

Comparing the role of boundary organizations in the governance of climate change in three EU member states

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Abstract

A plethora of institutional forms has emerged whose remit is to link climate change science to policy-making. These can be understood as boundary arrangements where science and politics meet and intertwine; when formalized these may be referred to as boundary organizations. This article examines boundary organizations and their role in climate change governance in three EU member states: Germany (FRG), United Kingdom (UK) and The Netherlands (NL). A multi-level conceptual framework and tentative causal model steer the comparison. It demonstrates how context at the political-cultural and problem governance levels is crucial to understanding the operation and impact of boundary organizations. We find that the climate change policy issue is generally treated as a moderately structured problem with goal agreement. However, given this problem structure, 'climate change' is framed differently: as primarily economic (UK) or environmental (FRG) or in between (NL), and as primarily mitigation (UK, FRG) or adaptation (NL). In all countries, but in FRG and the NL more than in UK, climate change issue politics is split in two sub-arenas: one 'environmental' (to do with adaptation), the other 'economic' (to do with mitigation and/or energy transition). National boundary arrangements are more (FRG, NL) or less (UK) stable over time, between bureaucratic-cum-advocacy and technocracy-cum-learning in all three countries, depending on policy domain, policy stage and political context at the time. They in turn sit within national political-cultural spheres that we characterize as, for this policy issue, primarily corporatist (NL), personalized and meritocratic (UK), and corporatist veering towards consensual (FRG). The multilevel conceptual framework for mapping boundary arrangements and detecting causal patterns therefore serves to satisfactorily describe, compare and explain national differences in expert advice on climate change policy.

Keywords

boundary work; boundary organizations; climate change governance; policy making; science-policy interaction; comparative policy system analysis

INTRODUCTION

Like many environmental problems, climate change has become visible and comprehensible only as a result of increasing scientific knowledge. Compiled by the Intergovernmental Panel on Climate Change (IPCC), climate science has been at the heart of attempts to build a comprehensive global policy regime centred around the UN Framework Convention on Climate Change (UNFCCC) (Gupta, 2010). The IPCC is a well-known and prominent example of a boundary organization. The concept of *boundary organization* was introduced by Guston (2001). Simply put these organizations 'straddle the shifting divide between politics and science' (Guston et al., 2000). They exist at the frontier of the two different social worlds of politics and science, but they have distinct lines of accountability to each. They involve the participation of actors from both sides of the boundary, as well as professionals who serve a mediating role (Guston 2001). Boundary organizations are the formalized manifestation of *boundary arrangements*, a wide variety of collaborative configurations that straddle and mediate the boundary between professional-academic networks and public sector or policy organizations (Clark et al., 2011). The role of boundary arrangements is to organize the productive interaction between science, policy and politics. Boundary arrangements are embedded in, and shaped by their contexts of policy networks and political-cultural spheres, as depicted by the multi-level framework developed by Hoppe (Figure 1, Hoppe, 2010a, 2010c). Using examples from three European countries, we describe and explain how boundary arrangements in national climate change governance have adjusted to their national contexts.

A MULTILEVEL CONCEPTUAL FRAMEWORK AND TENTATIVE CAUSAL MODEL

In this section we begin by setting out a multilevel conceptual framework for the empirical study of boundary organizations and the work they are engaged in, i.e. giving science-based policy advice (Hoppe, 2010a; 2010b; Hoppe et al. 2013). 'Framework' we use in the sense of an analytical scheme, relating concepts in a logical and/or plausibly descriptive way. We will specify a number of key concepts, each corresponding to the levels of the framework. The concepts indicate analytically coherent sets of observable phenomena. We use well-known typologies for each of the concepts to classify and analyze our data. We advance over our previous work (Hoppe, 2010a, 2010c; Hoppe et al., 2013) through the formulation of a tentative causal model. We use 'causal model' in the sense of regular patterns or pathways between observations, as captured through the typologies, concepts and conceptual model (Schlager, 2007; Goertz, 2006). This enables us to compare systematically and with descriptive rigour findings in the three selected cases and to test some of the hypotheses derivable from the tentative causal model.

The relationship between science and politics is often conceptualized as a linear process of knowledge transfer, dissemination, research use or impact (Weiss, 1979; Landry et al., 2001; Nutley et al., 2007). Policymakers and politicians like to suggest that they are 'on top' and call on the services of scientists and experts who supposedly are just 'on tap'. Scientists see their role as neutral, objective and independent, speaking 'truth to power'. However, both these 'sacred' narratives neglect the more 'profane' truth of the two-way, interdependent character of knowledge production and communication between experts and policymakers. The production of policy advice cannot be described in terms of clear boundaries between science and politics, and the zones of engagement and transgression are inevitably fluid and vague. From a macro-perspective, science-policy interactions are on-going co-productions (Jasanoff, 2004) between the scientization of politics and the politicization of science (Weingart, 1999). At meso- and micro-level this does not mean a complete blurring of boundaries. Given the need for participation of actors from different institutional spheres in the production of policy advice, a division of work is required. However, such a division is not easily decided upon. *Boundary work* can then be understood as the attempts to define practices in contrast to each other through demarcation, as well as

attempts to find productive coordination across these boundaries through a division of labour that is more or less stabilized (Gieryn, 1983; Halffman, 2003). Concern for high-quality performance makes expert advisors and policymakers mutually dependent; yet, they have to guard their separate identities and formal independence. Therefore, boundary work is full of paradoxes and dilemmas: the relationship will never be smooth and easy, it will always be contested.

We posit that boundary work occurs at multiple levels in a society, not just in boundary arrangements but also at micro-level in policy advice and implementation projects, at meso-level in policy networks, and at macro-level in the political-cultural sphere. We assert that the characteristics of these levels influence the ways in which boundary work takes place in a specific situation. This line of reasoning is depicted in a conceptual framework which specifies the relations between the key concepts (Figure 1). It draws together insights from older work and more recent research perspectives (Gieryn, 1983; Jasanoff, 1990; Guston, 2001; Miller, 2001; Hoppe, 2005). An extensive treatment and rationale of the framework can be found in Hoppe (2010a, 2010c).

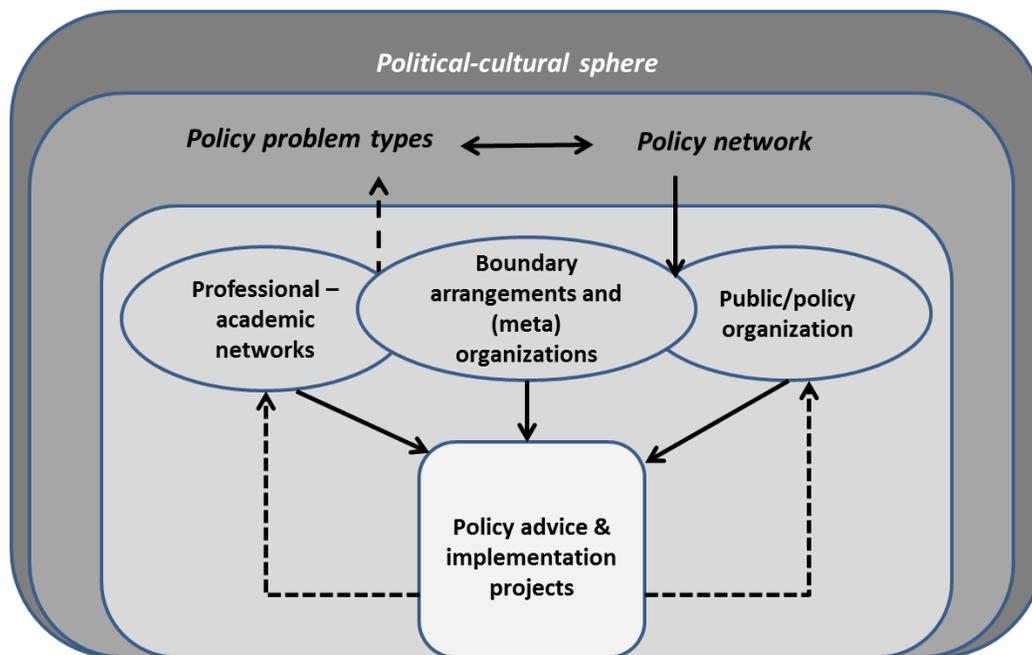


Figure 1 Multi-level conceptual framework for boundary work (from Hoppe et al. 2013)

The framework distinguishes the four levels of science-policy interaction mentioned (and is described more fully below). The overall task of the system is to process policy problems assisted by science-based knowledge that is credible, salient and legitimate (Cash et al., 2002, 2003). Problem processing itself is a complex of interdependent sub-processes (Hoppe, 2010):

1. Problem framing: to describe what the problem is, e.g. 'climate change is a global problem of mitigation' or 'climate change is a local problem of adaptation'. This delineates what the problem includes and what it does not, and may specify cause-effect assumptions.
2. Problem structuring: to reduce the normative ambiguities and cognitive uncertainties for problem resolution, e.g. by doing research to understand how mitigation can be achieved (cognitive structuring), or by choosing market-based carbon emission reduction strategies (normative reduction).

Problem structuring is the pivotal cognitive-cum-political strategy in problem processing. Using a well-known typology in business administration, organization studies and policy sciences, there are four problem types, defined by (dis)agreement on goals/values on the one hand and on means on the other: SP=structured problems (means and goals/values agreement), MSP(g)=moderately structured problems with goals/values consensus and means disagreement, MSP(m)=moderately structured problems with means consensus and goals/values disagreement, UP=unstructured problems with disagreement on means and goals/values. Different problem types result in different problem governance styles (Figure 2).

3. Knowledge and actor selection: what knowledge(s) and which knowledge bearers and knowledge users are relevant for policy problem processing depends on the outcome of 1 and 2, and also the reverse: the actors included influence 1 and 2.

4. Regulating relations between society (politicians, stakeholders, public, etc.) and experts: these are mostly tacit rules of who is allowed to contribute their expertise to policy processes (scientists, lay people, professionals, etc.) and how this contribution is made (sequential, specialized, or parallel, integrated, etc.).

Below we describe the levels more extensively. We elaborate on the meaning of the key concepts in each of these levels and their scope in terms of typological classifications of observations.

Political-cultural sphere

There is strong evidence that responses to new policy issues are influenced by political cultures and regulatory styles (Renn, 1989, 1995; Halffman, 2005; Lentsch and Weingart, 2009). For example, Jordan et al. (2011) clearly show how policy instrument design is strongly influenced by national policy styles and cultures, and is not the technical, apolitical process that the label ‘policy instrument’ suggests. The political-cultural sphere indicates a particular governance space which coordinates the production, dissemination and acceptability of knowledges for political decisions, amongst other activities. ‘Knowledges’ is used in the plural because, normally, political decisions have to align different types of knowledge from different actors: citizens, professionals, bureaucrats, experts. The political-cultural sphere acquires some of its special character precisely because it implicitly or explicitly manifests a particular ‘civic epistemology’ (Jasanoff, 2005, 2011), i.e. taken-for-granted expectations about the legitimacy and validity of these intertwined knowledges (Miller, 2007; Hoppe, 2010b).

| <i>type</i> | <i>political cultures</i> | <i>most (and less) preferred problem type</i> |
|---------------|--|---|
| hierarchal | corporatist: aims to sustain trust in the authoritative decision making body | Structured (weak in moderately structured) |
| egalitarian | consensual: aims to produce solidarity within society | moderately structured with possible ethical conflicts (fair in unstructured problems) |
| individualist | adversarial: aims to produce evidence to win the policy argument | moderately structured with goal consensus (fair in structured problems) |
| fatalist | fiduciary: aims to produce faith in the governance or regulatory system | none |

Table 1 Cultural Theory preferences for policy types (source: Hoppe, 2002)

Characteristics such as state structure (unitary, federal), voting system and party politics also shape this sphere. Various typologies were developed for this level. We follow Renn (in Löfstedt and Vogel, 2001 p. 406-412) to distinguish four ideal-types which are loosely based on Cultural Theory (Thompson et al., 1990). Following the arguments elaborated in Hoppe (2002) we postulate that each of these has a preference for a different problem type and the related problem governance style (Table 1). Preference for a problem type means that the dominant cultural type in question is predisposed to treat any problem as if it were that problem type, even if outsiders would make a different assessment. This relationship between political culture and problem types leads to one set of hypotheses that we will investigate. To note that most cases will be a specific mix of more than one ideal-type. Furthermore, Halfman and Hoppe (2005) argue that a country's political-cultural sphere is never unitary, but a mixture of different political cultures can be observed in any country.

Policy networks and problem governance style

The characteristics of the political-cultural sphere are not sufficient to describe what influences boundary work, because each policy domain has its own policy network, i.e. structured relations of information and communication, and of resource and other power dependencies between policy actors that somehow 'specialize' in a particular policy issue. For example, the domain of water management in The Netherlands has more cultural similarities to water management in UK than to the health sector in The Netherlands. Moreover, such issue networks develop different styles of policy politics, i.e. the particular combination of cognitive processes ('puzzling') and competitive interaction ('powering') that are characteristic for policymaking in a particular domain (Hoppe, 2010b).

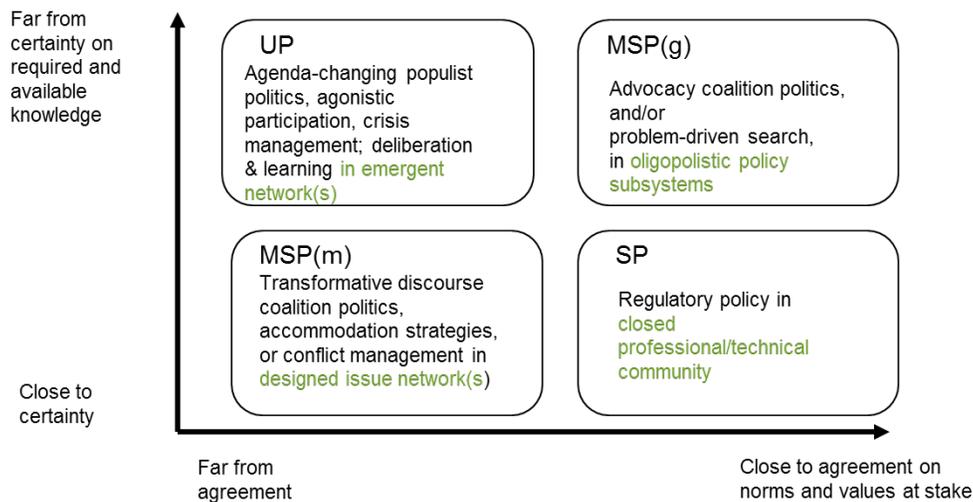


Figure 2 Problem types (Hisschemöller and Hoppe, 1996) and type of problem governance style (from Hoppe, 2010b p. 142)

Legend: SP=structured problems, MSP(g)=moderately structured problems with goal consensus, MSP(m)=moderately structured problems with means consensus, UP=unstructured problems

More particularly, the problem type that is dominant in a policy domain during some period of time strongly impacts on the problem governance style (Hoppe, 2010b) (Figure 2) where we distinguish regulatory policy, advocacy coalition politics and/or instrumental (re)search, transformative discourse and accommodation politics, or conflict-ridden politics and crisis management. The dominant problem type constrains, but does not determine, what types of boundary arrangements can be effective; these

are summarized in the respective quadrants of the typology in Figure 2 and will be discussed below. This relationship between problem type and problem governance style leads to a second set of hypotheses that we want to investigate:

1. In the case of structured problems (SP; strong value consensus and knowledge certainty) a rule-based approach to governance permits ‘outsourcing’ or ‘delegating’ problem solving to bureaucratic or scientific/professional, closed epistemic communities (Haas, 1992).
2. In the case of unstructured or ‘wicked’ problems (UP; high value dissent and lasting deep uncertainties) a conflict-ridden governance style of argumentative contestation will come about, allowing numerous and different types of stakeholders to play a role, perhaps with ad-hoc boundary arrangements as spaces for open deliberation and social learning.
3. Intermediate problem types of moderately structured problems (goals or means; MSP(g) or MSP(m)) give rise to pragmatic, professional or advocacy networks and arrangements.

Tensions arise when a policy problem is dealt with as if it is one type, while in fact it should be dealt with as another. Most commonly, this occurs when policy problems are dealt with as if they were structured while in fact there is high value dissent on goals and/or there are lasting deep uncertainties in the knowledge base. Hoppe et al. (2013) describe how this applies to climate change governance. The problem typology was used as partial explanation for problem governance style in local authorities by Wesselink and Gouldson (2014).

Boundary arrangements

Boundary arrangements (Clark et al., 2011) include a wide variety of collaborative configurations that straddle and mediate the boundary between professional academic networks and public sector or policy organizations (Guston, 2001). Boundary arrangements are involved in boundary work for policy problem processing, and perform tasks useful to both sides of the institutional divide. To get an idea of the variety of boundary arrangements, a typology of boundary arrangements was developed and empirically tested for The Netherlands by Hoppe (2005, 2009) (Figure 3). In this typology, boundary arrangements are distinguished by two criteria: the position on whether or not science and politics ultimately serve the same purpose (convergence/divergence), and the preference for the primacy in the policy-advisory process, i.e. epistemic and scientific authority, or political authority.

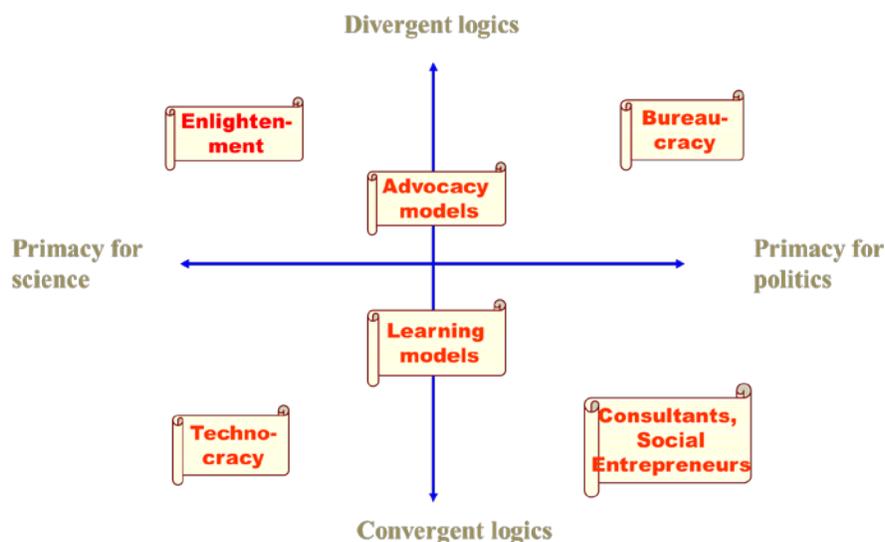


Figure 3 Typology of boundary arrangements (Hoppe, 2005)

Successful boundary arrangements are those that have adjusted to their context of policy networks and political-cultural spheres. Importantly, boundary arrangements in turn may, but not necessarily do, influence their context, especially at the level of the policy networks: the two-way dotted arrows in Figure 1 are deliberate. This relationship between problem governance style and boundary arrangements leads to a third set of hypotheses that we want to investigate. These are explained in full in Hoppe (2010b) and summarized in Table 2 (see further down, last two columns).

Boundary work in projects

Science-policy boundary work is most clearly visible in policy advisory and implementation projects, e.g. as described for interactions between an academic department and policy departments in local councils (Wesselink and Gouldson, 2014). In such projects the boundary is at its most fuzzy and has to be negotiated in the smallest details. Important aspects of micro-level boundary work are unwritten rules, habits and expectations for dealing with uncertainty, with conflicting knowledge, and with different knowledge types; the impact of project design on learning by participants; maintenance, building or erosion of trust; and the organizational flexibility of the project itself. The quality of boundary work at this level can be evaluated by the degree to which criteria of credibility (technically adequate in handling of evidence), legitimacy (fair, unbiased, respectful of all stakeholders) and salience (relevant to the decision or policy) are simultaneously achieved for multiple stakeholders (Cash et al., 2002; Cash et al., 2003). Because of its multitude of examples and level of detail, we will not analyze boundary work in projects here.

TOWARDS A CAUSAL MODEL

The conceptual framework with its key concepts (political culture, problem types and problem governance style, boundary arrangements) and their categories allows rigorous and systematic comparison of cases. In this article, we posit that the type of boundary arrangement in place is constrained but not fully determined by the dominant problem governance style, which in turn depends on the preferred problem type and therefore the political culture. We take boundary arrangements for climate change policymaking in three West-European countries as our cases: the United Kingdom (UK), Germany (FRG) and the Netherlands (NL). This represents an extension of the descriptive and normative application of the framework to boundary arrangements for climate change at the international (IPCC/UNFCCC, EU) and national levels (USA, India) (Hoppe et al., 2013). Our choice of these three cases is suggested by a double research goal. First, we like to establish the usefulness of the conceptual framework in greater detail. Second, we explore possible causal links in our multilevel conceptual framework by testing hypotheses that result from a simple causal model derived from the conceptual framework. This research goal requires a most-similar comparative research design (Mill, 1843) in which very similar cases are compared that only differ in the dependent variable, on the assumption that this would make it easier to find those independent and intermediary variables which explain the presence/absence of the dependent variable.

As a first step in the exploration, our tentative causal model deliberately portrays only one-way causal links (Figure 4).

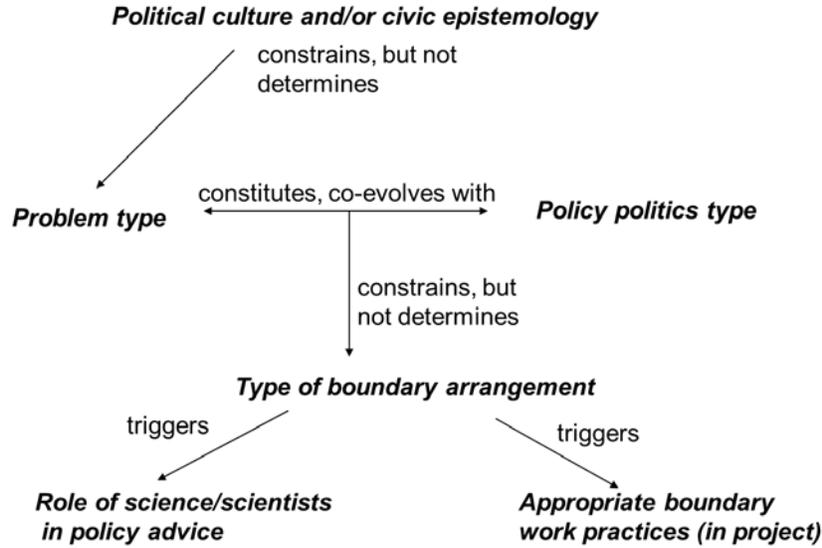


Figure 4 Tentative causal model for explaining type of boundary arrangement

The hypotheses on the causal links in this model are as follows (Table 2, summarized from Table 1, Figure 2 and Hoppe 2010b Chapter 5). If our hypotheses are correct, a certain situation will have characteristics in one single row of Table 2, for example A2→B2→C2→D2. We will now explore to what extent we can find this in our interpretation of the literature on three EU countries.

| Political Culture | → Preferred Problem Type | → Policy Politics | →Boundary Arrangements* |
|-------------------------------|--------------------------|--|---|
| A1. Hierarchical corporatist | B1. SP | C1. regulatory policy | D1. Technocracy & Bureaucracy (Consultancy) |
| A2. Egalitarian consensual | B2. MSP(m) | C2. transformative discourse and accommodation politics | D2. Learning (Technocracy) |
| A3. Individualist adversarial | B3. MSP(g) | C3. advocacy coalition politics; instrumental (re)search | D3. Learning (Enlightenment) |
| A4. Fatalist fiduciary | B4. UP | C4. conflict-ridden politics, crisis management | D4. any |

Legend:

SP=structured problems, MSP(g)=moderately structured problems with goal consensus, MSP(m)=moderately structured problems with means consensus, UP=unstructured problems

* preferable arrangement types listed first, in brackets possible types

Table 2 Causal chain for types of boundary arrangements

MAKING CLIMATE CHANGE INTERNATIONALLY GOVERNABLE

While this article focuses on three EU member states, because of the world-wide influence of global problem framing and agreements on national climate governance we will first discuss the most salient features of climate change policy and politics in the international arena (see Hoppe et al., 2013 for a full treatment).

A global climate change regime complex

Key among the international boundary arrangements are the Intergovernmental Panel on Climate Change (IPCC) which coordinates the production of 'policy-relevant and yet policy-neutral' scientific work (Hulme and Mahony, 2010) and the less-known Subsidiary Body for Scientific and Technological Advice (SBSTA) of the United Nations Framework Convention on Climate Change (UNFCCC), which has been referred to as a 'gatekeeper' linking the scientific information provided by the IPCC to the policy-oriented needs of the Conference of the Parties (COP) (Siebenhüner, 2003; Miller, 2001). In addition to ensuring issue recognition and mobilizing political support, in this international boundary work crucial cognitive steps were taken to structure and frame the climate change problem, which also determined the three interdependent elements that shape any public policy problem: problem ownership, causality, and accountability (Gusfield, 1981; Hoppe, 2002). A first step was to settle the *causality* of the problem. In line with scientific consensus on a global climate crisis scenario and scientific practices of using Global Circulation Model simulations, climate change was politically defined as a *global* issue and substantially as an issue of global warming through excessive greenhouse gas emissions (Roe, 1994; Miller, 2004; Hulme, 2009). This 'globalisation of the atmosphere' also settled the *ownership* of the problem: only the UN as global governance regime could tackle a global warming problem. Problem ownership settled, *accountability* disputes immediately sprang up. The global scaling of the climate change problem results in a notable scale asymmetry experienced by local populations who are asked to meet locally concentrated short-term costs (around which there is little uncertainty), in order to reap globally dispersed future gains (around which there is much uncertainty). To a considerable extent due to pressure from developing countries (Fischer, 2012) adaptation is gradually rising in importance on the international agenda. This involves a fundamental re-framing away from the global scale and away from climate science as the main source of policy information.

EU as 'leader' in international climate politics?

These global policy choices set in motion remarkably similar responses at other levels. The EU has always cast itself in the role of symbolic and diplomatic leader of an international climate policy regime. As the primary environmental boundary organization in the EU (Scott, 2000), the European Environmental Agency (EEA) contributed to the early formulation of EU greenhouse gasses stabilization targets. The EEA is credited by some authors for strong conceptual contributions to climate change policy framing by the design of market- (and not: tax) driven policy instruments, the precautionary principle (its study *Late Lessons from Early Warnings*, 2001) and methods and procedures for iterative risk assessment (Dammann, 2011). In spite of this common framing, in a prophetic article, Wynne (1993) described the EU's emerging climate change policy as 'early warning' for the importance of differences in political culture for policy design and implementation. He anticipated that differences between economic sectors and countries, especially between the North (Denmark, The Netherlands, Germany) and the South of Europe (Italy, Spain, Greece), would cause deep and lasting disagreements on binding carbon reduction targets due to different carbon intensities. Wynne in a sense pictured the EU as 'social laboratory for global governance' (Wynne, 1993).

NATIONAL RESPONSES

All EU countries are so-called Annex I countries, i.e. they are legally bound to reduce their greenhouse gas emissions by the UNFCCC Kyoto Protocol. For our analysis we selected three European countries that play a prominent role in EU climate policy: United Kingdom, Germany and The Netherlands. These three countries represent rather similar cases, and thus are appropriate in a multiple similar-case comparative research design. Another reason for selecting these countries is the fact that boundary arrangements and their contexts have been studied here to some extent so that one could rely on lots of secondary data, while this is not the case elsewhere.

While the contents and conduct of policy debates in climate change are different in each country, they all reproduce two important features from the international levels: framing the climate change problem as global and biophysical, and a strong initial focus on mitigation as a solution. This policy framing called into being an instrumental role for science and limited opportunities for re-framing. How these characteristics play out, especially regarding the role of boundary arrangements, is largely determined by the different national macro- and meso-levels: the political-cultural sphere and the policy networks.

Boundary work in the United Kingdom: climate change and competitiveness

Political-cultural sphere

The composition of expert advisory bodies broadly accords with Jasanoff's characterisation of the civic epistemology of the UK, in which knowledge making institutions are built on the British conception of the public servant: 'persons of proven standing whose right to participate in knowledge-making for the state could not be seriously questioned' (Jasanoff, 2005 p.261). In Britain, policy makers and experts gain credibility through years of serving the public good, and 'the personal integrity of the members gives credibility to the bodies they constitute' (ibid p.253). Jasanoff has called the British political-cultural sphere and its public epistemology 'communitarian', but it strikes us more as a meritocratic hybrid between an individualist/adversarial culture (every individual can go up through excellent competitive performance...) and a hierarchist and corporatist culture (...towards a deserved position defined within the system).

Problem governance style and problem structuring strategies

Since the 1980s climate change has been steadily growing in significance on the UK scientific and political agenda. According to some observers, it is now one of the 'major determinants of national regional and, often, local environmental policy in the UK' (Hulme and Turnpenny, 2004 p. 105). In 2000 the first UK Climate Change Programme was published, outlining how the UK planned to meet its Kyoto obligations through (among other things) a Climate Change Levy and a UK emissions trading scheme. While adaptation is mentioned in one breath with mitigation at this most general policy level, in practice the emphasis in UK climate change research and action has been increasingly on mitigation and especially market-based solutions. While emissions trading schemes are proposed as a response to the climate change issue, the promotion of emissions trading by UK policy-makers can also be understood as strategies to favour the competitiveness of the UK economy (Barry and Paterson, 2004; Paterson, 2009), which is often framed as a transition to a low carbon economy (Foxon et al., 2013). Indeed, in their analysis of the policy networks associated with climate change in the UK, Turnpenny et al.(2005) argue that the Prime Minister and the Treasury hold key influences in the government, 'more than in many Western countries', and argue that 'climate change action depends on the position of these actors' priorities' (Turnpenny et al., 2005 p.7). In November 2008 the UK passed the Climate Change Act, which outlined a long-term legally binding framework to tackling climate change, committing the UK to an 80%

cut in emissions from 1990 levels by 2050 (achieved through action in the UK and abroad), and a carbon budgeting system that caps emissions over five-year periods.

Boundary arrangements

The analysis of boundary arrangements in the UK is complicated by the fact that Scotland and Wales are increasingly making their own arrangements. If these are different then we focus on the situation in England. In England prior to the Climate Change Act, responsibility for climate change policy resided with the Department for Environment, Food and Rural Affairs (DEFRA) and was therefore implicitly framed as environmental issue. With the new Act mitigation policy was transferred to the newly created Department of Energy and Climate Change, leaving DEFRA with the more difficult to 'sell' adaptation issues: these are less easily quantifiable and economic justification for action is difficult. In addition, funding for adaptation research and action has steadily diminished. These developments tally with the dominant framing of climate policy as competition-oriented and market-based emissions reduction. Contrary to the two other countries studied here, due to the UK's two- now three-party system, any direct 'green' political influence or policy discourse has been remarkably absent.

One of the main UK boundary arrangements, the Tyndall Centre for Climate Change Research is a partnership of several UK universities. Its objectives identify it as a boundary organization: 'To be an internationally recognized source of high quality and integrated climate-change research, and to exert a seminal influence on the design and achievability of the long-term strategic objectives of national and international climate policy'. In the Tyndall Centre governance structure, actors from science and policy are represented (Tyndall Centre website <http://www.tyndall.ac.uk/>). Established when the Labour party took office in 1997 and until its demise by the new Conservative-Liberal Democrat government in 2012, the UK Climate Impacts Programme (UKCIP), based at Oxford University, also worked explicitly at the 'boundary between scientific research, policy-making and adaptation practice (Hulme and Dessai, 2008, Lorenzoni et al., 2007). Its aim was 'bringing together the organizations and people responsible for addressing the challenges climate change will bring' (UKCIP website <http://www.ukcip.org.uk/about-ukcip/>). UKCIP has produced a number of influential climate scenarios (Hulme and Turnpenny, 2004, Hulme and Dessai, 2008) and the organization was is one of the key boundary organizations in the UK. After the change of government in April 2012, for England its tasks were transferred to the Environment Agency (EA) in the Climate Ready programme, along with some of the staff responsible for it. This change reinforces the framing of adaptation as an environmental issue, more specifically a water management issue (since this is where the EA's expertise lies), neglecting impacts on sectors like trade, transport, health, etc. UKCIP was generally considered independent and trustworthy by important stakeholders (Porter, oral comm.); however, the Climate Ready programme does not have this status because it is hosted by the English environmental regulator. UKCIP's former audience considers the Climate Ready outputs a potential precursor to regulation and do not wish to be associated with the production of these reports (Porter, oral comm.). With the demise of UKCIP and the failure of Climate Ready to produce any noteworthy output, consulting firms are now moving into the advisory gap where science has to be translated into policies and action. This is in fact in line with the UK government's policy of relying on market-based governance of climate issues.

Findings UK

In terms of the conceptual framework and causal model, the findings of the British case may be formulated as follows: a rather personalized meritocratic political culture with a hierarchist twist, initially (T=1) a preference for moderately structured problems with considerable goal consensus, dealt with by a problem governance style allowing both bureaucratic and advocacy modes. As the policy issue matures, in a later period (T=2) its preferred problem type shifts to more fully structured, dealt with in a problem governance style that changes to combined engineering-and-technocracy. The sequence or

transition in time can be explained by the UK three-party system and very unitary national state structure which allow strong policy swings between one government and the next.

Formally (for codes see Table 2):

T= 1: A3 (+ some A1) → B3 → C3 → D3 (advocacy + bureaucracy)

T=2: A3 (+ some A1) → B1 → C1 (and remnants of C3) → D1 (technocracy)

Boundary work in Germany: Climate change policy as ‘avoiding catastrophe’

Political-cultural sphere

German political culture has ‘historical roots in corporatist arrangements typified by close collaboration between the state and functionally organized interest groups’ (Hatch, 2007 p. 42). It can be characterized by an emphasis on consensus and cooperation, with coalition governments being a ‘basic German feature’ (Weidner and Mez, 2008 p. 359) as a result of the system of proportional representation which makes it difficult for any one party to form a government by itself. This system offers also parties such as the German Greens relatively easy access to seats in parliament. A mix of ingredients characterize the German system, including: ‘legal positivism, strong judicial and administrative review, federalism and a vertical, intergovernmental relations (‘Politikverflechtung’), the high status of the state bureaucracy, a historically well-organized civil society and a tradition of delegating tasks or corporatism’ (Hoppe, 2010c p.116).

Jasanoff characterizes the civic epistemology of Germany as ‘consensus-seeking’ (Jasanoff, 2005 p.250). The state is actively involved in the production of knowledge, acting to ‘separate discursively hybrid public spaces into realms of cleanly technical deliberation, and more impassioned political (hence civic) engagement’ (ibid. p.261). In Germany trustworthiness ‘is more a product of institutional affiliation than of proven personal service to citizens or the state’ and hence enquiry commissions, expert committees etc. all need to be balanced ‘according to a tacit understanding of the map of interests and positions considered essential to fact finding and deliberation on any given issue’ (ibid p.262). In contrast to the UK system that is based on personal standing, in Germany ‘it is the pre-existence of trustworthy institutions that underwrites the credibility of the individuals who represent them’ (ibid. p.263).

Policy networks and problem structuring strategies

No doubt because of the political presence of the Greens in government and parliaments on federal and regional levels, Germany has been an important player in the international climate change policy arena. Since the late 1980’s it acted as an ‘agenda setter’ in international negotiations (Weidner and Mez, 2008), and it is highly influential in the commitments taken on by the EU under the Kyoto protocol (Hatch, 2007). Germany has some of the most ambitious greenhouse gas reduction targets in the world. However, other authors point out that ‘despite Germany’s self-positioning as a global climate policy leader, it will face significant difficulties living up to this image in the future, [...] the history of German climate policy shows that short-term economic interests, especially those to do with regulating carbon-intensive industries and the German car industry, have frequently won key political battles’ (Michaelowa, 2008 p. 160; cf. Hustedt, 2013). There is little climate scepticism in Germany and there has been virtually no public debate about the strength of the scientific evidence on climate change (Beck, 2011), and neither has decision making in Germany been hampered by remaining scientific uncertainty. The precautionary principle and the polluter pays principle have been central to the development of German environmental policy ever since the first federal Environmental programme was adopted in 1971, and these have been key elements of the German framing of the climate debate that also have worked their way into international policy (Cavender and Jager, 1993 p. 7). Another important framing

crystallized in 1987 when the Energy Working Group of the German Physics Society published a warning of 'impending climate catastrophe' and became the dominant national way of framing the issue' (Beck, 2011). There is, however, some evidence that the 'climate catastrophe' framing is losing its grip on the German imagination: in recent years the debate has been framed in terms of adaptation and a security risk (WBGU, 2007 p. 1).

Boundary arrangements

One of the key events stabilizing the German climate science-policy boundary was the EnqueteKommission (Inquiry Commission) on Preventative Measures to Protect the Atmosphere, which was set up in 1987 during the heightened polarisation s around the linked issues of nuclear safety and climate change. The work of the EnqueteKommission 'was most crucial in the formative years of German GCC policy. [It] stepped in to fill a political vacuum left by the political parties, interest groups and government agencies, none of which were prepared to deal with the global warming question, let alone provide leadership' (Hatch, 2007 p.43). Beck (2011) argues that the EnqueteKommission conformed to key features of the German civic epistemology: experts in the commission were selected by a political body rather than through scientific bodies as in the US, and the commission embodied a broad and inclusive form of institutional representation. As a microcosm of the society that would be affected by its policy advice, the Commission achieved increased trustworthiness in line with Germany's civic epistemology whereby trust is typically a product of institutional affiliation and objectivity is achieved through the broad incorporation of all the relevant viewpoints (cf. Jasanoff 2005 p.267).

Two other significant bodies straddle the boundary between science and politics in Germany and can rightfully be considered as boundary organizations: the German Advisory Council on the Environment (SRU), and the German Advisory Council of Global Change (WBGU). They show similar mixed membership and have scientific as well as political tasks. For example, the SRU is 'an expert advisory body whose mission is to describe and assess environmental conditions, problems, and political trends and to point out solutions and preventive measures'. Hustedt (2013) stresses that in spite of the 'translation-for-policy'-work of these boundary arrangements external to government, in Germany the expertise for climate change issues rests mostly with experts of the responsible organizational units inside the departments; and, to some extent, with permanent or ad-hoc working groups of civil servants representing ministries. More particularly, and rather different from The Netherlands, these external advisory bodies direct their reports and advisory messages toward single lead ministries, especially the Federal Ministry for Environment, Nature Conservation and Nuclear Safety, and, to a lesser extent, the Federal Ministry for the Economy and Technology (Hustedt, 2013). Although the German 'energy transition' ('Energiewende') brought more coordination between these two departments than in any other EU country, Hustedt (2013) nevertheless concludes: "All in all, the policy advisory system is characterized by varying problem perceptions reflecting the strong role of individual ministries, which inhibits agreement on which knowledge is deemed relevant and valid for policy advice." In other words, boundary work in Germany is still seen as mostly part of political advocacy, but executed in a largely bureaucratized institutional setting.

Findings Germany

In terms of the conceptual framework and conceptual model, our findings may be summarized as follows: a deeply institutionally entrenched corporatist culture with a consensual, egalitarian twist constitutes and co-evolves with a preference for structuring problems as moderately structured with considerable goal consensus, dealt with in a problem governance style that allows a combination of bureaucratic and advocacy styles of boundary arrangements. What needs better explanation is the somewhat egalitarian twist in a thoroughly corporatist culture. Both a federalist state structure (equality

between the regions/Länder) and the influence of the Green Party (with strong egalitarian ideological elements) could be explanatory forces here. It means that culture is partly a dependent variable, influenced by state structure and political party strength as independent variables.

Formally (for codes see Table 2):

A1(+A2) → B3 → C3 → D3 (advocacy + bureaucracy)

Boundary work for climate change in the Netherlands: Re-politicizing climate change policy?

Political-cultural sphere

The Dutch political-cultural sphere is fragmented (Halffman and Hoppe, 2005). On the one hand, there is the technocracy-inspired and policy-oriented-learning world of the planning bureaus, of which the PBL is one of the most important. In spite of being 'on tap' to policymakers by formally belonging to (now) the Ministry of Infrastructure and Environment, it frequently looks like the PBL is 'on top': it rationalizes political debate, and contributes to transparent accountability for the government's policy performance. PBL's most important political function may well be in creating a shared definition of reality without which negotiation in policy conflicts would be near impossible (Halffman, 2003). In other words, the PBL is a bulwark against 'fact-free politics'. They turn unstructured problems into structured or moderately structured ones with presupposed value and goal consent. On the other hand, there is the energy-transition advocacy coalition which is dominated by more mainstream bureaucracy-driven and political advocacy-inspired epistemologies. The boundary arrangements discussed above use the standard policy-analytic discourses, methods and techniques of expert advisors working in long-standing pragmatic relations; they provide evidence-informed intelligence, i.e. information derived from available and usable sound science (De Vries, 2008; Halffman, 2003). Within the bureaucracy of the Ministry of Economic Affairs, expert civil servants translate this policy analytic discourse in policy advice.

Policy networks and problem structuring strategies

Since the 1970s, Dutch environmental policymaking has evolved from a mono-sectoral to a multi-sectoral policy subsystem, evidenced in a series of National Environmental Policy Plans that coordinate overlapping policy areas. Climate change slowly gained the status of privileged emblem in environmental policy. Since 1996, Dutch climate policy has been guided by the precautionary principle and is supported by highly developed and institutionalized public architecture for the governance of science-based expertise and policy advice (Halffman, 2005). The Netherlands dutifully shared the ranks of the European Union leadership pushing for ambitious national greenhouse gas reduction policies. As long as the EU did not touch Dutch taxation sovereignty (by demanding an energy levy), neither the big Dutch regime-players in energy production nor Dutch politicians objected to the ambitious 'commitments'.

However, since the early 2000s public and policy debate has re-politicized, sacrificing the precautionary principle when expedient. An important trend making for re-politicization of the climate change debate is the ever more explicit trade-off between mitigation and adaptation, and between climate policies and energy policies (Bruggink, 2006). Maintenance of oil imports and new gas imports to keep exploiting the Dutch energy-processing and distributing infrastructure, therefore, constitute important short-term national economic interests. In addition to this major re-politicization of climate change mitigation, the rise of a new and highly successful populist political party, the Party for Freedom (PVV), has given climate change deniers a voice in parliament. One political implication is the appointment of a climate-sceptic science journalist as special government advisor, tasked with detection and correction of errors in the recent IPCC's Fifth Assessment Report. In the past this would have been indisputably a task for the established boundary organizations discussed in the next paragraphs.

Due to its local in a delta which is largely below sea level, adaptation to climate change is a far less contentious issue, although squabbles over details occasionally erupt. Like in UK, it is framed mainly as water management issue related to rising sea levels and increased river runoff. Inspired by an international re-prioritization of climate adaptation, the ad-hoc Delta Committee formulated new strategies for water management. The Committee chairman instigated a fierce controversy when he defended the choice of a worst-case scenario of sea level rise of between 0.65 and 1.3 m as 'science-based' when it was clearly political, which undermined the impact of its advice (Van Rijswoud, 2012). Economic interests quickly caught up, arguing that efficiency and implementation feasibility meant choosing IPCC's 'more plausible' sea level rise projections of 0.35-0.85 m, thus trumping the Committee's political choice for using the precautionary principle and a worst-case scenario.

Boundary arrangements

For environmental issues the pivotal boundary organization is the environmental assessment agency PBL (Plan Bureau voor de Leefbaarheid, formerly Milieu en NatuurPlanbureau, MNP). Other boundary organizations are Deltares (for water management), Wageningen University and Research Centre (for land use and agricultural aspects), and the Royal Dutch Meteorological Institute (KNMI), while large science-for-policy projects sponsored by the Dutch National Science Foundation (NWO) also fulfil this role, for example the programmes Knowledge for Climate, Space for Climate, etc.

PBL was tasked to deliver instrumental and conceptual knowledge contributions to climate change policy by the Dutch state, the EU, and, from the very start, IPCC. It has used its own and IPCC-generated knowledge to depoliticize public debate by successfully acting as guardian or 'linesman' for public and policy debates (Halffman, 2005). However, in the early 2000s, PBL was confronted with an internal dispute over the credibility of their simulation models. The internal quarrel between experts spilled over to parliamentary debates. In a neat example of combining coordination and demarcation in boundary work, PBL survived this crisis by adopting and implementing explicit guidelines for dealing with scientific uncertainties (the demarcation) that include a process for stakeholder consultation on acceptable uncertainties and their communication (the coordination) (Janssen et al. 2005, De Vries, 2008).

The energy transition advocacy coalition has its own boundary organizations. Next to its principal advisory body, the General Energy Council (recently abolished), the Ministry of Economics is served by expert advisory bodies like the Netherlands Energy Research Foundation (ECN), the Netherlands Agency for Energy and Environmental Research (NOVEM), later transformed in a research and service center, Agentschap NL, for both larger and medium-and-small enterprises (SME).

Findings Netherlands

A corporatist culture with an elitist twist, but slightly differently shapes in the two involved policy domains, environment and energy. This constitutes a preference for moderately structured problems with considerable goal consensus; in the environmental policy network these problems are dealt with by technocracy (planning bureaus) and advocacy and learning, in the energy network the problems are dealt with by bureaucracy and strong advocacy coalition (business) politics.

Formally (for codes see Table 2):

environment: A1 → B3 → C3 → D1 (technocracy + learning)

energy A3 → B3 → C3 → D3 (advocacy + bureaucracy)

DISCUSSION

All in all, we find that in this limited data set of just five rather similar cases our hypotheses are mostly confirmed (Table 3). According to our hypotheses, each case would show a combination of only types 1, or types 2, etc. We see this is (mostly) the case in UK at T=1 and in the Dutch energy case. In other cases, types 1 and 3 are combined. We may conclude that these results show conjunctural causation, i.e. different causal paths may lead to the same result, rather than one-to-one causal additivity (Aus, 2009). To better explain the results we need to draw in additional explanatory mechanisms. These concern political structure (voting system, composition), policy issue maturity, and stability of systems.

| country cases | Political Culture | Preferred Problem Type | Policy Governance Type | Boundary Arrangements Type |
|----------------|-------------------|------------------------|------------------------|----------------------------|
| UK T=1 | A3 (+A1) | B3 | C3 | D3 |
| UK T=2 | A3 (+A1) | B1 | C1 | D1 |
| FRG | A1 (+A2) | B3 | C3 | D3 |
| NL environment | A1 | B3 | C3 | D1 |
| NL energy | A3 | B3 | C3 | D3 |

Table 3 Case analysis summary (for codes see Table 2)

The differences in political structure between the three countries concern the political manifestation of 'green' values vs. economic interests, and the stability of party representation in government. In the UK's first-past-the-post electoral system the 'Greens' have minimal political representation. In Germany, the Greens have their own political party which is represented in the federal (Bundestag) and in regional (Länder) parliaments. However, even for the Christian Democrats and Social Democrats environmental policy is an important issue. In The Netherlands the Greens are part of a small leftwing political party with parliamentary (but not cabinet) representation. Again, in the UK's first-past-the-post electoral system strong policy shifts occur, not just at the policy governance level but also at the political-cultural level, and boundary arrangements are temporary. In Germany and The Netherlands coalition governments make for a more stable environment for boundary arrangements. A second factor at play is the maturity of the policy issue. In UK, with maturation of the climate change issue the problem type became more fully structured at T=2 compared with T=1, and boundary arrangements changed accordingly (though not just for that reason). Mismatches may then also be caused by inertia in the system. We do not expect political culture (level A) to change rapidly, while a new government or new problem owners (level C) may cause immediate changes in problem governance style. At the same time, established boundary arrangements (level D) will show resistance to change, and not match the new problem governance style.

CONCLUSIONS

In this article we used insights and concepts from older knowledge utilization literature and more recent studies on co-production of policy-related knowledge and advice. We proposed a multilevel conceptual framework for the analysis of boundary work, with typologies for each level to derive descriptive categories. We applied these categories to climate change policymaking in three EU countries: UK, Germany (FRG), and The Netherlands (NL). We showed how characteristics of policy networks and their

problem governance types, as well as the wider political-cultural sphere influence which arrangements exist and how they function. However, a wider application to other countries is needed in order to explore the usefulness of the framework further, especially in unexplored political-cultural areas. This would pertain not only to the typologies used. It would have to address especially the causal drivers impacting on the three 'variables', or levels, of the conceptual framework and the causal links between them. In our descriptions, we started to tease these out. For example, in the UK case the drift in the climate change issue framing from moderately structured to more fully structured appears to be due to the conjunctural impacts of the political system as such (few parties, first-past-the-post electoral system), government structure (unitary and highly centralized), a change of government, and the maturation of the policy issue. In The Netherlands, as a halfway-house between centralized and decentralized politico-administrative regime, functional policy domain and policy network specific influences seem to be at work more than in the UK or Germany. In the comparison performed here, surprisingly, only Germany comes out as nationally homogeneous although it is a federal state. These tentative findings call for testing and expanding the conceptual framework into a fully-fledged theory, with clear specification in terms of conjunctural causation.

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