5-2020

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Citizenship, Rights, and Cultural Belonging

WORKING PAPER SERIES

No. 104 | May 2020

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Constitutional and Institutional Structural Determinants of Policy Responsiveness to Protect Citizens from Existential Threats: COVID-19 and Beyond

Abstract:

A multitude of government forms and institutional variations have the same aims of serving their countries and citizens but vary in outcomes. What it means to best serve the citizens is, however, a matter of broad interpretation and so the disagreements persist. The ongoing COVID-19 pandemic creates new metrics for comparing government performance – the metrics of human deaths, or, alternatively and as we pursue it here, the metrics of the speed of government response in preventing human deaths through policy adoption.

We argue in this essay that institutional and government systems with more authority redundancies are more likely to rapidly generate policy in response to crisis and find better policy solutions compared to centralized systems with minimal authority redundancies. This is due to a multiplicity of access points to policy making, which increase the chances of a policymaker crafting the “correct” response to crisis, which can be replicated elsewhere. Furthermore, citizens in centralized and unitary governments must rely on national policymakers to get the correct response as subnational policymakers are highly constrained compared to their counterparts in decentralized systems.

As policy authority is institutionally defined, these policy authority redundancies correspond to specific institutional and constitutional forms. In this paper, we provide a mathematical/formal model where we specifically analyze the contrast in the speed of policy response between more centralized and autocratic states versus democratic federations.

Constitutional and Institutional Structural Determinants of Policy Responsiveness to Protect Citizens from Existential Threats: COVID-19 and Beyond

Politics is all about strategy, and institutions are all about incentives to the strategic agents of politics. That is not our focus in this essay, however. Here, we evaluate the baseline capacity of political systems that the institutions specify to avert policy error in an existential emergency, where all their citizens are immediately threatened, like in the onset of the COVID-19 pandemic.

1. Policy responsiveness in an emergency

A multitude of government forms and institutional variations compete around the world in terms of best serving their countries and citizens. What it means to best serve their citizens is, however, a matter of broad interpretation and so the disagreements persist. The COVID-19 pandemic created new metrics for comparison of governments' performance – the metrics of human deaths, or, alternatively and as we pursue it here, the metrics of the speed of government response in preventing human deaths through policy adoption (Pueyo 2020).

We argue in this essay that institutional and government systems with large authority redundancies have a greater capacity to generate a quick policy response than systems with centralized policy authority because of their ability to error-correct. Furthermore, belief update mechanisms and technology-experience evidence operate at a greater pace in high authority redundancy systems as compared to centralized authority systems. Redundancy generally indicates that multiple organs in the system have the ability to take over the functions of failed components either without diminishing the resulting performance of the system or not diminishing it catastrophically (Charbonneau, P. 2017, Haimes 2018). For policies, this means that policies of subnational governments can serve as adequate substitutes for their constituents for the absent policies of the national government, and vice versa.

As policy authority is institutionally defined, structural redundancies in policy authority correspond to specific institutional and constitutional forms. While such correspondence cannot be considered absolute, and informal rules as well as reaching a specific ‘balance’ in authority legitimacies can influence the presence of redundancies (see, e.g., Breslawski 2020, Mershon and Shvetsova 2019a, 2019b), we here explore the comparison of democracies and autocracies as higher- versus lower-redundancy policy mechanisms. Because of the independence of many public agencies and the norms of public accountability, we take a democracy to be a more policy redundancies-rich environment than autocracies. Here we argue that democracies generally, and federal democracies in particular, increase redundancy in policy authority by separately empowering agencies and administrators whose accountability is broad and public. This gives democracies the mechanism of ‘policy rescue’ by bypassing the events of ‘signal’ error in some information chains via parallel information chains that also supply information to the national political leadership. Democracies also partially disperse policy authority to independent and semi-independent policy agencies. Policy authority is further dispersed in federations, where governments at multiple levels have broad overlap in jurisdictions for policy-making. The main feature of federations and other decentralized polities is the existence of multiple layers of government that overlap in their jurisdictions. In the language of complex systems, federations have not only the ‘overlap’ (when only some actions can be taken in several places but others are monopolized), but also ‘duplication’ (where everything can be done everywhere in the system) (Dekker 2016). In such systems, each citizen can expect support from at least one government operating in each of those layers, and the officials operating those governments have mandates (and electoral incentives) to offer such protection.

Illustrative here is the relative timing in the US and UK policy responses during the crucial period of late January-March of 2020, when the spread of COVID-19 was still possible initially to contain, and later to substantially reduce. Both nations' leaders adopted similarly dismissive stances during the initial phase of the pandemic, yet while Johnson's position closely corresponded with his country's policies, Trump's views coexisted in time with significant strong COVID policy response from sub-national authorities and public agencies (Shvetsova et al. 2020).

2. System Redundancies and Policy Authority

Scholarship on system redundancies in complex systems dates back to the seminal work by Von Neumann on reducing error in information processing in automated systems, or the "synthesis of reliable organisms from unreliable components" (Von Neumann 1956). Fundamentally, assuming that error in a receiving signal will occur with some independent probability in every receiving component, it would reduce the rate of failure of the system to act on the signal if multiple components in it are collecting and processing the incoming information. Since then, it has become the point of consensus that a systems' ability to adequately withstand various shocks, including external attacks, depends on the system's topology (Newman, Barabasi, and Watts 2009), which in the case of government networks is the way in which the receiving and processing of information into decisions is institutionalized.

Political institutions, such as constitutions and more, set up systems of policy authority, which vary substantially across the globe. Political processes arising from such institutions are characterized by authority structures ranging from extremely centralized to extremely diffused. Furthermore, surpassing the redundancies as described in automatic systems and at par with distributed degenerative biological complex systems (Edelman and Gally 2001), redundancies in policy authority structures extend beyond information processing and into what is called the overlapping jurisdictions – the ability of multiple semi-autonomous 'organs' to produce *the same* policy response. This is akin to an alarm going off separately in the fire station and the police department, with both sets of responders showing up on the scene independently. Indeed, in the case of overlapping jurisdictions, the alarm effectively goes off in several police stations at once and all of them are obligated to respond to the scene independently of each other. Though arguably some efficiency may be lost in the latest scenario, the reliability of getting someone to show up quickly is increased.

3. Authority redundancies from Overlapping Policy Jurisdictions Improve Policy Responsiveness to Emergencies

When the system of government has multiple points of access to generating policy response, like in federations, the timing of appropriate policy response in a crisis situation is on average faster as compared to a system with centralized policy authority. Schematically, we can represent the extremes in authority systems' levels of redundancy as autocracy (totalitarianism) on the one end of the spectrum and democratic federalism on the other. Unitary, centralized democracies can be tentatively placed in-between.

Figure 1 depicts the policy response to new information in fully centralized authority structures. One 'organ', at the top, receives new information, 'signals', and makes policy decisions. As the 'signal' arrives, there is a probability of error in whether it actually reaches the decision-maker or is lost. Notice, that the decision-maker itself does not add the probability of error, and accurately reacts to the message that it received: either 'signal' or 'no signal.' This is to say, that the policy maker is assumed to know exactly what to do and be motivated to do just that in response to the signal of a public emergency – all politicians are perfect in this rendition. In the schematics in Figure 1, the probability of policy error for the fully centralized policy authority thus equals the probability of signal error.

[Figure 1 is here]

Figure 2 is a schematic representation of centralized but democratic policy making. It is a multiplex system, where multiple receptors independently attempt to receive the signal. Again, there is positive error probability, or as put by Von Neumann, "with every basic organ is associated a positive number ε such that in any operation, the organ will fail to function correctly with the (precise) probability ε. This malfunction is assumed to occur statistically independently of the general state of the network and of the occurrence of other malfunctions" (p.62). In this system, multiple 'organs' have a say, as each independently receives the 'signal,' each with probability 1-ε, which we assume to be the same probability as in Figure 1. The inputs are then aggregated via some institutional rule, for example, simple majority, and that information state directs the policy decision that single Authority, A, will produce. Unless ε is too high, or the level of consensus required for action is too demanding, a multiplex will reduce signal error relatively to the centralized system as in Figure 1. Policy error here is still the same as final signal error, but reduced from the base signal error which is exogenously set by the environment.

[Figure 2 is here]

Figure 3 represents the federal structure. Instead of aggregating information according to some institutional rule, each 'organ' receiving the signal has a decision-making function, each constituting a separate policy authority. These policy authorities coexist insofar as their jurisdictions overlap, i.e., when either one of them can produce the policy that covers citizen *i*. Because the same policy function is performed by either one or all of these decision-makers, the system like this has *policy redundancies* built in. In the language used for biological systems, the system is *degenerate*.

[Figure 3 is here]

Political institutions and political process of federalism generate systems of overlapping jurisdictions, as in Figure 3. Our model below pertains to the institutional form of overlapping jurisdictions. Federations also have non-overlapping jurisdictions, policy-making when restricted to which amounts to centralized policy making in a multiplex system (as in Figure 2) applied to disjoint subsets of the country's population. We do not incorporate this feature in the model. We also exclude for simplicity the multiplex nature of inputs that various policy authorities with overlapping jurisdictions might each rely on. While this is certainly an important aspect to further explore in the future, e.g., when comparing inputs from centralized versus federalized specialist agencies, this is beyond our current scope.

4. Redundancies in policy authority and independent learning

To give our model an intuitive interpretation, suppose that the emergency is the COVID-19 pandemic and the policy that is appropriate upon receiving the 'signal' is a stay-at-home order. Once such signal is sent – once the information is available that extreme epidemiological measures are necessary (perhaps obtained from observation and research of an outbreak elsewhere in the world) – our presumed automaton-policy makers who receive the signal automatically do what is needed. Those that receive the signal, perfectly adhere to their public mandate and at the earliest opportunity issue the stay-at-home policy. Each policy-maker receives the signal (conditionally in the signal going out) with the probability 1-ε.

In order to evaluate redundancy-based advantages in system responsiveness, we compare responsiveness in the centralized authority schema in Figure 1 with the federal schema in Figure 3. Specifically, our comparison is aimed at the probability of policy error as experienced by a sample citizen served by each of these authority systems. Policy error as experienced by a citizen is the outcome for a citizen of a likely deadly infection in the context of a failing healthcare system, if we follow the same COVID-19 pandemic interpretation.

Formally, we denote the set of all governments in a polity as G, and its subset, the set of all governments responsible for protecting a representative citizen i, as $J_i \subseteq G$. According to our definition, federal polities are characterized by the set G having at least three elements and the set J_i having at least 2 elements. We will assume for present purposes that in unitary states, $|G| = |J_i| = 1$. This makes our theorized unitary state quite stylized, as of course in reality multiple administrative levels exist there as well, with varying policy prerogatives delegated down to them in different nations. This also takes out of the consideration by the unitary democratic model the potential policy authority of public agencies.

Each government, $j_i \in J_i$, independently from other governments, monitors the environment for the threats to the citizen i. Once a threat is on the horizon, they try to learn as much as possible about it and make a policy according to the severity of the threat. Here we will focus on a single threat with true severity θ and assume that this variable can only take values of 0 and 1. We also assume that there are only two types of policies a government can choose: protect and not protect, $P = \{0,1\}$, and that this policy will affect a citizen if and only if the citizen is in that government's jurisdiction.

Assuming that automaton-authorities process received signals perfectly and adopt the subsequent policy error-free, we construct the base model of a governments' learning and reaction. As a government sets out to investigate the threat, it randomly (and independently from other governments) samples the body of evidence. We assume that the body of evidence consists of the messages of two types – the ones suggesting that the threat is severe ($\theta = 1$), true messages. The other type are the messages suggesting that the threat is not severe ($\theta = 0$), or erroneous messages. The proportion of the messages that correctly reflect the true state generally depends on the true state. Here we assume that the proportion of the erroneous messages is ε, with $\varepsilon \in (0, 1)$. That is, the pool of evidence necessarily contains both accurate and inaccurate messages. If the true message is that the threat is high, θ=1, then the probability of receiving the message that the threat is low is ε.

Formally, denote the message that government j selects from the pool as $\mu_j \in \{0,1\}$. Then from the assumptions above,

$$\Pr(\mu_j = 1 | \theta = 1) = 1 - \varepsilon \quad \forall\, j \in J$$

For now, we assume out the ability of the government to choose a reaction. Each government is programmed to act upon the first message it picks from the pool of evidence and to choose protective policies if this message suggests that the threat is high and non-protective policies if the message suggests otherwise. To state formally, $p_j(\mu_j) = \mu_j$.

Proposition 1. If citizen i is facing a severe threat, the probability that he will receive protection is $(1 - \varepsilon^m)$, where $m = |J_i|$.

Proof: Denote the event that government j protects citizen i as Q_i^j. Since a government's response does not affect the citizens outside of its jurisdiction,

$$\bigcup_{j \in G} Q_i^j = \bigcup_{j \in J_i} Q_i^j = \left(\bigcap_{j \in J_i} (Q_i^j)^C \right)^C$$

Since $p_j(\mu_j) = \mu_j$, $\Pr\left((Q_i^j)^C \middle| \theta = 1 \right) = \Pr(\mu_j = 0 | \theta = 1) = \varepsilon$. Since the messages sampled by governments are independent from the messages sampled by other government,

$$\Pr\left(\cap_{j \in J_i} (Q_i^j)^C \middle| \theta = 1 \right) = \prod_{j \in J_i} \Pr(\mu_j = 0 | \theta = 1) = \varepsilon^{|J_i|}$$

Thus, the probability that the citizen i receives protection from any government $j \in J_i$ is

$$\Pr\left(\cup_{j \in G} Q_i^j \middle| \theta = 1 \right) = 1 - \Pr\left(\cap_{j \in J_i} (Q_i^j)^C \middle| \theta = 1 \right) = 1 - \varepsilon^m,$$

where $m = |J_i|$, the number of layers of government with a mandate to protect citizen i. □

Corollary 1. A citizen is more likely to enjoy protection from threats in a decentralized polity than in a unitary state.

Proof: By assumption, $0 < \varepsilon < 1$, therefore $\frac{d}{dx}(1 - \varepsilon^m) = -\ln(\varepsilon)\,\varepsilon^m > 0$ and $1 - \varepsilon^m > 1 - \varepsilon \;\forall\; m > 1$. □

Notice once again that by assuming that decision makers are automatons, Proposition 1 implicitly assumed that all politicians are the same: honest, educated, hardworking, and decisive. Also that they all have their constituents' full mandate to protect them from the extreme public health threat.[1]

The probability that the correct signal would reach somebody and inform policy-making in at least one layer of government with jurisdiction over citizen i is $1 - \varepsilon^m$, which is greater than the unitary government probability of $1 - \varepsilon$. A citizen in a federal democracy is more likely to receive a public health policy that would protect her than a citizen in a unitary democracy or in an autocracy. Of course, since Proposition 1 applies to a single information period, this conclusion also applies to a single information period. In the next period, the next 'signal' arrives, and governments that made an error in period 1 will have an opportunity to correct their policy choices then, or possibly even later.

5. Policy dissemination in diffused authority structures

Policy dissemination occurs through beliefs update: observing the policy response in peer jurisdictions helps a politician to make the right choice. Politicians can learn how real the threat is by observing how other politicians are responding. In other words, they can update their

[1] This result parallels the results for generally specified "performance levels" in Bender (1985, p. 46-48).

beliefs by watching each other. This is important, because the actions of other policy makers indicate which type of signal those policy makers have received.

In the model that we specified in Figure 1, there are a lot of certainties. If a politician manages to receive the signal to act, we assumed she knows with probability 1 – with certainty – that her information is accurate. We also assumed that she enacts the policy with probability 1 if she received the signal, and with probability 0 if she did not. This all is sufficient for another politician, who has previously failed to act, to update her beliefs to a certainty that action is necessary, when she observes at least one among the rest of jurisdictions adopting the policy.

In our model, adoption of a strict policy indicates that the received signal was that such policy is necessary. In our model, also, we already know that the signal is a true one. In a more general specification, a politician does not know that for a fact, so she weighs her information critically. In line with the automaton analogy, we must allow for the possibility of different machines having different built-in biases for their response. We assumed no biases toward information of a particular type or from a particular source, but the decision-maker may in fact be "built" with such a bias. Besides, even if one's own signal is missed, observation of what the other governments have done may affect policy correction even without any additional new signals. We show below, that the direction of the update from observing a peer politician implementing a strict policy is towards implementing a similarly strict policy in own jurisdiction, too.

A slightly more complex model of learning and decision allows to capture these additional benefits of policy authority redundancies. In this model, we assume that each government is a Bayesian decision-making automaton.

Governments share some prior beliefs that will affect not their perception of the threat itself, but of the necessity to respond to the threat, should it arise, with a protective policy. We assume that these beliefs are biased, in the signaling sense, meaning that they are consequential in decision-making because of putting a higher probability on the "rightness" of one course of action over another. Substantively, this *action prior*, ϕ_0, might have been determined by the constituency's and government's past history, recent policy episodes, the way its healthcare system prioritizes public versus private health, etc. We will interpret this probability ϕ_0 as the predisposition of politicians to perceive the threat, $\theta = 1$, as an epidemiological threat requiring some government-led public health response rather than treat it as a matter for doctors and patients.

As before, governments randomly and independently from each other sample the messages about the threat $\theta = 1$ from a pool of evidence that contains ε proportion of false messages.

In order to account for the individual biases of a government, we add a parameter that describes each government *j*'s perception of each information source, $k \in K$, where K is a set of all information sources. Specifically, we define $\hat{E}$ as a set of probability distributions for each government over their individual (thus subjective) "trust" in each specific information source. Each "trust" probability function, $\hat{\varepsilon}_{j,k}$, returns government *j*'s subjective probability of dismissing the signal $\theta = 1$ if its source is k. This assumption is just a complication on our previous discussion, where it was in effect assumed that all $\hat{\varepsilon}$ were similar and equaled ε.

Further assume that each government accrues political benefit $b > 0$ if it shields the citizen in time of crisis. The cost of the protective measures, including their political cost, is $c > 0$.

In Stage 1, the government learns and makes a policy determination based on the message that it received on its own. Assuming that the government's prior beliefs are not enough to push them into action regardless of the signal, such as for example maintaining strict public health protocols just because that would be a good precaution to do so and so should be their standard operating procedure, that government's prior is such that

$$\frac{1-\phi_0}{\phi_0} > \frac{b-c}{c}$$

The cost-benefit condition for whether the protective measures will be implemented only by the governments that drew cautionary messages and only if

$$\frac{1-\phi_0}{\phi_0}\frac{\hat{\varepsilon}}{1-\hat{\varepsilon}} < \frac{b-c}{c} \tag{1}$$

As long as condition (1) is satisfied, Proposition 1 also holds for this model of decision-making. If the threat is real and condition 1 holds citizen i will be protected with probability $\left(1 - \prod_{j \in J_i} \hat{\varepsilon}_{j,k}(k)\right)$, which is greater than any individual $\hat{\varepsilon}_{j,k}$.

From condition (1), the critical factors of the decision-making include the distrust to the evidence that the government receives, the relative costs of implementing the protective measures and the value of human life, as well as the prior beliefs about how appropriate it is to respond to the threat with policy in addition to medicine.

In Stage 2, governments in addition can observe the policies if those are adopted by other governments in the polity. Suppose once again that error probabilities are perceived similarly by all governments, i.e., that $\hat{\varepsilon}_{j,k} = \hat{\varepsilon}_k$, the prior is neutral, and that the cost-benefit calculus is such that every government responds if the message it received is $\theta_k = 1$. Then given the share of faulty messages in the pool of evidence, they will expect to observe $\lfloor |J|(1-\varepsilon) \rfloor$ strong policy responses, and $\lfloor |J|\varepsilon \rfloor$ governments that do not issue a response. With these data, the updated beliefs about the severity of a threat in this much simplified set up, as long as $\varepsilon < 1/2$, and the true state of the world is $\theta_k = 1$ – the threat is in fact severe, the protective policy is likely to fully propagate in such a system even to the governments that did not receive the correct message, in which case the probability that citizen *i* receives policy protection after the first signal becomes 1.

If we return to the story that some governments are more cautious about the evidence than others and that some governments' costs of implementing protective measures (relatively to the value of a citizen's health) are higher than others', some may not implement the policy even if they observe the signal that $\theta_k = 1$. Assume for example that $\frac{b-c}{c}$ follows a continuous distribution with probability function $F(\cdot)$, and that the prior in J is once again biased. In this case, the probability that a citizen gets protected is

$$\Pr\left(\cup_{j\in G} Q_i^j \,|\theta = 1\right) = 1 - \left(F(x)\right)^{|J_i|}, where\ x = \frac{1-\phi_0}{\phi_0}\left(\frac{\hat{\varepsilon}}{1-\hat{\varepsilon}}\right)^{\lfloor |J|(1-2\hat{\varepsilon}) \rfloor} \qquad (2)$$

From equation (2), the chances that a citizen is protected increase with the number of governments in the polity and with the number of layers of the government.

6. Conclusion

An order like shelter in place is a very costly policy to the constituents, is very disruptive to lifestyles and to the economy, and it is also a type of policy that needs to be implemented early, prior to the public actually witnessing how high the health costs of not doing so would become. Thus an honest politician would not issue such an order unless she received a signal (information) that would clearly require such drastic response. (In truth, even a dishonest politician has no incentives to rush such an order because, if done right, the public would be protected from the virus and not experience health-related losses, affected only by the economic losses from the protective measures).

Thus even while limiting the present enquiry to the structural institutional capacity for quick policy response, we can speculate that multiple access points to policy-making can lead to cost reductions. The ability to observe and compare efficacy of multiple alternative solutions to the same underlying problem would lead to the improvement of the technology of policy response as policy-makers correct their choices to adopt the higher-performing solutions (Weingast 1995). Late adopters face lower administrative cost from policy design and implementation, as they can learn from the experience of success and failure of policy elements in the early-adopter jurisdictions.

Another form of cost – the political price to pay from the fallout from the disgruntled constituents is also reduced, as they observe multiple decision-makers responding to the same signal and so can update their own beliefs regarding whether the policy in their locale is truly justified.

Furthermore, as additional information continues to arrive, and either repeats or strengthens the original signal, policy correction becomes more and more likely even in a fully centralized authority structure. If the same signal is simply repeated, that gives a politician another chance to receive it. If a new, stronger signal is sent, the chance that the politician will receive it now is higher than in the previous period with a weaker signal. Stronger signals can be interpreted as signals sent by more authoritative sources (the message is thus better heard), or more sources reiterating the same message (the message is louder).

As we assess the benefits of structural redundancies, it is only right to acknowledge that these come with potential efficiency losses. Aside from operating and electing multiple governments, extra costs might be accrued from policy inefficiencies due to replicating efforts within jurisdictions and such things as outbidding for resources (though see Bendor 1985). There may arise enforcement inefficiencies due to inter-jurisdictional policy discrepancies, along with ‘arbitrage’ opportunities for economic agents who operate across jurisdictional borders. Additional resource limitations might come from implementing a policy at a government level either below or above that which would be optimal for the task. Even the policy designs themselves may be inferior from the outset sue to the severity of the budget and resource constraints in isolated jurisdictions. And inconsistency in policy articulated for the same constituents by different levels of government may have not only enforcement, but also legitimacy implications.

A very important structural consideration that could be added further is the “quality” of the automaton which we assume the decision-maker is. Continuing the machine analogy, both processing and decision –making capacity may be high or low as that machine’s pre-set characteristic.

While many more features of institutional and decision-making structures could be brought into analysis, our conclusion here makes possible the baseline comparison. In the short term, constitutional regimes with greater authority redundancies have the structural capacity to offer citizens faster protective policy response from new uncertain threats. Thus when not weeks, but days and even hours count, such systems have the structural capacity to save more lives.

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Figure 1. Centralized Authority System

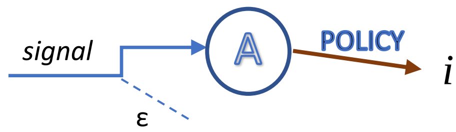

Figure 2. Multiple Inputs Authority System (centralized democracy)

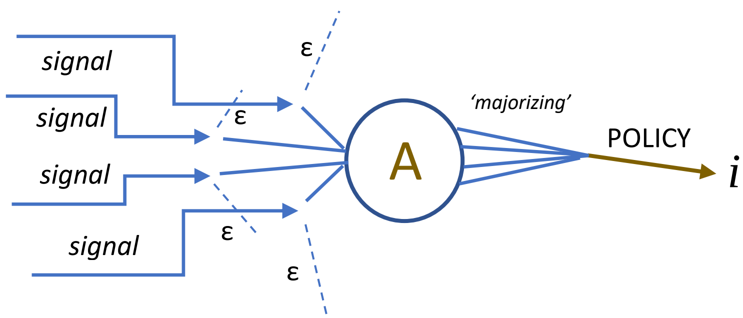

Figure 3. Multiple Policy Authority System (federations)