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Global crisis governance in response to scientific information: Comparing and understanding regulatory responses from WHO and IPCC concerning the COVID-19 and climate crises

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Abstract

This article explores determinants of effective communication for crisis responses across functional sub-systems at diverse public organisation levels. That is done by analysing WHO and IPCC statements on COVID-19 and climate change, and governmental responses, drawing on Denmark as a pilot case. A functional sub-system is constituted by binary codes, embodying the sub-system's key logic. Sub-systems respond to information triggering their logics. The analysis shows that with an emphasis on effective governance and the delivery of health care, the WHO was effective in generating governmental action on COVID-19. By contrast, the IPCC's extensive deployment of the true/false logic of science is less effective for activating governmental response. Addressing public governance and relevance of Luhmann's systems theory, our findings suggest that decision-makers can be prompted into action through deployment of arguments that connect to governments' logic. This finding holds potential for improving communication between scientific and governance agencies for crisis responses.

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Key words

Application of systems theory to empirical situations; climate change; determinants of communication; governance responses; health crisis

Resumen

Este artículo explora los factores determinantes de una comunicación eficaz para responder a las crisis a través de subsistemas funcionales en diversos niveles de organizaciones públicas. Para ello se analizan las declaraciones de la OMS y el IPCC sobre la COVID-19 y el cambio climático, así como las respuestas gubernamentales, tomando Dinamarca como caso piloto. Un subsistema funcional está constituido por códigos binarios, que encarnan la lógica clave del subsistema. Los subsistemas responden a la información que activa su lógica. El análisis muestra que, al hacer hincapié en la gobernanza eficaz y la prestación de asistencia sanitaria, la OMS fue eficaz a la hora de generar medidas gubernamentales en relación con la COVID-19. En cambio, el amplio despliegue de la lógica de la ciencia verdadero/falso por parte del IPCC es menos eficaz para activar la respuesta gubernamental. En lo que respecta a la gobernanza pública y la relevancia de la teoría de sistemas de Luhmann, nuestros resultados insinúan que el despliegue de argumentos que conecten con la lógica de los gobiernos puede inducir a la acción a los responsables de tomar decisiones. Este hallazgo puede mejorar la comunicación entre los organismos científicos y de gobierno en las respuestas a las crisis.

Palabras clave

Aplicación de la teoría de sistemas a situaciones empíricas; cambio climático; determinantes de la comunicación; respuestas de gobernanza; crisis sanitarias

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1. Introduction

Climate change is recognized to be a major global crisis and wicked problem (e.g., Lazarus 2009, Angeli *et al*. 2021). For decades, natural scientists have warned about the risks of extensive increases in temperatures, sea levels and changed weather patterns due to rises in green-house gas (GHG) emissions. The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 with the goal of preventing detrimental human interference with the climate. Regulation under the UNFCCC system took a large step forward with the 2015 Paris Climate Change Agreement (UN 2015). Yet, responses at the national governance level remain insufficient (IPCC 2023). By contrast, the COVID-19 health pandemic, also a global crisis (Muralidar *et al*. 2020, Raghuvir *et al*. 2020) and a wicked problem (Angeli *et al*. 2021, Auld *et al*. 2021), spurred quick and intensive regulatory response by many governments around the world to reduce the spread of the virus. The difference in national governance responses to those two urgent crises, therefore, begs an exploration of determinants of such responses. For both climate change and COVID-19, expert bodies under the United Nations (UN) have played major roles for the provision of information and advice for nation states to adopt relevant measures: for climate change, the IPCC; for COVID-19, the World Health Organisation (WHO). Both are advisory bodies without powers to demand action on the part of states. Global responses to the pandemic have shown that regulatory uptake to global crises affecting human welfare and lives need not be protracted or ineffective. An understanding of the causes for the difference may help provide insights for scientists as well as policymakers and regulators towards more effective responses to the climate crisis as well as other crises that are yet to arrive.

With a few exceptions (notably Sweden and Brazil) governments around the world responded to the pandemic through policies, guidance and legislative measures that included restrictions on gatherings and movement, as well as lockdowns of different intensity to contain the spread of the virus (Hale *et al.* 2020, Yan *et al.* 2020, Christensen *et al*. 2023). Among those, the government of Denmark adopted several measures that were aligned with WHO advice on finding, isolating, testing, and caring for (potentially) infected people (Marin 2020, WHO 2020a). In contrast, national governance responses such as cutting GHG emissions at the national level continue to be deficient (IPCC 2018, IPCC 2023), despite the urgency as well as dire longer-term effects of climate change. Climate change has already adversely affected human physical health and mental health, and is contributing to humanitarian crises (IPCC 2023). The IPCC (2023) predicts a more than 50% chance that global temperature rise will reach or surpass at least 1.5 degrees C between 2021 and 2040. This will lead to floods, droughts, extreme weather, to mention a few effects, not only affecting humans, but the entire ecological system (IPCC 2023). The effects of the COVID-19 pandemic were also dire: it caused an estimated 7 million deaths in the 3.5 years from late 2019 to mid-2023 (WHO).[1] More than 767 million individuals are confirmed to have been affected by the virus (WHO, see footnote 1), which in its most harmful version continues to cause severe respiratory problems. At the onset, the lethal effects of the virus were highly visible in terms of

[1] WHO COVID-19 dashboard. Available at: https://COVID19.who.int/

people being severely ill, suffocating due to pneumonia, causing pressures on hospitals, cremation services, and cemeteries.

With some exceptions (e.g., Auld *et al.* 2021, Patel and Dickson 2022), regulatory responses to climate change and COVID-19 have mainly been analysed separately by social scientists. Partly hinging on time-sensitivity, it has been argued that COVID-19 is perceived as a 'crisis' (i.e., an imminent risk), whereas climate change is considered as a 'permanent risk' that does not require extraordinary intervention (Ruiu *et al*. 2020, Patel and Dickson 2022). However, it has been recognised for decades that climate change poses imminent as well as longer-term threats to the eco-system and humanity, even if the exact implications were not fully understood (IPCC 1990/92). The very first IPCC Assessment Report highlighted climate change as a challenge with global consequences (IPCC 1990 in IPCC 1990/1992), and the constant message in IPCC reports over the years is the urgency of climate change and the need for action. So far, the application of systems theory to the COVID-19 and climate crisis is limited. Morgan (2022) and McConnell (2021) argue for a systems-thinking approach to recognize COVID-19 and place major social or global health challenges into the wider societal context. Applying a Luhmannian systems-theory perspective, Le Ravalec *et al.* (2022) suggest that the economic system is unable to properly capture messages from its environment on climate change. That analysis, however, is not expanded to COVID-19 responses.

The absence of a comparative exploration of the responses and a deployment of systems theory leaves a dual knowledge gap: both in terms of lessons on what conditioned the swift responses to COVID-19 and the tardiness of responses to climate change; and in terms of more general awareness of insights that systems theory holds for responses (or lack thereof) to global crises. In this article we contribute to filling that gap by deploying systems theory as a theoretical framing for the analysis of empirical data comprising information from IPCC and WHO and national governance responses. In applying systems theory in this context, we introduce a novel approach to the comparative understanding of responses to the crises, at the same time engaging in an emergent trend (Campilongo *et al.* 2021) of applying Luhmann's systems theory to empirical cases. Our analysis focuses on the communication perspective of the theory. Communication in Luhmann's sense reduces complexity and binds communication in time and between the communicating parties. The analysis in here first examines the binary code used by the relevant international scientific body, and then, the governance response and language deployed by the national government on which the uptake-analysis is based. As a point of departure, scientific bodies can be expected to deploy the science logic of true/false; whereas governments are likely to respond to messages in their logic of power/no-power or its corollary, power/opposition.

By governance responses we understand a range of governmental initiatives, from the launch of new policies through guidance and the adoption of enforceable hard law. Denmark serves as a pilot case study for the analysis of governance responses at the nation state level. It is a Nordic and European country that responded largely in line with WHO advice (Marin 2020), and also a (self-professed) climate-change leader (Tilsted and Bjørn 2023). Partly based on this pilot research, we plan to later consider other countries' governance responses. For space reasons we do not include media directly in the analysis, however, we recognise that media played a significant role in

the transmission of information on COVID-19 as well as on governance responses, and that media play a role in the transmission (or lack thereof) of scientific knowledge and responses on climate change.

The article proceeds as follows: Section 2 briefly reviews the causes and effects of COVID-19 and global warming, the roles of the WHO and IPCC regarding knowledge and responses, and national-level governance responses in Denmark. Section 3 introduces the communicative aspects of Luhmann's social systems theory, explains the role of functional sub-systems' binary codes in communication, and how this serves towards analysing communicative conditions for responses across science, policy and law. Because the results of this article speak to a larger audience than experts in Luhmann's social systems theory, we include an introduction to key elements of that theory. Section 4 explains method, whereas sections 5 and 6 analyse communication and governance uptake COVID-19 and climate change information respectively. Section 7 concludes.

2. Background

2.1. Climate change and the IPCC

Although climate change science and predictions did not really catch on until the 1980s, scholars warned about climate change already in the 1960s (American Institute of Physics n.d.). In response to rising concerns, the IPCC was established by the UN Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in 1988. IPCC is defined in the UNFCCC as the key UN body for the purpose of scientific and technical advice on climate change (UN 1992, art. 21a). IPCC collaborates with 'UN Climate Change', a secretariat tasked with supporting the global response to the threat of climate change (UN 1992, art. 21a). IPCC publishes a general, synthesis or topical report about every 2-4 years. Those reports feed into the regular negotiations under the UNFCCC, including the regular Conference of the Parties (COP).

Despite the IPCC and the evolution of the UNFCCC regime, including the Kyoto Protocol and the Paris Agreement, the UNFCCC regime has been found to be deficient in addressing climate change. Much of this goes to the strong focus on emissions targets, which particularly prior to the Paris Agreement turned CO2 emissions into a commodity, rather than spurring effective normative and governance change (e.g., Petroula *et al.* 2004, Stiglitz 2010, Hermwille *et al.* 2017).

2.2. COVID-19 and WHO

Founded in 1948, the WHO's overall objective is the attainment by all peoples of the highest possible level of health (UN 1946, art. 1). For practical purposes, core functions include monitoring public health risks, coordinating responses to health emergencies, providing technical assistance to countries and setting international health standards and guidelines (WHO website).[2] Therefore, the role of WHO for global health management is comparable with the role of IPCC as to global climate management in

[2] WHO Research for Health. See: https://www.who.int/our-work/science-division/research-for-health

that they are both expert bodies that issue advice to national governments and other entities based on scientific data.

Starting 20 January 2020, the WHO held regular press conferences of around 30-90 minutes, providing updates on the COVID-19 virus and advice on responses from a health perspective. Press conferences became less frequent as the health crisis subsided in 2021 and 2022.

2.3. Denmark: organisation and responses to climate change and COVID-19

At the nation-state level, in Denmark, national responses to climate change and COVID-19 were developed and managed by the government under the responsibility of the Cabinet led by the Prime Minister, sector ministries and agencies.

A member of the European Union (EU), Denmark's climate action is compelled by EU policies and legislation on GHG reductions, in particular the EU Emissions Trading System (ETS) and CO2 allowances. From 2014 Denmark stepped up climate policies to promote a low-carbon economy, including policies and strategic frameworks to expand green energy and reduce GHG emissions, and the establishment of the Climate Council to advise the government on climate policies and needs. The 2020 Climate Act aims to reduce GHG emissions and obtain climate neutrality by 2050 or earlier in line with the Paris Agreement.

Over the years, climate change has been the responsibility of ministries and executive agencies of climate, environment, and/or energy.

Health issues are charged on the Ministry of Health (in March 2020 until January 2021 called the Ministry of Health and the Elderly), in collaboration with specialised executive agencies. The national Board of Health (*Sundhedsstyrelsen*) is the key body for the purposes of scientifically based responses as well as nation-wide health-governance. During the early onset of COVID, governance measures developed swiftly, and televised press conferences with the Prime Minister, Minister of Health and/or Director-General of the Board of Health became major channels of information from the government to the populace.

Denmark had its first confirmed COVID-19 case on 27 February 2020. In a televised and radio-broadcast press conference in the evening of 11 March 2020, the government announced a lockdown (Prime Minister's Office 2020), affecting public institutions. School pupils, higher education students, educational staff, and public employees were to study/work from home. Private associations were encouraged to also lock down. The initial two-week lock-down was extended several times. Later, (partial) lockdowns were introduced through 2021.The announcement of the first lockdown was followed by a decision on 13 March to close the borders (Altinget 2020).

3. The communicative aspects of social systems theory

At the overall level, systems theory is an interdisciplinary field connecting principles and concepts from several autonomous fields of science, including physics, biology, sociology (arching to sociology of law), political science and economics. Systems theory regards systems as constituted by complex collections of elements in a mutually interactive relationship. Systems may be biological, electrical, social, etc., in turn

comprised of functional sub-systems. Sociologist Niklas Luhmann's theory, which has come to be widely applied in socio-legal contexts, focuses on of the social system and its sub-systems (Nobles and Schiff 2012). The social system's functional subsystems include the health, political, economic, legal and media systems, which in turn are defined by so-called binary codes and, according to Luhmann's theory, consist of communication (rather than human beings or actions) (Luhmann 1995, 1986, King 1996). Systems theory offers a fundamentally different way of understanding society than the institution-focused approach that social scientists frequently apply. Application of systems-theory to institutional issues is often considered counter-intuitive; yet as Thornhill (2023) shows, doing so is both possible and can be a source of useful insights. Indeed, precisely because of the emphasis on functions and how communication across functional sub-systems can serve to generate change, applying a systems-theory approach may help disclose communicative and governance dynamics across institutions, for example on normative pressures and adaptation to societal needs, which may be observable but not similarly explicable from an institutional perspective (Buhmann 2017).

Binary codes comprise the key interest or logic of the (sub-)system, and its opposite. The positive aspect expresses the essence of the function, meaning that a threat to the positive aspect is also a threat to the functional sub-system. The science sub-system is constituted by the binary code of true/false; the health system by sick/healthy; the political system by power/not power or its corollary, power/opposition; the media system by news/not news; the legal system by legal/illegal or corollaries, like mandatory/voluntary, etc. (Nobles and Schiff 2012, Buhmann 2017). Based on Luhmann's theory, further functional sub-systems have been defined. For instance, the family system is defined by a logic of care as a prerequisite for the intimacy that characterizes a family (Blom and Van Dijk 2002). In this context, the opposite of care can be defined as an unwillingness to exercise care for the in-group or those who are vulnerable, which by extension makes the entity break down due to lack of intimacy.

In Luhmann's systems theory, communications are processes which produce meaning. Meaning materialises when the information carried by the communication is understood by the recipient. Communication, therefore, hinges on the understanding which it creates. In systems theory, law is not a system of institutions or primarily a coercive order, but a facilitation of expectation and consequential adaptation (Luhmann 1992, 1993/2015, cf. Teubner 1993). As expressed by legal sociologist Brian Tamanaha, from Luhmann's perspective, law 'is present whenever someone communicates, or even thinks, in legal terms' (Tamanaha 1997, 103).

A system is closed in terms of communication but cognitively open to its environment. The environment of a social sub-system is constituted by other sub-systems. A sub-system can react to its environment and adapt to external pressure through structural coupling, a mechanism of irritation within a system that triggers adaptations to pressure from another (e.g., Luhmann 1991, Rogowski 2015). As a sub-system will react to foreign elements ('irritants') from another sub-system (Luhmann 1986, Teubner *et al.* 2005), that process can be deployed to facilitate change in a sub-system. Sometimes likened to virus, irritants serve as external guidance on adaptions necessary for the sub-system to survive and respond to threats to its core rationality. Irritation may be transmitted from the environment through signals which a recipient sub-system can relate to in its own

internal code. If the signals are adequate for the subsystem to digest, it will take action and adapt (King 1996, Teubner *et al.* 2005). For example, the health system may issue information on major risks of rise in the number of sick people, in turn resulting in challenges to hospitals, key in the publicly funded health service system in a welfare society and therefore the political system. This may generate a response in the political system because that system will perceive the challenges to hospitals as a potential risk to its own power: if it does not act to protect the services provided by public hospitals, it will be seen as ineffective. That may undermine its political legitimacy and result in reduced votes at the next election, eventually leading to loss of power (and a risk of shifting from power-holder to opposition). From Luhmann's systems-theory perspective, communication occurs when the political system digests and acts upon the pressure from its environment, *in casu* the health system. This allows for an understanding of dynamics across societal organisations that in the institutionalist assumption of pressures generating organisational change (e.g., DiMaggio and Powell 1983) does not provide. For example, the institutionalist UNFCCC regime has continued to surprise by its ineffectiveness, causing the commodification of the carbon credits to be blamed but with limited understanding of why the UNFCCC regime has not been more effective, despite the continuous warnings by the IPCC. Systems theory's emphasis on communication in binary logics and the significance of activating the logic of the recipient system to generate change provides a fundamentally different analytical lens.

4. Method

We take our theoretical point of departure in the communicative aspects of Luhmann's systems theory and apply this to an empirical body of information on climate change and COVID-19 at two levels: the international level, where we look at information from IPCC and WHO; and the national level, where we draw on the case of Denmark as a pilot case for a larger study. To explore feasibility and obtain insights for the larger study, we start small in terms of communicative events and timespans.

The empirical body regarding the climate crisis include IPCC reports 1988-2023 with a particular emphasis on the 22 'summaries for policymakers' published 1990/92-2023 (rather than the full reports) to get an overall idea of the deployment of binary logics; and Danish authorities' or agencies speeches or other texts on measures 2014-2023, when Denmark stepped up on national governance measures. The empirical body regarding the COVID-19 comprises transcriptions of WHO press conferences January-March 2020 (in total 40); and transcripts of press conferences on COVID-19 measures transmitted through TV or radio by the Danish Prime Minister, the minister of Health and the Director-General of the national Board of Health. This covers the time from when the WHO addressed the COVID crisis in (almost) daily press conferences for global audiences, until the Danish government announced the lock-down and closing of the borders on 11 and 13 March.

Coding was manual because we wanted to understand the connection between arguments and responses at a level for which we felt computer-assisted coding was not adequate. Because we had observed that communication on COVID-19 led to fast responses, we first analysed WHO texts to identify the general trends in use of binary logics. Then we analysed the Danish government's press conferences or press releases to identify connections between systems-specific arguments and responses. Coding was

based on the binary logics of the science, health, politics, law, and the family/care systems. Next, we proceeded to analyse IPCC reports and climate change responses, based on the same coding. Regarding government responses, we considered authorities' deployment of the political and legal logics to determine whether and how WHO or IPCC statements caused irritation that triggered regulatory responses from authorities; and to what extent they deployed any of the involved logics (science, health, family, politics, and law) in their onward communication with companies and citizens.

5. The COVID-19 Crisis

5.1. WHO statements

In January 2020 it became clear that COVID-19 was spreading outside China. As WHO recognized the potential health threats to other countries, the organisation began calling on governments to take action to curb transmission. Those arguments are well exemplified by statements at the WHO press conference on 29 January 2020:

> The continued increase in cases and the evidence of human-to-human transmission outside China are of course both deeply concerning. (…)
>
> So in a situation like this, you can stand back and say, well, there's nothing we can do, this is spreading out of control, or you can use the knowledge you have of previous epidemics of these viruses and of the current trends and you can identify the tactics that you can use to stop the virus. If you don't choose to do that and if you choose to stand back and watch and observe, then it will unfold as it unfolds. When people talk about R0s and transmission dynamics and all of that, they talk sometimes as if that's an abstracted concept. Well, in reality you can affect those numbers by what you do. (WHO 2020b)

The above statements largely addressed the health system's logic of sick/healthy, but in some case made a connection between that logic and governments' logic of power, targeting their capacities to deliver:

> The (numbers) that everyone talks about can be affected by human activity for the negative and for the positive. (…)
>
> We are concerned for (…) least developed countries, that they have the capacity to detect and respond should the need happen. (WHO 2020b)

Statements also connect to governments' logic when discussing the need for 'preparedness' to prevent wide transmission of the virus, also relating to their capacity to respond to citizens' needs:

> An ounce of preparedness is worth a ton of response (…). The peak will occur as soon as we put together a package of interventions that are designed to stop the virus. So we need to focus (…) on our actions in the coming days and weeks. (WHO 2020b)

The next day, WHO declared a public health emergency of international concern. Again, statements were in the health system's logic of sick/healthy, while also connecting to the logic of governments by alluding to their tasks and ability to deliver:

> The speed with which China detected the outbreak, isolated the virus, sequenced the genome, and shared it with WHO and the world are very impressive. (…) In many ways, China is actually setting a new standard for outbreak response (…).

> We don't know what sort of damage this virus could do if it were to spread in a country with a weaker health system. We must act now to help countries prepare for that possibility'. (WHO 2020b)

Whereas on 30 January 2020, early parts of the press conference connected to governments' logics, later parts stepped up from a health system perspective, not only talking about sickness/health, but about death, the ultimate crisis and loss:

> There are now 7834 confirmed cases, including 7736 in China, representing almost 99% of all reported cases worldwide. 170 people have lost their lives to this outbreak, all of them in China. (WHO 2020b)

Since the early press conferences, WHO had reminded audiences that lost lives were living human beings who were now grieved by their loved ones. This brought in the family logic of care, and underscored the potential weakness of governments and public health set-ups unable to deliver, as evident in statements made on 30 January 2020:

> We must remember that these are people, not numbers. (WHO 2020b)

The science system was deployed to inform governmental decisions on whether to close borders:

> … WHO doesn't recommend limiting trade and movement. We call on all countries to implement decisions that are evidence-based and consistent. (…) Review preparedness plans, identify gaps, and evaluate the resources needed to identify, isolate, and care for cases, and prevent transmission. (…) Share data, knowledge, and experience with WHO and the world. (WHO 2020b)

Despite, or perhaps rather, because of WHO's deployment of the science system's logic, as expressed in evidence and data in statements intended to change governmental practices, governments in fact continued to close borders, in other words, defying the governance steps desired. East Asian countries took the lead; others followed suit.

During February 2020 the virus spread to many countries around the world. WHO continued deploying the health system's logic while also highlighting that the outcome of ineffective governmental efforts to curb transmission would be higher numbers of dead citizens, thereby alluding to governments' (in)competence, as for example on 3 March 2020:

> … 12 new countries have reported their first cases and there are now 21 countries with one case only. (…). The actions these newly affected countries take today will be the difference between a handful of cases and a larger cluster. (WHO 2020c)

The ultimate effect of sickness was emphasized – the risk of death, was noted on the same date:

> As we get more data we are understanding this virus and the diseases it causes more and more. This virus is not SARS, it's not MERS and it's not influenza. (…) That means more people are susceptible to infection and some will suffer severe disease. Globally about 3.4% of reported COVID-19 cases have died. By comparison, seasonal flu generally kills far fewer than 1% of those infected. (WHO 2020c)

That argument was put more strongly on 5 March, through a statement exposing the threat not just to individuals' health but to countries and therefore to governments' effectiveness:

> This epidemic is a threat for every country, rich and poor (…). The solution is aggressive preparedness. (…) We're concerned that in some countries the level of political commitment and the actions that demonstrate that commitment do not match the level of the threat we all face. (WHO 2020d)

The argument continued by invoking the power of governments as leaders, not just single ministries (like health ministries) but 'the whole government':

> These are plans that start with leadership from the top. Coordinating every part of government, not just the health ministry. Security, diplomacy, finance, commerce, transport, trade, information, and more. The whole government should be involved. (WHO 2020d)

Having activated the logic of governments, urging them to serve as leaders in an emergency, which could be important for retaining power, WHO reverted to the health system's logic but in such a manner that the risk of poor health also connected to the family logic. In a sense, countries were portrayed as one single family with members owing care to one another, something that could only be achieved if the government delivered on its tasks:

> So activate your emergency plans through that whole government approach, educate your public so that people know what the symptoms are, and know how to protect themselves and others. Increase your testing capacity. Get your hospitals ready. Ensure essential supplies are available. Train your health workers to identify cases. Provide careful and compassionate treatment, and protect themselves from infection. (…) This is a serious disease. It's not deadly to most people, but it can still kill. (…)
>
> There is something all of us can do to protect vulnerable people in our communities. That's why we keep talking about solidarity. (WHO 2020d)

The country-as-family argument was expanded towards urging governments to call on all forces for a joint effort to reduce spread of transmission, so that health systems would not be overburdened, and lives could be saved. This is also evident in a WHO statement on 5 March 2020 :

> Command, control, coordination, coherence. And (…) an all of government approach. Community, society, public sector, private sector, and government coming together to work together. (…) I think all of you have seen that health systems, even some health systems with a very small number of cases, have already struggled (…) So we need to get our health systems stronger. (…) The spread is uncontrollable. Regardless of what we do. So we focus on saving lives. (WHO 2020d)

While reverting to scientific data, explanations of data invoked implications for individuals whose loved ones might be at risk, therefore potentially a family logic at the mercy of governments' effectiveness. Implicit in the explanation provided on 9 March 2020 of 70 % of Chinese cases having recovered is that 30 % had not:

> Of the 80,000 reported cases in China, more than 70% have recovered and have been discharged. It's also important to remember that looking only at the total number of reported cases, and the total number of countries, doesn't tell the full story, except the potential the virus has. (WHO 2020e)

On that basis, WHO began to call on governments to introduce measures that would normally be considered drastic and a failure of (democratic) government:

> Action must be taken to prevent transmission at the community level to reduce the epidemic to manageable clusters. Depending on their context, countries with community transmission could consider closing schools, cancelling mass gatherings, and other measures to reduce exposure. (WHO 2020e)

On 11 March, hours before the Danish government announced its lock-down, WHO announced new numbers worrying from the health system's logic, as well as the family logic because a loss of life could be a person who did not receive adequate care, amounting to a failure on the part of government:

> In the past two weeks the number of cases of COVID-19 outside China has increased 13-fold and the number of affected countries has tripled. There are now more than 118,000 cases in 114 countries and 4,291 people have lost their lives. Thousands more are fighting for their lives in hospitals. In the days and weeks ahead we expect to see the number of cases, the number of deaths and the number of affected countries climb even higher. (WHO 2020f)

On that basis, the WHO proceeded to announcing an international pandemic, turning this into a call for government action once again with risks of ineffectiveness being lost lives:

> WHO [is] deeply concerned both by the alarming levels of spread and severity and by the alarming levels of inaction. We have therefore made the assessment that COVID-19 can be characterized as a pandemic. (…) I remind all countries that we're calling on you to activate and scale up your emergency response mechanisms. Communicate with your people about the risks and how they can protect themselves. (WHO 2020f)

The WHO reminded governments that effective measures might include lockdowns, to be assessed against its legitimacy ('acceptability', duration, etc):

> The decision to close schools and to do lockdowns or shut down particular parts of a country are entirely based on a country's own risk assessment and it's a mix of measures. (…). Governments make decisions based on a mixture of issues; the risk, the likely impact of a measure, the acceptability of the measure, the length of time the measure has to be left in place. (WHO 2020f)

The implications of ineffective governance steps were spelled out in terms of drastic measures that citizens might not like (extensive social distance requirements) or overwhelmed health systems:

> When you lose track of the outbreak then you have to create social distance between everybody because you don't know who's infected. (…) The difficulty is that if you do not try and suppress this virus it can overwhelm your health system so there have to be very strong efforts made to suppress infection, to push the infection back because at the very least it will take the pressure (…) [and] allow your health system to remain in control and achieve some success in reducing case fatality. (WHO 2020f)

WHO even mentioned Denmark directly in its call for effective governance:

> Spain's number of cases has accelerated very, very quickly over the last couple of days, as has France's, as has Norway's, as has **Denmark'**s (…) [I]t's very important that countries in the European Union (…) assess whether the efforts they're taking are good enough in terms of suppressing transmission and pushing back the virus and then obviously preparing their health systems to cope with the cases that do occur. **All countries need to review their strategies right now.** (WHO 2020f; emphasis added)

5.2. Denmark's response

When the Danish government announced a lock-down in the evening of 11 March 2020, it basically responded to WHO's call, noted just above. This seems very logical: a pandemic had hit, the numbers from China showed deathrates exceeding those of the common flu, especially for the elderly and vulnerable; and evidence from China (and the European country of Italy) showed that health systems were overburdened in terms of space, staff and equipment. The speakers present at the press conference (the Prime Minister, the Minister of Health, the Directors of the Board of Health and the National Police, and the Head of the Foreign Ministry's department for citizens' affairs) indicates that the Danish government was implementing the 'one government' approach called for by the WHO. Except for the Police Director, who wore a police uniform, all were dressed in black (Unger 2020), an unusual dress code for Danish government ministers and civil servants. Black outfits are normally used for funerals, especially when an entire group is similarly dressed. The televised press conference therefore gave off a very somber impression suggestive of death and loss. References were made to press-photos of army trucks being deployed at night to carry truckloads of dead bodies from Bergamo, one of the worst-hit Italian cities, where not only hospitals but also crematoria were overstretched.

The Prime Minister opened her statement by referring to the family logic, calling for people to help one another in the face of the difficult situation. She noted that the increase in confirmed COVID cases had more than tripled in one day, and increased 10-fold from just two days earlier. On that basis she immediately jumped to the case of Italy, which was already in lock-down. Alluding to the effectiveness of her government in taking action, she observed that,

> As government agencies, citizens and as a country we have one single task, more important than any others: We must avoid too many Danes becoming infected at once. Like what happed in Italy.[3] (Prime Minister's Office 2020)

This also shows how the complexity of COVID-19 became reduced to a simple dichotomy of life and death, a binary logic that connects to the family logic of care by implying the ultimate loss of loved ones; but also one that is fundamental to all functional sub-systems because as social systems they are made up by individuals who decide on and undertake actions in response to irritation, even if their essence is communication. Moreover, the binary code of any functional subsystem is about *its* life or death. A government unable to handle fundamental threats to life and death is not an effective government, and likely to lose power the next time citizens get a chance to show their preferences. A health system losing many lives when people are sick fails fundamentally in its most important task, which is to turn sickness into health so that the formerly sick can be discharged and no longer 'belong' within the health systems' function.

The Prime Minister built part of her argument by connecting first to the family system's logic of care:

[3] Statements in Danish are translated by the authors.

> We have a major obligation to help (…) those who are the most vulnerable to disease, such as people with chronical disease, cancer and the elderly. Out of consideration of them, the virus must not [be allowed to] spread. (Prime Minister's Office 2020)

Alluding to the risk of hospitals and health providers being overstretched, the Prime Minister referred to health science endorsing social distancing as the key strategy to avoid transmission. Following that, she invoked the family logic:

> We need to stand by each other and take care of each other. But we must do this differently from what we normally do. Danes normally engage in intimacy by being close. Now we need to do so by keeping a distance from each other. (…) We will need to show care to others. (Prime Minister's Office 2020)

The family logic communication was so effective that the public nick-named the Prime Minister 'Mummy'.

The analysis of the Danish government's responses to WHO's statements on COVID-19 demonstrates that from a systems theory perspective, WHO was effective in communicating in ways that triggered governmental action. It activated the political system's logic by alluding to the role and tasks of government and the risks of a government losing power in the face of a (health) crisis. Governments may feel under pressure if citizens feel concerned and unsafe because the public health system appears unable to offer care to loved ones that the family cannot provide themselves (e.g., if hospitals have to deal with too many sick people or their own staff are sick); or because they fear getting sick (and lacking care) and perceive that to be a result of inadequate governmental decisions, e.g. in limiting social contacts to spread transmission.

What is interesting in this context is that climate change is also about life and death: for individual humans, for other life on land, life in water, and ecosystems. Responses are also more complex than closing schools and imposing lockdowns temporarily, or inventing vaccines. So, what does an analysis of the IPCC and Danish responses tell us?

6. The climate crisis

6.1. IPCC reports for policymakers

From early on, IPCC has issued summaries for policymakers. Since the early reports (1990/92), despite that audience, the statements are highly framed in the logic of science: findings on climate change are preceded by headings noting whether they are 'certain', 'confident', or 'predict(ions), based on current models'. Such headings invite a debate on whether the reported information is true or false, thereby locking the debate in the system of science rather than giving off a message of an urgent need for governments to act. Moreover, the findings are reported in a strictly scientific manner, with graphs, numbers, calculations and complex quantitative data that are not conducive to triggering governments' political or legal logics. This also applies to recommendations for actions, such as '[a]ssessment of potential leaching of toxic chemicals with sea-level rise', '[d]etermination of ecological impacts of Arctic and Antarctic sea ice reductions' (IPCC 1990/92, 109), or 'predictions of global mean sea level rise of about 6 cm per decade over the next century (with an uncertainty range of 3-10 cm per decade' (IPCC 1990/92, 117). From a systems theory perspective, because a sub-system will only adapt to its environment when irritants activate its own logic, information on ice mass, sea ice or sea

level rises over centuries will fail to trigger the logics of governments and therefore responses, unless the significance is explained in ways that explicate implications for their power or loss thereof.

Similar barriers for communication between subsystems apply to later policy-maker-summaries. For example, the 2000 report on emissions scenarios states,

> *Future (… GHG) emissions are the product of very complex dynamic systems, determined by driving forces such as demographic development, socio-economic development, and technological change.* Their future evolution is highly uncertain. Scenarios are alternative images of how the future might unfold and are an appropriate tool (…) to assess the associated uncertainties. (…) The possibility that any single emissions path will occur as described in scenarios is *highly uncertain*. (IPCC 2000a, 3, emphasis original)

Although the findings are reported with higher certainty than the 1990/92 reports, the information is wrapped in scientific uncertainty and reservations, confined in the logic of science, as something that cannot be fully proven.

Another summary for policymakers on land-use and forestry introduces uncertainty and challenges its own truthfulness, stating,

> There are many possible definitions of a 'forest' and approaches to the meaning of the terms 'afforestation,' 'reforestation,' and 'deforestation' (…). The choice of definitions will determine how much and which land [areas] are included under [subsequent] provision (…). The amount of land included will have implications for the changes in carbon stocks accounted for (…). (IPCC 2000b, 5)

The 2000 report on climate change opens with a statement fully versed in the logics of science, and therefore little apt to trigger reaction in other sub-systems:

> What can scientific, technical, and socio-economic analyses contribute to the determination of what constitutes dangerous anthropogenic interference with the climate system as referred to in Article 2 of the [UNFCCC]. (IPCC 2001, 2)

The other framing questions/headings also ask for scientific knowledge and evidence. For example, the next heading reads,

> What is the evidence for, causes of, and consequences of changes in the Earth's climate since the pre-industrial era? (IPCC 2001, 4)

Ironically, this and eight additional questions serving as headings for the summary for policymakers are reported to be derived from 'submissions from governments and were approved by the IPCC (IPCC 2001, 2).

The 2007 synthesis report's summary for policymakers remains logged in the logics of the system of science, by continued references to evidence and scientific data. For example, the opening states,

> Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level. (IPCC2007, 2)

The 2014 report, preceding the Paris Agreement, also predominantly displays use of the scientific logic. However, some points are more detached from information on evidence and data, and, rather, relay information in ways that can more easily be digested by

economic or political functional subsystems. An example of a summary of causes of climate change:

> Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. (IPCC 2014, 4)

Or on irreversibility:

> Many aspects of climate change and associated impacts will continue for centuries, even if anthropogenic emissions of greenhouse gases are stopped. The risks of abrupt or irreversible changes increase as the magnitude of the warming increases. (IPCC 2014, 16)

Still, the report remains loaded with terminology fitting the logic of science, including multiple pieces of information framed as supported by 'limited evidence', 'medium evidence', 'low confidence', 'medium confidence', 'high agreement'. Even for other functional sub-systems, the scientific system's continuous deployment of the true/false dichotomy and implicit questioning of its own findings as being potentially false is not conducive for conveying irritants to generate change with other subsystems.

That may be changing somewhat. The 2023 Synthesis report still deploys science-system binary codes, but also introduces information fit to activate the logic of governments and therefore serve as irritants to spur them into action. For example, the benefits of acting soon are summarized in ways that refers to investments and enabling policies, as well as economic-system related language as 'losses or damages':

> Deep, rapid and sustained mitigation and accelerated implementation of adaptation actions in this decade would reduce projected losses and damages for humans and ecosystems (*very high confidence*), and deliver many co-benefits, especially for air quality and health (*high confidence*). Delayed mitigation and adaptation action would lock-in high-emissions infrastructure, raise risks of stranded assets and cost-escalation, reduce feasibility, and increase losses and damages (*high confidence*). Near-term actions involve high up-front investments and potentially disruptive changes that can be lessened by a range of enabling policies (*high confidence)'.* (IPCC 2023, 27)

Climate change is a highly complex topic and the reports were developed by scientists who were asked to work as such. However, the result has been reports confined by the logic of science. From a systems theory perspective, such information does not possess the communicative quality to cause irritation that may lead to adaptation in another functional sub-system.

This suggests that despite overwhelming scientific information on climate change, the IPCC's scientists have failed to communicate the urgency so as to generate irritants for other functional sub-systems required to act, notably the political and legal sub-systems of public governance. Not until 2014 did the IPCC gradually start to deploy messages fitting other logics, coinciding with the preparation leading to the Paris Agreement. References to loss and damage, suitable for triggering the economic system, are interesting as efforts to involve the economic system with the result that economic language has become adapted into the scientific code, or as an express effort to engage the economic system in climate change action (countering the trend suggested by Le Ravalec *et al.* 2022).

6.2 Denmark's response

Like the rest of the EU, many of Denmark's governance responses on climate change until around the early 2010 mainly comprised formal ratification of the UNFCCC and its elements, including the Kyoto Agreement. In line with this, much of the action took the form of delivering on the commodified CO2 trading regime.

Against this backdrop, the Danish government's stepping up on climate policies, including the adoption of the Climate Act in 2020, may be understood as a response to the IPCC's 2014 and 2018 reports and the Paris Agreement. From a legal perspective, the Climate Act is unusual because it is an act about policy-making, not about enforceable obligations and rights. The government's responses to previous UNFCCC outcomes had mainly had the form of ratifying international agreements or following EU policy lines on ETS, but without much nationally oriented response. This also suggests that the previous IPCC reports did not succeed in getting the Danish government to understand the urgency beyond global governance responses.

Following a public announcement of an ambition towards early ratification of the Paris Agreement (Allentoft 2016), climate minister Lilleholt's ratification proposal was presented to Parliament in early October 2016. The explanatory comments explain the legal commitments undertaken by ratifying governments, including to plan and implement climate mitigation initiatives and report to the UN, funding to assist developing countries' transition, and GHG quotas. The statement notes that,

> EU and Member States, including Denmark, can only become parties to the Paris Agreement when their individual ratification processes have been completed. By complementing the Danish process Denmark can contribute to advancing the process in other Member States. (Lilleholt 2016)

This statement argues mainly from a political system perspective, presenting the government as effective in terms of follow-up on in terms of legal system action (ratification) on its policy commitment in Paris, and moving ahead of other governments. While it is not surprising for a government presenting a policy proposal for a legally binding ratification, it confirms how governance action on climate changes can proceed fast when the argument is framed in the logic of the systems of relevant decision-makers. That is further underscored by other parts of the explanatory comments, which walk readers through main points of the Paris Agreement and the UNFCCC with an emphasis on legal obligations, administrative burdens and economic implications for states parties, but little on the scientific data.

For example, the statement summarizes the Paris Agreement as follows:

> Through the Paris Agreement, parties to the UNFCCC commit to global targets on
>
> - Keeping average global temperature rise well under 2°C compared to pre-industrial levels and work towards restricting temperature rise to 1.5°C
> - Enhance mitigation capacity for the harmful effects of climate change and resilience to climate change
> - Make financial flows consistent with the transition to low emission and resilience to climate change. (Lilleholt 2016)

Explanations of how Denmark may deliver on these goals were also couched in the logics of politics and law:

> Denmark's ratification of the Paris agreement has no implications for the national budget. Legislation to implement the EU's NDC for the Paris Agreement is not yet adopted in the EU. It is therefore difficult to predict the final economic implications (…) Eventual EU law on EU climate and energy policies 2021-2030 may have considerable budgetary and economic implications for the public and private sectors. (Lilleholt 2016)

A half-page section on environmental implications is the most explicit part on the scientific implications. However, it ends:

> As the Paris agreement commits parties to reporting new reduction targets every five years, the Agreement is expected to contribute further to the reduction of GHG emissions. (Lilleholt 2016)

This expected outcome is also explained in terms of legal commitments and policy objectives. Confirming the significance of getting governance decision-makers on board through messages activating their logics, it also displays limited transmission of the complex scientific background for and implications of climate change. This may help explain the limited encouragement by the Minister for public and private organisations to do their part, contrasting with the communication in March 2020 by the Prime Minister and Danish authorities to the public and private sectors and citizens to reduce COVID-19 transmission.

This observation is further underscored by the way in which the Energy Agency introduces Denmarks' climate governance on the front of its website. It notes that,

> Danish climate policies is [sic] driven partly by compliance with international climate obligations, and partly by achieving national targets in the energy sector, which is a major source of greenhouse gas emissions from Denmark. The regulatory framework for the Danish climate related policies is laid out in the Danish climate law. (Danish Energy Agency, website)[4]

This suggests that despite calls for speedy action in the IPCC's 2018 and 2023 reports, the government's recognition of the crisis remain determined by the logics of the political and legal systems.

7. Conclusion

This article contributes to filling a dual knowledge gap of a comparative analysis of determinants of governance responses to the COVID-19 and climate change crises, and applying systems theory to understand the extent or limits of such responses. Through an analysis of WHO press statements January-March 2020 and IPCC summaries for policy-makers 1990-2023, we have shown that COVID-19 information, especially on the effects of the virus, was communicated by WHO in terms not just of the health system's logic, but also those of politics and law, as well as the logic of the family sub-system, whereas the IPCC tends to communicate in scientific terms (true/false) that fail to activate the logic of key functional sub-systems for governance (law, politics). The analysis shows that through its emphasis on governments competences and the delivery

[4] Danish Energy Agency, Danish climate policies. See: https://ens.dk/en/our-responsibilities/energy-climate-politics/danish-climate-policies

of health care, WHO was effective in spurring the Danish government into acting in line with WHO recommendations. By contrast, the IPCC's extensive deployment of the true/false logic of science fails to activate governmental decisions-makers. When eventually IPCC began deploying logics of politics and law, it advanced national agreement on the Paris Agreement. More generally, the IPCC reports' decrease in scientific and increase in political system arguments targeting policymakers since 2014 as compared to earlier reports can be understood to have ushered in more focus on national governance measures. Nevertheless, as evidenced by recent findings (IPCC Core Writing Team 2023a), IPCC still fails to generate adequate action among national governments to reduce GHG emissions.

We also showed that the Danish government adopted the family logics suggested by WHO, passing this on to citizens as a call for mutual assistance to combat the crisis but also to demonstrate its own commitment for the survival of citizens as members of the 'national family'. That logic is not found in IPCC report, nor in the Danish government's response to the climate crisis, despite its applicability in the climate crisis context.

The analysis of WHO and IPCC statements suggests that decision-makers can be prompted into swift and responsive action, provided statements on scientific data (whether on climate or health) are made in ways that connects to the binary code of the government and its audience, particularly connected to its survival. This insight holds important potential for onward communication between international or national scientific and governance agencies to respond to crises: scientific information, on planetary or individual survival, must be translated into implications for governance bodies, connecting to what they must do to survive, i.e., to stay safely on the positive side of their logic. Accordingly, increased awareness among scientists and expert bodies on the communicative aspects of systems theory and the logics that motivate decision-makers to take action may advance the speed of governance responses. The systems-theory-based empirical analysis has allowed us to explore connections between information provided by international scientific expert bodies, and national governance responses. We suggest that such analysis deploying systems theory in an institutional setting can enrich the wider scientific and practice-oriented debates on how to advance governance responses to crises, not just among systems scholars but also with institutionalists.

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