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Exceptional or just well connected?
Political entrepreneurs and brokers in policy making.

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Abstract
Policy brokers and policy entrepreneurs are assumed to have a decisive impact on policy outcomes. Their access to social and political resources is contingent on their influence to other agents. In social network analysis entrepreneurs are often closely associated to brokers, because both are agents presumed to benefit from bridging structural holes; e.g. gaining advantage through occupying a strategic position in relational space. Our aim here is twofold. First, to conceptually and operationally differentiate policy brokers from policy entrepreneurs premised on assumptions in the policy process literature; and second, via social network analysis, to use the output of core algorithms in a cross-sectional analysis of political brokerage and political entrepreneurship. We attempt to simplify the use of graph algebra in answering questions relevant to policy analysis by placing each algorithm within its theoretical context. In the methodology employed we first identify actors and graph their relations of influence within a specific policy event; then we select the most central actors; and compare their rank in a series of statistics that capture different aspects of their network advantage. We examine betweenness centrality, positive and negative Bonacich power, Burt's effective size and constraint and honest brokerage as paradigmatic. We employ two case studies to demonstrate the advantages and limitations of each algorithm for differentiating between brokers and entrepreneurs: One on Swiss climate policy and one on EU competition and transport policy.

Key words: Policy entrepreneurs, policy brokers, social network analysis.
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Discussion: On exceptionality, centrality and brokerage elasticity

The starting point for this research was that SNA offers several measures that may depict the conceptual difference that brokers and entrepreneurs have in policymaking processes. Borrowed from policy process theories, the basic assumption was that brokers and entrepreneurs search for different pathways to influence policymaking (see also Dur 2008), and are thus differently embedded in a policy network as they display distinct relational profiles. Table 1 summarized the network concepts and measures we used to highlight the difference among those two types of agents. This has allowed us to go beyond an analysis of political agency as merely the sum of actions of political agents.
As hypothesized, elementary centrality measures in general, and betweenness centrality in particular, can differentiate those that are most engaged and likely to be influential in a policy process. But there are several actors in a network displaying high centrality without having a remarkable impact on the policy process. We predicted that positive Bonacich power would fit the profile of policy entrepreneurs; negative would fit the profile of policy brokers. We found instead that policy

entrepreneurs are actors who activate ties to both, well and poorly connected others, in order to influence and/or control them. Concerning Burt's positional advantage and disadvantage measures we got mixed results in both case studies. We conclude that effective size and constraint help identify those exploiting structural holes, but do not sufficiently disentangle policy brokerage from policy entrepreneurship. Finally, the honest brokerage measure appears consistent for identifying compromise seeking policy brokers: in contrast to entrepreneurs, brokers in both case studies had high honest brokerage scores.

Congruent to our findings here we would suggest that policy entrepreneurs are central in both Bonacich power measures and a structural hole advantage through Burt's effective size measure. Policy entrepreneurs therefore have at the same time high levels of centrality and high levels of network brokerage. Such a relational profile implies informational advantage and high levels of influence. Policy brokers rank high on honest brokerage which implies that they are unique interlocutors between different segments of a network. Making this distinction allow us to disambiguate the agency of political brokers and entrepreneurs but also classify a new class of agency we term here exceptional, to portray the relational profile of those agents that oscillate between roles.

The agents we have identified here as exceptional rank high on almost all measures of centrality and brokerage we employ. Such agents appear to be central, connect different clusters and have a high proportion of their brokerage as 'honest'. Exceptional political agents score high on both network brokerage and network centrality, that imply a structural position with potential contradictions. The case study analysis has allowed us to confirm an intuition that these are actors that have oscillated between roles. Exceptional agents do not only have a structural advantage but shift roles to suit circumstance. This could make them difficult to predict for their opponents while remain a reliable source of information or influence for their supporters. This reflects to some degree what Paddgett and Ansell (1993) have termed "robust action" to describe the type of control Cosimo de Medici exercised on medieval Florentine politics. His role ambiguity translated into an advantage in the same way that in our cases studies exceptional agents appear to be brokers for some of their alters and entrepreneurs to others.

There are a number of network contingent concepts that we consider relevant, but for which we lack data to test our assumptions, such as network cognition and network horizons. These could indicate directions for future work in the field. In terms of network cognition, our assumption is that an accurate mental map of their relational environment could provide a major advantage to political actors, related to insights from the theory of cognitive social structure (Krackhardt 1999). This could also more clearly differentiate between policy brokers and policy entrepreneurs since the latter would need more accurate cognition of network brokerage opportunities than the former.

We further assume that an agents' network horizon could provide an advantage (Friedkin, 1983). The theory here assumes that success depends on cognition of who their associates are connected to, those that see further into their relational horizon (Friedkin 1998). Our assumption here is that policy brokers would need an accurate view of the relations between alters of their own alters. So, in terms of cognition of network topology, policy entrepreneurs would have a better comprehension of the 'global' network while policy brokers would be able to see the benefits they can draw from their local networks (relations of their alters). The former would value opportunities of information flow across different clusters in the relational topography, while the latter resource flows that can be reaped

through strong ties.

We conclude that comparing network statistics provided a unique insight into actors relational constraints and opportunities (table 2 and 3) which would not have been possible from a cross sectional design employing conventional policy analysis. And we have also provided a theoretical justification to the old adage that context matters. In policy environments with low levels of contestation, central actors are powerful. Centrality does not directly translate to power in a fragmented and clustered policy space. Unanticipated policy outcomes result because influence is harder for political actors to assess and power could lie with those that broker influence between opposing clusters or those that seek balance and compromise through group cohesion. In that respect network analysis allow us to directly reflect and theorize on issues of power and its dissemination in political systems.

And a word of caution. The effects of agency on social structure, whether the latter is conceived as an institution or a network of relations, are difficult to capture on a cross sectional design. A longitudinal analysis would be much preferable. Furthermore, the descriptive analysis employed here adequately explores how social structure impacts political agency, but for a further caveat. The relational behaviour of political agents is rarely unidimensional. Indeed the recognition that actors interact in multiple, co-evolving and parallel social worlds is neither novel nor revolutionary. The analysis of such data is still at an early stage however. An interest in complexity (Uhl-Bien et al. 2008) and attention in the analysis of agency in tandem with structure, objects, values, beliefs and events (Carley 2009) indicates the future for explanatory and predictive social science.

As far as descriptive SNA is concerned, future research should explore further the elasticity of brokerage based on our claim that exceptional actors oscillate between roles. This we assume allows them to suit specific relational situations and task demands. Network analysis is conducive to capturing power relations as it can be employed to contingently consider information, reputation, support and conflict information as reflected in the relations of policy makers. As demonstrated here, it is also consistent with method and data triangulation.

Decoupling Relational Power in Policy Networks: A Longitudinal Analysis of Exceptional Agency

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INTRODUCTION

Only few actors participating in policymaking dispose of formal decision-making power and control over policy outcomes. Most other actors try to gain access to and influence decision-making in exchange for providing information and expertise (Henning 2009, Bouwen 2002). Further, political actors collaborate with others in order to coordinate activities to compensate for their limited individual resources (Heaney 2014). These mechanisms give rise to complex networks among actors participating in public policymaking. Public policy is therefore the outcome of a complex pattern of interaction of a variety of private and public entities (Leech et al. 2009).

Yet, not all actors trying to gain access to decision-making are successful in doing so, and only a limited number of actors actually enjoys regular access to and influence over decision-making. On the contrary, the bunch of actors interested in a particular policy process enjoy only indirect access to formal decision-making power through intermediate alters (Beyers and Braun 2013). Actors who dispose of particular policy influence or regular access are often called exceptional agents, brokers or entrepreneurs. Without having formal decision-making authority, these actors are said to leverage resources, to have an above-average willingness to get active, but also to be willing to risk failure (Mintrom and Norman 2009; Svensson and Öberg 2006). They impact policy outputs decisively through their ability to occupy powerful network positions (Christopoulos and Ingold 2014). Exceptional agency is not defined as an attribute or as personality, but rather as a role an actor plays within a given policy process and at a given time (McCaffrey and Salerno 2011; Mintrom 2000). In a network perspective, exceptional agents are located “at the right place”, occupying strategic and powerful network

positions (Smith et al. 2014; Christopoulos and Ingold 2014; Brass 1984). More concretely, a state agency being the only interlocutor between the government and private interest groups might for instance become an important source of information for policymakers in the design of regulations that conceive of the private sector as major target group. Alternatively, actors gatekeeping between opposed coalitions might be in the position to propose feasible policy solutions and negotiate a compromise (Beyers and Braun 2013; Ingold and Varone 2012). Such positions are inherently dependent on the overall network structure and are thus conceived of as potentially changing roles than fix actors' attributes.

In this paper, we argue that actors' positional power in networks influence future behaviors and outcomes (Smith et al. 2014), i.e. that such powerful positions pay off in terms of relational advantages over time because of information control or access to decision-making. Given that actors are generally power-driven (Stokman and Zeggelink 1996), they should be keen on preserving their powerful positions. First, we therefore ask: Can actors occupying powerful network positions maintain their positions over time?

Second, an actor holding a powerful position is expected to benefit from this role over time (Smith et al. 2014). Actors unable to keep their powerful network position could still take advantage of their position and gain other relational advantages in the policy network. Second, we therefore ask: Can actors occupying powerful network positions gain other relational advantages over time?

To answer these questions, we adopt a longitudinal perspective, analyze changes over time based on network descriptives, and finally run a Stochastic Actor-Oriented Model (Snijders et al. 2010) on the collaboration network of Swiss climate policy over two decades and at three points in time. Besides adopting a longitudinal perspective and applying sophisticated network models, one major added value of this paper lies in the conceptualization and operationalization of the independent variable, i.e. exceptional agency: we make the distinction between (1) powerful positions driven by overall network structures, i.e. positions that strongly depend on the positions of other actors in the overall network; and (2) powerful positions given by an actor's network location within or between coalitions.

The remainder of the paper is structured as follows: first, we review the literature on actors' interactions in policy networks and identify two major expectations regarding tie preservation or decay over time. Second, we introduce powerful network positions as independent variable driving actors' interactions. In the third and fourth sections, methods, data and cases are introduced. We then present results from the Stochastic Actor-Oriented Models for network dynamics. Finally, we discuss the impact of powerful

network positions on actors' interactions, highlighting insights about the preservation or decay of ties over time.

THEORY

Actors' interactions in policy networks

The central assumption in the literature on policy networks is that political outcomes are affected by a variety of state and non-state actors (Adam and Kriesi 2007; Sabatier and Jenkins-Smith 1993; Svara 1998). As technical, financial, and political resources are fragmented and no actor alone has enough resources to unilaterally influence public policy-making, collaboration with other actors is necessary if actors want to influence policy outputs (Berardo and Scholz 2010; Henry 2011). This relational exchange is organized in so-called policy networks (Laumann and Knoke 1987). While it is widely acknowledged that the final decision authority is the most important resource in policy making, authors largely agree that authority can be exchanged for other resources such as information, public support or technical expertise (Leifeld and Schneider 2012; Henning 2009; Pappi and Henning 1999, 1998; Knoke et al. 1996; Coleman 1986; Choi and Robertson 2013). This results in a network of actors where many groups gain indirect access to decision-making through intermediate actors (Beyers and Braun 2013: 3).

Evolution of network relations over time

Our starting point is the idea that building network relations and (in-)direct access to decision-making is one pre-condition for an actor to be able to influence policy outputs and outcomes (Ingold and Leifeld 2014; Fischer 2014). Yet, networks are dynamic phenomena per se because the behavior of actors in the network results in constantly changing network configurations (Snijders 2005). When taking account of the network dynamics and adopting a longitudinal perspective, contradictory expectations exist on whether actors seek and manage to preserve relations towards others or not.

The first expectation is that actors tend to preserve their relational profile over time in order to guarantee continuous access to decision-making. This is mainly relevant for actors who can only impact policy outputs during the so-called influence stage of the policy process. During the influence stage, all sorts of actors may engage in lobbying activities; whereas the voting stage is restricted to decision-makers and elected politicians only (Stokman and van den Bos 1992). Actors with no formal decisional power continuously seek to impact decision-making during the influence stage. Yet, even actors holding formal decisional power try to keep their relational profile: They do so in order to gain political support so that they are able to access the voting stage and achieve a final decision (and do not "fall back" into the influence stage). To sum up, all sorts of political

actors are basically power-driven and therefore seek for relational stability in order to impact outcomes decisively (see also Stokman and Zeggelink 1996).

The second, opposite expectation states that relationships weaken over time. According to Burt's concept of "bridge decay" (Burt 2005; 2002), relations are dissolved when the interaction of interest is over. He argues that there are often exogenous factors that explain why a relation between actors is established; but such new or opportunistic interactions may dissolve very quickly. Such a decay function may also be observable in policy networks, but probably strongly depends in what stage of the policy process actors are involved in. Following the logic of the policy cycle,[1] actors' interest in establishing ties with others may change over time. The difference between the policy formulation and implementation stages is that the focus of attention shifts from the voting power of decision-makers to task execution and the implementation of decisions (Bardach, 1979; Fischer et al., 2012; Torenvlied and Thomson, 2003). The interest of actors to translate their beliefs and preferences into policy outputs is thus stronger in the decision-making than in the implementation phase (Ingold and Fischer 2014). One can therefore assume that relations decay over time within a given political decision-making process between the decision-making and implementation stages.

Considering these contradictory arguments, the aim of this paper is to investigate if actors manage to stabilize their relational profile over time and/or if powerful network positions pay off over time in terms of other relational advantages in the network (i.e., gaining access to and being approached by others). For our hypotheses, we rely on the network literature and policy analysis literature which argue in favor of tie preservation. Powerful network positions – driven by structural devices or coalition configurations – are said to impact the stability of relational profiles.

Disentangling network power

A central issue in understanding any type of network is recognizing which actor in the network has power (Smith et al. 2014). Exceptional agents in policy networks manage to impact policy outputs and outcomes decisively, not least through their strategic position and ability to exploit structural advantages (Christopoulos and Ingold 2014; 2011). Instead of simply differentiating between formal and informal decision-making power – and according to our theoretical arguments – we take advantage of the network approach and adopt a more nuanced perspective by disentangling different types of powerful network positions. Power has been related to an actors' relational profile for a long time, as already Weber (1927, 38, cited in Weiss 1996) defines power as "the probability that

[1] We acknowledge the literature that criticizes the rather descriptive and static nature of the policy cycle approach (Sabatier and Jenkins-Smith 1993), and that bargaining may happen throughout the whole policymaking process (Lester and Goggin, 1998; Nakamura, 1987),

one actor in a social relationship will be in a position to carry out his will despite resistance, regardless of the basis on which this probability rests." The power of an actor is thus a structural construct and not a simple attribute. This also implies that network power depends not only on the behavior of the actor in question, but on the set of other actors an actor is connected to. It is often argued that structural power is all about what position an actor takes in the network (see Smith et al. 2014). In this paper, we argue that structural power is only one aspect of network power, and make the crucial distinction between powerful network positions that are driven by structures of the whole network versus powerful network positions dependent on an actors' network location within or between coalitions). Following the first dimension based on structural properties of the network, powerful network positions can be the result of the overall network configuration and thus be driven by the structural profile of other actors (alters) an actor is connected to. We argue that a powerful position driven by the overall network configuration is inherently different from relational power driven by an actor's location within or between coalitions. With respect to the second dimension, powerful positions are the result of where the actor is located within the structure of actors' coalitions in the network. More specifically, a powerful network position depends on whether an actor is active within its own coalition, or manages to establish ties across coalitions. We thus compare powerful positions driven by the whole network structure (dimension 1) to powerful positions driven by an actors' location in the coalition structure (dimension 2). The final aim is to see if both types of powerful network positions are similar or not with respect to their stability over time and their ability to help actors establishing network ties over time.

Powerful positions driven by structural configuration of the whole network (Dimension 1)

Exceptional agency is associated to positions of privilege within a relational structure. The core assumption of exceptional agency is that structural positions reflect agent actions. They therefore reveal strengths and weaknesses of their agency. In political networks such privileged structural positions are associated with power (Lauman and Knoke 1987).

Burt's concept of "structural holes" (Burt 1992) is one prominent approach to investigate powerful positions that may reflect a relational advantage in policy networks. The ability of an actor to control relations between actors is one of the underlying mechanisms that determine the power of a broker's position (Smith et al. 2014: 162). A broker is thus defined as an intermediary actor between two otherwise disconnected others, i.e. it "bridges a structural hole" (Ingold and Varone 2012). Obtaining resources indirectly is

especially attractive as there are low costs to actors in sustaining these indirect ties (Sherestha 2012: 308; Burt 1992; Granovetter 1973). Actors thus try to achieve brokerage positions in order to become more powerful; or fill structural holes as a result of other actors' relational profile.

Alternatively, Bonacich (1987) weigths the number of ties an actor has with the relational power of alters (for an application see Ingold 2009) for the assessment of power or the aggrandizement of actors' political capital (Christopoulos and Ingold 2014). An important difference can be made between accessing and controlling relational resources (Smith et al. 2014; Brass 1984). First, access can be associated to leveraging power by being connected to powerful others, where the centrality of alters augments the power of the focal actor. Second, actors can also benefit from controlling relationally weak alters, i.e. to be connected to alters which have only few connections themselves. In sum, a powerful position can be the result of being related to powerful (Bonacich influence), but also to weak (Bonacich control) alters. Even more than Burt's power conceptualization, Bonacich's power resources directly depends on the power and embeddedness of alters.

Based on this literature we argue that actors occupying power driven positions wish to either keep them or exploit them further by creating other relational advantages. We thus formulate our first hypothesis:

> Hypothesis 1: Actors holding powerful network positions tend to considerably exploit network relations over time.

We acknowledge that powerful network positions can be, on the one hand, the result of actors' motives, interests and strategies. Actors might thus actively seek such powerful positions by strategic action, the aggrandizement of their political capital, the interest in effective and efficient public service deliveries, the translation of their values in policy solutions, or the furthering of their political agenda. On the other hand, powerful network positions can also be the result of the overall network configuration. Some actors thus "fall" into powerful network positions not necessarily because they were seeking them, but because of the relational strategies of other actors in the network. One important characteristic of powerful network positions driven by the structural configuration of the whole network is that even if actors actively seek such positions, they always also depend upon the relational profile of their alters.

Powerful network positions driven by actors' location within and across coalitions (Dimension 2)

Several authors state that similar beliefs are the basic condition for actors' building coalitions in policy processes (Sabatier and Jenkins-Smith 1993). Coalition membership,

or whether political actors are in favor or against policy change decisively, impacts their access to decision-making and influence of the final output (Beyers and Braun 2013; Baumgartner et al. 2009). In earlier work, we showed that ideologies and shared beliefs rather than power structures drive collaboration relations among actors in a policy process over time (Ingold and Fischer 2014). Here, we bring ideology together with the power an actor holds in a policy network. Similar than Beyers and Braun (2013: 2), we argue that ties of actors within and across coalitions together are of value. Put differently, we argue that the position an actor occupies within a coalition structure decisively influences its future relational position in the policy network.

Smith et al. (2014) show that allies and adversaries in political networks are inextricably linked. Instead of studying ally and enemy relations separately, they consider the network as a whole and argue that powerful positions are impacted by both, the solicitation of allies, and the countering of potential threats from adversaries (ibid, 2014: 163). Ally and enemy relations are therefore also an important relational pre-condition for the identification of coalitions and the degree of conflict within a subsystem (Fischer 2014; Henry 2011; Ingold 2011). Generally, the position an actor occupies within or between coalitions adds an important explanatory factor to individual resource endowment and hence the likelihood to access decision-making (Beyers and Braun 2013: 4). More concretely, following Beyers and Braun (2013), we make a crucial distinction between actors active within their own coalition and actors creating ties towards members of other coalitions.

This distinction is linked to the concept of social capital in the network literature. Social capital is defined as a resource stemming from social interaction. As outlined by Adler and Kwon (2002, 24; see also Ramirez-Sanchez and Pinkerton 2009), probably the most prominent contributions to structural approaches of social capital were made by Coleman (1990, 1986) and Burt (1992). The former argues that closure of the network, and thus increased interconnectedness among actors, leads to trust-building and effective norms, and thus strengthens social capital within a given community or process (Coleman 1986). Applying this idea to coalitions in policy networks, increased within-coalition activity and interconnectedness indicates an increase of social capital (or bonding social capital, see Berardo and Scholz 2010). The idea of social capital might also apply to policy networks, where we re-conceptualize it as political capital. Political capital in policy making is the ability of an actor to enhance their impact through structural resources gained from the policy network. When political capital is conceptualized as strong ties and closure effects, we can follow Beyers and Braun (2013) who demonstrated that within-coalition brokerage pays off in terms of access to politicians. Based on this, we formulate our second hypothesis:

Hypothesis 2: Actors engaged in within coalition brokerage tend to considerably exploit network relations over time.

Burt, in contrast to Coleman's focus on closure, argues that strong ties might be constraining and that the potential for social capital lies in weak ties (Burt 1992). Weak and sparse ties facilitate information flow and the diffusion of innovations, which then has a positive impact on brokerage and the creation of links among groups of actors that would not otherwise be connected (bridging social capital, see Berardo and Scholz 2010). Applied to network coalition structures, this argument emphasizes the across-coalition activities of actors should pay off in terms of access to administration (Beyers and Braun 2013). Generally, it defines political capital through Granovetter's (1973) "strength of weak ties" argument, from which we deduce our third hypothesis.

Hypothesis 3: Actors engaged in across coalition brokerage tend to considerably exploit network relations over time.

Contrary to dimension 1, the identification of coalition structures is crucial before one can identify powerful network positions. Once an actor's location within coalitions is identified, its structural position towards allies and enemies will be assessed. Power positions related to the whole network structure (dimension 1) and structural power positions driven by actors' location within and across coalitions (dimension 2) are not mutually exclusive.

METHODS

Assessment of exceptional agency through powerful network positions

Given that the assessment of the independent variables, i.e. the powerful network positions, is not straightforward, an in-depth methodological discussion of how to identify exceptional agents in policy networks follows. We first introduce network positions driven by structural configurations, and then powerful positions that depend on an actor's location within and across coalitions.

One prominent approach to methodologically assess structural holes and brokers able to bridge them is betweenness centrality. Betweenness centrality (Freeman 1979) is defined as the number of shortest paths between any two actors in a network on which an actor is situated. The greater the number of exclusive shortest paths an actor occupies, the easier it is for this actor to cut off indirect connections between other actors, or manipulate information or other resources that travel through the network (Muñoz-Erickson et al. 2010, Scott 2000). The gatekeeping role that an actor holds through betweenness centrality comes very close to what Burt defines as "occupying structural holes" (Burt 1992).

Bonacich (1987) introduced two measures in order to operationalize the idea that actors can benefit from being connected to powerful or weak others, respectively. For both cases, Bonacich (1987; for methodological details see Christopoulos and Ingold 2014) introduces an iterative estimation approach which weights the simple degree centrality of each node by the degree centrality of the other nodes to which it is connected. The index uses an attenuation factor (positive or negative) that can be based on the centrality of alters to which ego is connected.

To identify powerful network positions driven by an actor's location within the coalition structure, the first step consists of assessing coalitions within the policy network. Coalitions are said to be constituted of members sharing similar views, preferences or beliefs, and engaging in a non-trivial degree of coordination among them (Henry 2011; Sabatier and Weible 2007). One prominent network profile to identify such coalitions is the assessment of ally and enemy structures among actors involved in a policy subsystem (Weible and Sabatier 2005). Actors sharing similar beliefs and coordinating actions tend to be linked through ally relations; whereas two actors with distinct world views and no joint policy strategies or actions rather share enemy relations. Through the assessment of structural equivalence of actors' relational profile (see Fischer 2014; Ingold 2011), actors with the same relational profile are assumed to be members of the same coalition. Two coalition members thus share ally relations among each other and towards the same alters; and relate to members of the other coalitions through enemy relations.

Once coalitions and coalition members are identified, within and across coalition brokerage is assessed via degree centrality of an actor towards members of its own (within) or the opposite coalition(s) (across). Normalized degree centrality, as used here, measures the number of ties an actor sends (out-degree) or receives (in-degree) in relation to the total amount of possible ties in the network (see Scott 2000). Within coalition brokerage is thus assessed via the relative number of relations an actor holds towards its own coalition members; and across coalition brokerage is assessed via the relative number of relations towards members of all other coalitions. For both, within and across coalition brokerage, we rely on the average of in- and out-degree centralities.

Importantly, exceptional agents are defined as actors doing well in exploiting the above mentioned centrality measures. We thus define exceptional agents and "considerable centrality" as scores above the mean. We justify this by considering that a potentially exceptional relational position will be reflected in above average centrality and brokerage measures. Prominence on different centrality roles is associated to the theoretical assumptions behind each algorithm (Christopoulos and Ingold 2014).

Stochastic Actor-Oriented Model for Network Dynamics

Stochastic Actor-Oriented Models (SAOM) for network dynamics allow analyzing the evolution of a network over time (van den Bunt et al., 1999). As revealed by their name, SAOM are explicitly actor-based and model network evolution based on actors' rational choices. The assumption that actors' behavior drives the evolution of the network structure is in line with the strong focus of this study on exceptional agents and their agency. SAOM identify statistically significant tendencies in the evolution of the network over time, as opposed to a situation where network ties would be sent and received at random. Statistically significant tendencies correspond to constellations in the collaboration network that cannot be due to random processes of tie formation. These specific constellations can be related to the actor level (specific activity or popularity of given types of actors) or the dyadic level (systematic correlation of two types of relations). What is more, SOAM also model network dynamics partly based on the current network structure. This is important as with network data, ties cannot be assumed to be independent from each other, which complicates statistical analysis (see e.g. Cranmer et al., 2012). SOAM therefore combine continuous time Markov analysis and random utility models (see van den Bunt and Groenewegen, 2007; Snijders et al., 2010). Continuous time means that network changes are assumed to be continuous and proceed in small, incremental steps, even though network changes are observed at discrete moments in time (Snijders et al., 2010). The Markov assumption states that for any point in time, the probability distribution of the future network given current and past states of the network is a function only of the current network. This means that all relevant information is assumed to be included in the current state of the network (Snijders et al., 2010).

The continuous time assumption implies that the network is modified by a number of sequential steps, in each of which an actor can create one new tie, terminate an existing tie, or do nothing at all. The probability of such a change depends on actors' preferences and constraints, i.e. actors are assumed to maximize their expected utility by initiating, dissolving or maintaining a tie. These preferences and constraints are included in an objective function, which measures how attractive various different tie changes are for an actor (Snijders et al., 2010). The objective function includes three elements, a) attributes of the actors, b) characteristics of actors' relationships, and c) the existing network structure in which an actor is already embedded. First, attribute effects are introduced in the models by node covariates. With node covariates, attributes of the sender (outgoing tie) or receiver (incoming tie) influences whether a tie exists or not. Second, relationships between two actors are modeled as dyadic covariates, where another type of tie between two actors is supposed to influence the existence of a tie in the network under study. Third, endogenous network effects capture the existing network structures an actor is currently embedded in. Basic examples are reciprocity effects, which measure to what

degree actors tend to reciprocate existing ties, or triadic effects, which measure to what extent actors tend to create ties to actors with which they are already indirectly linked.
Like in generalized linear statistical models, the objective function is assumed to be a linear combination of a set of effects (Snijders et al., 2010). The estimates of the parameters in the objective function can be regarded as normally distributed and can therefore be tested by referring to the t-ratio (Snijders et al., 2010). As these models are too complex for the application of classical maximum likelihood estimation procedures and testing methods, estimation is based on the method of moments and the Monte Carlo computer simulation to approximate the expected values of the statistics (van den Bunt et al., 1999). Caution should be taken with respect to interpretation of SAOM results: As the models do not make any assumptions about whether the initial network is in a long-term equilibrium, results cannot be interpreted as increase or decrease over time, but simply as non-random tendencies.

Case and data

This research is based on the analysis of a Swiss policy process in the field of climate policy. Swiss climate policy has been characterized over almost two decades by conflict lines among mainly two types of actors, business representatives and center-right parties on one side; green NGOs and left parties on the other (Sutter 2012; Ingold 2008). Between 1995 and 2012, Swiss climate policy is thus dominated by two stable coalitions – a pro-economy and a pro-ecology coalition. An intermediate group of actors, mostly constituted by Federal agencies and scientific institutes, was long time engaged in so-called cross-coalition mediation, or behaved as rather neutral source of information (Ingold and Varone 2012). Three periods of Swiss climate decision-making are analyzed: The period between 1995 and 2000 constitutes the policy formulation face where the new Act on CO2 emission reductions was negotiated, designed and finally introduced. The second phase embraced the period between 2002 and 2005. During that time, the first revision of the act took place, and the conflicts between the opposing coalitions rose, as they had very different preferences about policy instruments to introduce. To abate CO2 emissions, pro-economists wanted to continue with the already introduced voluntary measures; whereas pro-ecologists were in favor of the introduction of inventive measures. Finally, and in 2005, the Swiss government decided to introduce a mix of both abatement measures; this compromise was strongly impacted by the intervention across coalitions by so-called policy brokers (Ingold and Varone 2012). The third phase between 2008 and 2012 consists in a major turn: besides climate mitigation, also goals and measures for climate adaptation were integrated in the new CO2 act. If this phase can be conceived as policy reformulation, the empirical studies showed that it comes rather

close to the implementation of the old act with some revisions on the level of policy instruments (Ingold and Fischer 2014).

Data for this research was gathered through surveys with the so-called political elite. Therefore, interviews were conducted with and written statements coded from representatives of Federal agencies, private interest groups, political parties, trade unions, science, and environmental NGOs. We followed the premise that today's decision-making is shaped by collective actors and organized interests rather than by individuals (Knoke et al. 1996). First, and following the decisional and positional approaches (Knoke 1983), we identified those organizations within the political elite that participated in at least two of the pre-parliamentary and parliamentary phases for each of the three periods. We further added those actors holding formal competences and responsibilities in Swiss climate policy decision-making. This first list was then presented to 2-4 experts per period: through the reputational approach, they indicated actors that were particularly relevant in shaping climate policy outputs. They could further add actors to our list.

We ended up with a set of 34 actors for which data was gathered in all three time periods (see Appendix 1 for the full list of actors) based on interviews (all three periods[2]), postal surveys and additional coding of written statements and policy positions (period 3; Rohrer 2012; Sutter 2012; Ingold 2008). For all three periods, we have a response rate of 100% and the survey included the very same question about actors' collaboration. When answering the following question, each survey partner was presented the pre-defined actors' list: "With which actors did your organization strongly collaborate during (1) policy formulation of the CO2 act (1995-2000); (2) during the first revision of the CO2 act (2002-2005); (3) during the implementation and respective re-formulation of the CO2 act (2008-2012)?" Answers to this question allowed us creating the collaboration network included in the SAOM models outlined below.

To assess within and across coalition activities, coalitions were identified based on each actors' ally and enemy profile (see section above). Survey respondents answered the following questions, again having the full actors list at their disposition: "With whom did your organization share ally or, to the contrary, enemy relations regarding the design of Swiss climate policy during (1) policy formulation of the CO2 act (1995-2000); (2) during the first revision of the CO2 act (2002-2005); (3) during the implementation and respective re-formulation of the CO2 act (2008-2012)?" .

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[2] Interviews for periods 1 and 2 were conducted in 2005 and data gathered at the same point in time for both periods. We have to note that data for the first period was thus gathered in a retrospective way. Results of table 2 however show that there is a considerable difference in density and tie formation between periods 1 and 2 why we are confident that actors did not have the tendency to replicate the current situation into the past.

Survey participants could add actors to their collaboration and ally/enemy profile. Furthermore, and to account for organizational type, we created an attribute indicating if an actor was a state actor (Executive actor, federal agency) or not.

ANALYSIS

To answer the two questions that are guiding this research, results are presented in two sections: first, we present evidence for the fact that actors potentially keep powerful network positions over time; and second, we investigate if powerful network positions lead to the creation and attraction of ties over time.

Overall network and descriptive statistics

Table 1 below shows density values for the three periods and tie changes in the two intervals under study. Whereas the overall density of collaboration increases between the decision-making phase of the CO2 act (first period, t1) and the first revision of the act (second period, t2), it decreases again between the second period and the re-formulation and implementation phase (third period, t3). In both intervals, 6% of the collaboration ties stay constant, 12% of all possible ties are "activated" between t1 and t2, and 14% of all possible ties are dissolved after period 2.

Table 1: Descriptive statistics of network change

Density of collaboration network

Observation	t1	t2	t3
Density	0.08	0.18	0.10

Tie Changes Between Periods

Interval	Total	0 → 0	0 → 1	1 → 0	1 → 1	Jaccard
t1-t2	1156	931	133	18	74	0.329
	100%	81%	12%	2%	6%	
t2-t3	961	738	30	131	62	0.278
	100%	77%	3%	14%	6%	

There are 195 missing observations at t3.

We can observe tie creation and preservation between t1 and t2, whereas evidence for overall tie decay exists between t2 and t3. We keep those overall patterns of the collaboration network in mind for the detailed analysis of powerful network positions over time.

Keeping and losing powerful network positions over time

Table 2 below indicates the amount of actors that hold powerful network positions above the mean. It further shows if actors are able to keep those positions over time and between periods t1, t2 and t3. Results are presented for betweenness centrality, Bonacich power and influence, and within and across coalition degree centralities. An important amount of volatility over time, e.g. actors occupying positions of exceptional agency at t1 but not at t2 and vice-versa, would indicate that exceptional agency is a role played at some points in time rather than a fix attribute.

The first three lines of table 2 indicate that almost the same percentage of actors holds centrality measures above the mean at all three points in time. Considering betweenness centralities, 26% of actors at t1, 21% at t2, and 29% at t3 receive an above-average score. The percentages are also stable, but slightly higher for degree centrality towards the own coalition and towards other coalitions. Between 30 and 40% of actors occupy an above-average position with respect to these indicators. Bonacich influence and control are exceptions, as the range of actors with above-average values is not constant over time: With respect to Bonacich influence, i.e. a powerful position because of relations to many well-connected others, the number of actors who can be described as exceptional agents increases over time. Whereas at t1 32% occupy such a position above the mean, we observe a jump to 65% and 68% respectively at t2 and t3. During policy redesign and implementation, two third of actors are connected to well-embedded others. Establishing ties to well-connected others requires time and knowledge of the network structures. The reverse situation can be observed with respect to Bonacich control, i.e. powerful positions due to the control of the relations of weak others. While such positions might pay off in the policy formulation and redesign, when power games are important, less actors tend to occupy such a position of control when it comes to implementation.

Table 2 : Descriptive analysis of exceptional agency over time

	Betweenness	Bonacich influence	Bonacich control	Degree own coalition	Degree other coalitions
%above mean t1	26%	32%	47%	35%	35%
%above mean t2	21%	65%	47%	38%	32%
%above mean t3	29%	68%	32%	35%	32%
constant t1-t2 (%of all)	12%	15%	26%	18%	21%
correlation t1-t2	0.43	-0.30	-0.05	0.59	0.58
constant t2-t3 (%of all)	15%	53%	18%	12%	6%
correlation t2-t3	0.43	0.40	0.19	0.11	0.01
correlation with betweenness t1	/	0.59	0.67	0.50	-0.02
correlation with betweenness t2	/	-0.71	0.58	0.54	-0.06
correlation with betweenness t3	/	-0.40	0.49	0.48	0.51
correlation with Bonacich influence t1	21%	/	0.65	0.64	0.02
correlation with Bonacich influence t2	0%	/	-0.61	-0.47	-0.05
correlation with Bonacich influence t3	15%	/	-0.45	0.16	0.05
correlation with Bonacich control t1	24%	29%	/	0.41	-0.01
correlation with Bonacich control t2	12%	21%	/	0.47	0.04
correlation with Bonacich control t3	18%	15%	/	0.53	0.31
correlation with degree own coalition t1	21%	18%	24%	/	-0.02
correlation with degree own coalition t2	24%	18%	18%	/	0.08
correlation with degree own coalition t3	15%	29%	18%	/	0.60
correlation with degree other coalitions t1	15%	18%	15%	9%	/
correlation with degree other coalitions t2	6%	21%	21%	21%	/
correlation with degree other coalitions t3	21%	18%	24%	21%	/

Still, the mere percentage of actors with above-average values says nothing about whether these positions are actually occupied by the same actors over time. Indeed, considering the centrality measures above the mean that stay constant over time (table 2, lines 4 to 7), it appears that only 6-26% of all actors in the network keep their powerful network position over time. An exception is given by Bonacich influence positions, when 53% of all actors are able to keep their powerful position between t2 and t3. Looking at the lower part of table 2, we see that only up to 29% of actors who hold a powerful position according to one type of centrality measure do so also with regard to another centrality measure.

There is thus about one fifth of the actors in the whole network that manages to keep positions over time and across different centralities. As a consequence, we conclude that exceptional agency is a rather volatile than a stable phenomenon.

Yet, when having a closer look at the specific actors (table in Appendix 2), we can identify five to six actors that manage to keep above-average positions over time as well as with respect to different centrality measures. Earlier results confirm that those actors can be identified as exceptional agents (Christopoulos and Ingold 2014); and in-depth case study analysis showed that they manage to impact Swiss climate policy outputs decisively (Ingold 2008). They are either key players of the pro-ecology coalition (Swiss Environmental Agency (BAFU); green NGOs (WWF; VCS)), or of the pro-economy coalition (Petrol Union (EV); Economiesuisse; FRS).

Stochastic Actor-Oriented Models (SAOM)

Results of the SAOM appear in table 3. Powerful network positions are measured as described above. The five types of centrality measures are estimated in separate models. For each of the five different types of exceptional agency, we then run three different models. The first includes all three time-points and analyzes tendencies in the network between t1 and t3. The second model is restricted to the evolution between t1 and t2, while the third model of each type of exceptional agency refers to the dynamics between t2 and t3. Note that models did not converge for betweenness at t1-t3 and t2-t3; nor for Bonacich control at t1-t2 and t2-t3. We do therefore not discuss them further.

Table 3: SOAM results

	Betweenness model			Bonacich control model			Bonacich influence model			Degree own coal. model			Degree other coal. model		
	t1-t3	t1-t2	t2-t3	t1-t3	t1-t2	t2-t3	t1-t3	t1-t2	t2-t3	t1-t3	t1-t2	t2-t3	t1-t3	t1-t2	t2-t3
Rate parameter p t1-t2		**6.34**		**20.63**			**10.21**	**5.61**		**10.15**	**5.44**		**16.53**	**6.31**	
		(0.62)		**(8.22)**			**(1.40)**	**(0.52)**		**(1.58)**	**(0.48)**		**(4.41)**	**(0.61)**	
Rate parameter p t2-t3				**10.08**			**12.35**		**9.23**	**9.25**		**11.38**	**11.16**		**11.08**
				(1.13)			**(1.58)**		**(0.97)**	**(1.06)**		**(1.39)**	**(1.47)**		**(1.28)**
Exogenous effects:															
Exceptional ego		-0.06		**-0.06**			**0.07**	**-0.09**	0.34	**-3.28**	**-3.76**	-0.47	**-2.36**	**7.77**	-0.66
		(0.04)		**(0.02)**			**(0.01)**	**(0.05)**	(0.27)	**(0.64)**	**(1.87)**	(1.12)	**(0.74)**	**(4.10)**	(0.97)
Exceptional alter		0.00		0.01			0.01	**-0.07**	-0.13	**-1.51**	**-1.40**	**2.10**	**-2.01**	2.20	0.99
		(0.02)		(0.01)			(0.01)	**(0.03)**	(0.08)	**(0.43)**	**(0.78)**	**(0.80)**	**(0.64)**	(1.45)	(0.82)
Exceptional to state		-0.31		0.02			-0.62	-0.88	-1.25	-0.16	-0.68	**-1.91**	**-0.41**	0.38	**-2.24**
		(0.50)		(0.22)			(0.26)	(0.60)	(1.14)	(0.30)	(0.54)	**(0.62)**	**(0.23)**	(0.45)	**(0.58)**
State to exceptional		0.30		0.02			0.30	0.11	**1.89**	0.51	0.73	-0.74	**0.78**	-0.47	0.00
		(0.54)		(0.29)			(0.31)	(0.69)	**(0.84)**	(0.34)	(0.69)	(0.52)	**(0.27)**	(0.08)	(0.52)
state ego	DNC	***-0.96***	DNC	*-0.04*	DNC	DNC	***-0.37***	***-1.14***	*0.22*	***-0.66***	***-2.05***	*0.50*	***-0.32***	***-1.56***	*0.17*
		(0.42)		*(0.22)*			***(0.22)***	***(0.50)***	*(0.64)*	***(0.22)***	***(0.67)***	*(0.37)*	***(0.18)***	***(0.64)***	*(0.29)*
state alter		***0.34***		***0.51***			***0.80***	***0.67***	*1.84*	***0.43***	*0.42*	***1.73***	***0.74***	*0.01*	***1.51***
		(0.26)		***(0.15)***			***(0.16)***	***(0.27)***	*(1.19)*	***(0.16)***	*(0.29)*	***(0.30)***	***(0.14)***	*(0.30)*	***(0.27)***
preference homophily		***0.42***		***0.61***			***0.48***	*0.36*	***0.60***	***0.80***	***0.43***	***0.47***	***0.59***	***0.42***	***0.44***
		(0.22)		***(0.11)***			***(0.12)***	*(0.27)*	***(0.31)***	***(0.15)***	***(0.30)***	***(0.19)***	***(0.11)***	***(0.22)***	***(0.18)***
Network structure effects:															
outdegree		***-1.46***		***-1.71***			***-1.90***	***-1.51***	***-3.33***	***-2.09***	***-1.43***	***-2.72***	***-1.84***	***-1.44***	***-2.65***
		(0.16)		***(0.08)***			***(0.11)***	***(0.22)***	***(1.01)***	***(0.13)***	***(0.29)***	***(0.32)***	***(0.09)***	***(0.18)***	***(0.29)***
reciprocity		***0.82***		***0.67***			***0.60***	***0.92***	***1.18***	***0.85***	***0.92***	***0.79***	***0.63***	***0.72***	***1.01***
		(0.26)		***(0.15)***			***(0.17)***	***(0.32)***	***(0.44)***	***(0.17)***	***(0.30)***	***(0.32)***	***(0.15)***	***(0.28)***	***(0.30)***
transitive triplets		***0.45***		***0.19***			***0.27***	***0.62***	***0.31***	***0.32***	***0.62***	***0.24***	***0.22***	***0.48***	***0.24***
		(0.08)		***(0.02)***			***(0.03)***	***(0.13)***	***(0.10)***	***(0.04)***	***(0.11)***	***(0.05)***	***(0.02)***	***(0.08)***	***(0.05)***

DNC = did not converge. Figures in bold indicate statistical significance (p smaller than 0.01).

The SAOM include the following variables. First, the five specific centrality values that assess to which degree an actor is an exceptional agent according to the measure are introduced in the SAOM as node covariates, and their tendency to send (exceptional ego) or receive (exceptional alter) collaboration ties is assessed. Second, and in order to investigate whether these roles allow actors to contact state actors (exceptional to state) or be contacted by them (state to exceptional), we create a dyadic covariate. For example, when assessing the relations from state actors to exceptional agents, the node covariate corresponds to the value 1 for a relation between a state actor and an actor with an above-average centrality score. Further, given the specific role of state actors in political decision-making, we also control for the out- and in-degree of state actors (state ego and state alter), assessed by a dummy variable as described above. The “state ego” effect is negative in most models, indicating that state actors have a negative tendency to establish collaboration relations with other actors. Note that this is not true for the second time period (between t2 and t3). The “state alter” effect is positive in most

models. This is evidence for the popularity of state actors as formal decision-makers. Finally, given that collaboration among political actors is strongly influenced by the similarity of their preferences (i.e., Sabatier and Weible 2007), we control for "preference homophily", which turns out to have a positive effect on the establishment of collaboration between two actors in all models but one. Further, our models also include two structural properties of networks as controls, i.e. the tendency of actors to reciprocate ties (reciprocity) and their tendency to create ties to actors to whom they are already indirectly linked (transitive triplets). As can be seen in table 3, these structural features always have a significant influence on tie formation over time.

Turning to the variables of interest, the "exceptional ego" variable assesses to what degree the exceptional agent has a positive or negative tendency to approach other actors for collaboration. Note that this variable is called "exceptional ego" in all models, i.e. it refers to the specific type of centrality that the model includes (first row). Concerning centrality measures from dimension 1, results show that the stronger an actor is tied to weak others (Bonacich control), the smaller the tendency that this actor creates ties towards others, at least for the model analyzing the three time points (t1-t3). Bonacich influence, i.e. the fact that an actor is tied to well-connected others, shows a different pattern: During the overall process (t1-t3), and between t2-t3, actors with higher Bonacich influence tend to send more ties towards others. Being linked to well-connected others thus pays off over time and in terms of creating ties towards other political actors. Still, as can be observed from the non-significant results with respect to the "exceptionl to state" variable, Bonacich influence does not help actors to connect with formal decision-makers like state actors. Only two results are significant when we look at whether other actors connect with exceptional agents ("exceptional alter"): Actors with Bonacich influence show a negative tendency of being approached by others (t1-t2). Still, state actors tend to contact actors with strong Bonacich influence, at least during the implementation period of the policy process (t2-t3). No significant effects can be observed for actors occupying a powerful network position defined by betweenness centrality.

Considering dimension 2, actors with considerable within and across coalition activity (degree own and other coalition models, table 3) have a negative tendency to create ties towards all other actors in the network and over time, including state actors. One exception holds true for actors with high across coalition activity between the policy formulation and re-design phases: actors displaying a high degree centrality towards members of the other coalition significantly engage in tie creation over the two time points. Further, also state actors tend to connect with actors which hold relations to other

coalitions (t1-t3).

DISCUSSION

The first question addressed in this paper was if actors holding powerful network positions are able to keep them over time. Considering all actors over time, there exists evidence of high volatility in occupying central network positions operationalized via betweenness, Bonacich power, and degree centralities above the mean. Generally, we confirm our basic assumption that exceptional agency is not a fixed attribute, but is a role that an actor can occupy or not. Yet, we know that a policy process is usually not influenced by a large number of exceptional agents. Having a closer look at table 1, and looking at actors having the highest centrality measures (table in Appendix 2), results have to be nuanced: the five actors with the highest betweenness centrality at t1 also keep this gatekeeping role at t2 and t3. And even more interestingly, they occupy other central network positions within and/or between coalitions; and with one exception even considerable Bonacich power. Looking at within and across coalition brokerage, approximately one fifth of all actors seem to keep their exceptional role either linking coalition peers or members of the opposing coalition. We conclude that most actors only sporadically occupy powerful network positions. But there is the tendency that actors who occupy the most powerful network positions (1) keep this role over time; and (2) combine several powerful network positions within the overall network, their own coalition, or across coalitions.

We further asked if powerful network positions pay off in terms of tie creation or attraction over time. According to our first hypothesis, we assessed powerful network positions driven by network configurations. Overall, results show that this hypothesis cannot be fully confirmed. Considerable betweenness and Bonacich centralities to not positively impact tie creation, but seem – with few exceptions - to pay off in terms of tie attraction over time. The first part of those results thus leads to the conclusion that exceptional agency is a rather short term phenomenon. Actors holding a powerful network position are potentially active within the collaboration network in one specific process stage, but do not keep this advantage across time. However, it seems that they are perceived by their alters, and mainly by state actors, as powerful agents. Alters are keen to keep or establish relations to exceptional agents over time. Furthermore, we wish to highlight that Bonacich influence is the only centrality measure that displays a positive tendency for tie creation over the overall (t1-t3) and one (t2-t3) investigation period. Having ties to central others gives an incentive to actors in creating relations within the network over time. Interestingly however, they have a negative tendency to approach

state actors: Being related to strongly embedded others does thus not guarantee access to formal decision-making.

Considering our second hypothesis and investigating powerful positions within coalitions, results show, with one exception, that this does not considerably induce tie creation or attraction of coalition leaders over time. Results further do not confirm what Beyers and Braun (2013) found in their analysis: following these authors, coalition leaders more easily access politicians and state actors. This might also be true here at one point in time; but over three periods in time, within coalition activity does not seem to guarantee access to state actors. The picture is a different one for across coalition activity (hypothesis 3): There seems to be a tendency for across coalition brokers to send and attract ties over time. The second hypothesis has to be rejected whereas the third hypothesis can partially be confirmed. As previous studies have shown (Ingold 2011; Sabatier and Weible 2007), coalition structures are rather stable over one decade or more. This might lead to the fact that across coalition activity is a relevant driver for tie creation and attraction over time; thus it is possible to impact decision-making while seeking compromise solutions with coalition opponents.

Overall, we can conclude that tie preservation or decay is associated with different phases of the policy process. While we can observe a boost in tie creation during the phases of policy formulation and (re-)design, ties tend to decay towards policy implementation. Asking what role exceptional agents may play in such a process, our results provide at least two interesting insights: first, and if an actor is able to send and attract ties over time seems to depend upon its position in the collaboration network. Being related to central others or being engaged in across coalition brokerage pays off in terms of tie creation and attraction over time. Second, state actors are particularly keen to access such exceptional agents holding powerful positions within the network, but also within and across coalitions.

CONCLUSIONS

This article investigated the role of so-called exceptional agents in policymaking over time. With the help of descriptive statistics and a Stochastic Actor-Oriented Model (SAOM) we investigated if exceptional agents manage to keep their role over time, or send and receive ties considerably over time.

First, general results confirm that exceptional agency is rather a role than an attribute. The high volatility of actors occupying central positions in the network and within and across coalitions shows that exceptional agency, assessed through network activity and position, is overall a rather volatile phenomenon. However, within one specific policy process over time, around one fifth of all actors manage to keep their central role of

gatekeeping and engage in cross-coalition activity over several stages in the political process. Even when assessing exceptional agency through network activity and thus through the role actors play in a specific structural setting, some actors seem to exploit this position constantly. Further research on other policy domains and in different institutional settings should aim at confirming that a small group of specific actors manage to keep their role as exceptional agents and thus use it as an attribute and not only as a role.

Second, we were interested in the question if policymaking over time rather follows a logic of "bridge decay" or "tie preservation". General results show that relations tend to increase between policy design and formulation; but when looking at the overall process, including implementation, a general tendency for bridge decay exists. Even the most central actors in the network tend to lose rather than create ties over time. Interestingly enough, two exceptions exist: actors tied to other central actors in a first period in the process tend to considerably attract ties in a second period. This was assessed via Bonacich influence measures. Similar to state actors holding formal decision-making power, and being popular partners over the whole policymaking process, also well-connected others seem to be attractive to political actors integrated in the same policy network. Similar results are found for actors gate-keeping across conflicting coalitions: they tend to preserve their ties over time.

Third, we proposed the distinction between powerful network positions driven by the overall network configuration and powerful positions driven by an actor's location within and across coalitions. There is no general pattern that one type of powerful positions guarantees more stable relational patterns than the other. Nevertheless, one has to note that coalition structures tend to be stable over time, thus less volatility can be expected when an actor manages to exploit coalition structures rather than overall network configurations. This is true as central positions in the overall network strongly depend on relational activities of all actors included in the network.

To conclude, we answer the two main questions addressed in this paper. First, we wanted to know if actors tend to keep exceptional positions within one policy network over time. Generally, they do not, but the few actors that can be identified as exceptional agents through their above-average centrality in the network definitely have the tendency to preserve this network advantage. Second, we asked if exceptional agents manage to create and attract ties significantly over time: again, there is no general tendency for such a mechanism. The overall network follows a "bridge-decay" characteristic. These results are interesting, not only from a conceptual and methodological point of view. If there are actors managing to exploit network advantages and thus political capital systematically, it

would be important in terms of effective and efficient policy design to know more about those exceptional agents and their behavior.

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Appendix 1: Actors' list

Actors' abbreviation	Full name	Organization type
AEE	Agency for Renewable Energy	Advisory organization for renewable energy issues
BFE	Swiss Federal Office of Energy	Federal Agency
BUWAL	Federal Office for the Environment	Federal agency
Cemsuisse	Association of the Swiss Cement Industry	Umbrella organization of Swiss cement producers
CVP	Christian Democratic People's Party	Government party, 15.3% vote share in 2011
Economiesuisse	Economiesuisse	Umbrella organization representing the Swiss economy, supported by more than 30,000 businesses of all sizes.
EFV	Federal Finance Administration	Federal Agency
EnAw	Energy Agency for the Economy	Representing the Swiss economy and industry in energy issues
Energieforum	Energieforum	Representing industry and private concerns in energy consumption issues
Equiterre	Equiterre	Green NGO
EV	Swiss Petrol Union	Organization representing 95% of the Swiss petrol industry (27 members in 2009)
Factor AG	Factor AG	Private consultation firm
FDP	Free Democratic Party	Government party, 15,1% vote share in 2011
FRS	Road traffic association	Umbrella organization of car importers and private traffic
Greenpeace	Greenpeace	Green NGO
Grüne	Green Party of Switzerland	8.4 % vote share in 2011
HEV	Swiss Houseowners' association	Swiss Houseowners' association
Infras	Infras	Private scientific organization
NCCR Climate	National Competence Center of Research on Climate Change	Scientific organization of the Swiss national science foundation
OcCC	Advisory Body on Climate Change	Scientific organization formulating recommendations to the Swiss Parliament; member of the Swiss Academy of Natural Sciences
OEBU	Association for ecological integration in business management	Representing ecological and sustainable concerns within Swiss private sector
Proclim	Forum for Global and Climate change	Scientific organization; member of Swiss Academy of Natural Sciences
Prognos	Prognos	Private scientific organization
SECO	State Secretariat for Economic Affaires	Federal Agency
SGB	Swiss Federation of Trade Unions	Trade Union
SGCI	Swiss Association of Chemical and Pharmaceutical Industry	Umbrella organization of chemical and pharmaceutical enterprises and laboratories
SP	Social Democratic Party of Switzerland	Government party, 18.7% vote share in 2011
SVP	Swiss People's Party	Government party, 26.6% vote share in 2011
Swissmem	The Swiss Mechanical and Electrical Engineering Industries	Umbrella organization of Swiss mechanical, electrical and engineering industries (MEM industries)
TCS	Touring Club Switzerland	Organization for road traffic in Switzerland, more than 1,5 million members
TravailSuisse	TravailSuisse	Association of Trade Unions
UVEK	Federal Department of the Environment, Transport, Energy and Communication	Federal Department
VCS	Association for Transports and Environment	Organization promoting public transport and environmental solutions in private transportation
WWF	World Wildlife Foundation	Green NGO

Appendix 2: Actors' centrality measures over time

Actors	Betweenness			Bonacich influence			Bonacich control			Degree own coalition			Degree other coalitions		
	t1	*t2*	*t3*	*t1*	*t2*	*t3*	*t1*	*t2*	*t3*	*t1*	*t2*	*t3*	*t1*	*t2*	*t3*
AEE	0.00	0.49	0.00	5.87	-3.62	0.00	2.36	2.24	0.00	0.06	0.44	0.00	0.09	0.22	0.00
BUWAL	17.98	20.61	9.47	15.34	-10.54	-0.37	15.96	0.46	4.09	0.2	0.28	0.21	0.09	0.08	0.33
BFE	1.10	12.20	12.74	4.84	-9.47	-1.83	10.64	-2.27	12.90	0.14	0.36	0.32	0.04	0.11	0.10
CVP	0.00	9.93	1.22	0.00	-9.39	-4.39	0.00	14.82	9.54	0.00	0.18	0.11	0.00	0.09	0.10
Cemsuisse	0.00	1.62	0.67	0.21	-9.02	-10.26	1.18	5.87	6.36	0.18	0.45	0.07	0.00	0.04	0.05
EFV	0.54	0.08	0.00	3.08	-1.31	-0.05	3.65	0.31	3.43	0.08	0.11	0.07	0.16	0.10	0.10
EV	10.03	5.15	2.50	-1.34	-6.53	-10.61	6.95	1.55	9.28	0.27	0.55	0.04	0.00	0.04	0.05
EnAw	0.00	2.92	1.80	0.00	-8.10	-6.06	0.00	6.05	2.47	0.00	0.18	0.11	0.10	0.08	0.08
Energieforum	1.75	1.53	0.28	14.81	-7.78	-6.36	7.42	5.12	0.09	0.36	0.45	0.04	0.02	0.20	0.03
FDP	0.30	2.27	0.00	2.52	-2.24	-3.80	0.04	-2.40	1.39	0.18	0.27	0.04	0.00	0.10	0.03
FRS	7.33	7.47	5.74	11.05	-10.95	-18.36	6.79	9.38	13.49	0.36	0.59	0.00	0.00	0.05	0.00
Factor	0.00	0.00	0.00	2.52	-2.08	0.00	0.04	0.20	0.00	0.03	0.18	0.00	0.00	0.24	0.00
GP	0.00	0.06	0.00	0.00	-1.98	0.00	0.00	-1.86	0.00	0.03	0.39	0.04	0.03	0.05	0.00
Grüne	2.56	0.32	0.00	9.60	-3.27	0.13	6.48	2.96	5.47	0.5	0.39	0.11	0.11	0.24	0.00
HEV	0.00	0.36	0.00	0.00	-0.72	-10.88	0.00	3.29	-0.54	0.14	0.41	0.00	0.02	0.11	0.00
Infras	0.00	0.54	0.00	0.00	-8.09	-0.42	0.00	3.41	1.23	0.03	0.14	0.11	0.06	0.48	0.00
NCCR	0.00	0.00	0.00	0.00	-3.95	0.00	0.00	4.50	0.00	0.00	0.04	0.00	0.00	0.09	0.00
OEBU	1.77	0.98	0.00	9.33	-3.09	-1.74	7.49	5.31	10.70	0.11	0.14	0.14	0.00	0.02	0.05
OcCC	0.00	0.14	1.89	0.97	-3.78	0.09	5.44	4.22	2.19	0.06	0.28	0.04	0.02	0.07	0.04
Prodim	0.00	0.38	0.00	0.97	-3.78	0.09	5.44	4.22	2.19	0.06	0.28	0.00	0.05	0.04	0.00
Prognos	0.00	0.10	0.00	0.00	-4.82	0.00	6.74	4.22	0.00	0.03	0.11	0.00	0.03	0.15	0.00
SECO	4.14	2.59	3.41	7.86	-6.70	-0.30	14.24	6.37	7.01	0.14	0.14	0.11	0.06	0.08	0.15
SGB	0.00	0.00	0.00	0.00	-1.57	0.00	0.00	-0.83	0.00	0.00	0.00	0.00	0.00	0.02	0.00
SGCI	0.87	0.12	0.00	-1.30	-1.18	0.00	6.51	-0.95	0.00	0.18	0.07	0.00	0.03	0.08	0.00
SP	0.00	0.00	0.00	0.00	-2.16	-0.14	0.00	-3.33	12.52	0.2	0.22	0.21	0.03	0.06	0.03
SVP	2.07	0.13	0.00	1.21	-2.24	-0.03	4.08	3.29	1.71	0.18	0.23	0.04	0.00	0.08	0.03
Swissmem	2.24	1.24	0.32	10.91	-3.90	-7.74	5.01	2.79	4.66	0.36	0.27	0.04	0.06	0.04	0.03
TCS	0.00	0.08	8.51	-0.03	-4.46	-8.30	2.92	-0.24	-0.96	0.14	0.32	0.04	0.09	0.42	0.03
TravailSuisse	0.00	0.00	0.00	0.12	-2.24	0.00	1.66	-2.53	0.00	0.1	0.00	0.00	0.03	0.10	0.00
UVEKGS	0.00	1.16	2.01	0.00	-4.43	-0.37	0.00	4.68	4.09	0.03	0.11	0.18	0.31	0.46	0.18
VCS	3.66	1.19	0.00	6.78	-1.52	0.00	8.92	4.20	0.00	0.4	0.50	0.11	0.13	0.33	0.00
WWF	0.00	34.03	0.00	0.00	-11.59	0.00	0.00	19.46	0.00	0.08	0.78	0.14	0.16	0.15	0.00
ecosuisse	7.76	11.69	10.31	9.23	-7.67	-15.36	4.53	9.96	12.24	0.55	0.73	0.07	0.03	0.20	0.05
equiterre	0.00	0.23	0.00	1.02	-1.12	0.00	4.19	0.68	0.00	0.03	0.07	0.00	0.00	0.03	0.00