Contested emergency: Five gaming strategies between environmental and economic science-policy-society coalitions

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Abstract: The Greek word nomos is usually taken to mean a law or a convention governing human conduct. The concept has been developed to understand social and economic order comprising three aspects: appropriation, production and distribution. In the present paper, I focus on appropriation and define it as the knowledge claims being made and circulated in science-policy-society interactions. Three general rationales are identified: the linear (speaking truth to power), the co-production of knowledge (making sense together) and the post-truth (inventing facts for friends). The objective of the present paper is to examine how the environmental coalition has attempted to ease the problems of climate change and biodiversity loss and how the economic coalition has responded to these strategies as well as how both coalitions have used the three science-policy-society rationales. I will identify and discuss five game-theory inspired strategies that the environmental coalition has used as well as outline some examples on how the economic coalition has responded to the knowledge claims by the environmental coalition. The knowledge claims are not static but rather evolve dynamically in interactions between competing coalitions. This highlights the relevance of the recent idea that actors working at the science-policy-society nexus need to consider their opponents and tailor their knowledge claims not only based on science or on their own objectives but also in a way that counters and anticipates the opposite coalition's knowledge claims and decisions. Based on the analysis, I propose that the interactions between environmental and economic coalitions can be understood as a "Contested Emergency". This paper highlights the relevance of knowledge claims in shaping the complex landscape of environmental governance and the challenges for movement towards a post-fossil future. The knowledge claims regarding the contested emergency end up grounding certain visions of future spatial orders and imply fundamentally different possible nomoi ranging from sustaining the status quo build on economic growth through technological solutions to radical transformative measures seeking to avoid social-ecological collapse.

Keywords: Science-Policy-Society Interfaces; Global environmental problems; Post-truth politics; Game theory as heuristics; Nomos

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Introduction

Among the most urgent challenges for sustainable human-environment interactions are climate change, loss of biodiversity and the unbalanced use of ecosystem services (UNFCCC 7 March 2017; Kremen & Merenlender 2018). While the scientific community has increasingly more knowledge on these problems, the knowledge is often underused or even misused leading to inaction (Adger *et al.* 2010; Posner *et al.* 2016; Ripple *et al.* 2017). In the present paper, I will assume that this misuse of knowledge and political inaction relate to certain orders governing human conduct. The theme of this *Nordia Yearbook* is energy and nomos, a concept which originates from Greek, meaning a law or convention. Carl Schmitt (1993) aimed to use nomos to develop a comprehensive consideration of social life in its unity, and to that end proposed that there are three aspects to the more fundamental concept of nomos: appropriation, production and distribution (Millerman 2014). Therefore, nomos can be understood by looking at these aspects, which are relevant for various scientific disciplines (Schmitt 1993). Appropriation is defined by the Oxford English Dictionary as the act of taking something that belongs to somebody else. Production is about ways to use, for example, environmental resources, and produce subsequent goods and services. Distribution is understood here as ways in how benefits resulting from production are allocated, which is about what and how much a given nomos can offer its supporters.

Arguably, there is no single nomos, but instead many nomoi that are parallel but often competing rationales to arrange social and economic orders (Luisetti *et al.* 2015). Millerman (2014) lists some key different nomoi that are also relevant for understanding the human-environment relations and underpinning the environmental problems (e.g. democratic, non-democratic, capitalist, socialist, fascist, traditional, ethno-nationalistic systems). On the other hand, a single nomos may consist from a particular kind of interactions between actors that are located within the nomos. For example, the Cold War nomos was not socialism or capitalism, but rather their mutual rivalry formed a global nomos for decades.

The focus of this paper is on the interactions between two competing coalitions with different agendas to advance sustainability: the environmental coalition and the economic coalition. The environmental coalition consists of organisations, initiatives, businesses, policymakers and scientists who promote the view that environmental problems, like climate change and biodiversity loss, are urgent and severe, and need actions that require the prioritisation of "green" solutions over economic growth. The economic coalition consists of organisations, initiatives, businesses, policymakers and scientists who consider that human well-being is best achieved via promoting economic growth. However, there are also overlaps and synergies possible within green growth. Yet more often the coalitions are competing with each other to gain power. To cope in this competition, the coalitions need to respond

and adapt to the knowledge claims of the other coalition. In this competition, the coalitions use various science-policy-society rationales in a strategic manner.

The rationales for arranging science-policy-society interactions and ways to make and promote the knowledge claims considered in this paper have implications for the emerging Nomos in the face of the post-fossil transformation. Three general science-policy-society rationales are considered in the present paper: the linear ("Speaking truth to power"), the co-production of knowledge ("Making sense together") and the post-truth ("Inventing facts for friends"). Linear science-policy-society rationale implies that scientists produce knowledge, and then it is assumed to be used in decision making. The linear rationale has been widely criticised (e.g. van Kerkhoff & Lebel 2006), but it is still persistent, e.g. in the idea of an evidence-based policy (see Newman 2017). It is appropriate in situations with homogeneous values and low uncertainty (Pielke 2007). The co-production of knowledge rationale has been promoted since the 1990s with concepts like mode-2 science (Gibbons *et al.* 1994) and post-normal science (Funtowitz & Ravetz 1993), and it is suitable in situations where uncertainty is high and the values involved are in conflict (Pielke 2007). The post-truth science-policy-society rationale implies that decisions and opinions are not based on scientific facts or knowledge but rather on interests, beliefs, views, value positions and populist arguments, fake news and manipulation of facts (see Lockie 2017; Rose 2017). Whether post-truth rationale is suitable for any situation can be debated, but it usually occurs in deeply polarised

situations between competing and exclusive policy options.

The making of knowledge claims by the competing coalitions is understood as the appropriation of the science-policy-society landscape towards a preferable direction. Zimmer (2015) points out that in Schmitt's work on the nomos of the Earth, a fence was seen as the beginning of land appropriation and as a basis for later emerging laws. Here, appropriation is not understood as land appropriation by a fence, but rather the appropriation of the science-policy-society landscape by knowledge claims. The knowledge claims are not in themselves exclusive or rival resources, but when they enter the sphere of decision making, the competition between different knowledge claims intensifies. The appropriation is, therefore, about controlling the knowledge and facts that may be used in policymaking and decision making. Science-policy-society interactions lay a knowledge foundation, which is used to justify, deny, legitimate and enact certain decisions for the environment or economy. These decisions prepare the grounds for systems of production and distribution. The present paper focuses on appropriation, but it is useful to note that the production takes place in the domain of political economy and political ecology, and distribution is about social organisation consisting of economic structures, policy decisions and informal social practices on how to distribute benefits and burdens resulting from production. Production and distribution link, for example, to energy and food production, use and consumption of fossil fuels, which are often path dependent, meaning that the reliance on economic growth is often hard to transform. In such

situations, the competing knowledge claims by the two coalitions are taking place.

The objective of the present paper is to examine how the environmental coalition has attempted to ease the problems of climate change and biodiversity loss and how the economic coalition has responded to these rationales as well as how both coalitions have used the linear, co-production of knowledge, and post-truth rationales to further their agendas. I will employ game theoretical heuristics, which advises to think about how the underlying setting and the context of the game shapes the actors' strategies to pursue their aims. I will identify and discuss five game-theory inspired strategies that the environmental coalition has used as well as outline some examples on how the economic coalition has responded to the knowledge claims by the environmental coalition. This is important as science-policy interface organisations need to pay increasing attention and respond to their opponents for making an impact on environmental governance (Sarkki *et al.* 2019). I will next outline some insights on the game theory and science-policy-society interaction literature that are merged together in a subsequent section on the five gaming strategies. I will discuss some points linked to each three considered science-policy-society rationales, and finally propose that the interaction between the economic and environmental coalitions points to a "Contested Emergency", which may evolve into fundamentally different ideal types of nomos.

Background

The two coalitions

The basic setting examined in the present paper consists of two competing discourse/policy coalitions (Hajer 1995): the environmental coalition and economic coalition. Hajer (1995) uses the concept of storyline and discourse coalition, which *"is the ensemble of a set of story lines, the actors that utters these story lines, and the practices that conform to these story lines, all organized around a discourse."* (Hajer 1993: 47). In section 3, I will use some specific examples around biodiversity loss and climate change. However, to provide grounds for a wider interpretation of the arguments between the environmental and economic discourse coalitions, I propose that the discourse coalitions can be defined by the connection of their arguments to some UN Sustainable Development Goals. The economic coalition capitalises, for example, SDGs on No poverty (SDG 1), Zero Hunger (SDG 2), Good health and well-being (SDG 3), Decent work and economic growth (SDG 8) and Industry, innovation and infrastructure (SDG 9). On the contrary, the environmental coalition sees that the earth system is also needed to support the above SDGs, and, therefore, prioritises Responsible production and consumption (SDG 12), Climate action (DSD 13), Life below water (SDG 14) and Life on Land (SDG 15). In this paper, I will take up a few arguments and initiatives by the environmental coalition and examine how the economic coalition has responded to these arguments.

Game theory can be based on cooperative (coalitions compete and cooperate to create value) or non-cooperative models (actors aim to maximise their utilities in certain situation and by specific activities) (Chatain 2016). The present paper introduces the competing coalitions by way of cooperative game theory (application of the median voter theorem) to picture the overall situation between the two coalitions, to understand their links to sustainable development, and to outline some potential dynamics that illustrate which societal developments may change the minds of people to support either of the coalitions. Cooperative game theory is suitable in situations where actors compete and cooperate as coalitions to create value by policy decisions. However, the environmental and economic coalitions often do not collaborate, and they aim to maximise their utilities/objectives, which the other coalition is often seen setting out to deteriorate. Therefore, a more in-depth examination is done via non-cooperative game theory about the dynamics between the two coalitions.

The application of non-cooperative games is justified by the trade-offs between maximising economic benefits and mitigating climate change or halting biodiversity loss. For example, the global science-policy platforms, the Intergovernmental Panel on Climate Change (IPCC), and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) (Brooks *et al.* 2014), are key players in making knowledge claims for the environment. According to an IPCC report: *"Ambitious mitigation actions are indispensable to limit warming to 1.5°C while achieving sustainable*

development and poverty eradication" (Allen *et al.* 2018). Despite these powerful knowledge claims, however, the US withdrew from the Paris agreement. While there are certainly middle grounds intertwining environmental sustainability and economic growth, as shown in figure 1 below, the setting between the environmental coalition and economic coalition is still rather often polarised regarding climate change and knowledge claims concerning its mitigation. On the other hand, biodiversity loss is considered as a severe problem, and to halt it requires societal transformations (e.g. Cardinale *et al.* 2012). Economic costs of inaction are huge, but *"valuing of biodiversity impacts by businesses and financial organisations, however, remains limited"* (OECD 2019, 12). IPBES chair Sir Robert Watson stated that *"The member States of IPBES Plenary have now acknowledged that, by its very nature, transformative change can expect opposition from those with interests vested in the status quo, but also that such opposition can be overcome for the broader public good"* (https://ipbes.net/news/Media-Release-Global-Assessment). Therefore, the environmental coalition again sees the key challenge as the ability to achieve transformation against vested economic interests. In conclusion, there seems to be frequent trade-offs between the environmental and economic coalitions, which both seek to maximise different utilities. This justifies the use of non-cooperative game theory in the analysis.

To understand the competing environmental coalition and economic coalition, I briefly employ the median voter theorem, which assumes that the options for voters can be placed under a

single dimensional line (e.g. from left to right), and that the voter has one favourite alternative among the options along the continuum (e.g. Black 1948). The environmental coalition and economic coalition form another kind of continuum: from top-down environmental tyranny to anarcho-capitalism at the extremes. However, as these end points are rather hypothetical, I posit that the environmental coalition and economic coalition are more towards the centre. Both coalitions aim to enhance sustainability, but with highly divergent strategies and primary focus. The environmental coalition obviously values the environment and seeks primarily to advance ecological sustainability and considers that production needs to be arranged within the planetary boundaries. The environmental coalition often sees

distribution in terms of fairness and justice and points out that benefits and burdens deriving from global environmental changes are not equally distributed. The economic coalition emphasises the necessity of continuous growth, and aims to protect investment value and vested interests, for example embedded in certain kinds of practices of production. The economic coalition often considers distribution in a way that is linked to private interests, and equality in terms of equal opportunities for people to pursue material wealth. It is also assumed that, in the middle, the coalitions fight for supporters who could choose either of these coalitions. Here, it is assumed that social sustainability is equally important for both (see Figure 1).

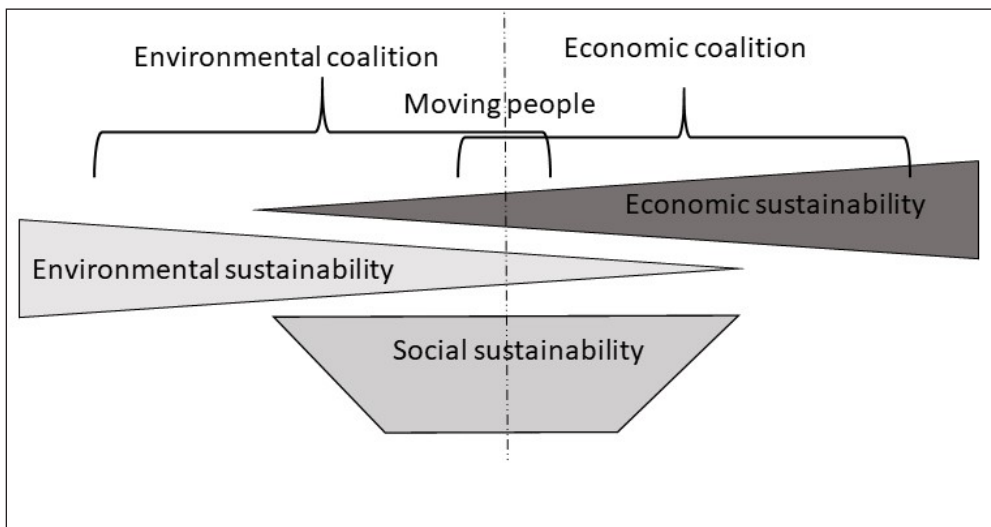The environmental coalition and economic coalition can be seen to be

Figure 1. Application of the median voter theorem in respect to the environmental coalition and economic coalition. Social sustainability is seen as objective for both, but when going towards the far end in both ends of the continuum, it is likely that the social sustainability will suffer either from top-down environmental tyranny or by extreme forms of capitalism.

competing for supporters. The supporters' choices are dynamic. Below, I make some basic assumptions on what kind of societal changes would affect the number of supporters:

More supporters for the environmental coalition:

- Extent of environmental problems: the more problems there are, the more support there will be for the environmental coalition.
- Environmental awareness: the more environmental awareness and aims to anticipate future changes there are, the more support there will be for the environmental coalition.

More supporters for the economic coalition:

- The more environmentally sustainable technology is, the more support there will be for the economic coalition.
- Economic recessions and unemployment lead to citizens demanding that policymakers emphasise economic growth more.

Contradictory developments:

- The more immigrants there are, the more polarised the opinions will be.
- The more rigid the environmental regulations are, the more support there will be for the economic coalition.

Some insights from non-cooperative game theory

Non-cooperative game theory can shed some light on the dynamics of defection and collaboration between the coalitions. Game theory is derived from experimental economics where a certain kind of settings or games are created and tested with simulations with people making choices in them. The promise is that people's rational behaviour and most successful strategies in given situations can be identified based on the games. One of the most famous game settings is the Prisoner's Dilemma. Hardin (1968) proposed that use of commonly owned pastures by herders is characterised by economic rationality and therefore result in the tendency of the actors to exploit the common pastures for short-term interests at the cost of long-term sustainability as well as long-term benefits for the herders. Hardin called such situations the "Tragedy of the Commons". Likewise, the Prisoner's dilemma is characterised by competition between actors who follow their individually rational strategies and which, therefore, results in collectively unsustainable outcomes (Taylor 1987; Hardin 1992). Assurance game has been proposed as a solution to Prisoner's dilemma as it can evoke motivations to act for the common benefit by developing mutual trust between the actors breaking down the selfish behaviour for the common benefit (Kyllönen *et al.* 2006) (Table 1). Transformations from Prisoner's dilemma towards assurance game are facilitated by trust building, which require repeated interactions between the stakeholders to realise that the collaboration is mutually preferable and in the long term a better option than defection (Taylor 1987; Seabright 1993). Furthermore, the logic of the prisoner's dilemma often changes when the game is iterated bringing in the possibility for reciprocity (Axelrod 1987).

Table 1. Rank of individually rational preferences in the prisoner's dilemma and assurance game. CC=all cooperate for safeguarding long-term benefits from ES; DD=all defect and drive their own interests; DC=One defects and the others cooperate, i.e. one will be a free rider and enjoy the benefits of cooperation while the others will bear the burden; CD=One cooperates and the others defect, i.e. the others freeride and one will bear the burden. (Modified from Kyllönen *et al.* 2006).

Order of preferences for individuals	Prisoner's dilemma	Assurance game
Best	DC	CC
Second best	CC	DC
Third best	DD	DD
Worst	CD	CD

In this paper, I focus on two interrelated fields: 1) climate change and 2) biodiversity and ecosystem services. Both of these fields can be argued to reflect the tragedy of the commons kind of dynamics being characterised by the inability of people to stop climate change or ecosystem service decline with institutional arrangements (Lant *et al.* 2008; Paavola 2011; Costanza & Liu 2014; Duraiappah *et al.* 2014). Collaboration across the environmental coalition and economic coalition gap is often perceived as a threat for both coalitions: the economic coalition would lose some of the potential to exploit the environment, and the environmental coalition would have to compromise its environmental objectives, which they consider serving the common benefit. Therefore, defection may seem as a tempting strategy for both coalitions in the interactions with one another. Here, I focus on collaboration and defection at the level of knowledge claims that are pushed to decision making.

Science-policy-society rationales

The present paper looks at the interactions between the two coalitions via appropriation, which is understood as knowledge claims. The knowledge claims can be made at least by following three general science-policy-society interaction rationales: linear, co-production of knowledge and post-truth rationales.

The linear science-policy interaction rationale assumes that when scientists produce valid and credible knowledge, it will be applied by policymakers and other stakeholders to inform decision making. The linear model is developed and suitable for problems where modernist and technocratic views on the ability of science to provide neutral policy recommendations are possible and expected (van Kerkhoff & Lebel 2006; Pielke 2007). Linear rationale targets policy decisions without attention to knowledge co-production processes that would involve policymakers and stakeholders. It is assumed that scientific peer-review will ensure the trustworthiness of the knowledge and it is then the task of policymakers to apply that knowledge. The linear rationale is suitable for simple decision making contexts where facts are certain and values and decision preferences are not contested (Funtowicz & Ravetz 1993; Pielke 2007) and where the issue

in question can be managed by a single perspective provided by, for example, modelling or otherwise standard operations (Gallopín *et al.* 2001; Koetz *et al.* 2012). The linear rationale is often based on one-shot interactions where the knowledge delivered by scientists informs decision making.

The science-policy-society relationships have evolved throughout the years from the linear model towards more co-production of knowledge (van Kerkhoff & Lebel 2006; Edenhofer & Kowarsch 2015). The co-production of knowledge rationale aims to answer to the wicked character of environmental problems and their solutions, where facts are uncertain, stakes are high, values are in play and most of the solutions lead to another set of problems (Funtowisc & Ravetz 1993; Sharman & Mlambo 2012). The co-production of the knowledge rationale is sometimes also referred to "mode-2 science" (Gibbons *et al.* 1994), as *"making sense together"* (Hoppe 1999) and implies that the knowledge is targeted for and co-produced with decision makers taking account their concerns (Lövbrand 2011). Such co-production blurs *"the boundaries between science and non-science and integrates knowledge production and use"* (Turnhout *et al.* 2013: 355). It has been convincingly shown that the linear rationale is suitable for clear decision situations with uncontested facts and values, whereas the co-production of the knowledge rationale can cope with complex and wicked problems characterised by irreducible uncertainty, by intermingled fact claims and value judgements and a plurality of values (e.g. Funtowicz and Ravetz 1993; Pielke 2007). The co-production of knowledge does not only target policy

decisions like linear rationale, but also targets the production of the knowledge that is informing the decisions.

The post-truth rationale refers to the science-policy-society rationale, where decisions and opinions are not based on scientific facts or knowledge, but rather on interests, beliefs, views, value positions and populist arguments, fake news and manipulation of facts (see Lockie 2017; Rose 2017). The post-truth rationale is gaining momentum even to the degree where "Post-truth" was chosen as the word of the year in 2016 by Oxford English Dictionary. The post-truth rationale has eroded the trust of citizens and voters regarding science and media. The popularity of post-truth arguments is largely based on making the arguments that fit supporters' world views and interests, even if these arguments are false.

The post-truth rationale is relevant in the contexts of climate change and biodiversity loss as exemplified by the following examples. Regarding climate change, a mega review paper showed that 97% of climate scientists consider climate change to be real and caused by humans (Cook *et al.* 2016). Despite this, climate change sceptics thrive, and the US withdrew from the Paris Agreement. The impacts of the post-truth rationale are manifested in the climate change discussions by the denial of existence of anthropogenic climate change by President Trump and his supporters (Kantor 2017). The post-truth rationale is also manifested in the domain of biodiversity and ecosystem services. The global assessment report on biodiversity and ecosystem services by IPBES (2019) states in its summary for policymakers that

"An average of around 25 per cent of species in assessed animal and plant groups are threatened, suggesting that around 1 million species already face extinction, many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss". Against this finding, it has been asserted that the current extinction of species is not a problem. This claim is supported by the relatively low number of confirmed extinctions. Furthermore, a director of a pro-fossil fuel group, and frequent guest on Fox news, claimed that *"As with the manufactured 'climate crisis' they [IPBES] are using the specter of mass extinction as a fear tactic to scare the public into compliance"* (Platt, 22 June 2019). Mass extinction along with the IPBES report have also been called "Fake News" (Delingpole 23 May 2019).

It is widely perceived that the post-truth rationale erodes the trust of the opponents and are based rather on "defection" to drive one's own interests than to collaborate for mutual and common benefit. On the other hand, the environmental coalition may also fall into (stealth) issue advocacy driving an agenda in a way that is not necessarily trustworthy (see Pielke 2007). For example, IPCC has been criticised for a lack of transparency and the selective use of evidence regarding the so-called "Glaciergate". IPBES has also been criticised for not taking local concern and alternative forms of knowledge versus globalised science properly into account (Turnhout *et al.* 2016; Löfmark & Lidskog 2017). In this line, it has been noted that

Table 2. Science-policy-society interaction rationales, metaphors and underlying assumptions to contribute to solving complex problems.

Science-policy-society rationales	Metaphor	Assumption
Linear	Speaking truth to power	Scientists can discover facts, and they should bring them to policymakers to inform decisions and enhancing evidence based policy
Co-production of knowledge	Making sense together	Complex problems need the involvement of policymakers and stakeholders into knowledge co-production. Scientists should keep the issues open and leave the decisions to policymakers
Post-truth	Inventing facts for friends	Facts can be manipulated, used selectively and even invented to push an agenda justified by that the modified truth fits to the certain world views leading to polarisation with other world views.

"issues of global climate change or biodiversity loss do not enter the scientific realm as neutral objects of inquiry; they are from the very beginning (that is, from the phase of problem definition) value-laden and guided by a transformational perspective (envisaged progression towards a more desirable state of affairs)" (Popa *et al.* 2015: 46).

Table 2 links the three science-policy-society rationales to key metaphors and assumptions. As shown in the literature on the non-cooperative game theory hereinabove: players can choose to collaborate, defect or not play the game.

Five gaming strategies

Typically, game theory focuses on players' interests, existing rules and motivation structures, for example seeking to understand the rationales behind collaboration or defection, as in the Prisoner's Dilemma game. However, this obscures how the games may change due to the players' actions. Thus, it is not only about how players play the game, but also how they attempt and sometimes can change the structures of the game (Pel *et al.* 2016). In addition, players may also choose not to play the game. I propose five abstracted strategies that the environmental coalition can choose to respond to the economic coalition in the age of wicked environmental problems (Table 3).

Prisoners

The environmental coalition can pursue its objectives in interactions with the economic coalition by a strategy called prisoners, who never know what the other side is up to, and who are afraid to collaborate in a belief that the trust they give to the opposite side is misused against their interests. This strategy is based on the Prisoner's Dilemma game situation. However, the Prisoner's Dilemma can also be manifested in continuous interactions characterised by a lack of trust between

Table 3. Five gaming strategies.

	Playing the game	Changing the game
Collaboration (Co-production of knowledge)	**Spouses:** iterated reciprocity and trust lead to a virtuous cycle (Assurance game).	**Construction workers:** Changing the science-policy field by new initiatives, organisations and projects that may change the rules or even underlying logics of the interactions.
Defection (Post-truth)	**Prisoners:** iterated defections lead to a lack of trust and down-ward vicious cycle (Prisoner's dilemma).	**Masters:** In-depth knowledge about the science-policy field and ability to manipulate and exploit the existing relationships and structures for one's own benefit.
Not playing the game (Linear model)	**Outcasts:** not-responding to the changing science-policy contexts and post-truth politics or efforts to push transformative agenda outside existing structures proposing radical systemic change.	

science and policy, by the selective use of evidence to justify certain policy options, by the populist promotion of solutions that fit to the existing ideologies, by the clash of diverse policy coalitions and by the denial of the opposite side's view even in a shallow manner. When iterated, this strategy leads to a vicious cycle where collaboration is non-existent, and reciprocity is lacking with no attempts to break the counter positions resulting in a downward spiral of distrust. An example of prisoner type relationships between the environmental and economic coalitions includes climate scientists' and IPCC's responses against climate sceptics and President Trump. Increasing public discussion has also polarised even more with increasing climate denialism (Maza 11 November 2019). The environmental coalition has responded to climate denialism by the argument that even if you do not believe in anthropogenic climate change, you have to deal with the consequences. This will justify adaptation and mitigation (McLaughlin 7 August 2019). With the case of extinction deniers, IPBES has opened a Twitter chain titled "How did @IPBES estimate that 1 million species are threatened with #extinction?" These examples show growing polarisation and finding again new arguments to counter the opposite side. It seems that the prisoner strategy leads to arguments and counterarguments in far ends without any signs of finding a mutually accepted middle ground for a basis of new collaborations.

Spouses

The relationships between the environmental coalition and economic coalition could be ideally characterised by a virtuous cycle, which results in the mutual employment of the "Spouse" strategy. The spouse strategy would make the environmental coalition vulnerable to being deceived by trusting the economic coalition. Thus, especially the beginning of the spouse relationship is challenging as there may not yet be any established trust and, therefore, the coalitions may need to perform a "leap of faith" and assume reciprocal collaboration and trust. The plausibility for deception decreases when the relationship is iterated, and it can be hypothesised that trust and attempts for collaboration are reciprocated by the other party (Axelrod 1987). Therefore, if the spouse strategy is mutually used, it can turn the prisoner's dilemma into the assurance game, where collaboration is more beneficial for both parties than deception. There are some regional and local spouse strategies. For example, carbon neutral municipalities (e.g. municipality of Ii) (Chela 2019) and nature-based tourism in national parks (e.g. Oulanka national park) (Metsähallitus, 9 February 2018) aim to integrate economic and environmental sustainability. In the above examples, the collaboration has been fruitful.

Construction workers

The environmental coalition may choose to play the "Construction worker" strategy: a game changing collaboration. This

means that the sustainability coalition acknowledges the changing science-policy contexts and seeks to actively identify the structural gaps in the field that hinder the relationships between the environmental coalition and economic coalition. The gaps may then be closed by building new organisations, initiatives and projects, and linking to powerful actors changing the structure of the game. For example, the evolution of global change research and climate change science eventually led to establishing IPCC, which contributed significantly to the final major policy outcome: the Paris Agreement. Even with such efforts to construct the policy field towards enhanced climate action, it seems that vested private and national interests downplayed the Paris Agreement into an agreement without any ability for enforcement and thereby blocked structural change that was aimed to be constructed. On the other hand, biodiversity and ecosystem service assessments have also evolved, and now IPBES is functioning under the umbrella of the UN making it a major player in the biodiversity ecosystem services domain. The Convention on Biological Diversity (CBD) was also established after a process of long-term science-policy negotiations. CBD's current policy impacts include National Biodiversity Strategies and Action Plans, which are done by over 170 countries. Therefore, the construction worker strategy includes continuous efforts to change structural conditions under which the environmental coalition and economic coalition compete. Construction workers do not simply play the game, but also aim to change its rules, or even underlying logics by which the rules are built (see

Pahl-Wostl 2009). The above-mentioned examples include national policymakers (who also represent economic interests) as members of the plenaries of the global platforms. However, industry stakeholders in CBD, IPCC and IPBES are rarer, and networking is more done especially with science organisations supporting the sustainability agenda, and currently increasingly also with local people, who are assumed to promote environmentally sustainable solutions. In addition, IPCC has been accused of the political manipulation of scientific judgements and the credibility of IPCC summaries has been questioned (Laframboise 4 September 2019). Thus, the opposing side may aim to deteriorate the credibility of the "construction workers" new structures, and accuse the environmental coalition of the manipulation of facts.

Masters

Master strategy focuses on strong attempts to change the game and to dominate the opposing side even in questionable ways. The Master strategy is linked to the knowledge broker role called the "Detective" implying the need "*to be cognizant about hidden motives, political games, and interpersonal ties behind advocacy strategies*" (Rantala *et al.* 2017: 6), and the use of such knowledge in a reflexive and strategic way (Kunseler 2016). In Master strategy, the environmental coalition builds relationships, recognises the strengths and weaknesses of various actors, knows which string to pull to make an impact and can manipulate the policy players and utilise the potential trust towards them for their

own ends. Masters justify the rather cynical approach by arguing that happy endings for all are simply not possible and that environmental problems are so pressing that they legitimate even controversial means to oppress the economic coalition. For example, the environmental coalition may use evidence strategically to select facts that support policy action against climate change (e.g. Glasiergate) and to secure biodiversity and ecosystem services (e.g. to emphasise the extinction rate or highlight the (assumed) values of ecosystem services). These examples highlight the Master strategy, where the discourse on environmental policies and the economy is placed in a new context by choosing facts that support the environmental coalition's agenda. While Master strategy can be perceived as a logical response to post-truth politics, the downside is that it erodes trust towards organisations practising it by undermining the image of science as the provider of presumed truth. The first example of Master strategy is Fridays For Future movement, which has emphasised that the policymakers should take seriously the scientific insights to enhance the intergenerational justice that is linked to the climate change. Fridays For Future can be seen as a Master strategy because it emphasises the future for today's youth as justification for climate action and changing the game. It also openly accuses policymakers for inaction. Fridays For Future has been pointed out to rely too much on the "listen to science" argument, instead of pinpointing ethical and political underpinnings of climate change (in)action (Evensen 2019). While the responses to Fridays For Future movement have been generally positive, including providing an opportunity for Greta Thunberg to speak in the UN meeting, the Fridays For Future movement has also been countered by hate speech in social media.

3.5 Outcasts

The environmental coalition may choose not to change their practices at all as a response to the challenge of economic coalition playing post-truth politics. It may be considered that Outcast strategies will move the environmental coalition out of the field and make itself meaningless. However, the Extinction Rebellion initiative can be seen as an example of a meaningful applications of the outcast strategy. It aims to stop environmental degradation in a socially just way by non-violent civil disobedience. Extinction Rebellion uses arguments of policy inaction and distrust of policymakers, inequity, biodiversity loss and responsibility of people towards nature as headlines to evoke resistance (Extinction Rebellion 2019). Extinction Rebellion is a loosely networked grassroots initiative already with a global reach which was only established in 2018. As an unintended consequence, it may also accelerate societal polarisation between those who are part of the movement and those disturbed by its civil disobedience (e.g. in counter demonstrations). However, Extinction Rebellion seeks to exceed support of 3.5% of the population, a threshold assumed to be needed for a transformative change. Thereby, for them, it is rather irrelevant if resistance against them occurs. The outcast strategy is justified by the idea that only a

relatively small percentage of supporters is needed for achieving the targeted change.

3.6 Overlapping gaming strategies

The five game strategies were presented hereinabove as separate and caricature like strategies for interactions between the environmental and economic coalitions. However, in practice, it is likely that the different strategies are overlapping. The environmental coalition is likely to play collaborative strategies with the actors in the economic coalition when they tend to consider sustainability also as an economic opportunity. On the other hand, it is likely that the environmental coalition distrusts and even defects the actors, who for example deny climate change or biodiversity loss. Thus, the environmental coalition is likely to play different strategies with different actors at the same time. Therefore, the game theoretical heuristic exercise cannot recommend one single best strategy for the environmental coalition. The spouse strategy is good with trusted actors. The prisoner strategy may be used with opponents who are unlikely to collaborate, and there is strong belief that the opponents will defect the trust. In some cases, the Master strategy may be used where trust is already lacking and where the opponents are defecting all the time. However, the Master strategy is likely to deepen distrust leading to a downward spiral in the relationships with those who are manipulated and exploited by the Masters. The construction worker strategy, however, can be seen as important at all times to gradually change the field towards

the preferable direction. Finally, even the Outcast strategy can be used occasionally because the environmental coalition does not probably want to play each game available at various forums, for example those dominated by economic interests. Experimentation with the proposed gaming strategies in different situations may help the environmental coalition in solving the pressing environmental challenges of today.

Discussion

The five gaming strategies examined hereinabove highlight that, to fight environmental problems, the environmental coalition has been using all three science-policy-society rationales: linear, co-production of knowledge and post-truth. While prevailing understanding to address wicked problems emphasises the importance of the co-production of knowledge, I propose that the linear and even post-truth rationales may also have their place in fighting environmental problems.

Defence of the linear rationale?

The linear rationale has been considered as incompetent to address problems which include high uncertainties and heterogeneous and contested values (Funtowitz & Ravetz 1993). Climate change and biodiversity loss certainly have these characteristics. However, I propose that the linear science-policy-society rationale can be useful in addressing these problems. This is because these are highly complex

and global problems with consequences for humanity as a whole. Understanding the basic dynamics of these problems requires science, which relies on a robust methodology. In addition, the credibility of science on climate change and biodiversity loss can be enhanced by communicating uncertainties in a transparent way (see Ho & Budescu 2019). Interdisciplinary research groups including a range of experts from different disciplines can also be helpful to gain a credible and holistic picture on environmental problems. Heterogeneous values can be addressed by assessing trade-offs related to advancing climate change and biodiversity loss. The conditions of robust method, communication of uncertainties, assessment of trade-offs and interdisciplinarity can be fulfilled within the linear rationale. Given the complexity of biodiversity loss and climate change, pure science and resulting natural scientific facts are surely needed, and there is a defence to be made for the linear science-policy-society rationale. For example, Fridays For Future has emphasised that the policymakers need to take action based on scientific knowledge. In the post-truth age, scientific self-critique towards the linear rationale would likely also undermine the credibility of science, and expose scientific facts to populist misconstruals, which do not have a scientific basis. Science can credibly produce knowledge to describe the dynamics and consequences of environmental changes, but solutions need to be negotiated and decided by policymakers and be legitimated within the society. Indeed, societies need to be able to ground their decisions on robust science and deliberate the implications for appropriation, production, and distribution

that are emerging from environmental problems and their solutions. IPCC and IPBES have the potential to do provide that kind of knowledge.

Why might the co-production of knowledge fail?

The co-production of knowledge is preferred by many as the best available means to better understand global environmental problems. The premise is that when many actors are included into knowledge co-production, they will adopt the messages and commit to action. However, the above analysis of the five gaming strategies highlighted some complications. This is because in the co-production of knowledge, the starting point is trust between those producing the knowledge. However, the examples of responses of economic coalition to the environmental coalition highlights the lack of collaborative attitude and defection by questioning opposite knowledge claims. Opponents of the environmental coalition are not part of the knowledge co-production processes and if they would be included, it is possible that they would rather act in the way of questioning the facts and underlying processes of the co-production of knowledge. Therefore, the co-production of knowledge rationale faces a basic challenge of the Prisoner's dilemma, where the worst situation is to play trustful collaboration when the opponent is defecting. Therefore, it seems that the co-production of knowledge has limitations to address the type of situations it was designed to solve: wicked

problems with divergent values. However, the co-production of knowledge within a coalition helps to build more robust, credible, legitimate and relevant messages. More insights are needed on how to treat opponents to sustain and enable the benefits of the co-production of knowledge.

When to use and how to respond to post-truth argumentation?

When looking at the environmental coalition, it seems obvious that IPCC and IPBES cannot fall into post-truth argumentation because it would compromise their scientific credibility. The trust between the economic and environmental coalition has been compromised especially by denialism of climate change and biodiversity loss. However, attacking the opponents' facts may be useful for the actors playing the Outcasts strategy. For example, Extinction Rebellion challenges policymakers to speak truth and demands action. For Extinction Rebellion, trust is not an issue, and they are not even aiming to get the majority of the population on their side. Instead, they consider that 3.5% support from the population is enough to turn the system around. This percentage may be achieved by mobilizing those who are disposed to attack the economic coalition by civil disobedience. On the other hand, the environmental coalition needs ways to respond to the opponents utilising the post-truth rationale. Neimark *et al.* (2019) have proposed three potential responses deriving from political ecology: 1) expose (to use science to critically think about how truth claims emerge and how they can be

judged), 2) engage (to show how different sectors are linked together and where their agendas are conflicting to understand a wider contextual frame and generate new critical ideas about action), and 3) Teach and learn (to illuminate alternative facts, to decentre some forms of science as hegemonic ways of knowing, and to place all ways of knowing within the power relations that perpetuate them).

Conclusion: "Contested Emergency"

The current world order is no longer characterised by competition between capitalism and socialism, but rather a battle that is more about environmentally detrimental capitalism and environmental concern. The present paper has examined this battle with the help of game theory. Based on the examinations above, I propose that this battle should be called "Contested Emergency". This reflects the rather widespread and severe environmental concern which is reflected, for example, by the EU parliament declaring a climate emergency (Rankin 2019), and by Extinction Rebellion stating that *"the science is clear: It is understood that we are facing an unprecedented global emergency"* (Extinction Rebellion 2019). This emergency, however, is contested by some in the economic coalition by denying that climate change and biodiversity loss are caused by people or even that they pose a serious problems for humanity at all.

It seems that there is a deep polarisation between those calling the situation an emergency and those denying it. Therefore, the current "Contested Emergency" does

not consist of a single world order, or a nomos, but rather from the interactions between two opposite coalitions which make knowledge claims that contradict each other. Collaboration across the coalitions seems difficult, as implied in section 4.2. Moreover, the post-truth rationale has been used, at least to some extent, by both sides, where the agenda is more important than truth. This being the case with the "Contested Emergency", it is relevant to briefly think about the plausible future directions.

The economic coalition believes optimistically and uncritically in economic growth that will be ensured also in the future by technological development. In contrast, the environmental coalition seeks to warn society about potential tipping points, which could lead to the breakdown of societal processes and the economy as a result of deeply altered environmental conditions. Climate change and biodiversity loss denialism is a strategy by the economic coalition to manage the environmental emergency to maintain spatial order based on fossil fuels and economic growth as the only viable options to enhance human well-being. The liberal market economy as a global nomos seems to be challenged by the environmental emergency. The market economy has faced environmental challenges also in the past (e.g. Heynen *et al.* 2007), but now widespread scientific consensus, societal concern and political initiatives for transformation are stronger than ever. In the Guardian, it has been pointed out that *"Ending climate change requires the end of capitalism. Have we got the stomach for it?"* (McDuff 18 March 2019).

This widespread feeling of emergency has necessitated the evolution of responses, which would ensure the continuance of business-as-usual. In his analysis of the post-Soviet nomos, Prozorov (2010) has pointed out that "management of anomie" may maintain certain spatial orders against pressures for change. In this light, the environmental emergency can be interpreted as an anomie, which the economic coalition seeks to manage by denialism or by reference to prohibitive costs and economic consequences. Denialism blocks transformative change, and the persisting nomos of the fossil capital is also supported by vested interests and the existing power relations motivate argumentations against the environmental emergency. However, given the looming societal collapse due to environmental crises, political inaction may be dangerous. Negative consequences are experienced also in economic terms, and it has been robustly suggested that the costs of inaction in the future will be an order higher than the current costs of action for avoiding the negative impacts of environmental crises (OECD 2019). Such reasoning could perhaps speak to the rationales held by people within the economic coalition. This is important, because people often take up and use only knowledge that fits their world view, while knowledge that does not fit is ignored.

In case of a societal breakdown, the post-truth strategy and denialism will likely meet their end, as the wide ranging social and economic impacts materialize and cannot be ignored any longer. Therefore, it is no longer a question of whether

climate change is true because its concrete impacts are experienced in peoples' daily lives. The future may bring forward spatial orders that can be characterised as conventional worlds, barbarisation or great transitions (Raskin *et al.* 2002; Hunt *et al.* 2012). Conventional worlds rely on the current fossil capitalist nomos and are based on the assumption that the business as usual is somehow sustainable. The communicated environmental emergency may also be downplayed by business-as-usual practices. These conventional worlds are characterised by a medium level of policy reform or by reliance on markets. These so-called conventional paths could, however, be extensions of current world order proceeding towards the acceleration of environmental crises, which may later lead to collapse, in case critical tipping points are exceeded. Barbarisation would result in a scattered fortress world as a result of the failure of the state system and the breakdown or closure of (statist, capitalist, neo-colonial…) societies. A fortress world could emerge as a result of increasing climate change, which could cause millions of people to migrate to regions with more favourable conditions. In such case, for example, Europe could close its borders and become "fortress Europe". In case of a breakdown, environmental and social crises would cumulate, get out of control and thereby lead to a vicious cycle of conflicts as well as institutional disintegration and economic collapse. On the other hand, if policymakers and societies would take transformative action in the face of emergency, then the global liberal market economy as the world order could change,

to be replaced by locally centred eco-communalism or by new ways to combine economy with environmental sustainability. It is possible that the challenges posed by the anomies rooted in the climate and environmental crises will usher in the new nomoi, in whatever forms and scales they may come.

Such considerations open up views that are not considered by the economic coalition's post-truth denialism. The denialism as a rationale for argumentation seems to be rather incapable to envision alternative futures beyond reliance on fossil fuels or potential progressions brought forward by technological innovation. However, such focus on the perishing world order and its extension by an almost mythic belief on technology may be shattered by their potential inability to avoid societal collapse due to environmental change. In the case of societal collapse, even spatial orders characterised by top-down environmental tyrannies could emerge. Such orders would be dominated by environmental imperatives, and be perhaps exclusive towards alternative knowledge and perspectives because of the perceived necessity to secure environmental sustainability to enable future human well-being. Such environmental tyranny could lead again to linear science-policy-society interaction rationales, where science would be used to define the environmental dynamics and limits of economic manoeuvring space. In such case, the co-production of knowledge could be restricted to those representing the environmental coalition. According to IPCC and IPBES reports, the situation is alarming, but there could still be time to

initiate a transformation to avoid a potential future collapse. It is hoped that there are enough supporters for the co-production of knowledge to identify transitions that can avoid collapse in a way that meets democratic ideals and ensures human well-being within the planetary boundaries.

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