, make global governance increasingly complex (Keohane and Victor 2011; Abbott 2012; Alter and Raustiala 2018).

The question of who holds authority within these complex governance structures becomes a crucial one. In this context, a growing literature is scrutinizing the work of IPAs (Biermann and Siebenhüner 2009; Eckhard and Ege 2016; Bauer, Knill, and Eckhard 2017) whose influence on global policymaking processes has often been ascribed to their authority (Barnett and Finnemore 2004; Busch and Liese 2017; Zürn 2018).³ However, the concept of authority is multifaceted and various forms of authority have been identified in the literature. Most prominently, IPAs possess legal-rational authority (Barnett and Finnemore 2004). Based on Max Weber's tripartite classification of authority, legal-rational authority is derived from the laws and formal rules that created the bureaucracy (Weber 1922). Hence, the legal-rational authority can be considered as the basic source of authority or, as Barnett and Finnemore put it, "[b]ureaucracies are by definition authorities – the rational-legal authorities in their domain of action" (2004: 20). The rational-legal authority is also described as *de jure* authority, which puts IPAs 'in' authority (Friedman 1990).

In contrast to the *de jure* authority, expertise and information are often associated with *de facto* authority, which make actors 'an' authority (Katsikas 2010: 117). This type is also referred to as expert authority (Busch and Liese 2017; Littoz-Monnet 2017). IPAs possess unique knowledge and expertise about the procedures of the institution that they are part of, turning them into an international organization's institutional memory (Bauer 2006). Moreover, they can have expertise within their policy field and provide information about distinct policy

³ Eckhard & Ege (2016) provide an excellent overview of the literature on determinants of IPA influence. Beyond an IPAs authority, they find that structural aspects such as "hierarchy, personal selection, specialization and distance from policy-makers" (p. 968) also influence policymaking opportunities. Moreover, external factors such as the policy area, the salience of an issue area, as well as the control capacities of member states have been found to be crucial factors for IPA influence.

options (Littoz-Monnet 2017). IPAs have been found to be central actors within their policy domains, by publishing and disseminating important information for stakeholders regarding a policy issue (Jørgens, Kolleck, and Saerbeck 2016). Hence, their expertise and knowledge are often considered to be the core of their power (Barnett and Finnemore 2004).

Other sources of authority that can be found in the literature are moral authority (Hall 1997) and authority associated with the senior leadership of IPAs (Barnett and Finnemore 2004). These two forms are intertwined because they often are derived from moral claims made by individuals, such as the UN Secretary General (Busch and Liese 2017). Authority rooted in the senior leadership of an IPA, however, can also be considered charismatic authority as defined by Weber (1922). What unites all different forms of authority mentioned above is that they all only occur on a relational level. Authority is considered an asymmetrical social relationship based on recognition which enables actors to exert influence (Simmerl and Zürn 2016).

A concept that is closely related to that of authority but needs to be distinguished from it, is legitimacy. Defined “as beliefs of audiences that an IO’s authority is appropriately exercised, and legitimation as a process of justification and contestation intended to shape such beliefs” (Tallberg and Zürn 2019: 583), legitimacy thus is an assessment of authority and requires authority to exist in the first place.

Beyond conceptualizing authority of IPAs, a few scholars also undertook the vital task of measuring different forms of IPA authority. Hooghe and Marks (2015) analyzed *de jure* authority of different IPAs using a quantitative approach. They find that the extent of *de jure* authority is dependent on the number of member states of the IO and the scope of its policy portfolio, and hence, varies greatly across IOs. An approach to measure *de facto* expert authority of IPAs was conducted by Busch and colleagues (Busch et al. in this issue). They also use a quantitative approach to measure *de facto* expert authority, inquiring domestic civil servants about the authority of IPAs, and compare their results with Hooghe and Marks’ (2015)

and Zürn et al. (forthcoming) data sets for *de jure* authority. They show which IPAs are attributed more *de facto* expert authority than *de jure* and vice versa. Ecker-Ehrhardt (2012) measures *de facto* expert authority of various actors (not only IPAs) using a communication theoretical approach, which defines authority as a discursive mode of power. Analyzing media coverage of the Darfur crisis, he finds that UN agencies, such as UNICEF and UNHCR are overwhelmingly perceived as authoritative sources.

This article aims to add to this emerging strand of literature by assessing the digital authority of IPAs. Building on the different conceptualizations of authority discussed above, we argue that we can measure *de facto* authority of IPAs by studying communicative relationships on Twitter. In the next section, we explain how we aim to measure this form of authority in the digital sphere.

Towards digital authority

Twitter has become a widely used communication tool for political purposes (Conover et al. 2011; Dubois and Gaffney 2014; Williams et al. 2015; Häussler 2019). Due to the nature of the platform, it has become the most important OSN for political communication. First, Twitter users usually have public profiles. This makes interactions with users across different geographic areas easy in comparison to other OSN such as Facebook, where many users are private, and interactions rather occur among friends which are more likely to be closer to each other. Second, the use of hashtags on Twitter allows public discourses to emerge and to be identified around specific issues easily. Thus, Twitter creates a digital public sphere that enables interactions between a variety of political actors but also citizens. Especially during high-level political events, Twitter is used by these actors to communicate with each other and the wider public to inform about or comment on current negotiation processes and outcomes. By using Twitter, IPAs can reach actors that are outside of the formal negotiations. Extending policy

debates beyond the official parties to multilateral negotiations and observers, secretariats may try to build transnational support for the policy issues at stake, thereby raising pressure from the outside on national governments to continue and successfully conclude negotiations (Jörgens et al. 2017). Hence, the relatively informal character of digital communication carries the potential of enhancing a bureaucracy's *de facto* authority by reaching stakeholders outside of the multilateral negotiation system within which they operate. By engaging in the digital public sphere, IPAs can potentially contribute to the solution of global policy problems (in our case, climate change). Second, by spreading information on Twitter, IPAs can promote either their initiatives or the policy preferences of actors that they want to strengthen. This could be described as a process of (self-) legitimation (Duncombe 2017). A potentially influential position of IPAs has also been found for the annual climate change negotiations (Conferences of the Parties, COPs) under the United Nations Framework Convention on Climate Change (UNFCCC) (Jörgens, Kolleck, and Saerbeck 2016; Kolleck et al. 2017).

As a micro-blogging tool, Twitter allows its users to write short messages up to 280 characters⁴, so-called tweets, and to share them with their followers. Within these tweets, users can refer to all other users of the platform. This communication provides the relations that are the main interest of our study and, as we argue, enable us to measure authority. Relations on Twitter are either created through a *mention*, a *retweet*, or a *reply*. A *mention* occurs if a user writes a message and links another user within it, using an @-sign. When users answer to messages of other users it is referred to as a *reply*. Moreover, users can share tweets of other users with their followers, which is called a *retweet*. Debates around specific topics can be identified through the hashtag-sign #. For example, tweets referring to climate conferences use the hashtag #COP and the corresponding number of the conferences, e.g., #COP21 for the 21st COP that took place in Paris in 2015.

⁴ The limit was extended from 140 to 280 characters in 2017.

Due to these characteristics, Twitter can be conceived as a digital public sphere which allows to analyze authority structures. We refer to *de facto* authority of political actors in OSN as *digital authority*. Hence, we aim to add another layer to *de facto* authority. We argue that OSNs are not detached from the “real world” but present another dimension to it. Therefore, OSN can allow to identify patterns similar to the “real world”. However, these platforms also develop their own dynamics that are important to consider, for example, the tendency to strengthen radical opinions. Thus, patterns identified in OSN are not necessarily a direct mirror of the “real world” but can rather provide an additional dimension to *de facto* authority. It is therefore important to account for *digital authority* to create a more comprehensive account of *de facto* authority of political actors.

We argue that due to the rather informal character of the digital public sphere, IPAs can stretch beyond the limits of their mandate. For example, Twitter communication is less subject to critical scrutiny by nation states than official secretariat documents. Moreover, communication in the digital sphere is faster and increases the chances for IPAs to build support for specific positions in the ongoing negotiation process. IPAs can make use of these opportunities by acting as knowledge brokers, giving voice to certain positions of transnational civil society in the negotiating system, and, conversely, building external support for certain positions. It is a form of inverse “boomerang pattern of influence” (Keck and Sikkink 1999) where IPAs may try to increase their influence on multilateral negotiation outcomes by bypassing the negotiation parties and directly seeking transnational allies to try to put pressure on the parties from outside. Hence, digital authority is likely to go beyond the limited *de jure* authority that IPAs possess.

Based on these considerations regarding the opportunities of the digital public sphere and the global authority structures described in section 2, we aim to derive expectations about the digital authority attributed to different types of actors and test them in a subsequent analysis. Instead

of assessing authority in absolute terms, we use a relational approach. This means that we analyze authority of IPAs in comparison to state and non-state actors.

First, it has to be acknowledged that state actors continue to play a central role within multilateral negotiations. Despite the partial shift of authority from nation states to non-state actors (see also the previous and next sections), nation states are still likely to be attributed higher levels of authority than non-state actors. Nation states are the primary actors negotiating multilateral agreements and therefore we expect them to be often targets of advocacy strategies online. Hence, the authority of state actors in the “real world” is likely to be mirrored in the digital sphere.

Second, we expect IPAs to be attributed similar degrees of digital authority as state actors. IPAs perform important functions for different groups of actors. For nation states, IPAs’ role as a direct information source within the multilateral negotiation system can provide them with epistemic or expert authority, making them a trusted source of information that is potentially shared online. For non-state actors, IPAs’ potential to be brokers and orchestrators might make them important communication targets in issue-specific online debates. Due to these multiple roles of IPAs, overall, we expect them to be attributed similar authority to state actors in the digital sphere.

Third, we expect non-state actors, such as business, research, and civil society organizations to be attributed less authority than IPAs and state actors. Although non-state actors’ authority has increased within the global governance regime over time, they are unlikely to be attributed more digital authority than IPAs and nation states when compared directly. Non-state actors hold *de facto* authority through their expertise and resources (e.g., research organizations, businesses and think tanks), however, we expect that their policy preferences or expertise are not systematically sought after by national governments in the digital sphere during multilateral negotiations, but rather in national debates that precede multilateral negotiations. Therefore, we

argue that non-state actors are likely to be attributed less digital authority than IPAs and state actors.

In line with other studies, we propose to measure *de facto* authority on Twitter through the number of times an actor is the addressee of communication (Ausserhofer and Maireder 2013; Riquelme and Gonzalez-Cantergiani 2016). Hereby, we do not distinguish the different types of communication that occur on Twitter, i.e., mention, retweet, or reply. All of these communicative actions allow to measure digital authority. If an account engages in any kind of communication with another account on Twitter, we assume the targeted account holds *de facto* authority. For example, when account A *mentions* account B directly in a tweet, it draws the attention of B to A. This shows that it is important to A that B knows about A or the message that A shares within its tweet. When A *retweets* a message of B, either to show support or to criticize, this also indicates *de facto* authority of B because the message of B was worth the reaction of A. A similar logic applies to replies: if A replies to a tweet of B, B must be important enough to be replied to. Hence, we argue that the more other accounts mention, retweet, or reply to an account, the more authority they attribute to the user.

The case of global climate policy

We will use the field of climate change as a case to study digital authority of IPAs with the help of SNA. Shifts in authority structures within the policy area as well as the increasing prominence of IPAs within recent literature make the case especially relevant for our purpose. From a research design perspective, we decided to examine the area of climate change because the annual negotiations (COPs) offer the opportunity to gather data over time to create a more comprehensive picture. Moreover, climate change has emerged as an important topic in international politics, which attracts a lot of attention and hence creates loads of Twitter data that can be analyzed.

Climate change is a policy field that has seen a lot of growth in transnational initiatives (Pattberg and Stripple 2008; Bulkeley et al. 2012; Roger, Hale, and Andonova 2017). Due to the nature of the challenge that climate change poses, it is an area especially favourable to transnational governance (Andonova, Betsill, and Bulkeley 2009). Climate change affects many different sectors and various groups of society across borders. Moreover, multilateral negotiations did not result in sufficient climate action. The pressure to address climate change as fast as possible is therefore rising and non-state actors are actively encouraged within the Paris Agreement to participate (UNFCCC 2015, Decision 1/CP.21).

Due to the increasing relevance of transnational governance schemes and initiatives, some authors argue that authority within global governance has shifted away from nation states towards non-state actors (Hoffmann 2011). They claim a private sphere of authority has been created governed by NGOs, businesses, and other non-state actors (Betsill et al. 2015). Other scholars perceive TCG initiatives rather as complementary to the multilateral process (Bäckstrand et al. 2017; Hickmann 2017). Instead of a shift of authority, they speak of a reconfiguration of authority structures (Hickmann 2017) or a deep intertwining of public and private authority (Green 2013; Bäckstrand et al. 2017). Both strands, however, observe a substantial change of authority structures within global climate governance.

This reconfiguration or shift of authority structures has implications for the authority of IPAs as well. Traditionally, IPAs, are regarded as servants of member states, and thus their relationship with and importance to nation states has been examined thoroughly (Abbott and Snidal 1998; De Francesco 2016). Within the multilateral process, IPAs are administrators and information providers to member states and observers to the negotiations. However, within TCG, IPAs are often perceived as ‘orchestrators’ which use soft governance modes and act through other like-minded actors to steer their targets towards their governance goal (Abbott et

al. 2015; Abbott 2017; Hickmann et al. 2019). IPAs are hence crucial actors within both governance spheres, the multilateral as well as the transnational one, putting them amid nation states and non-state actors.

The IPA at the core of the climate regime complex is the UNFCCC secretariat. Accordingly, it has obtained a lot of attention from scholars (Busch 2009; Jinnah 2011; Hickmann et al. 2019). The climate secretariat has been found to exert influence within different issue areas (Jørgens, Kolleck, and Saerbeck 2016; Kolleck et al. 2017; Michaelowa and Michaelowa 2017). Hickmann et al. (2019), for example, show that the secretariat is increasingly engaging through ‘orchestration’ in a policy dialogue with non-state actors, and thus, has taken on a more active role over the past years. In addition to the climate secretariat also other IPAs, such as the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP), have been found to exert influence by disseminating different kinds of information to stakeholders (Saerbeck et al. 2020). These studies indicate that the expert authority of the secretariat can be considered to be the basis of its influence.

The climate secretariat has also been identified to exert influence in the digital sphere. Using Twitter data in combination with descriptive SNA measures, Jørgens, Kolleck, and Saerbeck (2016) found that the climate secretariat occupies a central position within the communication network around climate and gender, indicating the IPA’s authority in terms of being an information broker. These results are not limited to the issue of gender and climate, however. Kolleck et al. (2017) observed an influential climate secretariat in the digital sphere also during the actual climate negotiations on the topic of climate change education. Our analysis builds on these studies and uses inferential network analysis techniques based on Twitter data to measure the authority of IPAs in the digital sphere.

Data and methodological approach

Twitter data

The Twitter data analyzed for this study covers the UN climate negotiations during five consecutive COPs (2013–2017). We added two days before and after each conference so as not to miss any relevant information. We obtained the data from a third-party vendor called Texifter using a search query with specific hashtags and keywords, such as #COP21 or #unfccc⁵. We received raw data from which we created data sets appropriate for network analysis. Overall, the data sets contain between 240,000 tweets in 2013 and over four million for the year 2015.

The OSN Twitter can be described as a public space, which enables communication among individual and collective actors. Not all communication that occurs during COPs is important, hence identifying relevant actors within the Twitter network becomes a crucial task. This process is also known as boundary specification. Based on our definition of digital authority, we use the measure of in-degree, i.e., how often an account was mentioned, retweeted or replied to, to identify the most authoritative actors for each of the five COPs. Using this approach, we extracted the 300 most authoritative actors (the ones with the highest in-degree) during COPs in each year (2013-2017). These actors and their interactions form the base of our analysis. Hence, we examine authority patterns within a high-authority sample.

The nodes in the networks represent Twitter accounts (both individuals and organizations) and the edges represent retweets, mentions, and replies. To compare the specific network behavior of different organization types, we coded the involved accounts by hand and assigned them to the following groups: business, NGOs, state actors (incl. sub-state), media, research organizations, IOs/IPAs, transnational initiatives, others. Concerning the group of IOs, we

⁵ For further information on the data gathering process, see Goritz, Kolleck, and Jörgens (2019).

assume that the secretariats of the IOs, the IPAs, are managing the Twitter accounts. Overall, we obtained directed and unweighted one-mode networks.

Methodological approach

For the present study, we employ exponential random graph models (ERGMs) as described by Robins et al. (2007). Calculating ERGMs is an inferential network technique that can be used to statistically examine the topology of a network. The underlying assumption of this approach is that ‘the patterns within networks can be seen as evidence for ongoing structural processes’ (Lusher, Robins, and Koskinen 2013: 10). This, in turn, allows to test hypotheses about factors influencing the structure of the network. The main idea is to model the characteristics of a theoretical network and fit them to an observed network by estimating their parameters. Put in other words, the dependent variable within an ERGM represents the observed network (tie formation) and the independent variables – endogenous network statistics (i.e., self-organizing network dependencies) as well as exogenous covariates (i.e., structural attributes at the node- and dyad-level) – are modeled explicitly (Robins et al. 2007).⁶ This way, we can identify characteristics in the observed network that occur significantly more often in the empirical network than expected by chance. The received estimates can then be interpreted in the same way as in a logit regression model (Leifeld and Schneider 2012).

As we examined multiple networks, we estimated pooled ERGMs. This technique is used to calculate the average estimates of several independent, yet identical models (Leifeld, Cranmer, and Desmarais 2018a). Although some temporal dependencies might exist in our data set, we were not able to model them using a longitudinal analysis (with e.g. temporal ERGMs) due to

⁶ One of the main differences between ERG and regression models is the i.i.d. assumption of the latter, meaning that that the observations should be independent of one another and identically distributed. Especially in network-like structures this assumption would be violated due to the endogenous network formation processes that have been identified. Therefore, in ERGMs, these endogenous structural processes, such as reciprocity and transitivity are modelled explicitly (Cranmer and Desmarais 2011).

the high fluctuation of actors. We, therefore, decided to employ this approach. The model estimation was performed in the free and open-source development environment R (R Core Team 2019) with the ‘btergm’ package as implemented by Leifeld, Cranmer, and Desmarais (2019) in the ‘xergm’ meta-package (Leifeld, Cranmer, and Desmarais 2018b). The model was fitted using maximum pseudo-likelihood estimation (MPLE) (Leifeld, Cranmer, and Desmarais 2018a).

Model specification

The model we estimated contains both exogenous and endogenous covariates. As our main variable of interest, we used a node’s incoming ties differentiated according to actor groups, *actor type (alter)*. This presents our measure of digital authority. It allows us to detect whether some actor groups are more likely to be targets of communication than others. Similarly, we incorporated the outgoing ties of a node, *actor type (ego)*, which can be described as a measure of activity. Moreover, we included a term for homophily, *nodematch*, within actor groups. Homophily describes the phenomenon that “contact between similar people occurs at a higher rate than among dissimilar people” (McPherson, Smith-Lovin, and Cook 2001: 416). Homophily does not only apply to people, but also organizations, and hence is important to consider within network models. In our case, we assume actors of the same organization type to be more similar and therefore show a tendency to interact more frequently.

We also added the number of followers for each user in the respective years. Follower counts can also be used to measure authority in Twitter networks, however, it is only a passive measure. Accounts with many followers might be more likely to be targets of communication. Therefore, we decided to include the follower count as a control variable in our model. Twitter only offers metadata, such as follower count, for users who, at some point, actively participated in the Twitter communication, meaning that they had to be the source of interaction. As this was not

the case for all users involved in the analysis because some were only targets of interactions, we imputed missing data for follower counts using Fully Conditional Specification (FCS) as implemented in the MICE package by van Buuren and Groothuis-Oudshoorn (2011). To allow for a more concise interpretation of the estimates and to stabilize the model, we rescaled the number of followers by a factor of 0.00001.

As endogenous covariates, we added a term for reciprocity, which accounts for the phenomenon that if actor i mentions or retweets actor j , it is more likely that j , in turn, retweets actor i . Moreover, the model included variables to account for transitivity, which means: if actor i and actor j cooperate and hence have a tie, and i and k also cooperate, it is more likely that j and k will cooperate as well. This effect can be controlled for in ERGMs by including the geometrically weighted edge-wise shared partner distribution (*GWESP*) and the geometrically weighted dyad-wise shared partner distribution (*GWDSP*). Whereas the *GWESP* statistic accounts for the number of connected actors with shared partners, the *GWDSP* term includes both connected and unconnected dyads. To take into account actors with few shared partners, we weighted the *GWESP* and *GWDSP* terms by a parameter of $\theta=0.2$. This also leads to an increase in both model fit and convergence (Leifeld and Schneider 2012: 739).

We also included an *edges* term and *degree* terms as control variables in our model. The *edges* term keeps the number of ties constant throughout the simulations and controls for the density of the network. The geometrically weighted in-degree and out-degree terms control for the degree distribution in the network, emphasizing actors with few ties with a parameter of $\theta=0.2$. Finally, we added the term of betweenness centrality of alter, which measures how often an actor lies on the shortest path between two other actors (see, e.g., Borgatti, Everett, and Johnson 2018) to account for the structural significance of specific actors. Due to the wide range of values, the centrality values were normalized (z transformation).

Results

The results of the pooled ERGM are presented in Table 1. Coefficients can be interpreted like log-odds in logistic regression models. The first term in the table, *edges*, is similar to a constant in linear regression models and represents the likelihood of any dyad to form a tie within the network. The second term is *reciprocity*, which is positive and significant, meaning that actors are more likely to target someone if they have been targeted by that same actor before.

[Please insert table 1 here]

The next term, *actor type (alter)*, is the main focus of this study and indicates which actors are more likely to become targets of communication, and therefore by our definition, are attributed authority in the communication network. We use IPAs as a reference category since it allows us to assess how IPAs compare to other actors. The results are negative and significant for business, media, and transnational actors and negative, yet marginally insignificant, for NGOs and research organizations.⁷ The only actor group that obtained a small positive estimate are state actors, however, the estimate is not significant. This means that ties within the network are more likely to form if the target of communication is an IPA as compared to non-state actors. For state actors, we cannot observe a significant difference to IPAs when it comes to the likelihood of tie formation. It is important to note, however, that within the group of state actors, we included the COP accounts for each year because they are managed by the nation state that holds the presidency each year. Our results thus indicate that IPAs are attributed more authority

⁷ In the Appendix we provide robustness checks where we differentiate between retweets as well as mentions and replies. For the important covariates, the results remained very similar.

than non-state actors within the communication network but there is no significant difference between IPAs and state actors.

Subsequently, we included the term *actor type (ego)* to estimate the likelihood of a tie, dependent on the type of actor, who is the source of communication. For all actor groups, except for state actors, the estimates are positive. For NGOs, media, transnational actors, and uncategorized actors (others) the results are also significant. This implies that ties are more likely to occur in the networks when the ego is either one of these actor groups. Again, state actors present an exception with a negative but insignificant estimate. These results indicate that IPAs, similar to state actors, are not very active within the climate communication networks on Twitter when compared to non-state actors. These findings complement our former results that IPAs and state actors are rather targets than sources of communication. Hence, to be attributed authority, it is not necessarily crucial to be active in the communication network, according to our operationalization.

Concerning the control variables, the results support our expectations. The *homophily* estimates are positive and significant for most of the actor groups, including IPAs. Hence, the likelihood of a tie to be formed within the network is higher if the two nodes belong to the same actor group. Figure 1 illustrates the communication network for one conference (COP21) and the homophily structures become apparent. When including the number of *followers*, we differentiated between the followers of alter, ego, and the absolute difference between the follower count of ego and alter. We can observe that the follower count of ego is significantly negative in our model, indicating that, if the number of followers of ego increases, the likelihood for a tie in the network decreases. This implies that users with more followers are less likely to actively form ties in the network. Another estimate that we included in the model is the betweenness centrality of alters. The estimate is positive and significant, meaning that if alter

tends to occupy a strategic position in the Twitter network, it is more likely that ego communicates with alter.

Moreover, we accounted for the geometrically weighted in-degree and out-degree in order to include the tendency of nodes to establish links with popular nodes. The weighted outdegree is negative and significant, which can be interpreted that users are more likely to target users that have high degree scores. With GWESP and GWDSP, we included a last set of variables to control for transitivity effects within the network. Hereby, GWDSP is considered the baseline effect for GWESP, and thus both effects can be interpreted together (Hunter 2007). GWESP is significant and positive, whereas GWDSP is significant and negative. This means that after controlling for the effect that two ties might have a tie in common if connected or not (GWDSP), the effect that two ties have a tie in common is more likely to occur when they are connected themselves (GWESP) than by chance.

Our comprehensive model included various exogenous variables and endogenous network statistics, but we can still observe that IPAs are attributed a degree of authority comparable to that of state actors within the climate communication network even when controlling for these additional effects. Hence, our results can be used as an indication for the digital authority of IPAs in global climate governance networks.

[Please insert figure 1 here]

Discussion and conclusion

Our contribution aimed at conceptualizing and measuring authority of IPAs by using a network analytical approach. Using the case of global climate policy, we examined Twitter data during COPs with an inferential network analysis technique, called ERGMs, to assess the digital

authority, i.e., *de facto* authority of IPAs in the digital sphere, in comparison to other actors. We proposed to measure this concept in terms of being the addressees of communication.

The results of our analysis indicate that IPAs are attributed a degree of authority comparable to that of state actors within the observed networks. We find that ties within the networks become less likely when the target of communication (mention, retweet, or reply) is not an IPA or a state actor. These findings are in line with our expectations that IPA and state actors are attributed similar digital authority. The authority of nation states in global climate governance in the digital sphere might mirror to a great extent their “real world” authority in multilateral negotiations, where nation states are still the single most important actors. The various functions of IPAs during multilateral negotiations, as e.g. information providers, brokers or orchestrators, might help explain their digital authority. Our results lead to the suggestion that claims in the literature that authority within global climate governance may be shifting away from nation states (e.g., Hoffmann 2011) should not be overestimated.

Moreover, we find that IPAs are less active than most other actors on Twitter. All actor groups are more likely to be sources of communication, meaning that they mention, reply, and retweet more than IPAs. Similar to our first results, state actors present an exception. There is no significant difference for the likelihood of tie formation if the sources of information are state actors or IPAs. Non-state actors, in contrast, are more active than IPAs and state actors within the communication networks. There might be two motives behind this activity: First, this could indicate an advocacy strategy where non-state actors seek to feed information into the negotiation process, potentially through IPAs. This could be explained by the nature of their work, which often is centered around advocacy and awareness-raising (Briones et al. 2011; Guo and Saxton 2014). Second, the activity of non-state actors on Twitter might be perceived as a self-legitimation process. Since NGOs do not possess a formal mandate, they may use other measures to achieve legitimacy and influence global policymaking processes. Analyzing

orchestration efforts, Abbott and Hale (2014) have identified similar processes. Multi-stakeholder networks of non-state actors benefitted from the support of an IPA (the “orchestrator”) that provided legitimacy to the non-state actor network. In the digital sphere, Schuster, Jörgens, and Kolleck (2019) made similar observations in the field of education policy due to NGO activity on Twitter.

This finding is also complementary to our first one. If IPAs and state actors are perceived as authorities, other actors will try to interact with them to get their attention, disseminate their information, or participate in a discussion about information they tweeted. Hence, to hold digital authority it is not necessary to be extremely active, according to our operationalization.

Our findings can be interpreted as an indicator of the central roles of IPAs within the multilateral and transnational climate governance sphere and how international bureaucracies can use their digital authority to combine these two spheres. Non-state actors may see IPAs as a potential channel through which they can feed their policy preferences into the negotiation process. IPAs can then choose to pass this information into the multilateral negotiations. Our analysis does not allow us to assess whether and how IPAs use this information. Here, the main communication channels are not digital but direct between the secretariat and national delegations, often through the “special relationship” (Depledge 2007) between the UNFCCC secretariat and the Chairpersons of the climate change negotiations. Within the multilateral sphere, IPAs are traditionally perceived as administrators and information providers, and thus, are attributed authority by member states. The authority attributed to them then would result from their role as policy brokers in the multilateral process. Within the transnational governance activities, IPAs are often involved in the role of ‘orchestrators’ (Abbott and Hale 2014; Abbott 2017). These orchestrators are usually attributed little authority for hierarchical governance, therefore, they rather use soft inducements, such as persuasion, ideational support, technical assistance, endorsement, or shaming (Abbott 2017). These pursuits however can only be

successful if the orchestrator is attributed authority. Moral authority for shaming or endorsement and expert authority for technical assistance, for example. Hence, various groups of stakeholders within global climate governance are likely to attribute authority to IPAs.

Some limitations of our study must be considered. It must be noted that our measure of digital authority should be distinguished from other forms of authority. In the digital sphere, radical views might receive more attention and are thus more often targets of communication. Therefore, actors with polarizing opinions might hold more authority online than offline. For extremely polarized issues this conceptualization might thus be less adequate. Another important aspect to consider are the time frames used for this study. We used the annual COPs to examine digital authority structures in global climate policy. Although this approach has advantages, such as comparability over time, it might lead the results to be skewed towards state actors.

In this study, we presented an innovative approach to measure and compare *de facto* authority in the digital sphere drawing on the case of climate change policy. Future research could build upon these findings and test whether similar patterns can be observed for other policy areas as well, considering the above-mentioned limitations. Moreover, an analysis of interaction patterns of different actor groups with IPAs would allow to substantiate our interpretation that IPAs are attributed authority by various actor groups. On a general level, analyzing the differences and similarities of IPAs within online and offline networks is crucial to build a comprehensive understanding of IPAs in global policymaking.

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