Experiments and Beyond

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Experiments and Beyond

An Emerging Agenda for Climate Governance Innovation

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12.1 Introduction

This volume has discussed the role of experimentation in climate governance. Recognising the growing significance of experimentation in political and socio-technical responses to climate change, we have been interested in understanding how experiments in climate governance can lead to broader changes in the rules, practices, norms and arrangements constituting responses to climate change in widely differing settings. We have sought to move the analysis of climate governance experiments beyond a focus on single cases and to develop an argument for seeing experimentation as a new habitus in climate governance, defining the character of a range of responses which evoke new puzzles for climate governance. If experimenting is a new means of conceiving of and doing climate governance, then we also expect it to have broader outcomes beyond the moment of experimentation. Experiments are a means to an end, even if they are a continuous feature of political responses to climate change. Such an experimental conception of climate governance poses a set of major conceptual challenges. And this volume has sought to clarify what these are and to make contributions to their understanding and resolution.

Convinced that a creative dialogue between governance and policy studies and studies of socio-technical innovation would help in reframing experimental climate governance, we have sought in this volume to provide a forum for such a dialogue. Both fields have had complementary but largely disconnected debates about the generation of new ideas, the role of entrepreneurial activity and the wider adoption and diffusion of new ways of doing things. By encouraging a connection and a mutual grappling with each other's concepts and case studies, we believe that we have made some progress in developing a basis for richer understandings in both fields.

We have been concerned with a number of specific questions:

- What do climate governance experiments lead to beyond their particular contexts, and do they influence changes in norms, incentives, rules, behaviours, relationships and arrangements for addressing climate change mitigation and adaptation?
- If experiments are largely uncoordinated and entrepreneurial initiatives by new coalitions of actors, what direct outputs do the experiments produce (for example, ideas, networks, capabilities and narratives), and how do they come to have broader influence?
- What notions of diffusion, reproduction and embedding can best describe the process by which the multiple possible outputs of experiments come to generate broader outcomes?

In trying to answer these questions, we have been particularly interested in what we see as a significant gap between experimental activities and outputs, on the one hand, and wider outcomes and more lasting impacts of experimentation on the other. We have problematised this as a process of embedding the outputs of experiments in wider policy systems, and we have sought to explore various forms and underlying mechanisms for this process of embedding.

In this concluding chapter, we return to the challenges and questions posed in our introduction. First, we noted a fragmented landscape of activities designated as experiments coupled with greater interest in experiments in climate governance as well as a growing ambiguity about what constitutes experiments and about their distinctive features as governance mechanisms. Therefore, in the first part of this chapter we aim to clarify what we believe constitutes a governance experiment before assessing the process by which experiments come to have a broader influence through embedding. In this latter analysis, we are especially interested in actors and agency and how this shapes and influences what happens beyond singular experiments. Second, we argued in the introduction that given the growing interest in experimentation, little attention has been paid to how experiments can contribute to generating wider influence and change towards low-carbon and climate-resilient societies at the level of broader political and economic systems. This has been a core focus of this volume. Thus, in the second part of the conclusions, we highlight what it is that gets embedded and illustrate four different perspectives on the processes by which embedding can take place.

Third, we consider climate governance as a whole, including public, private and civic elements of governance, and assess what experiments may mean for societal responses to climate change in the round. In particular, how do experiments fit into climate governance arrangements? Can they generate significant policy changes

and outcomes that contribute to mitigating and adapting to climate change? Can we identify factors that lead to successful embedding of the learning and resources afforded by experiments? The concern here is about whether climate governance experiments will have more lasting impacts on climate governance, leading to the decarbonisation of societies and building resilience, especially for more vulnerable communities. It may be early to have clear evidence about such effects, but if we are to anticipate them, we need some conceptual apparatus for tracing through such impacts.

12.2 Clarifying What We Mean by Experiments and Embedding

Many of the claims to experimentation within climate governance hold the potential for bringing about radical new ways of dealing with deep structural problems linking climate change to how our economies and societies are organised. In practice, there is considerable variety in the kinds of initiatives that can be considered as climate governance experiments (see Chapter 1). This is both a valuable source of richness and a source of confusion that creates a risk of distraction away from some of the core problems and objectives of climate governance.

Before we can understand fully the transformative potential of climate governance experiments, we need to consider some crucial aspects of experimentation, inherent differences in the various approaches to experimentation that are being put forward and some of the critical challenges they face. Further specifying the different ways in which climate governance experimentation can be configured will enable us to understand better the relevance and means of their embedding.

Regardless of how defined and circumscribed any given experiment is, the focus of this volume has compelled us to think about boundaries and their crossing: when does an experiment begin and particularly when does it end? This question of boundaries becomes even more salient as it informs the kinds of obstacles, challenges and opportunities at play *beyond* experiments. In practice, experimentation in governing is not always neatly delimited by a boundary that simply needs to be overcome. There is a degree of 'messiness' involved in experimental practices and processes of their embedding, and this needs to be a topic for investigation if we are to say something useful about climate governance experiments and their multiplication, scaling, diffusion or reproduction. The likely explosion of 'climate experiments' will only make this sense-making challenge more salient.

When addressing this core problem, we have asked contributors to be explicit about what an experiment is, what it is intended for and when it becomes something other than an experiment. This means attending to the question of

boundaries when defining governance experimentation and being explicit about the difference between an experiment and the context of its embedding, as well as the object of such embedding – whether this is the specific experiments themselves or their outputs (see Section 12.2.1). This has led some authors to focus on the articulation of the boundary between experiments and their wider embedding, mobilising, for instance, hinge notions such as the 'pilot paradox' (van Buuren et al., Chapter 8), the 'twin notions' of 'anchoring and mobility' (Carvalho and Lazzerini, Chapter 3) or the seemingly paradoxical notion of 'permanent experiment' (Karvonen, Chapter 11). So, empirical studies recognise the inherent differences and resulting tensions between experiments and their embedding. There is a time, place and mode for experimentation, which structure how experiments are done, and how they can be evaluated. Equally, there is a time, place and mode for the embedding of experiments beyond the experimental context. These distinctions may differ according to the conceptual perspectives mobilised and the nature of experiments being considered. Nevertheless, they point to the need to problematise the boundaries between spaces of experimentation and spaces of embedding, as they may be in considerable tension.

In this section, we seek to bring further clarity as to the boundaries of experiments (when/where do they begin, and when/where do they end), the variety of actors involved and the claimed motives for climate governance experimentation. We consider the relevance of these boundaries, taking account of evident ambiguities, before developing an understanding of how such boundaries come into tension as experiments become more than experiments. As much as is possible, we try to clarify how boundaries come to be articulated, and how they are redefined and transgressed as the outcomes of experiments become more widely embedded.

12.2.1 Constructing Experiments

In the introductory chapter, we offered a number of metaphors to make sense of the multiplicity of ways in which experimentation is conceived in governance and policy studies and innovation studies. We also posited that experiments tend to be subject to pre-determined temporal, spatial and evaluative boundaries. Indeed, most formal experiments have (a) a beginning and an end tied to a budget, activities and expected outputs, (b) a particular institutional and geographical context within which experimental activities are carried out and (c) clear goals and means for their evaluation. These boundaries are seen as essential to defining the exceptional and distinct character of formal experiments – as close as possible to the metaphor of the lab, from which generalisable knowledge can be extracted. This suggests that as an experiment crosses these boundaries, it becomes more than an experiment (see Figure 12.1).

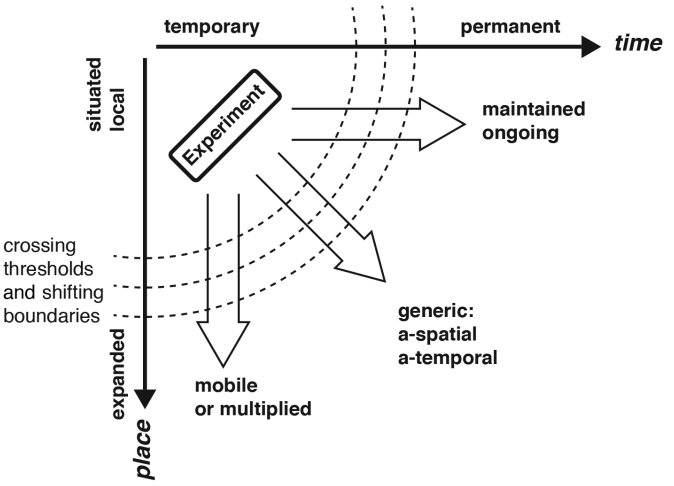

Figure 12.1. Temporal and place-based boundaries of experiments and paths to their crossing.

Experiments range from those specifically initiated as experiments with the intention of *experimenting* (what can be regarded as formal experiments), to more ad hoc and informal kinds of experimental climate action (i.e. informal experiments). Regardless of where experiments are positioned along this spectrum, Hoffmann (2011: 57) argues that experiments should not be considered as 'simply random and idiosyncratic initiatives'. In each case, we are considering discrete initiatives carried out by individuals, organisations or collectives that seek to address specific climate governance problems in ways that are not fully captured by conventional responses and arrangements.

At one end of the spectrum, ad hoc experiments may be relatively spontaneous and isolated (Castán Broto and Bulkeley, Chapter 4; Hölscher, Frantzeskaki and Loorbach, Chapter 7), emerging in multiple places as the result of favourable conditions (Karvonen, Chapter 11). Such experiments may provide common directions in practice communities or niches. They may not be labelled as experiments by their proponents, tending to have an emergent and situated character, whether or not they have a collective purpose. They stretch conceptions of experimentation as being inherently deliberate (cf. Kivimaa et al., 2017). The start and end points of such experiments may be difficult to distinguish. Further, they are more likely to produce emergent solutions to problems – by diverging from existing practices and routines – than being organised to specific ends, such as a more climate-resilient city or a region.

At the other end are *deliberate*, *formalised* and *structured* experimental settings, often initiated by established governance actors (e.g. public authorities,

municipalities, industry, non-governmental organisations [NGOs]) with the objective to learn from a variety of 'pilots' and demonstrations (van Buuren, Chapter 8; Nair and Howlett, Chapter 9; Heiskanen and Matschoss, Chapter 10; Karvonen, Chapter 11). For these more structured settings – still quite rare in climate governance – fragmentation may be less of a problem since experimentation is highly directed and inscribed in a deliberate strategy. Such experiments tend to be more defined and bounded. They can be problem- or change-oriented, and desired end states are easier to recognise. Yet, evaluations of 'success' have so far tended to focus more on the level of outputs than the substantial broader outcomes they may have generated (Pallett, Chapter 5; van Buuren et al., Chapter 8; Heiskanen and Matchoss, Chapter 10). Table 12.1 illustrates a nomenclature of experiments as initiated by public or other actors and according to the extent of formal structure. The different dimensions considered need to be seen as extremes of formal and informal experiments and experiments initiated by different types of actors.

If the boundary of experiments can prove elusive, then the boundary between experiments and their embedding may be even more difficult to pin down. However, if we start from an assumption that the experimental does give way at some point to the post-experimental, then we also assume that there are temporal, spatial and socio-cognitive markers that indicate that an experiment is being embedded beyond its initial configuration. In the Introduction we argued that this would be (a)

Table 12.1. *Mapping the range of climate governance experiments*

		Initiating/lead actors	
		State (local, national or regional governments)	Non-state (citizens, NGOs, businesses)
Degree of formalism	Formal and defined	Policy instrument pilots Policy process experiments Public engagement experiments	Transition management and arenas Bounded socio-technical experiments Novel partnering networks acting as innovation platforms Living labs
	Informal open ended	Experimental governing frameworks based on more recursive rule setting and implementation Policy innovations not clearly defined as experiments and limited in terms of time and scale	New governance concepts Grassroots innovations Experimental business models Climate projects and initiatives Sustainability experiments

when an experiment is continued long enough or beyond an initially set end date; (b) when an experiment becomes larger, is multiplied or is replicated beyond the scope of its initial form or (c) when the knowledge and learning that an experiment generates is adopted in the actions and routines of people beyond the experiment, or institutionalised in ways of governing beyond the experiment.

12.2.2 Actors and Agency in Experiments

The range of actors involved in experiments extends from public policy actors (political decision-makers, civil servants and public agencies), through research organisations to a variety of private actors (see, for example, Pallett, Chapter 5; Farrelly and Bos, Chapter 6; Heiskanen and Matchoss, Chapter 10). Throughout the 'unpredictable career of climate experiments', external actors crop up to become involved in experimentation, whether out of genuine interest, aspirations for reaping direct benefits or associated reputational gains of 'flagship' initiatives. This may fulfil an effective function in terms of resource mobilisation by enhancing visibility and further articulation of successful initiatives. Yet, it is also a symptom of asymmetries in risk-taking between the initiators of experimentation and potential beneficiaries reaping the rewards of experimentation, including the potential for co-option and predation. The more visible climate experiments tend to attract more external interest and resources, irrespective of their actual climate benefits, as they may serve other political and commercial interests as well. The co-optation of experiments by others can be critical to ensuring the viability of initiatives through time and beyond initial funding periods, but may also lead to disengagement by initial members, as it 'stretches' their initial framing.

Contributions to this volume offer a variety of insights on who and what is seen as mediating and intermediating the embedding of experiments, and mobilising different types of boundary-spanning processes. Actors are central to embedding experiments but these actors may differ from those who initiate and undertake experiments. Heiskanen and Matschoss (Chapter 10) argue that, within experiments, its actors may 'have diverse or even divergent understandings of what is being tested'. Several authors differentiate between insiders and outsiders to experiments. Insiders comprise the 'coalition of the willing' that not only have the power to form and carry out experiments but also need sufficient leverage to influence the embedding of the outputs of experiments (Hölscher et al., Chapter 7). Outsiders would not have a central role in the experiment itself, but may prove highly important for its embedding. Such actors, including innovation, niche or transition intermediaries (Kivimaa, 2014) can aggregate learning and other outputs of experiments on a higher level, communicate such learning and outputs to

stimulate the replication of experiments or influence the emergence of new supportive institutional structures (Geels and Deuten, 2006; Geels and Raven, 2006;). Carvalho and Lazzerini (Chapter 3) show how Community Chance Aggregation concepts and practices became progressively legitimated and transformed in California by multiple actors (consultants, not-for-profit organisations) who become intermediaries 'actively and purposefully moving the concept across space and initiating new rounds of mobility'.

12.2.3 Motives and Objectives of Actors

In Chapter 1, we provided an overview of motivations for experimentation by exploring some common metaphors: testing hypotheses, setting designs, learning by doing, creating radical novelty, nurturing and ordering collective reality. These narrative frames link to the specific objectives of experimentation in different settings, the definition of 'success' and 'failure' and how these may be evaluated. Contributions to this volume have considered broader expectations and outcomes linked to experimentation, going beyond these metaphors, and how they come to be realised and produced.

Because most climate governance experiments are framed as projects, initiatives or pilots, they tend to involve rather practical definitions of objectives, targets and activities. One of the features of an experiment is that it must come to an end; perpetuation and transfer of outcomes is inherent to the motives of actors involved in experiments. Such practical considerations can be highly informative as to the starting motives and purposes of experiments. But it is in the nature of experiments that they mutate and change as they unfold. Objectives, targets and activities may change over time, as initiatives come to be reframed in the face of real-world challenges (see, for instance, Pallett, Chapter 5). Given the preliminary, provisional, untested and entrepreneurial nature of experimental configurations, and since the primary objective is to learn by doing and to try again, mobility and adaptation may be inherent to social experimental settings. In practical terms, the resources and motivation available to experimental actors are likely to be highly dependent on external sponsors and factors. Perpetuation and transfer of outcomes will also depend on these sponsors, making experimental actors sensitive to their interests and perspectives and modifying objectives, narratives and promises in tune with modifications in such interests and perspectives. Departures from the original premises of an experiment may already point to the start of a process of embedding lessons, resources and networks. Most views on experimentation emphasise learning as a key motivation. Such views range from simple 'testing' to internalising new ways of thinking, doing, acting and knowing. The latter may be a key step towards more transformative change.

In our original definition, experiments are always intended to have outcomes that can be transferred and adopted elsewhere. But there is a range of conceptions of what these outcomes may be, and different actors may hold differing and inconsistent views about what these outcomes will be. The simplest view is that an experiment will demonstrate a way of doing things so that it can be adopted more or less unaltered by others. If experiments are demonstrations, then they represent microcosms that are complete, fully ordered and functional and mobile so that they can be transposed to other contexts. The problem of replication will involve developing the needed resources, following the rules and learning how to do things, including education and training.

But the outcomes of experiments and their transfer is often more complex and contentious. Several contributions to this volume (Carvalho and Lazzerini, Chapter 3; Farrelly and Bos, Chapter 6; Hölscher et al., Chapter 7; van Buuren et al., Chapter 8) suggest a further dimension, that of the degree of *structuration* involving the abstraction of lessons, generalisation of knowledge and the modification of these lessons to new contexts. Experiments in this case are less microcosms to be emulated so much as examples which become generative analogies for others, clarifying problems, outlining general principles and providing encouragement that alternatives may be viable. Such analogies may also suggest different pathways for embedding, involving a shift from situated and particular action/knowledge to expanded relevance (diffusion) and/or structuration (abstraction, generalisation and institutionalisation). Most processes of embedding may include a combination of emulation and abstraction. For instance, Strategic Niche Management talks of the need for experiments to acquire generic and mobile features so that knowledge can be aggregated and circulated amongst relevant communities (Geels and Deuten, 2006). The embedding literature talks of embedding, dis-embedding and re-embedding (Geels and Deuten, 2006), while contributions in this volume discuss processes of anchoring, circulation and re-anchoring (Carvalho and Lazzerini, Chapter 3; Castán Broto and Bulkeley, Chapter 4). Expanding on the idea of the diffusion of experiments through time and organisational space (see Figure 12.1), we here add a third dimension of structuration (see Figure 12.2). We believe embedding should be viewed as being more than the emulation, diffusion or scaling of exemplars demonstrated in experiments; it should also include processes of abstract lesson-learning, adaptation and reconfiguration of governance systems.

We see embedding as typically including some more or less radical process of 'fitting' experiments and their outputs to post-experimental contexts. In this process, experiments tend to be reframed, co-opted and altered to become more adapted to the existing ways of doing things and of norms and structures. As they do so, their transformative influence may become more limited (Smith and Raven, 2012; van Buuren et al., Chapter 8), both in the sense of being modified to fit the

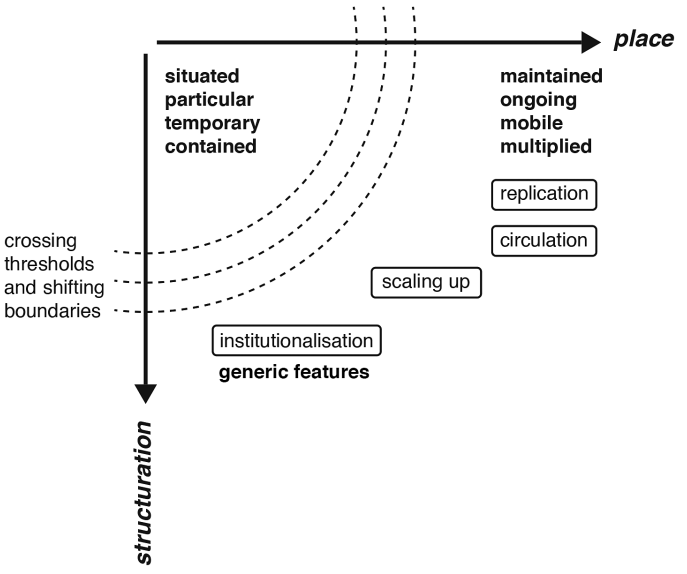

Figure 12.2. Experiment embedding as moving through spatial and structuration levels.

new host governance regime and in the sense that additional entrepreneurial and innovative work has been done, leaving the imprint of the experiment to be fainter. For example, Nair and Howlett (Chapter 9) and Carvalho and Lazzerini (Chapter 3) analyse the 'journeys' of specific policy experiments over time and place, through examples of community electricity procurement, insurance schemes and development projects for farmers in relation to climate change adaptation. This view places emphasis on embedding the outcomes of experimentation (e.g. Castán Broto and Bulkeley, Chapter 4; Farrelly and Bos, Chapter 6), including visions, narratives and insights about how change works, new governance rules and new businesses or citizens practice (Kivimaa et al., 2017). This mixed pattern of outcomes, a combination of the 'demonstration' and the 'analogy' views of potential outcomes, is recognised by actors involved in experiments and their embedding. This was explored in chapters that looked at the interface between isolated experimental outputs and their more aggregate outcomes (Hölscher et al., Chapter 7; van Buuren et al., Chapter 8; Carvalho and Lazzerini, Chapter 3).

In the context of sustainability transition studies and niche protection and development, Smith and Raven (2012) propose a useful distinction between strategies of 'fit and conform' as opposed to 'stretch and transform', indicating differing degrees to which niches and the experiments they contain fit to or transform existing selection environments. Applied to climate governance experiments, 'fit and conform' empowerment narratives suggest that embedding is not

transformational, as experimental outcomes adapt to existing governance and socio-technical structures. Conversely, the narratives of 'stretch and transform' describe a larger extent of change in which the practices, technologies, visions and rules proposed by the experiments lead to a reconfiguration of existing practices and structures.

12.3 Embedding Experiments: Paths, Processes and Challenges

12.3.1 From Outputs to Outcomes of Experiments

Whether part of a highly formalised and structured experimental *dispositif* or a more ad hoc and emergent process of adaptation and reconfiguration, climate governance experiments can be qualified by the outputs and outcomes they produce. The embedding of experiments raises a number of issues for evaluation: given the range of outcomes and pathways, how should objectives be stated and what should be the success criteria. There is a need for clarifying what experiments 'produce' as their outputs and outcomes, individually and in the aggregate.

The outputs of experiments are often described operationally in terms of specific activities and the fulfilment of objectives. The expected outputs range from market impact data (Tassey, 2014) to new, shared visions about future socio-technical systems (Kemp, Rip and Schot, 2001). 'Knowledge about how something (e.g. a technology, a service, a policy, etc.) "works in the real world"' (Kivimaa et al., 2017: 2), is often central to an experiment's justification (cf. Kemp et al., 2001; Brown and Vergragt, 2008; Tassey, 2014). In formal public governance, new goals, new instruments or new types of leverage mechanisms and implementing organisations could be expected as outputs of governance experiments (Jordan and Huitema, 2014; Upham, Kivimaa, Mickwitz et al., 2014). In informal governance settings, outputs of experiments may be less well-defined and associated with alternative modes of governing to more formal and established ways (Hoffmann, 2011). Kivimaa et al. (2017), on the basis of a systematic review of transition experiments literature, identify six kinds of outputs: discursive (new visions or integration of perspectives), technological (practical applications of new technologies), infrastructural (changes in planning for land use and infrastructure build-up), policy related and institutional (new planning practices, new actors in policymaking and changes in responsibilities in multi-level governance), business related (new business models) and citizen oriented (improved citizen engagement and emergence of alternative communities). Novelty also springs from more open search processes, such as in the case of 'failed experiments' that do not produce the expected outputs, but may reorient the search process in fruitful directions, by excluding certain paths or allowing focus on others. The history of innovation may

be seen as a history of unintended discoveries and surprises stimulated by unsuccessful experimentation (Abernathy and Utterback, 1978). But as we have seen, whether this is because of the failure to achieve an original promise or a failure to adapt to changing interests of sponsors and mutating selection environments is often hard to tell.

It is often the outputs – rather than the broader impacts and outcomes the experiments generated – that are used in measuring the success or failure of experiments. The absence of a consideration of outcomes in assessing experiments, which are important to embedding experiments, may be explained by the necessary investment of time and effort. Outcomes may be *intended* and linked to a purposeful process of realising specific expectations in practice, but also *unintended* surprises, traces and co-produced transformations of the surrounding context, participants, routines and practices. They range from short-term to longer-term. Short-term outcomes may come in the form of new narratives, policies, business practices and networks, knowledge as to what factors best promote change or even replication of the experiment in another setting (Kivimaa et al., 2017). Long-term outcomes, such as broader socio-technical change in markets or practices, may be initiated or contributed to by experiments (Brown and Vergragt, 2008; Berkhout et al., 2010).

In broad terms, we would bring attention to three kinds of outcomes of experimentation:

1. Practical or abstract knowledge and learning
2. Systemic and transformative change
3. Political ordering and mobilisation

First, a major objective and co-produced outcome of experimentation is new knowledge and learning (see, for instance, Farrelly and Bos, Chapter 6; Heiskanen and Matschoss, Chapter 10). This may be related to more conventional views of experimentation as testing and learning by doing, where the object of learning concerns the validation of claims about the external world and the means by which we may exert control on it. It may also concern knowledge about uncertainties and the limits of control and predictability. Retaining knowledge and learning derived from specific experiments is crucial to supporting their transposition elsewhere, their translation into more generic and mobile forms (e.g. via 'recipes' and 'templates') or the doing of further experiments along a given path. Beyond being a valuable currency, learning and knowledge stem from *social processes*. Crucial to the transformative potential of experimentation is 'second-order' learning (Brown and Vergragt, 2008), or the ability to learn how to learn. Yet, obtaining evidence of this as an outcome of experiments is difficult (Kivimaa et al., 2017). The fact that learning is always enacted by particular actors underlines the

importance of experimentation as a capability: 'hosting' experiments becomes crucial to building up expertise and innovative capabilities, as well as the capacity and routines to learn from multiple experiments.

A second outcome of experimentation is the capacity to transform the governance milieu through which it flows (see, for instance, Castán Broto and Bulkeley, Chapter 4; Pallett, Chapter 5). By transformation, we mean more discontinuous or radical changes in institutional structures, actor behaviours and problem frames. Beyond local transformation, this may refer to a multiplicity of processes that together contribute to radically new configurations or the reorientation of paths. Hoffmann (2011: 29) describes two ways in which climate governance experiments can disrupt the status quo to influence systemic transformative change: acting as 'first, a source of friction in politics and markets that catalyses demand for broad transformation in societies and economies, and second, a source of smoothing that provides the technologies and institutions to respond to the demand for transformation'. Pursuing this kind of systemic transformation objective implies quite different criteria by which to evaluate the outcomes of experiments, as it requires a shift from a focus on 'learning something new' to 'enabling and sustaining systemic change' when setting priorities and designing experiments. This may be an aspirational motivation for experiments, even if weakly signalled by initiators and sponsors, and this may explain obstacles to embedding, as suggested by van Buuren et al. (Chapter 8). That said, the transformative impact of experiments may also be overstated. While policy experiments can break institutional rigidities, to stimulate long-term governance changes, they need to be supported by radical changes in formal regulations and professional standards (Primmer et al., 2013). The potential for transformation may trigger experimentation, which in turn is sustained by other aligned changes to constitute transformation jointly.

Third, there may be broader political outcomes of governance experimentation through the reconfiguration of collective political and institutional orders. Any one of the metaphors on experimentation considered in Chapter 1 is the carrier for a certain appreciation of the world, our means of control over it and the principles and technologies by which it may be governed. Climate governance experiments produce and reproduce tools, associated norms, values and meanings and socio-political orders – which can promote the status quo or fundamentally rearrange collective realities. Experiments may be powerful tools for the empowerment of individuals and collectives as they open up new spaces for intervention beyond and across usual jurisdictions (Hoffmann, 2011), provide opportunities for the accumulation of expertise around new ways of handling climate governance and the creation and assertion of new roles (e.g. progressive advocates of change, intermediaries, system builders and involved users). Experimentation is also used for

more instrumental and potentially contested purposes. Demonstrations and pilots often focus on producing highly visible exemplars that serve additional purposes, such as enrolling external support, producing a positive image of the actors involved (as doing something about problems or being at the vanguard of developments) or contributing to hopeful narratives and boosting confidence in the future viability of a specific option (see, e.g., Hölscher et al., Chapter 7). Nair and Howlett (Chapter 9) also note that politics become more important determinants of the success of 'policy pilots' than the design of such pilots. Such outcomes may explain the apparently disproportionate costs of some flagship projects.

Expectations about the lasting outcomes of experimentation have consequences for how embedding may happen or how it can be evaluated. Because of our interest in embedding, we focus beyond the more immediate and project-specific success criteria often deployed to evaluate the outputs of discrete experiments. Instead, we suggest moving towards evaluations that enable comparison across different experimental contexts and which are designed to assess progress towards more systemic outcomes and processes. This leads us to question *what* it is that becomes embedded, and *how* this can be evaluated.

12.3.2 Processes of Embedding

Experimental activities are often understood as located upstream of longer sequences of change-oriented processes. For example, Grin, Rotmans and Schot (2010), in connection to transition studies and transition experiments, talk about three different processes that can follow from experimentation: *deepening* refers to learning as much as possible from the transition experiment in question, *broadening* refers to repeating an experiment in an adjusted form in a different context and *scaling up* to embedding an experiment in the existing structures, practices and narratives of an incumbent regime. Expressed as an outcome, deepening may be viewed as shifts in ways of thinking and of practices, as well as the organisation of physical, economic and institutional structures. Broadening is the replication of the experiment in different contexts, whereas scaling would influence established ways of thinking, doing and organising (Grin et al., 2010; Raven, Van Den Bosch and Weterings, 2010; Bos and Brown, 2012).

While this categorisation is a useful starting point, from the contributions of this volume, we see an emergence of new notions of embedding, including 'circulation' (Castán Broto and Bulkeley, Chapter 4) and a more critical view of replication and scaling up (e.g. Carvalho and Lazzerini, Chapter 3). Drawing on the insights from the chapters in this volume, we suggest that embedding can be captured under four macro-processes: scaling up, replication, circulation and institutionalisation, summarised in Table 12.2 and Figure 12.2. We see learning

Table 12.2. *Processes and elements of embedding experiments*

		Embedding processes			
		Scaling up	Replication	Circulation	Institutionalisation
Object of embedding (what becomes embedded?)	Experiment as a blueprint	Increase of the scope and length of the experiment (possibly ending the experiment status)	Creation of a new context and location-specific application of the experiment	No blueprint exists	Experiment continues and stops having an experimental status.
	Experiment as a source of knowledge and learning	Knowledge and learning becomes mainstreamed in the process of scaling	Diffusion and (re-) contextualisation of codified and practical knowledge	Flow, reuse and modification of knowledge and learning	Institutionalisation of knowledge and learning is generated by the experiment in form of rules, practices and scripts.
	Experiment as a source of new policies	Experiment's policy-relevant output/ outcome taken to more permanent and broader scale use	Replication, with adaptation, of an experiment's policy output/outcome to new contexts	Experimentation as a governance approach	Experiment's policy output/ outcome becomes embedded in formal and informal governance structures.
	Experiment as network development	Expansion of the (whole) actor network initiated by the experiment	Replication of an experiment's actor configuration, modified to new local circumstances	Actor networks evolve as an outcome of the flow of ideas and resources generated by experiments.	The experimental actor network configuration replacing formal and informal governance structures
	Experiment as a source of new socio-technical configurations	Broader uptake of the technological (or service) outputs of experiment	Diffusion and (re-) contextualisation of the technological (or service) configuration	Socio-technical configurations as a contingent outcome of circulating governance narratives and norms.	Technological (or service) configuration becomes a widely accepted solution.

Experiment as a stimulus for new practices	Mainstreaming of new practices emerging or proven in the experiment	Replication of adapted practices associated with the experimental design *or* anchoring to local context through situated practices enabling the uptake of technological (or service) configuration.	Practices pioneered in experiment become part of an assemblage of circulating governance practices.	Practices initiated by the experiment become an established part of formal and informal governance structures.
Experiment as political reordering	New governance regime modelled in experiment replaces an existing regime.	Governance regime is modified through the emergence of experiment-based rules and routines in different places	Governance regime absorbs, processes and internalises experimental outcomes – impacts on governance order unclear	Formal and informal governance is adjusted systematically, including redistribution of administrative and legal power.
Experiment as a trigger to transformation	Experiment overturns an incumbent governance and associated socio-technical regime.	Experiment leading to chains of similar experiments that cumulatively change the socio-technical setting	Experimental approach to governance changing the system from within.	Experiment initiates a process of de-institutionalisation and re-institutionalisation.

as an integral part of all these processes with the process and nature of learning differing in each form of embedding.

In studies on socio-technical experiments, scaling up is rarely examined critically although there are differing interpretations of what it may imply (e.g. Jolly, Raven and Romijn, 2012). For example, Jolly et al. (2012) refer to scaling up as having a wider impact at the location of the original experiment, including achieving greater penetration of target groups and extending services to new people, among other things. Laakso, Berg and Annala, (2017), in their meta-study of twenty-five articles on experiments, mention scaling up as integrating and applying the experiment at a higher system level. Hartmann and Linn (2009) cover not only the expansion but also the replication and sustaining of experimental configurations over time in their definition of scaling up. The conceptualisation of scaling ranges from a narrow 'making the experiment bigger' to considering both scaling up within and across locations and sustaining experiments over time (see also Figure 12.1). What is less clear is what features of the experiment are being scaled and how scaling takes place from a pluralism of possible pathways.

Scaling up may be a process in which an experiment is (and its outputs are) expanded in scope (geographical, administrative, financial, etc.) or duration. This assumes that scaling always implies expansion. It also assumes that expansion – of technologies, practices, actor-configurations and rules – is associated with adoption into standard practice of these experimental outputs. Some of the contributions to this book talk about crossing scales and breakthrough thresholds (Hölscher et al., Chapter 7; Nair and Howlett, Chapter 9). For policy piloting (as in Nair and Howlett, Chapter 9) or technology piloting, scaling up can occur through the adoption of governance modes and instruments in larger jurisdictions. However, for some climate governance experiments – particularly those that happen in more local or polycentric settings – scaling up appears to be rare. The experimental scale may be the appropriate scale for a given intervention, and its broader impact will depend on processes of replication. More profoundly, scale is a relative rather than an absolute idea, implying that scaling always needs to be understood in relation to something else, like a prevailing governance regime.

Replication is often proposed as a contrast to scaling. It refers to repetition and reproduction of an experiment in a new context (e.g. another policy domain) or location (e.g. new city or country). Replicability is one of the main characteristics of conventional experiments. Replication in social and political settings where learning is a principle goal usually involves adaptation to new contexts, locations, interests and problem frames. Thus, replication carries with it an idea of change along the way. Carvalho and Lazzerini (Chapter 3) illustrate how in the process of replication an initial experiment changes and adapts to its new location. They talk

about the individual journeys of specific solutions as '"spatialised" sequences of anchoring, recombination and mobility'. According to this view, the embedding of experiments is not a simple process of diffusion, expansion or replication of an exemplar, but a process of modification that negotiates an inherent tension between situated and mobile knowledge and practice. In effect, it requires experiments or their outcomes 'mobile' (Carvalho and Lazzerini, Chapter 3; Nair and Howlett, Chapter 9). Here, actors pursuing private or common goals, holding relational assets and engaging in deliberate interventions play an active role in overcoming the obstacles through active (re-)contextualisation and transformation of the governance intervention itself. While replication is often used to refer to the whole experiment, it may also entail specific tangible and intangible elements (such as a policy design or a technological configuration). Kivimaa et al. (2017) argue that this form of active and mobile replication is more typical of processes of embedding for climate governance than scaling up in the sense of expansion.

Circulation presents the embedding of experiments as the ongoing transformation and reconfiguration of existing regimes. According to Castán Broto and Bulkeley (Chapter 4), experiments can transform existing (urban) regimes by locally reconfiguring the circulation of socio-technical and socio-ecological flows. Fundamental to the lasting transformational impact of experiments on urban milieu is their ability to open new spaces for practicing a 'politics of hope'. The idea of circulation relates to the career of experiments seen as journeys (Carvalho and Lazzerini, Chapter 3; Pallett, Chapter 5; Heiskanen and Matchoss, Chapter 10). Castán Broto and Bulkeley (Chapter 4) suggest that circulation can be understood as involving (a) the movements of 'things' as calling for the realigning of existing relations (e.g. via new parameters and criteria), (b) a focus on those 'things' that can accompany or enable circulation of ideas or policies (e.g. templates, finance mechanisms and standards), and (c) amplification and dissemination processes that can extend the pool of receptive public (through e.g. the development of new imaginaries and visions that can support the mobilisation of expectations).

Institutionalisation can be described as a process in which an experiment, or its outputs or outcomes, becomes part of governance structures, rules, norms and routines, whether formal or informal. This can imply a variety of forms from standardisation of technologies (that have been developed through stages of experimentation) and professionalisation of new roles and activities (Pallett, Chapter 5), to the uptake and incorporation of new approaches into 'formal policies or implementation programmes' (van Buuren et al., Chapter 8). Institutionalisation can be a bottom-up and uncoordinated process, or be the outcome of a more directed process. In the latter, policy experiments can be understood as opportunities for the phased introduction of major government policies or programmes,

'allowing them to be tested, evaluated and adjusted before being rolled out nationally' (Cabinet Office, 2003; cited in Nair and Howlett, 2016: 69). Interestingly Nair and Howlett (Chapter 9) show that climate adaptation policy pilots in India have been integrated into existing mixes of policies mainly through incremental adjustments, while a process of institutionalisation as a form of embedding was only observed in one out of fourteen policy pilots. To succeed, institutionalisation may need to be preceded by a process where experiments deinstitutionalise or destabilise a prevailing governance regime before they can become embedded (cf. Turnheim and Geels, 2012; Kivimaa and Kern, 2016). Hölscher et al. (Chapter 7), by drawing on climate governance, sustainability transition and sustainability resilience literatures, depict two intertwined activities and related competences that are crucial for experimentation and its embedding: transforming and orchestrating. Their key argument is that transformative capacity held by those governing is necessary to achieve a high degree of novelty. Orchestrating capacity is crucial to create consensus about the direction of change and to mobilise action in a coordinated manner.

These different processes may coexist or they may occur in sequences. For example, replication may be a precursor of institutionalisation. The coexistence of plural processes better characterises the specificity and contextualisation of processes of embedding, as a social and political process. Overall, contributions to this volume show that when analysing and evaluating the embedding of experiments, we can distinguish between several features of experiments and a range of pathways along which governance experiments may act beyond their original project and time boundaries. These distinctions are organised in Table 12.2.

12.4 Implications for Climate Governance

The Paris Agreement (2015) emphasised the role of informal governance approaches and experimentation in tacking climate change. At present, a common issue with climate governance experiments is that, while typically problem-oriented, they are often isolated, fragmented and weak. To follow the path set by the Paris Agreement, there is thus a need to address the issue of fragmentation. It remains difficult to define where experiments may 'fit' within climate governance arrangements, how they may contribute to generate momentum for systemic changes in wider society and what is the scope for deliberate strategies to broaden their impact. We, therefore, suggest complementing the problem-solution oriented frame of experimentation with another frame that is oriented towards the ways in which experiments, collectively and through time, can lead to outcomes of a more systemic nature. We have suggested four processes that lead to the broader embedding of experimental outcomes.

In the academic debate about climate governance, two principal views exist. Hoffmann (2011) has framed 'experimental' climate governance as the multitude of ways of responding to climate change, which function independently of the United Nations negotiations and treaties. Such initiatives operate outside of the frame of multilateral climate governance (van Asselt, Huitema and Jordan, Chapter 2). They involve a variety of actors adopting trial-and-error approaches to problem-solving, operating at and across different scales, and relatively independently of each other. This emerging form of governance has been described as polycentric (Ostrom, 2010; Jordan et al., 2015). This is a different perspective to that taken by Sabel and Zeitlin (2012) and Zeitlin (2015) who talk about the formal European Union (EU) governance architecture as 'experimentalist'. By this they mean a specific system of governance including 'framework' rule and target setting at the EU level, subsidiarity in the implementation of rules and targets to national and local administrations, peer review of target achievement and periodic deliberative review of targets and rules. Sabel and Zeitlin (2012: 6) emphasise the polycentrism and multilevelness of the 'machine for learning from diversity' that constitutes EU rule-making and governance and draw attention to the destabilising effect which the recursive process of peer review between states and revision of rules creates for national administrations. The key differences between these perspectives are that one is global in scope, includes non-state actors and offers a less coordinated bottom-up view of experimentation, while the other is regional in scope, starts with co-ordinated political agreement about high-level goals and operates primarily through the regulatory and administrative procedures of state authorities.

We embrace both perspectives in our discussion about climate governance experiments and their embedding, as this will involve the crafting of formal and informal governance structures to make sense of the realities of climate action on the ground. The search for adequate means to coordinate such governance action – whether this involves the prevalence of top-down, bottom-up or other logics – can be seen as a larger 'experiment' in itself (van Asselt et al., Chapter 2). These differing perspectives also mirror the different forms of embedding that range from scaling up and replication of specific experiments to the aggregation of experimental outcomes in the form of circulation and institutionalisation.

Hoffmann (2011) sees a key role in this experimental governance setting for non-national governments and jurisdictions, including cities, counties, provinces, regions, civil society and corporations. Climate governance experiments have indeed received particular interest in the context of cities and urban environments (e.g. Evans, 2011; Bulkeley et al., 2012; Evans, Karvonen and Raven, 2016) – evidenced also in the contributions of this book (Castán Broto and Bulkeley, Chapter 4; Hölscher et al., Chapter 7; Heiskanen and Matchoss, Chapter 10;

Karvonen, Chapter 11). The urban scale is often seen as a fruitful context for a range of experimentation to take place and connect inhabitants with innovation actors, thus, enabling *experiments in practice* situated in specific urban social, economic, cultural and built milieus. While the importance of national or international scales for climate governance experimentation is acknowledged (Hoffmann, 2011), the potential of experiments has been much less explored on those scales and little literature exists describing experimental governance frameworks beyond REDD+ and the Clean Development Mechanism. This may refer to the haphazard nature of experimentation, possibly making it a poor alternative to national and international regulation, particularly in terms of power and accountability (e.g. Biermann et al., 2012; Hale and Roger, 2014; van Asselt et al., Chapter 2). However, in the absence of effective national and international regulation within international climate policy, and given the complex, contested and uncertain nature of the climate problem, a more experimental approach to governance may be well-fitted to climate governance across different scales. But if this is the case, robust frameworks to evaluate the broader influence and impact of experiments are needed to address the claim that experimentation is a smoke screen for lack of political and practical action to achieve the required transformations in systems and behaviours.

What then might be the features of an 'experimentalist climate governance'? Drawing on the previous discussion, we can identify three primary features. First, climate governance would need to be a frame for experimentation, including the provision of resources, the creation of adequate spaces with exceptional conditions, support for actors and an explicit link between experimental initiatives and wider climate protection and resilience goals. Second, it would be a frame for embedding experimental outcomes, in particular those likely to achieve transformative changes. Taking the example of EU governance, this would include a systematic process for reviewing the outputs, outcomes and potentials of climate governance experiments matched to procedures for embedding promising outputs on a broad scale. Finally, to achieve such broad-scale embedding, experimentalist climate governance would support the four processes of embedding: scaling up, replication, circulation and institutionalisation. There would be an understanding that each of these processes may have a role to play in different settings and that there may be cases in which different processes are employed serially and together to achieve the transformative changes being aimed at.

Such an experimentalist approach seeks to address a central problem for (international) climate governance: the problem of coordination. The Paris Agreement is a radical departure from the idea of the globally co-ordinated, rules-based governance of a global public good problem. It posits instead a loosely coupled, polycentric approach built from actions taken at multiple levels, with regular reporting

and peer review. Paris represents an appeal for novel forms of governance beyond the templates offered by globally coordinated, state-led approaches towards solutions beyond, below and outside the state-dominated regime, and towards greater experimentalism. There is a renewed mandate and high-level support for local action (e.g. UN Non-State Actor Zone for Climate Action represents one significant step in this direction) and the strengthening of supporting transnational organisations (e.g. ICLEI-Local Governments for Sustainability, the European Climate-Knowledge Innovation Community [Climate-KIC]) and accounts of a groundswell of local and community initiatives to tackle climate problems.

12.5 Conclusions

In this volume about governance and social experiments aimed at addressing multiple climate change problems, we have proposed to cast a fresh look and focused on their *embedding*. We have sought to focus discussions beyond individual experiments. This new research offers opportunities for further understanding the phenomenon of embedding, new approaches to climate governance and how it can be supported in practice. Such a shift in focus can provide a constructive frame for climate efforts that are increasingly turning towards the role of local and non-state action to deliver urgently required socio-technical transformations (Turnheim et al., Chapter 1; van Asselt et al., Chapter 2). At the same time, it can provide new ideas for state and substate public administrations to think about the role of experiments in their climate policy portfolios. We have extended from the view of Hoffmann (2011) and others in seeing a role for climate governance experiments and beyond also in formal state governance structures – not just at local levels and in informal settings. For both formal and less formal climate governance an urgent requirement for climate governance experimentation is to overcome the current fragmentation of initiatives, and their tendency to remain isolated or short-lived, which ultimately reduces their potential for lasting and wide-ranging change. We suggest that moving the terms of the debate on experimentation towards questions of embedding can constructively shift attention to such strategic and political problems.

Engaging with the embedding of experiments requires the problematisation of the boundary between experiments and their wider outcomes, in scope and time. A number of tensions play out across this boundary: between the particular and generic, the situated and mobile, the isolated and more aggregate, from creative variety to strategic focus, from emergent to institutionalised action and so on. Paying concerted attention to such tensions calls on an ability to facilitate articulation and alignment processes to and fro between the specifics of experimentation-in-context and more generalisable lessons for transformative intervention,

recognising the different mechanisms at play and the various relevant dimensions where they play out. This does require the development of new skills and capabilities by governance actors, well beyond the routine management and evaluation of projects. Innovation is something that requires capabilities and investments, and it is risky. Such a focus on embedding should not deflect attention away from the specifics of local projects and how they can be carried out and supported, but rather attract attention towards an equally important aspect related to the wider relevance and positive impact of experimentation for climate governance.

The contributions brought together in this volume have considered a wide range of views on how experiments become embedded, actively mobilising the disciplinary richness associated with the emerging phenomenon of climate governance experimentation. These views go well beyond a conventional focus on scaling and linear diffusion models. Alternatives to scaling considered here include the replication of experiments in new contexts, the circulation of experimental outcomes in different forms (knowledge, people, blueprints and so on) and the transformation of structures and governance regimes as experimental outcomes force a reconsideration of core rules and institutional logics.

Embedding, as a process, is difficult. It requires active work and engagement by participants, as well as time for systemic, institutional and actor-based dynamics to play out. Articulation and alignment are the main master processes at work in embedding, played out at different levels and across institutional, technical, social and political dimensions. Embedding is mediated through contexts, as well as by the specific politics of experimentation practices, including learning and knowledge accumulation, the build-up of networks and coalitions of actors, the emergence of new roles (e.g. intermediation, facilitation and governance entrepreneurship) and mobilisation around shared expectations and collective narratives.

The embedding of climate governance experiments concerns experiments themselves, as well as the outputs and outcomes of experimentation. In the former, central questions relate to how experiments can be reframed or repurposed to better 'fit' existing regimes and a variety of contexts, and how regimes can learn to handle, manage or orchestrate experimentation. In the latter, processes of transformative change become the main focus, for which individual experiments may be an agent or accessory of more structural outcomes. Furthermore, and particularly when considering the evaluation of experiments and their outputs and outcomes, it becomes necessary to look beyond the immediate outputs (intended and unintended) of experiments and to engage with the processes that enable experimentation and its embedding.

To this, we wish to add a reminder of the potentially empowering value of experimentation. Genuine experiments can be seen as spaces of emancipation wherein new actors (often excluded from currently prevailing arrangements) can

become empowered to contribute to collective problem-solving efforts. Recognising this emancipatory character of experimentation further challenges common views on scaling, diffusion and embedding as requiring the extraction and purification of situated knowledge and may justify a search for climate governance that respects and draws on the desires of local actors not to see their initiatives uprooted or co-opted, but simply acknowledged as relevant and meaningful. It remains to be seen whether such empowerment and emancipation pathways can become aligned with notions of 'orchestration' increasingly put forward within climate governance debates as means to recognise the relevance of more transnational and local action without imposing top-down logics (Abbott, 2012; Hale and Roger, 2014; Chan et al., 2015).

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