

# The Transformative Imagination

## Re-imagining the world towards sustainability

Diego Galafassi

Academic dissertation for the Degree of Doctor of Philosophy in Sustainability Science at Stockholm University to be publicly defended on Thursday 15 March 2018 at 10.00 in Vivi Täckholmsalen (Q-Salen), NPQ-Huset, Svante Arrhenius väg 20.

### Abstract

A central task for sustainability science in the Anthropocene is to offer guidance on alternative pathways of change. Even though this search and implementation of pathways towards sustainability is likely to require profound social-ecological transformations, little is yet known about the individual and collective capacities needed to support such transformations. This thesis explores the connection between human imagination and sustainability transformations, and introduces the notion of the *transformative imagination* to support methodological innovation in sustainability sciences, and practices aiming to support transformations towards sustainability. The *transformative imagination* is suggested to support fundamentally new ways of seeing, feeling, encountering and envisioning the world. The thesis takes a transdisciplinary action-research approach and studies how specific participatory practices, including the arts, may foster the transformative imagination as a means to more skilfully respond to, anticipate and shape social-ecological trajectories in the Anthropocene. The four included papers, each explores how practices may support particular features of the imagination as a transformative capacity. **Paper I** analyses a case in coastal Kenya where participatory modelling and future scenarios are applied to foster imagination of dynamics of interdependences and trade-offs within the context of poverty alleviation and ecosystems change. **Paper II** explores system diagrams and scenarios as practices for the development of social-ecological narratives that may support robust interventions in coastal Kenya and Mozambique. **Paper III** implements, and studies how an art-based approach based on performances, visual methods and an art installation, could support transformative visions of the Iberian Peninsula in the context of extreme climate change. **Paper IV** is a literature review of the potential contributions of the arts to transformations, in the context of climate change. These papers focus on different features of imagination, which under certain circumstances may progressively develop into societal transformative capacities with the potential to re-structure current social-ecological realities. Overall, this thesis is a step towards forging new kinds of reflexive, imaginative and deliberative practices that can support the emergence of local arrangements of a sustainable world where life can carry on.

**Keywords:** *ways of knowing, transformations, complexity, futures, practice, transdisciplinarity, creativity, art-based, embodied meaning, action-research, science-policy.*

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Mãe e pai.





## RESEARCH PAPERS

Three papers (Paper I-II-IV) have been published and the forth (Paper III) has been submitted to consideration, all in peer-reviewed, indexed, international scientific journals.

- I     Learning about social-ecological trade-offs (2017)**  
*Published in Ecology & Society Vol. 22, No.1 [2] 2017*  
**Galafassi D**, Tim Daw, Lydia Munyi, Katrina Brown, Ioan Fazey, Cecile Barnaud
- II    Stories in social-ecological knowledge co-creation (2018)**  
*Published in Ecology & Society Vol. 23, No.1 [23] 2018*, Special Issue on Designing transformative spaces for sustainability in social-ecological systems  
**Galafassi D**, Tim Daw, Matilda Thyresson, Sergio Rosendo, Tom Chaigneau, Salomão Bandeira, Lydia Munyi, Ida Gabrielsson, Katrina Brown
- III   Restoring our senses, restoring the Earth. The role of arts and imagination in climate transformations**  
*Submitted to Elementa Anthropocene*, Special Feature on Imagination and imaginative capacity for transforming to sustainability: Future thinking for a world of uncertainty and surprise  
**Galafassi D**, J. David Tàbara and María Heras
- IV   ‘Raising the temperature’: the arts in a warming planet (2018)**  
*Published in Current Opinion in Environmental Sustainability 31:71–79*, Special Issue 1.5°C Climate Change and Social Transformation  
**Galafassi D**, Sacha Kagan, Manjana Milkoreit, María Heras, Chantal Bilodeau, Sadhbh Juarez Bourke, Andrew Merrie, Leonie Guerrero, Guðrún Pétursdóttir, J. David Tàbara

Visual work available at <http://diegogalafassi.live>

# MY CONTRIBUTION TO PAPERS

I have initiated and led all papers that compose the thesis. As lead author, I was responsible for producing an initial draft that co-authors contributed to. I was also responsible for designing data collection in Paper II-III-IV and shared that responsibility with Tim Daw and Ioan Fazey in Paper I and with David Tabarà in Paper III. I conducted participant observation, interviews and focus groups in Paper I-II-III. Lydiah Munyi conducted interviews in Kenya for Papers I-II. I led data analysis in Paper II-III-IV and co-led with Tim Daw in Paper I. The research papers presented analyse three participatory designs, harboured within large multi-country transdisciplinary research projects (*Pmowtick*, *Spaces*, *Impressions*). For these designs, I contributed to the construction of the participatory model and scenarios in *Pmowtick* and supported facilitation during workshops (Paper I). In *Spaces* (Paper II) I have only studied the process and in *Impressions* (Paper III) I have directed performances and the installation.

## Author's additional relevant publications

Bergsten A, Galafassi D, Bodin Ö (2014). The problem of spatial fit in social-ecological systems: detecting mismatches between ecological connectivity and land management in an urban region. *Ecology and Society* Vol. 19, No.4 [6]

Daw T, Coulthard S, Cheung W, Brown K, Abunge C, Galafassi D, Peterson G, McClanahan T, Omukoto J, Munyi L (2015). Evaluating Taboo Trade-Offs in Ecosystems Services and Human Well-Being. *PNAS* vol. 102, no.22

Risvoll C, Fedreheim GE, Galafassi D (2016). Trade-offs in pastoral governance in Norway: Challenges for biodiversity and adaptation. *Pastoralism: Research, Policy and Practice* 6:4

Lade, SJ, Bodin Ö, Donges JF, Kautsky EE, Galafassi D, Olsson P, and Schluter, M. (2017). "Modelling social-ecological transformations: an adaptive network proposal." *arXiv.org*.

# SAMMANFATTNING

Transformationer för hållbarhet beror på vår föreställningsförmåga och vår förmåga att göra alternativa socialekologiska verkligheter levande. Atropocens utmaningar, såsom klimatförändringar, förlust av biodiversitet eller ojämlikhet är inte isolerade problem som kan lösas genom teknik och styrning. Utmaningarna är sammankopplade och adaptiva, vilket ofta kräver fundamentala förändringar i de antagandena vi gör om institutioner och på vilka sätt vi förstår världen.

Transformationer för hållbarhet är ett växande forskningsfält inom vetenskapen om hållbar utveckling och undersöker hur fundamentala förändringar kan katalyseras över kulturella, praktiska och politiska system, för att öppna upp för nya hållbara utvecklingsbanor. Medan behovet av fundamentala förändringar är erkänt, så kvarstår viktiga forskningsfrågor om vilka typer av praktiker som kan ge upphov till den typ av kapacitet som behövs för transformationer. För att belysa detta forskningsgap vänder sig ett ökande antal hållbarhetsforskare till kunskapsproduktion, sprungen ur transdisciplinär aktionsforskning med praktiker, beslutsfattare, konstnärer och medborgare.

Denna avhandling utvidgar denna forskningsfront genom att undersöka hur praktiker kan stödja transformationer för hållbarhet. Jag undersöker här kopplingen mellan mänsklig föreställningsförmåga och hållbarhetstransformationer. Jag introducerar begreppet *transformativ föreställning* med syfte att stödja innovation i metodologierna inom vetenskapen om hållbar utveckling samt i praktikerna, för att befärma transformationer för hållbarhet. Den *transformativa föreställningen* föreslås här stödja fundamentalt nya sätt att se, känna, möta och föreställa sig världen. Avhandlingen använder sig av transdisciplinär aktionsforskning och studerar hur specifika deltagandepraktiker, konst inkluderat, kan främja den transformativa föreställningsförmågan, som ett medel för att mer skickligt svara på, förutse samt skapa socialekologiska vägval i Antropocen. Var och en av de fyra artiklarna i denna avhandling undersöker hur praktiker kan stödja bestämda funktioner av föreställningsförmågan som en transformativ kapacitet. **Artikel I** analyserar ett fall vid Kenyas kust, i en kontext av fattigdomsbekämpning och ekosystemförändringar, där deltagandemodellering och framtidsscenario används för att främja föreställningar om dynamiker av ömsesidigt beroende och avvägningar. **Artikel II** undersöker systemdiagram och scenarion som en praktik för

utvecklingen av socialekologiska narrativ, som kan stödja robusta interventioner vid kusterna i Kenya och Mocambique. **Artikel III** implementerar och studerar hur konst baserad på uppträdanden, visuella metoder och installationer, i sammanhanget extrem klimatförändring, kan stödja transformativa visioner av den Iberiska halvön. **Artikel IV** är en litteraturgenomgång, i kontexten av klimatförändringar, av de potentiella bidragen som konsten gör till transformationer. Gemensamt för dessa artiklar är att de fokuserar på olika funktioner av mänsklig föreställningsförmåga, som under vissa omständigheter kan utvecklas progressivt, till en samhällelig transformativ kapacitet med förmåga att omstrukturera befintliga socialekologiska verkligheter. Jag reflekterar här kring utmaningar och möjligheter för konventionella samt konstnärliga sätt att gemensamt skapa kunskap inom aktionsforskning. Denna avhandling är ett steg mot att skapa nya sätt för reflexiv, föreställningsrik och deliberativ praktik, som kan stödja utvecklingen av lokala åtgärder för en hållbar värld.

## PREFACE

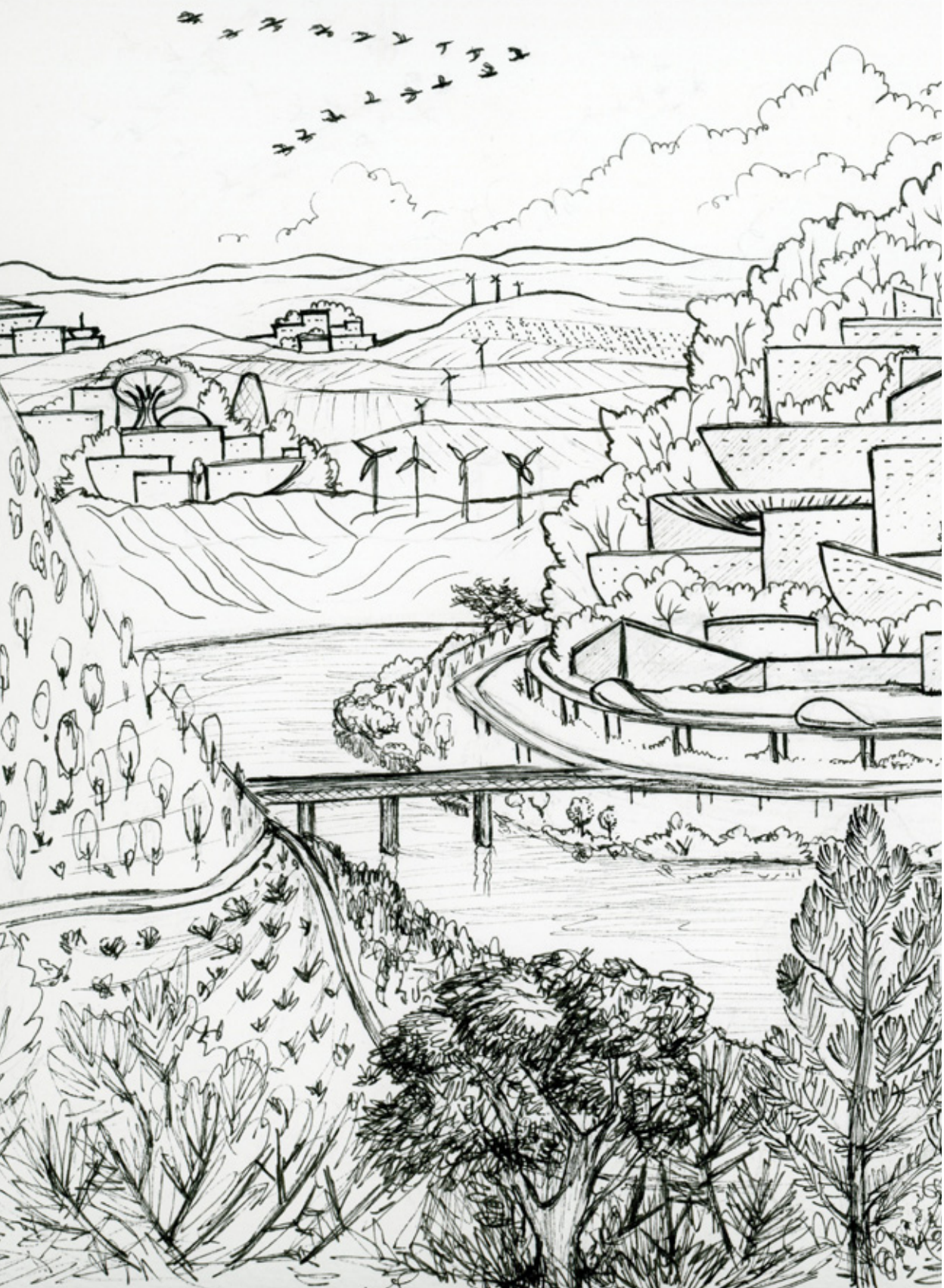
Under the guidance of my friend and sustainability educator Wolfgang Brunner, in August 2016 I spent 12 days on a remote coast of Gotland building a kayak. Wolfgang has built about 30 kayaks over the past 25 years and I was lucky and honoured to find myself that Summer in a group with a few other learners with absolutely no idea where to start. Standing in front of two 5.4 meters-long planks and lots of other pieces of wood, curved branches, twine and linen I felt helpless and excited: how am I going to transform these materials into something that can take me out onto the sea? On the first evening, as Wolfgang welcomed us under a tree at his open-air workshop, he did not hand out any information or map of how we were supposed to proceed. Instead, every day from early morning until dawn he was there, present. One step at the time, we were shown how to move forward. “*Measure the length of the plank against your height*”, “- *Tighten the string until the wood bends*”, “- *Check if it is good enough*”. We were constantly encouraged to ‘know for ourselves’. And in that struggle with the wood and twine, fully immersed in attention to the frictions and pulls of materials we slowly developed a sensibility for ‘how it should be’.

This experience in Gotland happened just a few weeks after I had met anthropologist Tim Ingold at the University of Aberdeen, Scotland. We spoke about how all knowledge is founded in skill. In fact, as an apprentice of the craft of kayak building, I could see that learning was not an instilling of some pre-formed ‘body of knowledge’ from the master to my beginner’s mind. Whenever I felt that I needed Wolfgang’s knowledge, I was not looking for general propositions about kayaks, but rather I needed his capacities of perception and judgement to help me figure out if I was on the right track. The further I went, the more I grew into those capacities myself. I saw learning as an active way of studying things; of learning how to notice and respond to materials in increasingly fluent ways. As Tim Ingold puts it, learning is an education of attention, which emerges from the crucible of experience. Not only through the interactions we have with the people with whom we share our lives with, but also from the engagements with materials and the dynamic ecologies we inhabit.

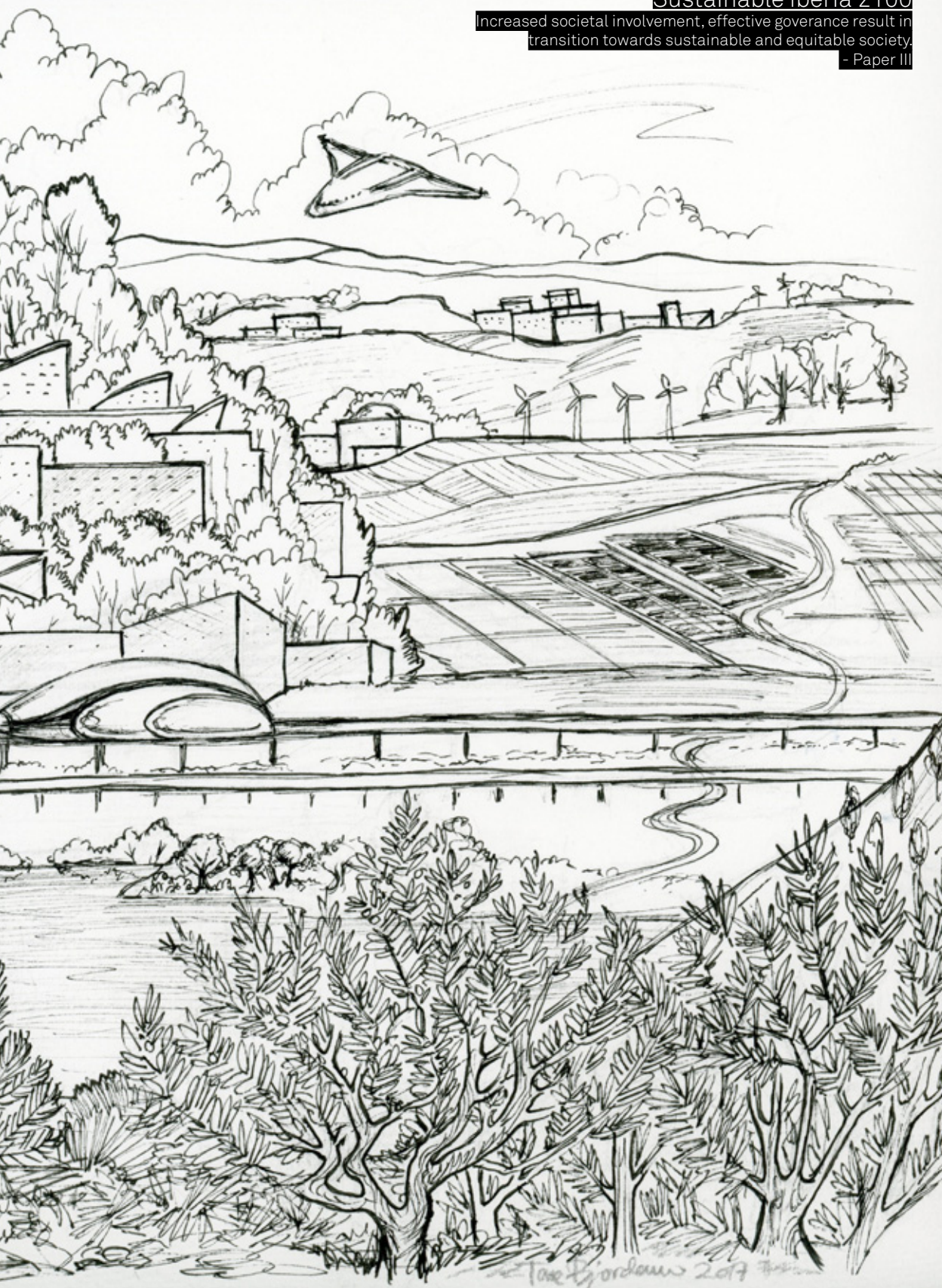
This thesis deals with transformations and the search for skills that can support transformations. The skills which we as scientists, practitioners and citizens are increasingly called into as we face major interconnected challenges. I report on ways through which groups can come together in a transdisciplinary spirit to study the social-ecological realities we inhabit in the search for new paths forward. The knowledge needed is right here in the world itself, or rather, it is to be found in our attentive engagement with it. This is not a knowledge solely of an informational kind. In life we learn numbers and figures but we also dream, think, love, laugh, feel and experience things we cannot explain to anyone else. As citizens we draw from our full experience to navigate the world, especially in times of rapid changes. Although I used very different approaches, sometimes thinking with systems, sometimes through the arts I see that they all cooperate in shedding light onto the possibilities of becoming more fluent in noticing and responding – corresponding – to the world we live in. These experiments are some of the ways through which we can study and educate our attention to re-imagine the world towards sustainability.













**The Bond You Hold**

Physical theatre, music and projections.  
 What is it like to live in a world beyond 2°C warming?  
 Lisbon, Portugal (2015)



**We Are Knot**

Open-ended participatory performance exploring the edge of human motivation  
 and willingness to act.  
 Cáceres, Spain (2017)







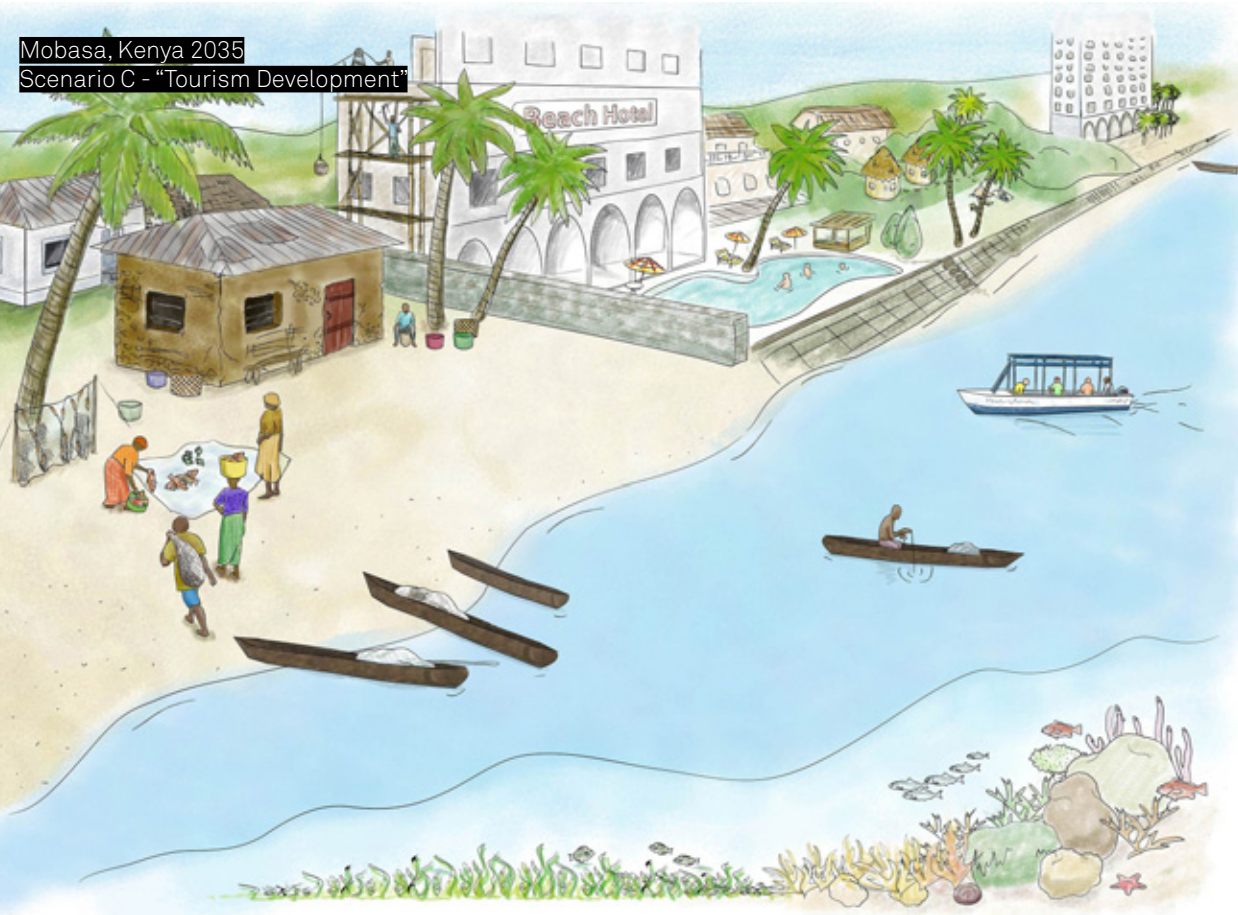


A-Corda  
Cáceres, Spain (2017)  
Interactive installation on Iberian futures  
under extreme climate change









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# INTRODUCTION

The world we live in is fundamentally shaped not only by the biophysical dynamics of the Earth we inhabit but also by the stories we use to organize and make sense of them in our everyday life. What we become conscious of and what is left out, how we look at and what it means to us, are keys to the way we navigate the world (Purdy 2015). This world is currently on a trajectory of unprecedented social-ecological change that humans have never experienced before (Steffen et al. 2015). Consequently, many of current stories and their related core values, beliefs, assumptions and worldviews such as the separation between humans and nature, the split between knowledge, values and emotions are no longer tenable. We live in a “renaissance” period where societies worldwide are prompted to reimagine what it means to be human in the Anthropocene (Folke and Gunderson 2012).

Key to this search are practices that can generate knowledge, meaning and human imagination to transform unsustainable trajectories. Transformations towards sustainability are becoming a wide field of research within sustainability science (O’Brien 2013, Olsson 2014, Feola 2015). Transformations are regarded as *fundamental* changes in practices, institutions and meaning-making structures underlying systems that shape the world we live in (Westley 2011, O’Brien 2012). Although sustainability scientists increasingly see transformations as central to responses to current global challenges such as inequality, climate change or biodiversity loss, there is still limited understanding on the practices and capacities that may enable and sustain transformative change (Moser 2016, Fazey 2017).

This is particularly urgent, not only because societies face major challenges due to interactive and interconnected stressors and vulnerabilities (Galaz 2014). But also because there is substantial knowledge available about these challenges, and potential solutions are being tested all over the world (Hawken 2018). In this context, it has been argued that one of the scarcest resources seems to be the imagination. Imagination of what problems *are*, what change *is* and how it can be

brought about in particular contexts so that they can catalyse and give shape to a wider movement of transformative change (O'Brien 2012; Wapner and Elver 2016). The ability to imagine and anticipate the future and to imagine how to reconfigure the present towards novel directions is central to transformations towards sustainability (Costanza 2000; Beddoe et al. 2009; Wiek and Iwaniec 2013).

### **Failures of Imagination**

The limited ability to respond at the scale and speed of current social-ecological change has by some been attributed to a failure of the imagination (Brown et al. 2010, Wapner and Elver 2016). For example, climate change can have interconnected and non-linear impacts that are not only highly unpredictable, but also at times “unthinkable” due to individual and collective psychological dynamics of risk aversion, denial, cognitive overload amongst others (Schoemaker and Tetlock 2012; Norgaard 2011; Gowing and Langdon 2016). For example, Tetlock (2003) describes how decision-making can be blinded to situations that pit sacred values against secular ones. Even to consider such options can be experienced as morally degrading – indeed a taboo. Similarly, Kari Norgaard’s research in Norway, showed how public officials use various strategies to actively hold information about climate change at a distance, in order not to feel guilt, fear, anxiety that arises from it and thereby keep the climate crisis off the political agenda (Norgaard 2011).

Failures of the collective imagination have also been put forward as plausible reasons for the limited responses in dealing with highly complex societal problems like the 9/11 attacks in New York in 2001 (De Goede 2008) and the global financial crisis in 2008 (Stewart 2009). One of the challenges lies in the seemingly limited abilities of decision-makers to bring various sources of knowledge together and the overreliance on ‘backwards-looking’ and incremental approaches in situations of high uncertainty and ambiguity. For instance, failing to account for and ask questions about unknowns – the “noncomputable” – can narrow perspectives on the world, discount the role of surprise and exclude crucial information in decision-making (Carpenter et al. 2009).

In this thesis I understand imagination as central to the individual and collective abilities of sense-making and innovation. It’s the ability to synthesize and integrate various aspects of knowledge, and to move beyond established frameworks of thinking and feeling to generate new ideas and

institutional resources for transformations (Wapner and Elver 2016). I will explore imagination in this thesis through transdisciplinarity and the arts.

Authors dealing with current sustainability challenges have made a convincing case that current ways of looking at the world may be largely unable to deal with the new context of the Anthropocene (Galaz 2014; Biermann et al. 2012). To address this gap, sustainability science is increasingly paying attention to the study of processes that entail the reconfiguration of knowledge systems by engaging with change agents, practitioners, policy-makers and communities in transdisciplinary efforts (Mausser et al. 2013). Attending to these calls for bolder, more creative and integrated transdisciplinary engagement, new ways of learning and knowledge creation are currently being prototyped and researched within sustainability sciences (Clark et al. 2016; Tàbara et al. 2017). For example, the large international scientific program Future Earth places ‘knowledge co-production’ at the heart of its endeavour as a way to generate situated, legitimate and salient knowledge (van der Hel 2016).

Similarly, repeated calls have been made to broaden the repertoire of approaches and practices for addressing global change by engaging with a richer conception of social sciences, arts and humanities (Hulme 2011; Castree et al. 2014; Lövbrand et al. 2015; Hackmann et al. 2014; Jasanoff 2007; ISSC 2013; Fazey et al. 2017). The central claim is that these fields of research can address ‘cultural’ aspects of transformations towards sustainability – as the set of beliefs, values, meanings and worldviews, ways of knowing and being (Horlings 2015; Westley et al. 2011; O’Brien 2012; Adger et al. 2012). Furthermore, framing global change only by its biophysical characteristics has often contributed to conceal the heterogeneous human causes, impacts and solutions (Hulme 2011). Engagement of social sciences, arts and humanities approaches is regarded as paramount to widen the range of problem framings and their solutions space (Hackmann et al. 2014).

## RESEARCH AIMS AND OVERARCHING QUESTIONS

This Ph.D. thesis explores the interface between imagination and transformation, with a specific focus on transdisciplinary participatory processes. These processes engage scientists, decision- and policy-makers, organizations, artists, citizens. I analyse the possibilities and limitations of specific *participatory practices* in fostering different features of individual

and collective imagination as a contribution to transformative capacities (Figure 1). The transdisciplinary processes I present have been designed around participatory practices. They include participatory modelling and future scenarios, that have been conventionally applied in sustainability science research; and art-based approaches, such as performances, visual methods and installation, which only more recently have begun to be integrated within sustainability science. These participatory practices have been proposed to support actors' abilities to respond to, or anticipate rapid change, and shift into novel social-ecological trajectories.

I study these practices through situated transdisciplinary action-research projects in Kenya, Mozambique and the Iberian Peninsula. These three case-studies represent a range of social and ecological contexts and issues, and provide conditions to study the implications of these practices for different features of imagination as a transformative capacity (Figure1).

My work is guided by the following broad research question:

*How may participatory practices, including the arts, contribute to fostering imagination as a capacity for transformations towards sustainability?*

This overarching question has been subdivided into more specific questions that are detailed on page 26 after the literature review. The thesis is composed of four research papers and this Kappa which provides an overview and reflects on the research conducted. In the next section, I explore current global challenges in more detail. I then proceed to review a variety of theories about transformations and transformative capacity. This is followed by a discussion of the emerging literature which establishes the linkages between transformations and imagination and how these may relate to processes of knowledge co-creation and the arts.

The Kappa also contains an overview of the methodology and methods applied in the thesis as a whole. I then summarize my research findings and provide overarching insights. In the concluding remarks I propose and develop the notion of the transformative imagination as one possible way to further transformations research and facilitate transdisciplinary processes involving the arts.



Figure 1. Research Papers I-II-III explore three different features of the imagination as potential transformative capacities. These features will be detailed in the theory section. Paper IV explores the links between arts and transformations in the context of climate change. This Kappa explores how imagination relate to transformative capacities.

# THEORETICAL FOUNDATIONS - TRANSFORMATIONS TOWARDS SUSTAINABILITY

*Transformations towards sustainability* has emerged as a key research frontier within sustainability. This chapter will establish the central arguments and literature underpinning my research in this field. I begin by exploring the notion of the Anthropocene and the challenges that sustainability scientists have described in anticipating and shaping its trajectories. I then review various conceptualizations of transformations within global change research and explore transformative capacity as a key research frontier connected to my research. This brings me to my conception of imagination as a transformative capacity. Finally, I turn to transdisciplinarity and the arts as two key source areas where participatory practices are being developed to support capacities for transformations. I close the chapter by expanding my overarching research question into four specific questions that were addressed in each of the research papers.

## ANTHROPOCENE TRAJECTORIES

We live in times of unprecedented social-ecological change. For Earth Systems Sciences, this means societies have embarked on an age where human activity is the predominant force driving the fate of planetary ecologies (Rockström 2009, Steffen et al. 2015). Anthropologists and historians point out that human action always has been decisive for the fate of local ecologies (Head 2014; Palsson et al. 2013). Yet, it is difficult to deny that the current worldwide speed and scale of social and ecological change gives rise to a context that humans have never experienced before<sup>1</sup>. This new emerging context is causing tectonic shifts in human

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<sup>1</sup> The centrality of human agency as articulated by Earth Systems Science raises conceptual and ontological issues that have started to be addressed within humanities and social sciences (Lövbrand et al. 2015, Brondizio et al. 2016). These have to do with anthropocentrism, the overlook of different historical trajectories and global inequalities by the use of a unified “humankind”.

consciousness leading to critical re-assessment of political systems, institutions, knowledge systems, organizational cultures, beliefs and worldviews (Dryzek 2014, Galaz et al. 2017, Olsson et al. 2017).

Climate change, biodiversity loss, and other rapid global environmental changes illustrate how human activity is profoundly affecting processes that sustained the conditions in which human societies have been thriving for the past 10,000 years (Steffen et al. 2015, Ellis 2015). Characteristic to the dynamic trajectories of the Anthropocene is the blurring between global and local scales, heterogeneous social and ecological effects with high uncertainty and limited predictability, periods of relative stability that can be followed by rapid and at times irreversible change (Gunderson 2001; Lenton et al. 2008; Rockström et al. 2009; IPCC 2014b).

While human development is deeply intertwined with this dynamic biosphere, tipping points, interdependent and non-linear change tends to fall through blind spots of organizational cultures (Ramalingam 2013). It has been argued, that current governance systems, institutions and worldviews are largely unable to respond to the interconnected social-ecological challenges of the Anthropocene (Galaz 2014). There is in fact a growing recognition amongst sustainability scholars, of the need for fundamental changes in institutions and organizations at multiple levels to tackle the underlying causes of these challenges (Westley et al. 2011; Pelling et al. 2014; Loorbach 2014; Galaz et al. 2016).

Some have argued that in some cases, incremental adaptation may perpetuate the underlying dynamics that give rise to risk and vulnerability (Pelling 2010). Anticipation and deliberate transformations thus may be required to move beyond proximate causes of risk like livelihoods and infrastructure to address the root causes of unsustainability within social, cultural and economic systems (Boyd et al. 2015; O'Brien 2012; Purdy 2015). It is in this sense that Dryzek (2014) calls for multiple, reflexive, deliberative and open practices that support the imagination of local configurations of the Anthropocene (Stirling 2011).

My thesis hence builds on the observation that transformations to sustainability are not only about solving technical problems but rather hinges primarily on our ability to imagine and bring to life different social-ecological realities (Beddoe et al. 2009, O'Brien and Selboe 2015).

## TRANSFORMATIONS AND TRANSFORMATIVE CAPACITY

The notion of *transformations* is gaining significant traction in global environmental change discourse. It has been identified by the Intergovernmental Panel on Climate Change as a strategy for tackling climate change (IPCC 2014a). Transformations have been conceptualized, and studied in a variety of ways across different disciplines (Brown et al. 2013; Feola 2015). Running across these various theories is the notion of *fundamental changes* in values, beliefs, worldviews, societal arrangements, practices and relationships between society and nature, leading to interactive, and often non-linear emergent changes across multiple scales and domains (Westley et al. 2011; Loorbach 2014). The use of the concept is to a large extent ambiguous and ranges from transformations as a metaphor that can be deployed to reflect on the nature of change in a certain context, all the way to theoretically informed analysis of transformative change (Feola 2015).

O'Brien and Sygna (2013) have identified four strands within transformation literature. First, within climate change research, *transformational adaptation* is understood as a climate response in places and situations of high risks and vulnerabilities. In such places incremental adaptation measures are unlikely to suffice, and changes in systems form and structure may be required (Kates 2012). The second strand, *transformations towards sustainability* comes from complex systems science and focuses on large socio-technical transitions or coupled social-ecological transformations for instance in energy systems, or food systems (Geels 2011, Loorbach 2007, Olsson et al. 2014). Within this stream, resilience scholars have also analysed transformations towards ecosystem stewardship (Westley 2011, Chapin 2010, Olsson et al. 2014). This field departs from an understanding that society is fundamentally dependent on the biosphere (hence a “social-ecological” approach), and gives particular focus to changes in natural capital and flows of ecosystem services as a result of reconfigurations of social-ecological relations (Olsson et al. 2014; Folke 2016). This field recognizes that systemic change is intertwined with changes in values, beliefs and systems of multi-level governance and management (Westley et al. 2011).

Another large corpus of work, primarily within psychology and cognitive sciences, relates to *transformation in behaviour*. This stream encompasses literature on how attitudes, values and beliefs are changed



through reflexivity (Kegan and Lahey 2009). Various aspects of human agency within transformations have been explored including research on individuals becoming agents of change or overcoming psychological or cultural barriers to climate response (Gifford 2011; Riddell et al. 2012; Witt et al. 2014; Horlings 2015; Horlings 2016). The fourth strand identified by (O'Brien and Sygna 2013) relates to *social transformations* which recognizes the need to move beyond technical dimensions of current interconnected challenges, to include fundamental restructuring of political, economic and social structures undergirding current systems (Pelling 2011; Manuel-Navarrete 2010).

In synthesis, O'Brien and Sygna (2013) suggest a framework based on *three spheres of transformations* highlighting the interconnections between various aspects of transformations studied across disciplines. The *practical sphere*, relates to behaviours and technical responses. It is in this sphere where transformative outcomes are most easily observed, for example in changes in consumption patterns. The *political sphere*, relates to systems and structures that define and constrain possibilities for practical transformations. This sphere encompasses the dynamics of ecological, cultural, economic, legal systems which set 'the rules of the game'. It relates to power arrangements and framings. This is the central focus of research interested in systemic processes that enable or constrain large scale transitions (Loorbach 2014; Olsson et al. 2014). The third sphere – *personal* – is where the individual and collective beliefs, values and worldviews are transformed. Mindsets are regarded as the most powerful source of systemic change, as they provide the basic assumptions that define systems (Meadows 1999).

My view of transformations engages primarily with the interplay between the individual and the systemic (personal and political spheres). I engage directly with changes in cultural dimensions of transformations, in particular dimensions of knowledge. From the resilience perspective on social-ecological transformations, I approach transformations with a view that human life is fundamentally intertwined with the life of the planet (Folke et al. 2011; Berkes and Folke 2000). Therefore, there is a normativity in this perspective which emphasizes the need to pursue transformations that focus on fundamental changes in current social-ecological arrangements to support reconnection of human development to the dynamics of the biosphere (Folke et al. 2011). This is particularly relevant in cases where livelihoods are tightly coupled to ecosystems and environmental change. **Paper I** and **II** focus more particularly on these

social-ecological dimensions of transformations. **Paper III** and **IV** draw from a view of transformations that gives emphasis to the interplay between systemic arrangements in societies (e.g. social, institutional and ecological structures) and the socio-cultural domain (e.g. meaning-making, values, emotions and assumptions). This is particularly important in exploring the role of imagination as a transformative capacity and an important research frontier in terms of methodologies that can deal with these dimensions of transformation.

### **Deliberate transformations**

A key research frontier in the field of transformations focuses on whether these processes can be deliberately initiated and sustained over time (Moore et al. 2014; Westley et al. 2013; O'Brien 2012). Writing from a complex systems perspective, by 'deliberate' or 'intentional', authors do not mean transformations as the implementation of an imagined blueprint. Rather, any intervention in the world is like a perturbation in a complex system that sets in motion a number of trajectories of change that far exceed human abilities to control and predict what may happen (Holling and Meffe 1996). Although in retrospect these changes can be understood to a certain extent, they cannot be predicted.

There is still limited understanding on the kinds of capacities that can catalyse transformative processes (O'Brien 2017; Fazey et al. 2017;). An early concept in this area is the notion of 'transformability' which is considered one of the three aspect of resilience (Folke et al. 2010). Olsson et al. (2010) understands 'transformative capacity' as the ability to break "lock-ins" that operate at different levels and scales and different part of a system. These lock-ins are particular feedback dynamics responsible for sustaining a system's existing trajectories (Enfors 2012).

Much of the research on deliberate transformations has focused on systemic analysis and the role of entrepreneurs and networks (Barnes et al. 2017; Westley et al. 2013; Cumming et al. 2005). Less attention has been devoted to the range of social, cultural and cognitive dimensions that may influence abilities to affect transformations. One examples is the study by Marshall et al. (2012), that found that place attachment, although important for adaptive capacity may be a barrier for actors to engage with transformative change. This suggests a possible trade-off between adaptive capacity and transformative capacity. Another example of a study highlighting the interplay between individual, interpersonal and systemic

change is Riddell et al. (2012)'s study of the conservation of Great Bear Rainforest. They found a range of important individual and collective processes crucial for the unfolding of transformations of views and conservation plans including the creation of powerful personal narratives, humanizing opponents, tolerating conflict and uncertainty, focusing on solutions, building an inclusive vision and understanding dynamics of psychological change (such as the relations between belief change and emotions).

Other progress in understanding capacities for deliberate transformations is the work of Olsson and colleagues on the role of governance ideas in generating alternative trajectories (Olsson et al. 2010). Also, Moore et al. (2014) based on empirical cases of transformations, has described key triggers of so called “pre-transformations”, which can be seen as part of transformative capacity. These triggers include sense-making, envisioning, developing networks and trust, emotional flexibility and personal transformations, skills in planning and learning (Moore et al. 2014; Marshall et al. 2012; van Kerkhoff and Lebel 2015; Tabarà et al. 2018).

I understand *capacity* as the skills of perception and judgement that grow from the direct, practical and sensory engagement with those with whom we share our lives with (Ingold 2011). A collective capacity is the synergy of individual capacities and the social-ecological reality they inhabit that can be brought to bear on a question or challenge. A transformative capacity is then the individual and social skills to create new beginnings from which “to evolve a fundamentally new way of living when existing ecological, economic, and social conditions make the current system untenable” (Westley et al. 2011).

## IMAGINATION AS A TRANSFORMATIVE CAPACITY

Imagination is emerging as a research area of interest in relation to transformations (Milkoreit 2017)<sup>2</sup>. Imagination is central to some of the key transformative capacities described above, such as creating future visions and personal narratives, sense-making, empathizing with other's perspective and so on. In this Section, after describing how I look at and

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<sup>2</sup> See Special Feature in the Journal *Elementa Science of the Anthropocene* “Imagination and imaginative capacity for transforming to sustainability: Future thinking for a world of uncertainty and surprise”.

define imagination, I will expand on the features of imagination explored in the different research papers and how they relate to transformative capacity.

## Imagination

Ideas shape the world. As these ideas at times get inscribed in norms, practices, institutions and in physical landscapes, they also shape future ideas (Purdy 2015; Patomäki and Steger 2010). Human imagination is therefore integral to the ways humans perceive and inhabit the natural world (Purdy 2015; Gottschall 2012; Boyd 2009). Imagination has been the subject of interest across an astonishing range of disciplines (see Table 1 for an illustrative sample of research fields). In its most encompassing understanding, the term imagination is used as synonymous to collective worldviews and the ideas societies hold about the world. It is used to point out tacit ways of *imagining* what life is at its basic ontological categories. For example, Taylor's (2004) notion of 'social imaginaries', as "a common understanding that makes possible common practices and a widely shared sense of legitimacy" (Taylor 2004, 23). Importantly, imagination is not a process anchored solely in the cognition of individuals but it is largely dependent on the organization of society and culture (and their histories) (Mangabeira 2014, 109). These arrangements propel or constrain the workings of the imagination, individually and collectively.

For the purpose of my discussion of imagination as a transformative capacity, I will focus on two key aspects of the imagination. Broadly, the *perceptual* aspect of imagination which relates to how imagination actively shapes and is shaped by human perception in an environment (Andrews 2014); and the *creative* aspect of imagination, which relates to the power of reaching beyond the ordinary, and of creating new ways of seeing and ideas for how to reconfigure the world (Mangabeira 2007).

The '*creative*' aspect is the most commonly discussed aspect of imagination. Imagination is usually seen as an integral part of creativity in its capacity to generate new ideas, images and consider new possibilities to solve problems (Sawyer 2011). Mangabeira (2007) sees imagination as the part of human mind that is able to grasp reality, and experiment with new combinations of meaning. In this respect, imagination is about finding new avenues for thinking and acting by loosening established assumptions and categories of the mind (Wapner and Elser 2016). It is non-rule governed and non-algorithmic. It's the ability to develop infinite new combinations

of meaning. It is through imagination that humans can consider different perspectives and empathize with others. (Camargo-Borges 2017, 92).

The paradox of the work of the imagination, according to (Mangabeira 2014), is that it “expands our access to the present moment by removing us from it” (ibid, 192). He adds, “we grasp a phenomenon from the perspective of proximate change; we progress in understanding a state of affairs by envisaging what it might become in different circumstance or as a result of certain interventions” (ibid, 141).

Beyond this ‘*creative*’ aspect of imagination, other scholars (e.g. Kant’s seminal work) have seen imagination as an active part of human perception (Bateson 1972). In this active *perceptual* aspect, imagination is our capacity to organize perceptions into meaningful coherent unities and hence central to the creation of meaning (Johnson 2014). Imagination supports integration of sense perceptions with memories and notions of possible futures (Pelaprat and Cole 2011). For Vygotsky (1980) imagination is “the process of resolving and connecting the fragmented, poorly coordinated experience of the world so as to bring about a stable image of the world”. It is through this aspect that the collective and the individual imagination intertwine to shape one’s perception and being in the world. For illustrative purposes, a particularly useful example to understand this perceptual aspect of imagination is the methods of Pacific navigation described by Turnbull (2003). By attending and imaginatively integrating sensory information of sea currents, winds, movement of migratory birds, colours of the clouds, and imaginary lines created by rising and setting points of stars on the horizon, traditional navigators are able to move skilfully through long distances towards their destinations (Turnbull 2003). Wayfarers and navigators find their way in the world with the support of the perceptual imagination. It is through this *perceptual* aspect of the imagination that ideas about the world become embodied in our experiences (Hepburn 1996).

This embodied perceptual imagination is also evidenced in how language shapes our understanding of the world. Lakoff and Johnson (1999) discusses how in everyday life imagination mediates the domain of worldly lived experience and the conceptual repertoire deployed to make sense of it. In Lakoff and Johnson (1999)’s view of the embodied mind, metaphors are central for human communication. For instance, if one speaks of “combatting climate change”, we draw an imaginative link between our experience of ‘fight’, ‘battle’ and the domain of action within climate change.

In sum, in this *perceptual* aspect we see imagination as an active aspect of human cognition, central to how we attend, synthesize and generate meaning from our experiences in the world (Brady 1998). Together, the *creative* and the *perceptual* aspects evoke a conception of imagination not as a purely abstract phenomenon in the mind, but rather as an active process central to both the generation of novelty and the synthesis of bodily perceptions in the material world (Johnson 2014). In other words, imagination unfolds between the world of ideas, and the world of sensory bodily lived experiences – “halfway between body and mind” (Claxton 2015, 72). In consequence it is a category influenced both by individual abilities and collective processes. In its sensory aspect imagination is attentive and explorative, and in its creative movement it is about freeing the individual and groups from established categories and evoking novelty.

Table 1. Sample definitions of imagination across disciplines.

Disciplinary field	Key concept and theoretical focus	References
Political science	Imagination as foundation of policy frames; Creation of ‘strong stories’ as mobilizing social change	Schön and Rein 1995, Hajer 2003
Sociology	The sociological imagination is “the awareness of the relationship between personal experience and the wider society” (Mills 1959), 5). Imaginary as “the ability to create and recreate institutions, norms and social relationships by first creating shared ideas or meanings about reality” (Castoriadis, 1997)	Mills 1959, Castoriadis, 1997
Philosophy	Social imaginaries as “largely unstructured and inarticulate understanding of a whole situation, within which features of the world show up with a particular meaning” (Taylor 2004), 23). Myths as “strong imaginative visions of a kind that we must have to shape our thought, to pull together its endless details into some necessary coherence”. (Midgley 2011, 16)	Taylor 2004, Midgley 2011
Psychology	“The term [imagination] may be used very generally to refer to the ability to conjure up images, stories, and projections of things not currently present and the use of those projections for entertaining the self, planning for the future, and performing other basic tasks of self-regulation.” (Taylor et al. 1998)	Taylor et al. 1998

Cont.

Cont.		
Anthropology	Imagination as a movement of opening, of “generative impulse of a life that continuously run ahead of itself” (Ingold 2015, 155)	Ingold 2001
Interdisciplinarity	Transdisciplinary imagination as the ability to attend to and incorporate multiple perspectives from various disciplinary traditions	Brown et al. 2010
Science and technology	Sociotechnical imaginaries as “collectively imagined forms of social life and social order reflected in the design and fulfilment of nation-specific scientific and/or technological projects. Imaginaries, in this sense, at once describe attainable futures and prescribe futures that states believe ought to be attained” (Jasanoff and Kim 2009:120)	Jasanoff 2001
Climate Science	A way of seeing, sensing, thinking, and dreaming the formation of knowledge, which creates the conditions for material interventions <i>in</i> and political sensibilities of the world	Yusoff and Gabrys 2011
Art and aesthetics	Core part of aesthetic judgement, freeing the mind from constraints of intellectual and practical interests	Hepburn 1984
Sustainability	A route to explore multiple kinds of possible sustainability pathways as “sustainability can no longer rely exclusively on scientific knowledge production to determine the right path to a single sustainable future”. (Bendor et al. 2017)	Maggs and Robinson 2016

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### Imagination as a capacity for social-ecological transformations

This conception of imagination as a creative force, and as part of practical and sensorial experience, is I believe particularly useful to the study of social-ecological transformations. Historically, shifts in environmental consciousness have at times emerged from an interplay between imagination and lived experiences of aesthetic, sensorial and emotional encounters with the natural world (Purdy 2015). Aldo Leopold’s direct encounter with the “eyes of the wolf” helped him to imagine the landscape as one living biospheric community (Leopold 1949), and Rachel Carson’s

evocative fear of a (imagined) “silent spring” without bird songs inspired her to write about the need to fundamentally reassess the relationship between humans and nature (Carson 1962). These are just two examples of how imagination, and aesthetic experiences can intertwine to affect cultural roots and powerfully reconfigure ways of being in the world (Purdy 2015; Moore et al. 2015).

Although imagination may seem central to many aspects of deliberate transformations, there is still scant understanding of its causal roles, whether and how it can be conceptualized as a transformative capacity, and how it may be fostered to support different stages of social-ecological transformations (Milkoreit 2017). Some of the imaginative capacities that appear in transformations studies include, for example, exploring possible futures, diagnosing the past, grappling with interconnectedness, empathizing with others perspectives, creating new ideas, narratives, images and framings, identifying institutional resources and next steps, considering alternative ethical stances and values. In this thesis I will focus on three features of imagination that draw from both the creative and the perceptual aspects discussed above (Figure 1).

First is visioning. Societal visions have been found as central to transformative processes (Wiek and Iwaniec 2013; Tàbara 2017; Olsson et al. 2008). The imaginative capacity to explore alternative futures and create visions is perhaps the most widely discussed topic on imagination within social-ecological systems research. This is the central piece of Milkoreit (2017)’s theory of imagination as a “linked cognitive-social processes that enable the creation of collectively shared visions of future states of the world”. The theory describes both the cognitive-emotional processes of individuals and the socio-political processes of developing shared imaginaries of possible futures within a group or societies.

Beyond the ability to grapple with the future, the second feature of imagination I explore is the ability to generate new ideas, images and metaphors that shape understanding of social-ecological relations (e.g. Olsson et al. 2004). The emergence of new ways of seeing social-ecological relations, and the consolidation of those insights into powerful narratives that can mobilize actors across a wide spectrum, is a clear pattern in empirical cases of transformations, particularly in their early stages (Huitema et al. 2009; Tàbara and Ilhan 2008; Olsson et al. 2004; Goldstein et al. 2013; Ernstson and Sorlin 2009). The power of novel ideas in policy transformation has been described across a range of different literatures under various concepts such as “new policy frame” (Schön and



Rein 1995), alternative system configuration (Olsson et al. 2006), alternative policy path (Pierson 2000), or strong stories (Hajer 2010).

The third feature of imagination I study is the ability of perceiving interconnectedness of social-ecological systems, visualizing interdependences, feedbacks and their dynamics of change (Sterman 2008). The sensibility to interconnections in social-ecological realities may be a transformative capacity in that it helps identifying leverage points and sources of lock-in, and in developing pathways that may cater for the needs of the most vulnerable (Ramalingam 2013, 241). Linked to this is the imaginative capacity of perceiving the world “through somebody else’s eyes” (including the natural world). These are particularly important sensibilities in an increasingly intertwined planet where changes are multifaceted and can generate trade-offs between different goals and aspects of human life (Daw et al. 2011) .

Thus, imagination is central to making choices in the world. It shapes the way we perceive and relate to the world; the ideas we hold about the world, and what it may become. Imagination is a necessary component of political, ethical and individual life and affects the way we may go about transforming it. Yet, (Milkoreit 2016) found that as crucial as it may be, imagination “hardly ever happen in the minds of political decision-makers today. It is a cognitive-emotional skill that needs to be learned and practiced” (ibid, 235).

Based on these elements discussed so far, I suggest imagination may be seen as a transformative capacity in the following manner. It is both an individual and a collective process. From the anthropological view of imagination, I see it as an *active* part of human perception that supports the process of making sense of practical and material engagement with the world (Ingold 2015), hence key to navigate transformations. Imagination in this sense is intensively practical – rather than abstract make-believe – and central to synthesis, meaning-making processes and perception of interdependencies in social-ecological realities. Imagination is also linked to the ability to innovate: the sensibilities to grasp systemic interdependences within social-ecological realities, and to move beyond established frameworks of thinking, generating novel ideas, images, narratives that give rise to insights on how to intervene and in what direction. In this sense, imagination creates the conditions for and galvanizes the cognitive and emotional resources for transformations. Based on this, taking from (Yusoff and Gabrys 2011) and extending within the context of social-ecological transformations I define imagination as *an*

*active “way of seeing, sensing, thinking and dreaming” that creates the conditions and sensibilities for material interventions to respond, anticipate and shape fundamental change towards sustainability.*

I have portrayed so far imagination as primarily a positive force, underpinning many of the aspects that give rise to deliberate transformations. Of course, imagination can also be associated to trajectories that undermine sustainability. Some argue in fact that is human ingenuity that has led to the patterns of ecological change observed globally. The conception of imagination as both a perceptual ability that helps societies to grasp the dynamics of the world and as a creative force that societies apply to innovate and create new beginnings can be helpful to understand this. A speculation could be made that current arrangements give primary attention to the creative aspects of innovation and less to the perceptual. Olsson and Galaz (2012) has proposed the concept of social-ecological innovation precisely as a way to bridge this gap. According to their view, the extensive global challenges societies face emerge from the lack of attention to the intercoupling of social and ecological dynamics. Innovations that do not take into considerations these dynamics have often led to the loss of vital ecosystems functions (Olsson et al. 2017). With the notion of social-ecological innovations, Olsson and Galaz (2012) are after ways through which the creative imagination can be informed by the dynamics of complex social-ecological systems. In short, how can the creative imagination be infused by a perceptual imagination of the social-ecological realities we inhabit when devising solutions to current challenges.

This section has outlined an understanding of imagination as a transformative capacity. Implicit in this understanding is the notion of imagination operating at and interweaving individuals’ cognitive-emotional level and the shared socio-cultural level. The task of the next two sections is to introduce *transdisciplinarity* and the *arts* as two key source areas of participatory practices that may foster imaginative capacities.

## IMAGINATION IN TRANSDISCIPLINARY PRACTICES

Although global in reach, impacts of climate change and inequality manifest differently from place to place, and across time (Hulme 2010). Global change is situated and the capacities to respond to its effects will vary according to local institutional and organizational context. Further,

the socio-cultural and historical context shapes the possibilities for imagining solutions.

The trajectories of the Anthropocene challenge the standard “deficit-model” of knowledge production and calls for more sophisticated, albeit challenging, ways of linking knowledge and action (Cornell et al. 2013; Clark et al. 2016; Pielke 2007). A “deficit-model” would assume that knowledge flows from basic research, largely untied to social priorities, to applied research and inevitably to practical benefits (Pielke 2007). Instead, a view of open knowledge *systems* as multiple, interrelated sources of knowledge organized around concrete practices has been proposed as more suitable perspective in the context of social-ecological transformations (Tàbara and Chabay 2013). This may lead to multiple ways of knowing and imagining challenges and possibilities (Stirling 2010). Tengö et al. (2017) has provided guidance to the intricacies of tasks that actors and institutions engage in creating robust ways to weave knowledge systems.

A strong interest has emerged within sustainability on co-production of knowledge in transdisciplinary research initiatives (van der Hel 2016; Moser 2016). These processes have been regarded as central to foster ‘conversations’ between scientific and expert knowledge and the knowledge, values, preferences, beliefs and imagination of communities, to give rise to co-produced ways of understanding possibilities and preferred pathways (Robinson 2004). Participatory knowledge co-production has been also linked to social learning (Muro and Jeffrey 2008), as a way to foster complexity thinking (Rogers et al. 2013), and to negotiation, deliberation and creation of values (Tschakert et al. 2016; Daw et al. 2015). However, important research gaps remain on how transformative capacities may be fostered in collective learning environments (Moser 2016).

Throughout this thesis I studied participatory practices in East Africa and the Iberian Peninsula to explore their potential to foster features of the imagination as a contribution to transformative capacity. Transdisciplinary spaces may offer possibilities, in an open and learning spirit, to create situated forms of understanding that are preliminary, tentative, modifiable yet robust and relevant. Many studies have shown however, how including multiple ways of knowing can be a way to open up new avenues of thinking, imagining and responding to interconnected change (Rittel and Webber 1973; Tàbara and Chabay 2013; Brown et al. 2010).

Generally, transdisciplinary processes involve a range of interest groups in a process designed around certain tools, techniques or practices. Within

social-ecological systems research dialogue (Innes and Booher 2010) and systems thinking (Ison 2008) are the most influential practices and permeate most approaches<sup>3</sup>. Some of the practices studied in this thesis come from systems traditions, such as *cognitive mapping* or *system diagrams* (Kok 2009; van Vliet et al. 2012), *narrative scenarios* and *rich pictures* (Kok and Van Delden 2004; Oteros-Rozas et al. 2015). *Participatory modelling* has also been a widely used approach since 1996 as a way to engage participants in transdisciplinary efforts to develop shared models and systems understanding – mainly through an approach known as *companion modelling* (Etienne 2011, Barreteau et al. 2003).

Although still sparse, a few insights can be traced in recent experiences in relating transdisciplinary spaces and imagination. Bennett et al. (2016) acknowledges that thinking radically about the future is challenging, highlighting the current lack of approaches to move human imagination beyond current state of affairs. Bennett et al. (2016) pointed out that in global scenarios there has been an overemphasis on either dystopic futures or overly optimistic utopias. A second insight relates to how the majority of practices used for knowledge co-creation, even those targeted at enabling transformative change (such as RAPTA (Maru et al. 2017)) are largely focused on fostering understanding of systemic dimensions and less on personal and collective capacities. For instance, transformations are likely to give rise to tensions and struggles on contested issues which can in turn generate lock-ins. Finding ways to include subjective dimensions and develop the skills to deal with them is critical (Carpenter et al. 2009), Maru et al. 2017). Maru et al. (2017), in reflecting on a recent experience with resilience assessment for transformations, suggested that emotional aspects of change are also necessary to acknowledge and address. Although there is plenty of evidence of the importance of emotions for decision-making (Berthoz 2006), for creativity (Csikszentmihalyi 1996), for climate response (Norgaard 2011), there is an apparent gap in developing practices able to embrace ambiguity, fears and other emotional ties that may emerge in the context of radical change.

In sum, there is a great interest, not only by sustainability scientists but also by practitioners in participatory transdisciplinary research. However, there are still major gaps in understanding how they may facilitate the types of learning, rich conceptions of knowledge and development of skills that can support transformations (Fazey et al. 2014, Moser 2016).

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<sup>3</sup> More details on the practices studied in this thesis are provided in Section *Methodology*

## ARTS, IMAGINATION AND SUSTAINABILITY

The arts are perhaps the field of human life most commonly associated with imagination. So far, I have made the argument that imaginative capacities may play a critical role in opening up transformative change towards sustainability. I have pointed to some of these imaginative capacities that have been discussed in transformations literature. I have identified the current gap in understanding how to foster these capacities and discussed the potentials within practices of transdisciplinary knowledge co-creation. In this section I explore the arts as another possible avenue for opening imaginative capacities for transformations.

There are vast opportunities for humanities and arts in engaging the complex social-ecological challenges of global change (see Fazey et al. 2017; Hackmann et al. 2014). Historically artists and artistic practices have played a role in influencing if not shaping institutional innovation and societal transformations (Sommer 2013; Mesch 2013). Under the rubrics of the arts appear radically different forms of activity ranging from classical European paintings to Amazonian crafts, chanting and storytelling - the arts are a constantly heterogeneous evolving force. Some of my key points about its role in transformations are not restricted to a few particular expressions. However, in this thesis I am more concerned with artistic forms and practices that engage with sense-making around the challenges of social-ecological change and sustainability. I'm also particularly concern with "participatory" forms. Although the character of this participation can vary significant – e.g. from reading a poem to taking part of a four weeks immersive future scenario in the Mojave Desert where a group of people can only use four gallons of water a day<sup>4</sup> (Janssen et al. 2017).

Apart from the fact that artists are increasingly invited to and engaging with transdisciplinary knowledge co-creation processes, my central point of departure connecting arts, knowledge co-creation and transformations is this: meaning and values are not only linguistic or cognitive processes; they also depend on and are shaped by a range of other factors including, memories, bodily sensations, emotions, intuitions, imagination (Johnson 2013; Lakoff and Johnson 1999). I call these 'more-than-rational' aspects of meanings and values. This is in line with the so-called embodied cognition perspective that sustains that meaning is rooted in our bodily

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<sup>4</sup> See Marco Janssen's project Drylab2023 inspired by Elinor Ostrom's work. <http://drylab2023.net>

experiences in the world (Clark 2016; Lakoff and Johnson 1999). For this 'embodied' perspective emerging in philosophy, anthropology and cognitive sciences, meaning grows from bodily perceptions, images, qualities, feelings and emotions (Johnson 2008). Insights from a wide range of disciplines support this, for instance the notion that emotions are central for judgement and decision making (Damasio 1994; Johnson and Tversky 1983; Schwarz 2000; Lerner et al. 2015).

'Embodied meaning' is seen as an aesthetic process of encountering the world in everyday life. What makes art particularly interesting is that it engages the same structures and processes that people use in everyday life to create meaning and values. In this way, the arts have a unique quality of enacting meaning beyond concepts and propositions. Johnson (2008) argues that art is important in that "it helps us to grasp, criticize and transform meaning and values" (Johnson 2008, 22). Pragmatist John Dewey claimed in *Art as Experience*, that art is a critical process of meaning-making in that it "provides heightened, intensified, and highly integrated experiences of meaning using all of our ordinary resources for meaning-making" (from Dewey 1934, quoted in Johnson 2008).

Eisner (2002) also claims artworks play an important role in refining our sensory system and nurturing imaginative capacities. They do this by offering people a focused opportunity to attend to qualities of sight, sound, taste and touch and in order to *experience* things rather than just receiving a description. Similarly, Augusto Boal, founder of the *Theatre of the Oppressed* inspired by the work of Paulo Freire, insists that crucial for the transformation of social consciousness is a form of non-verbal knowing he called "sensorial thinking" (Boal 2009). Similar to how I described the perceptual imagination, Boal (2009) sees *sensorial* thinking not as a storage of sensorial information. Rather, it is an active way of orchestrating and integrating sensory information with those already experienced. Boal (2009) observes that, although societies prize forms of discursive communication, concepts are never only sound and abstract meaning. They always "appear to consciousness together with fluttering clouds of images, that depend on our culture, personal past and the moment we live in" (ibid, 79).

My research has focused on two key aspects of art contribution to transformations: artistic practices as a form of research on social-ecological relations and artworks as facilitators of experience.

## Art-based research

Artistic practices can be a form of research to study social-ecological realities. Or as Erin Manning puts it, creative practice is a form of thinking (Manning and Massumi 2014). Artworks are the result of a specific artistic research practice developed by the artist. A dancer might devise a particular set of exercises that gives rise to certain kinds of movements and performance; the painter might devise a particular way of using brushes, paint and bodily movement or apply certain constraints on observation of a landscape. These practices afford certain kinds of interactions with the world and structure the creative process (Bayles and Orland 2001). They are ways of attending and probing the world (Smith and Dean 2009, Sullivan 2010, Manning and Massumi 2014). It is in this sense that artistic practices can be seen as ways of paying attention to the world (Ingold 2015). For philosopher Susanne Langer, artworks are a movement that gives form to human feeling (Langer 1953). More important than the artefacts art generates, the “moulding of the life of feelings”, according to Langer, is the most unique experience that arts can create (Langer 1953). Langer insists that “feeling” must be understood in its broadest sense, as “everything that can be felt, from physical sensation, pain and comfort, excitement and repose, to the most complex emotions, intellectual tensions, or the steady feeling-tones of a conscious human life” (Langer 1947, 15).

Art as research (or art-based research, or practice-led research) has a long history (Leavy 2015). McNiff (1998) defines art-based research as “the systematic use of the artistic process, the actual making of artistic expressions in all of the different forms of the arts, as a primary way of understanding and examining experience by both researchers and the people that they involve in their studies”. A social-ecological perspective would encompass also the ecologies of the more-than-human world (Berkes and Folke 2000).

## Art as experience

The second element of concern in regards to arts is that artworks can have an impact on imaginative capacities by promoting experiential forms of engagement. Artworks are facilitators of experience as they invite audiences and participants to take part into the life of the work. This has been particularly used within environmental change. Since many of the

environmental problems often do not belong to (or at least are hidden from) the ordinary everyday life, they might be difficult for people to engage with. Artworks, as ways of giving form to human feelings, can be an embodied way of meaning-making around social-ecological change (Knebusch 2008; Mazur et al. 2013; Curtis 2009).

Art-based research and art experiences may help dealing with ambiguity, loss and emotions (Bayles and Ordland 2001, Kingsnorth and Hine 2009). It may develop empathy for ecological restoration (Curtis 2009) and facilitating associative thinking which is considered key for creativity (Scheffer et al. 2015). In art experiences constraints of the imagination and fixed categories of thinking may loosen-up and uncommon connections between aspects of the world can give rise to new meaning (Eisner 2002). For Kagan (2014), the key role of the arts is to develop human sensibilities to the interconnectedness of life in the planet.

In sum, the arts may offer particular forms of embodied reflexivity and contribute new ways through which societies interact and make sense of complex challenges of the Anthropocene. The arts can help exploring experientially possibilities of alternative social-ecological arrangements, providing vivid spaces where to think and feel (Kagan 2015). Artistic practices and artworks can stimulate embodied, imaginative and emotional experiences that may promote novel ways of reasoning, valuing and responding to social-ecological change more linked to personal experience.

### **Artistic practices and sustainability**

Since the emergence of land art in in 1960s and 1970s, environmentally-based art has grown and expanded (Kastner and Wallis 1998). They encompass a rich set of forms from earthworks, sculptures, environments, performances and many others (Kastner and Wallis 1998). In recent years, an expanding frontier has emerged within sustainability science exploring the interface between arts and sciences<sup>5</sup> in particular within processes of knowledge co-creation. According to (Heras and Tàbara 2014) the growing interest in the arts comes from a search to expand the range of research approaches due to perceived limitations found in traditional scientific methods to integrate multiple forms of knowledge, emotion and action. Heras and Tàbara (2014) found that “performative methods” such as theatre can complement conventional participatory methodologies by

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<sup>5</sup> See for instance the Special Issue “Reconciling Art and Science for Sustainability” on the Journal Ecology and Society.



bringing out embodied knowledge through exploration, imagination, humour and empathic experience. For example, Brown et al. (2017) explored “forum theatre” (Boal 2000) as a way to reveal sources of risk and resilience with coastal communities in Kenya and UK. Through the various elicitation techniques their study shows how the approach was able to capture “what matters to people in times of change”. Heras et al. (2016) also used a theatrical approach building from Boal’s techniques to explore future scenarios with young people in a Man and Biosphere Reserve in Mexico. Key amongst their findings was the ability of the process to connect individuals concerns and desires with community challenges enacting awareness and sense of ownership of the future.

Other art practices such as mural art making and storytelling have also been applied with indigenous communities in the Arctic (Rathwell and Armitage 2016). They found that art objects can have a powerful influence in bridging knowledge between young and elders and helping communities to grapple with social-ecological change. (Milkoreit 2016) has hypothesized that climate-fiction is a powerful way to foster imagination regarding the intricate relationships between climate, society, economics, technology and politics by stimulating a range of aspects of learning including exploring values and ethical dimensions of climate change. Similarly, Merrie et al. (2017) has developed a science fiction prototyping method that expands conventional future scenarios approaches, and hence more explicitly encompasses non-linear change and co-evolutionary dynamics of integrated social-ecological systems. Some have highlighted how artistic practices can help people understanding the limits and potentials of human life in intricate ways. One example is Österblom et al. (2015) discussion on how the art of magic harnesses the limits of human cognition and hence can be an interesting way of engaging students with discussions about uncertainty, biases and attention.

Artistic practices have emerged as a frontier in social-ecological research but the linkages between arts, transformations and imagination are still largely unexplored. Studies so far have primarily explored social-ecological futures, and several scholars make a case for the ability of the arts to bridge and develop reflexivity in knowledge systems, to engage with plural values, to connect societies to nature, to others and to future generations (Tàbara et al. 2017; Milkoreit 2017; Yusoff and Gabrys 2011; Edwards et al. 2016). My research builds on recent experiences within social-ecological and transformations research to explore the potential of the arts in fostering

imagination and embodied ways of responding, anticipating and creatively engaging with social-ecological change.

## RESEARCH QUESTIONS

As elaborated above, the imperative of transformations towards sustainability is yet to be met with knowledge about the practices for facilitating transformative change (Page et al. 2016). I have discussed imagination as a potential capacity for transformation. I identified two key aspects of imagination as a transformative capacity, the creative and the perceptual. That is, to grapple with imagination as a capacity for transformation we need to understand it beyond its ability to generate images of the future and extend towards how it shapes the way we perceive and inhabit the world. I then explored three key features of the imagination that I will address in each of the research papers (summaries below). We saw transdisciplinary action-research is expanding within sustainability but relatively little is known about how these processes may generate capacities for transformations. I then moved to explore the arts as another possible source where novel embodied and imaginative practices are being developed. I'm particularly concerned with how these practices may forge ways to create, integrate and connect various ways of knowing, seeing, perceiving and acting in the world.

Within this research space, my main guiding question stated in the introduction – i.e. “*How may participatory practices of knowledge co-creation, including the arts, contribute to fostering imagination as a capacity for transformation towards sustainability?*” – has been subdivided into more specific questions. Each of these is linked to one of the four research papers that compose the thesis. Each question addresses a specific feature of imagination as a transformative capacity.

*Paper I* explores the question “*how can participatory practices foster sensibilities towards social-ecological interdependencies and values trade-offs?*”. Transformations are likely to encompass multiple trade-offs and dilemmas which at times can be sources of lock-in (Brown 2015). For example, when particular narratives ignore dynamics of trade-offs by promoting more attractive ‘win-win solutions’. Learning to address trade-offs is an important part of developing robust interventions in social-ecological

systems (Daw et al. 2015; Howe et al. 2014). The sensibilities to perceive the intertwining of various social-ecological aspects and their dynamics, and imagine how to put those insights into practice are important capacities for transformations (Folke et al. 2011).

*Paper II* explores the question “*how can participatory practices foster the development of social-ecological narratives*”. The ability to foster individual and collective imagination to build shared narratives that weave together meanings, knowledge, values, interests and new assumptions about the world, has been proven to be key in early stages of transformations (Olsson et al. 2006; Huitema and Meijerink 2010). With a case in Kenya and Mozambique, I seek to understand the possibilities of participatory practices of *systems diagram* and *futures thinking* for creating shared meanings and support inquiry into narrative assumptions.

*Paper III* explores the question “*how can art-based approaches support visioning in the context of transformations?*”. Visioning is regarded as a key transformative capacity in that it develops and awareness of desirable futures (Wiek and Iwaniec 2013; Costanza 2000). I develop and analyse an empirical art-based participatory approach to visioning in the context of high-end climate change in Iberia to understand how artistic practices and experiences can be practically engaged in shaping visions of the future.

*Paper IV* combines a literature review with a global synthesis of climate art projects and asks *how are the arts engaging with climate change and how may it contribute to transformations?* With this cross-disciplinary literature review I draw out key suggested contributions of the arts to transformations. I also analyse artistic engagement within the area of climate change by building and analysing a catalogue of existing worldwide climate-arts projects and initiatives.

In short, this thesis contributes an exploration of imagination as a potential transformative capacity (**Kappa**). The research papers studies three empirical cases (coastal Kenya, coastal Mozambique and Iberian Peninsula) to gain insight into how participatory practices (including participatory modelling, scenarios, visual methods and performances) may contribute to fostering three features of the imagination: the sensibilities towards social-ecological interdependencies and trade-offs (**Paper I**); the

capacity to develop social-ecological narratives (**Paper II**); and transformative visioning (**Paper III**).

In choosing a transdisciplinary approach to study these features of the imagination, my results report on changes that happened within the timeframe of the processes. To understand how these observed changes may evolve to effect systemic transformations lies beyond the scope of this research. Taken as a whole I expect insights emerging from this thesis to contribute to understanding practices and processes that foster the imagination so that societies can more skilfully respond, anticipate and shape social-ecological trajectories in the Anthropocene.

# METHODOLOGY

This thesis builds from and extends on-going efforts of sustainability science to co-design and co-produce knowledge with society. Transdisciplinarity in sustainability science is, as noted earlier, becoming more prevalent (van der Hel 2016). Sustainability scientists have striven to engage a broad and pluralistic approach to knowledge, and to deploy a wide range of ‘ways of knowing’ to describe particular problems and to engage societies in learning processes (Wals 2011; Scholz and Steiner 2015). No approach is neutral however. Undergirding each practice used to pursue knowledge is an understanding of the nature of the world (its ontological commitments) and how a researcher might go about studying it (epistemological directions). Moses and Knutsen (2012) support the notion that robust research designs should reflexively strive for an alignment between ontological commitments, epistemological inclinations and methods choices. Although Moses and Knutsen (2012) saw a general diminishing reflexivity by scientists on methodological issues, a wave of early career sustainability scientists are addressing these issues in the search for robust and agile research designs (Haider et al. 2017; West 2016; Enqvist 2017; Schill 2017; McGowan et al. 2014). The important insight is that simply putting together various methods and assuming they will yield increased clarity is problematic when their methodological underpinnings ‘misalign’. This is important in transdisciplinary contexts such as those in which I developed my research, in particular because of its goal of embracing multiple ways of knowing (Mauser et al. 2013, Tengö et al. 2014).

This thesis is built on three empirical cases of transdisciplinary processes and one review and global analysis of the emerging field of climate-arts. Two transdisciplinary processes were conducted in Kenya and Mozambique in the context of poverty alleviation and ecosystems change (**Papers I-II**) and the third in Iberian Peninsula in the context of high-end climate change<sup>6</sup> (**Paper III**). Each iterative transdisciplinary process was

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<sup>6</sup> High-end climate change (HECC) refers to possible futures where global average temperature raises above 2°C (Berry 2017).

designed around a set of participatory practices including systems diagrams, scenarios, performances and an art installation.

In this thesis, I make a distinction between the *participatory practices* that composed the transdisciplinary processes design (Table 2), and the *research methods* I utilized to conduct research on these practices (Table 3). The *participatory practices* (Figure 2) have been part of transdisciplinary processes designed by teams of scientists, within which I had various roles – I detail these in the section *My multiple roles* below. Each of these *practices* are derived from different “ways of knowing” the world (they have particular ontological and epistemological perspective), in that they structure participant interaction and commit participants to a particular way of perceiving social-ecological complexity. To study them I have applied a mix of *research methods* from the qualitative research tradition.

Next, I describe my own ontological departure and proceed to discuss how these assumptions shape the epistemological approach I took for the selection of methods.

## ONTOLOGY: ONE WORLD

At the heart of this thesis is a view of the deep entwining of the natural and the human world. We inhabit a world where human societies are fundamentally interdependent and co-constituted with nature. It is a world of becoming textured the ever-extending trajectories of living beings as they trail through the world. The entwining of life lines produces what Swedish anthropologist Torsten Hägerstrand called “the tapestry of nature which history is weaving” (Hägerstrand 1976), p.332). In this tapestry, there are no inside or outsides, only openings and ways through. It is not a field of interconnected points, but of interwoven lines. Not a network but what anthropologist Tim Ingold calls a ‘meshwork’. This meshwork is created from the ongoing correspondence – answering to one another – between life lines (Ingold 2015). This ontological position emphasizes how human cultures shape and are shaped by the ecological realities we inhabit. I do not conceive of mind and body as two separate ontological kinds, which leads me to align with a view that thought grows from the interplay of sensorimotor capacities and the world (Johnson 2008). This is a different conception of the mind than that held by the theory of representational mind, that contends the basic function of the mind is to create an internal representation of the external world. Instead, my view

places in focus the intrinsic relations between body, mind and the inhabited environment (Midgley 2011, Lakoff and Johnson 1990) and hence how meaning, values and knowledge emerge through embodied practice (Cook and Wagenaar 2011; Cooke, West, and Boonstra 2016).

From this ontological position, I see transformations as emergent trajectories from intertwined social and ecological dynamics. Action is first and foremost an “undergoing” of beings immersed in the currents of life. ‘Interventions’ are like a perturbation in a complex system that sets in motion a number of trajectories of change that far exceeds human ability to control and predict (Holling and Meffe 1996). Although in retrospect these changes can be understood (as history), they cannot be predicted. In this sense, deliberate transformations are not to be understood as the implementation of an already imagined blueprint into the future. Rather as actions in a constant state of departure from a current state of affairs.

## RESEARCH APPROACH

There are a few epistemological implications flowing from this ontological perspective. In this thesis, I acknowledge the existence of an observable reality but the observation of processes of change is subject to interpretation and meaning-making processes. Social structures in this view are actively shaped as people engage reflexively, assess them and deliberate on sustaining or transforming these structures. I recognize the central role of ideas with which societies think about the world and how these ideas shape the world we inhabit.

My research is situated within the principle of creating knowledge with society. I use the term “transdisciplinary processes” to denote an action-research<sup>7</sup> approach that strives to engage with knowledge and values from practitioners (Scholz and Steiner 2015; Nicolescu 2014). This is akin to the participatory action research (PAR) tradition (Pretty 1995). Flyvbjerg (2001) sees a form of research done *with* people, “sometimes to clarify, sometimes to intervene, sometimes to generate new perspectives, and always to serve as eyes and ears in our ongoing efforts at understanding the present and deliberating about the future” (ibid, 166). In PAR researchers and participants investigate an issue of collective interest in a cyclical process of exploration, knowledge construction and action (Reason and

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<sup>7</sup> The term “action research” was first introduced in K Lewin, “Action research and minority problems” in *The Journal of Social Issues*, 2(4) 1946, pp. 34-46;

Bradbury 2001). The process aims at developing scientific and socially relevant knowledge through iterative forms of critical research explicitly oriented to social change.

In being a solution-oriented field of research (Kates et al. 2001), sustainability science recognizes the importance of linking knowledge to action (Cornell et al. 2013). A PAR setting is particularly suitable to study transformative capacities because it brings a researcher to situations where the challenges and possibilities for knowledge generation are experienced. Where scientists, practitioners and citizens seek to grapple with the challenges of triggering novel social-ecological trajectories (Rittel and Webber 1973; Fazey et al. 2017).

The transdisciplinary processes I studied were initiated by scientists, therefore did not take a communities' concern as a starting point – as PAR approaches strive for (Kemmis et al. 2013). The processes were also not directly aimed at informing a specific political processes or agenda setting processes. For this reason, I think of them as spaces for “co-creation” – that is, spaces where sustainability scientists in the context of practically and theoretically informed questions engage with practitioners (of various walks of life) to co-develop understanding, framings, and perhaps values and ideas of how to engage with social-ecological challenges. Within these co-creation spaces, knowledge may be co-produced, integrated, cross-fertilized (Tengö et al. 2014).

I conceptualize the transdisciplinary processes I studied as situations, structured by various participatory practices, where participants can experiment with new practices which afford particular ways of seeing and encountering the world. Although not immersed in participants' everyday practices, these processes may create the conditions for reflecting on current practices and may open up new ideas for change. They offer a possibility to experiment with alternative ways of knowing, with the potential to develop capacities and skills relevant for transformational work.

As explained in the Section *Transformations and Transformative Capacity*, my view of transformations attends to the interplay between individual capacities, imagination, actions, choices, values, and the collective systemic dynamics. The analytical boundaries across my papers are primarily on the interplay between individual and collective meaning-making processes. For instance, I do not analyse directly how institutions or organizations undergo change. However, in working with individuals



that represent them, my research points to a range of possible of these transdisciplinary spaces that may lead to broader change in future.

In choosing to study transformative capacity in a transdisciplinary setting, the intention is not to measure capacities as they may be expressed and sustained in participant's everyday practices. Rather, the focus is on how various participatory practices may contribute to the development of various aspects of imagination for transformations.

## CASE STUDIES

This thesis builds on three empirical studies of knowledge co-creation amongst practitioners (including scientists) in East Africa in the context of poverty alleviation and ecosystems change (*Pmowtick* and *Spaces* project) and in the context of high-end climate change in Europe (*Impressions* project). These transdisciplinary initiatives were conducted within large multi-country research projects, involving dozens of local and international scientists (Table 2). The projects themselves were built on long-term collaboration between European and African researchers. Each project conducted a series of workshops which I refer to as transdisciplinary processes. *Pmowtick* and *Spaces* had two workshops with six months interval and *Impressions* had three workshops, each approximately a year apart. Each of the workshops were organized around a set of participatory practices. The set of cases provided opportunities to study more conventional practices like systems mapping and scenarios, and other less conventional practices from the arts such as performances and art installation (Figure 2). **Paper IV** is a literature review and a global study of artistic engagement with climate change.

The selection of cases was not defined at the start but evolved during the course of my Ph.D. They now represent a rich combination of complex social-ecological contexts, scales and includes cases both of global North and South. **Paper I** explores a local case (a specific landing in coastal Kenya). **Paper II** relates to a regional scale (a coastal region in Kenya and Mozambique) and **Paper III** is a large scale multi-country case (Portugal and Spain). Each of the cases provided suitable material to study the complexity of transdisciplinary processes. Despite their diverse settings, the key similarity was that they all invited a mixed group of participants from across various societal sectors and levels, and there was some level of overlap in the use of participatory practices (Figure 2).

I first joined project *Pmowtick* in Kenya (**Paper I**). The second project, *Spaces*, built on the experiences from *Pmowtick* and expanded the scope to include more cases in Mozambique (**Paper II**). The possibility of collaboration with project *Impressions* emerged along the way. In meeting the *Impressions*' project team, we identified a common interest and opportunity to combine my own artistic practice within visual arts and performance, and *Impressions*' goals of expanding the methodological approach to explore climate transformations from the arts perspective. Collaborating with *Impressions* project gave me the possibility to widen the range of practices studied and gave rise to the art-based process described in **Paper III**.

## PARTICIPATORY PRACTICES USED IN THE TRANSDISCIPLINARY PROCESSES

Here I provide a brief overview of the epistemological inclinations of the two broad families of participatory practices studied in this thesis: systems- and art-based. Some of these practices have been used across multiple cases (Table 2). Both approaches provide ways to grapple with complexity. They do so however with different epistemological underpinnings. Because I distinguish between them, the reader should not assume a stark division – e.g. art-based approaches do not exclude systems thinking altogether; systems-based approaches also involve experiential learning. These practices have been chosen as case studies because a) in the case of systems-based approaches, they have been widely used to support transdisciplinary initiatives, institutional change and governance; b) in the case of art-based because of my own practice within arts, and because they have been used extensively (particularly in Teaching and Education, Public Health research) to facilitate personal and collective change.

*System-based approaches* are rooted in a complexity perspective (Norberg and Cumming 2008). These approaches seek to map and understand causal relationships between different aspects of reality and hence rely heavily on the need to define boundaries (of the system as a whole and of different entities in the system) (Meadows 1999). These approaches understand dynamics by looking at how change propagates across relationships and how they are reinforced or dampened by feedback mechanisms. The most widely used practices are *system diagrams* or *cognitive mapping* and *scenarios* (Kok and Van Delden 2004; Peterson et al. 2003). More recently, Bennett et al. (2016) developed a technique for

‘futures mash-up’ that takes positive elements of the present to explore radically different configurations of the future. The ‘seeds approach’ departs from a positive theory of change (Cooperrider et al. 2000) and is intended to foster imagination of futures more attuned to the dynamics of the Anthropocene.

Different practices can be used with different epistemological positions (Ison 2008). For example, in the process reported in **Paper I** the practices were conducted with a tendency towards a realist position, as if there is “a system out there” that could be mapped through the process of participatory modelling. Assuming systems are models of the world (as ontologies) is a position associated to ‘hard systems thinking’ traditions’ (Ison 2008). ‘Soft systems thinking’ traditions, takes conceptual systems models as intellectual constructs (epistemologies) (Checkland 1985). The case studied in **Paper II** used systems-based practices with the latter inclination, first by allowing multiple groups to create multiple system diagrams, implying that a system configuration depends on how it is seen (Ison 2008).

*Art-based research* used in **Paper III** according to (Leavy 2015) is an extension of the qualitative paradigm in important ways. First is that qualitative methods such as interviews and narrative approaches, to a large extent, focus on meaning expressed in words. Art-based approaches can tap into other forms of meaning-making such as bodily experiences, movement, visual, skills, and others (Eisner 2002).

Art-based approaches are also particularly attentive to *process* and hence approaches knowledge as tentative, temporary and dynamic (Eisner 2002). Particularly important for my research, is the possibility that arts may contribute to opening up human imagination and creativity beyond a more narrow “purposive consciousness” (Bateson 1972) – i.e. ways of thinking that are narrowly analytical and solution oriented. Engagement with arts may foster experiences that are not ‘solution-oriented’ but rather question-based and reflexive that may help people to “imagine/enchant, detach/subvert and empower/catalyse” (Kagan 2014).

RESEARCH PAPERS		I KENYA	II KENYA MOZAMBIQUE	III PORTUGAL SPAIN
Dialogue	Bohm 1996			
Systems mapping	Ison 2008			
Participatory Modelling	Ettiène et al. 2001			
Interactive Prototypes	Barreteau and Bousquet 2001			
Scenario Planning	Peterson et al. 2003			
Seeds of Good Anthropocene	Bennett et al. 2016			
Performance	Leavy 2015			
Visual methods	Pink 2012			
Installation	McNiff 2013			

Figure 2. Participatory practices that composed the three transdisciplinary processes studied in this thesis and their key references. The number of dots on a single line represent the number of workshops that a particular workshop series had. Black dots mark the specific workshop in which the practice was conducted.

The move from system-based approaches to art-based approaches was driven by the search for complementarities between the various approaches. Apart from following emerging ideas in sustainability science community, I took on the opportunity to explore an art-based approach for two reasons. The first is that I have been a practitioner of Augusto Boal's theatre, and have witnessed the astonishingly powerful effects of the "theatre of the oppressed" in empowering vulnerable communities in Brazil, where I grew up. I have in this sense been primed to assume a potential in the arts for transformations in consciousness. The second reason came from the opportunity of meeting change agents in Kenya (during *Pmowick* project). There I understood the power of systematic thinking in systems-based approaches. However, I also noticed that what those practices considered as important information did not include some of the qualitative aspects such as stories and passion about finding better futures for the coast that I was hearing in direct engagement with participants. The experience left me with the conviction that those qualitative aspects of thinking and feeling were also relevant knowledge and robust ways of including them needed to be found.

## PARTICIPANT SELECTION

Since the transdisciplinary processes I studied were led by and encompassed a wide network of researchers (Table 2) I did not control the selection of participants. However, the systematic methodologies used for participant selection fulfil the standards of PAR in ensuring that relevant perspectives are present and power structures are represented. The projects *Pmowtick* and *Spaces* shared the same participant selection method based on (Brown et al. 2001) whereas project *Impressions* used a method based on (Ulysses Project 1996). Nonetheless, participant selection in all case studies shared some similar features. Both methods began by identifying key institutions and individuals from the case-study area. This was done via expert knowledge of team members and “snowball” recommendations by people in key organizations and institutions. Overall, participant selection gave priority to diversity of knowledge. For instance, inviting a balance of gender, public officials, community leaders, non-governmental organization, etc. Formal invitation letters were sent explaining the purpose and objectives of the project and terms of participation. The final list of invitees ranged from 16 (*Pmowtick*) to 25 (*Impressions*) and included community leaders, NGO’s, local scientists, policy makers and public administrators. A small number of invitees were not able to attend, and some of those sent another person in their place. This resulted in a few cases that not all organizations invited were represented.

The installation artwork discussed in **Paper III** differed from this selection model since it was open to the public in Cáceres, Spain for a period of two months. The goal was to open up discussions with the wider public, albeit at a much lower intensity of participation and interactivity. Visitors of the San Francisco Cultural Complex had the chance to contribute to the process of visioning, but not as actively as participants who participated in the performances and in the science-led workshops within *Impressions* process (more details in **Paper III**).

Table 2. Overview of the transdisciplinary processes studied in this thesis.

Transdisciplinary process	Context in focus and invited participants	Overall goal of the project	My contribution to process design	Related papers in this thesis
<b><i>P-mowtick</i></b> – Participatory modelling of well-being trade-offs in coastal Kenya	Coastal Kenya. Community representative, practitioners, scientists, NGO representatives, government officials	Improve understanding of trade-offs in coastal social-ecological systems in order to better address issues of community well-being and ecosystem degradation.	Co-creation of scenarios; implementation of interactive toy-model; workshop facilitation	Paper I
<b><i>Spaces</i></b> – Sustainable Poverty Alleviation from Coastal Ecosystem Services	Coastal Kenya and coastal Mozambique. Community representative, practitioners, scientists, NGO representatives, government officials	To enhance understanding of the coastal social-ecological systems in terms of feedback dynamics, trade-offs and opportunities for sustainable poverty alleviation in coastal Kenya and Mozambique.	I provided some guidance to the process design team in terms of key learning lessons from the previous project. I was responsible for designing and conducting process evaluation	Paper II
<b><i>Impressions</i></b> – Impacts and Risks from High-End Scenarios: Strategies for innovative solutions	Iberian Peninsula. Practitioners, scientists, NGO representatives, government officials	To advance understanding of the implications of high-end climate change, involving temperature increases above 2°C, and to help decision-makers apply such knowledge within integrated adaptation and mitigation strategies.	Responsible for creating art concept and artistic production	Paper III

Table 3. Research questions, object of study and research methods of each research paper.

Related papers in this thesis	This thesis research question addressed	Object of study	Research methods and data Collection	Analysis
Paper I	RQ1: how can participatory practices foster sensibilities towards social-ecological interdependencies and values trade-offs?	Systems diagrams, Participatory modelling, Scenarios	Interviews (12) Surveys (4x25) Participatory workshop (2) Ethnographic notes	Qualitative thematic analysis
Paper II	RQ2: how can participatory practices foster the development of social-ecological narratives?	Systems diagrams, Scenarios, "Seeds of the Good Anthropocene"	Participant observation Interviews Surveys Participatory workshop	Hybrid deductive-inductive thematic analysis; Triangulation between workshop data, interviews and process observations
Paper III	RQ3: how can art-based approaches support visioning in the context of transformations?	Art-based research, Performance, Visual arts, Installation	Direct observation Survey (12) Focus group (2)	Qualitative thematic analysis;
Paper IV	RQ4: how are the arts engaging with climate change and how may it contribute to transformations?	Literature, climate-art catalogue	Global review	Literature review and catalogue analysis



## MY MULTIPLE ROLES

One of the key pillars for reflexive transdisciplinary research is to be cognizant of the multiple and at times overlapping roles a researcher may have and how that affects research (Wittmayer and Schöpke 2014; Barnaud and Van Paassen 2013). It is challenging to grasp the myriad of biases that can emerge in this kind of research, but developing situational awareness and agility to switch roles depending on the stage of the process, is an important skill and contributes to robust science (Wittmayer and Schöpke 2014). I describe here the roles that I took within each transdisciplinary process by drawing from Wittmayer and Schöpke (2014)'s framework on different roles that sustainability scientists play in transitions processes.

In the first project (*Pmowtick*, **Paper I**) I acted initially as a “process facilitator” by co-designing the process and tools, and by facilitating activities during workshops. Session facilitation gave me a direct insight into how participants engaged with the various practices of participatory modelling and scenarios. However, it also meant a more partial and fragmented process observation. In the third project (*Impressions*, **Paper III**) I also acted as “process facilitator” by creating the artworks of performances and installation. The creation of an artwork is a long process and there is a risk of developing an attachment to the end product, and become biased against negative feedback. This can in turn influence the final report. I maintained a level of detachment from the final artwork by keeping my focus on the process and on the understanding of the artwork as one element in a shared journey with participants. From the beginning I understood the artworks as a means to a shared inquiry. Participants were also encouraged to shared their views via anonymous surveys (in year 1).

The second role I played was that of “reflective scientist” by collecting, analysing, interpreting and reporting data presented in **Papers I-II-III**. In **Paper I**, I switched from “process facilitator” to “reflective scientist” at the end of the workshop by attending debrief sessions amongst all facilitators, and by going back to notes taken during the workshops. In **Paper II** (*Spaces project*) I was exclusively dedicated to reflection. I was present in all workshops, and was presented to participants in the role of “independent researcher”, whose key objective was to understand the learning process. In **Paper III**, together with my co-authors we stimulated a focus group discussion after each performance. At that particular point my roles of facilitator and reflection overlapped.

A final role that I dealt with particular care, was that of a “change agent” (Wittmayer and Schöpke 2014). I assumed this role in all cases by the fact that

I am motivated by creating solution-oriented and empowering processes. As facilitators of transdisciplinary processes, we become enrolled in unfolding changes in these systems, to an extent that is often hard to grasp. In speaking to participants, I noticed that at times I was perceived by some participants as part of the international facilitation team of *Pmowtick* and *Spaces* projects and as someone who could potentially open material possibilities. Every time I noticed particular expectations of this kind, I reinforced the message that was given in the introduction of the projects – i.e. that this was a research project and we did not have the ability to intervene in the systems.

## RESEARCH METHODS USED IN THE THESIS

In this section I provide an account of my approach to participation with, analysis of and writing about processes of co-creation. Although the research methods are presented in a comprehensive and linear way, in reality the search for coherence and robustness was an iterative process between research questions, theory and methods.

### Data collection

I used qualitative methods including participant observation, focus groups, interviews and surveys. The workshops in Kenya were conducted in English, and most of the interviews were conducted in English. A few (3 in **Paper I**, 4 in **Paper II**) were conducted in Kiswahili which were then translated by the interviewer (co-author Lydiah Muniy). The workshops in Mozambique were conducted in Portuguese (my mother tongue). In project *Impressions*, performances contained Spanish, Portuguese and English statements (I am fluent in all three). Focus groups were conducted with all three languages as participants were encouraged to answer in their mother tongue, or the language they felt more suitable for their observation. I translated these in English for coding.

### Iterative reflexivity

For **Papers I** and **II** I used a broad approach to data collection allowing specific research questions to emerge, and be refined through the research process (Patton 2014). The way I got to more specific question was by implementing an iterative process of reflection to capture important dynamics as the

participatory process unfolded (Patton 2014). For instance, in **Paper I** I wrote memos about key moments and observations at the end of each day, and the facilitation team had a debrief meeting at the end of each of the workshop days. Notes from these reflective moments served as an input for refining research questions and analysis afterwards. In **Paper II**, the research team was composed of four other participant observers, and at the end of each break-out session I would debrief with each one of them to record important moments, key interpersonal dynamics, contentious discussions, etc. Each observer used a standardized form with important categories of observation drawn from social learning literature (Pahl-wostl and Hare 2004; Muro and Jeffrey 2008; Reed et al. 2010). These included for instance “conflicts”, “mood of the session”, “loudest/quietest participant”, etc. We discussed these categories before the workshop started and clarified each one. At the end of the workshop we (myself and the observers) reflected on the process as a whole. The ‘iterative reflexivity’ based on notes and impressions I gathered from these debrief sessions, provided initial themes for analysis that were then reconsidered in analysis – more details below.

### Participant surveys and interviews

Surveys were used in the form of questionnaires filled in individually by participants before and after the workshops in **Paper I** and **II**. Questions were open-ended and Likert scales, drawn from social learning literature (Muro and Jeffrey 2008) and addressed workshop experience, usefulness, new ideas, interpersonal relations and others. The surveys were used to create a structured way to compare results/experiences across all participants. However, some participants had difficulties in writing, and in particular surveys conducted at the end of workshops were often answered in a rush and with little detail. Hence surveys responses have been used sparsely, only analysed qualitatively and primarily used as another layer of contextualization for observations from the process. For example, in **Paper II** many participants stated in the survey that the level of novelty in the list of interventions suggested at the end of workshop was low. This substantiated similar observations from process observations and analysis of participants interviews.

In **Paper I**, co-author Lydiah Munyi has conducted semi-structured interviews (Kvale 2008) with the aim to understand participants salient learning experiences during the transdisciplinary process (**Paper I**). Unstructured interviews were also conducted by Lidiah Munyi with process facilitators (including myself) about challenges and key insights about the

process. A similar approach was used for **Paper II** but interviews were conducted also before workshops asking about participants' views on problems and solutions along the coast (narratives). In **Paper II** I conducted semi-structured interviews with participants in Mozambique and Lydia Munyi conducted those from Kenya. To minimize discrepancies between the interview approaches, these interviews were not conducted in parallel, therefore I was able to get familiar with the material from Lydia Munyi's interviews before conducting mine.

### **Interactive Focus group**

Focus groups (Krueger and Casey 2014) were used after each of the art performances presented in **Paper III**. Together with my co-authors we moderated sessions by starting with an open space for reflections, encouraging participants to reflect about different aspects of their experience. This provided participants with the opportunity to collectively make sense of their engagement with the art performance and link it to their own domain of action on climate change. The drawback is that a group session may have prevented more detailed and nuanced accounts that an individual interview might have provided. Also, this 'live' face-to-face feedback might have been constraining for some participants since they were also aware I was the one behind the creation of the works. However, given the level of disclosure and sense of explorative discovery all co-authors experienced in the focus group sessions, we have reason to believe the possible constraints did not compromise the process in a severe way.

### **Participant observation**

I was present in all processes, and participant observation (PO) has been a key methodology for my work. My view of participant observation follows the anthropological perspective of (Ingold 2011) who sees PO as learning with people. More than a method that placed me in some detached position from where I could monitor what was going on to then write an ethnographic account, I approached participant observation as someone seeking to learn from everyone else involved in the process. That does not mean I was a participant of the process myself in the sense of contributing to discussions, but rather that I acknowledge that as a researcher within these spaces, we cannot ever be fully detached. Direct observation (Denzin and Lincoln 2011) is the primary mode of data gathering in art-based research (e.g. Leavy 2009 and McNiff 1998).

The observations were open and unstructured but generally influenced by my interest in understanding the impacts and constraints of those processes. I was influenced by literature on transformations, social learning and embodied cognition (see more below) (Reed et al. 2010; Muro and Jeffrey 2008; Lakoff and Johnson 1999). As discussed in the *Iterative reflexivity* approach, I took notes, recorded conversations and wrote journals at the end of each day. I agree with (Saldana 2014) that researchers responses in the form of hunches and intuitions are part of the analysis (Saldana 2014; Denzin and Lincoln 2011; Tenni et al. 2003). Importantly, notes of these impressions were not taken at face value but used later as part of the coding process and assessed in the broader context of the whole dataset collected.

### Literature review and global catalogue

**Paper IV** is a literature review that links the arts and the issue of climate transformations. The review was expert-led with co-authors. Although co-authors represent a mix of sustainability scientists, social scientists, artists and practitioners, the disadvantage of having expert led review is that some areas of knowledge might not be well represented. For instance, none of the co-authors comes from the field of Psychology. We combined this approach with comprehensive searches of key terms in Web of Science (e.g. “art”, “transformations”, “sustainability”).

A global catalogue of artworks and art projects in **Paper IV** was constructed also via multiple methods. The first task was to define the boundaries of what “climate-arts” was. We included art projects and artworks dealing with climate change in its content or where artists had claimed the work to be about climate change. Then I used expert consultation – starting with co-authors of the paper – for catalogue entries and for relevant search terms. Google searches were conducted and systematically catalogued in Excel.

## DATA ANALYSIS

The data assemblage for **Papers I-II-III** are different than **Paper IV**. In contrast to for instance semi-structured interviews which generate statements organized around particular questions, participatory processes give rise to a wider span of data ranging from open-ended dialogues to voting polls. Importantly, the data assemblage contains data about participants interactions that occur within the workshop setting which is highly contextual, improvisational and often one-off (Denzin and Lincoln 2011).

For these three papers I applied a range of analytical strategies. Analysis did not happen only at the desk once field work was done but started already on the field (Patton 2014). For example, some of the key arguments in the research papers were intuited and hypothesized during the participatory process itself. Listening to participants seeking to come to grips with a particular question, or simply sensing the mood in the room, gave me important insights about the conduct of these processes. Importantly, these were noted as observations, and revised in a broader context of analysis once back at the desk. In this sense, the iterative reflexivity approach I described above also functions as a pre-analytical phase.

With some initial themes and ideas drawn from the reflections during workshops, I approached qualitative analysis drawing from thematic analysis (Braun and Clarke 2006). In all papers this process involved a phase of getting familiar with the dataset, generating initial codes, collating codes into broader themes or topics and refining themes. Codes evolved. The objective of the analysis was not to prove that a theme was right or wrong, but rather to explore how, when and why, during the workshops, events unfolded in the way they did. The analysis of patterns is the most common strategy in qualitative analysis. However, in a limited set of instances I have built my argument from evidence taken from ‘critical instances’ (Krueger and Casey 2014). This is a common practice used in analysis of situations that are not replicable, and for casting light on a certain unique dynamic that may hold important insights about a phenomena (Savage 2013).

The initial themes of coding were inspired by a range of literature. In **Paper I**, I used a social learning framework that emphasizes the three aspects of learning across individual, interpersonal and systems (Muro and Jeffrey 2008). **Paper II** deploys a communication lens that emphasizes the embodied mind perspective, and the role of lived experience in shaping the way communication unfolds (Newell 2012). In **Paper III**, I explore imagination and sensorial knowledge (Wapner and Elver 2016; Boal 2009). These different theoretical perspectives offered diverse ways of interpreting findings and explaining observed patterns.

## REFLECTIONS ON RESEARCH METHODS

There is serious struggle over standards, validity, assessment and trustworthiness in the kind of data I worked with (Leavy 2015). This is something that affects most transdisciplinary researchers (Wiek et al. 2014). I

will return to a broader discussion about participatory practices and assessment in the *Key Insights* section. Here I clarify the key limitations and challenges of my research methods and how I dealt with those in analysis.

These selected methods carry similar limitations widely discussed in interpretative research (Denzin and Lincoln 2011). Particularly in interviews, surveys and focus groups, there is a certain degree of risk of participants telling what the researcher ‘wants to hear’ (the so called “deference effect”) or telling something that makes the person look good (“social desirability effect”) (Denzin and Lincoln 2011). Hence there is a risk of bias in this material. The way in which this is normally dealt with in PAR traditions is to triangulate various sources of data. I addressed these issues in **Papers I** and **II** by comparing direct observation with survey data whenever possible, as a way to exclude clearly unrealistic comments such as “there were no disagreements [during the workshop] whatsoever”). In retrospect I realized that some of my interview and survey questions could have been framed more specifically which would have resisted better potential biases. For instance, one of the opening questions in **Paper I** interviews was ‘what were your key learnings?’ whereas in **Paper II** we asked participants to re-tell a memorable or surprising moment. A key limitation is that both interviews and surveys rely on self-assessment of learning. Due to difficulties of self-estimation of changes in skills and capacities there is a strong potential of bias in these responses (Kruger and Dunning 1999).

In the art-based project presented in **Paper III**, I had the dual role of creating the artworks, and co-lead the focus group discussions. This may have reduced participants’ willingness to express critical judgments as they were aware I was the one behind the creative process and the artworks presented in the exhibition. I have sought to mitigate this bias by viewing the expressivity in the answers, as part of the analysis. That is, answers with a distinguishable emotional content were assumed to have a higher level of sincerity and were therefore provided more emphasis in the analysis. This goes in line with art-based techniques of analysis (Leavy 2009, Harding et al. 1993). The use of memos were essential to perform this kind of analysis. It is argued that art-based research data can be more polysemic than other qualitative data – i.e. a certain signifier can have multiple meanings (Leavy 2015). For that, I have put effort in unpacking experiences in focus groups, holding back interpretations and reporting what was said. Nonetheless I acknowledge that these meanings can be incomplete since ultimately, I cannot know exactly another persons’ experiences.



I do not claim that the studies presented have extensive external validity. Conclusions are to be interpreted with the fact that studies have been selected and implemented in a way to support theory development rather than testing specific hypothesis. While external validity is low, the overall ambition has been to explore complex linkages between previously less-connected fields of research and generate new hypothesis.

Also, important to notice that my research reports only on changes and participants' experiences within the duration of the workshops analysed – save for those aspects reported in interviews a few weeks after the workshops. The ways in which these changes affect broader personal, organizational and institutional changes is beyond the scope of the research. By focusing on these transdisciplinary processes I am not looking at transformations processes as a whole, their various scaling processes, institutional entrepreneurship, etc.

The fact of being a white male researcher in cultures I was not acquainted with, comes with the challenge of seeking to grasp the impact that it may have had on research. Apart from the obvious cultural and linguistic challenges, my direct experience of the local cultural context was limited to the period of the workshop (from 2 to 3 days allowing a couple of days before and after the workshops). This is a significant limitation in terms of understanding local practices of social interaction, how knowledge is exchanged, figures of speech and other.

## ON PRACTICING TRANSDISCIPLINARY RESEARCH

The experiences I wrote about in this thesis have changed my perception of what sustainability is, how to engage in conversations about social-ecological change, what 'a problem' is, how solutions come about, and has led me to think deeply about leverage points of change. In this sense, I have learned and have been educated by these experiences into the challenges and possibilities for transformation. Although experiences in transdisciplinarity within sustainability science and action-research trace back several decades, it has been difficult to find proxies for studying these processes in relation to transformations.

It has been challenging to think about assessment, but they also made me rethink what 'monitoring' means in this context. Having open and transparent conversations with participants during the process has been the most illuminating source of information, more than any protocol of analysis I designed beforehand. By all means, guidelines for 'monitoring' are extremely useful, and they did help me as a beginner researcher not to be overwhelmed

by the amount of information that is shared, and the possible interesting entry points of analysis that I could conduct. However, in particular, emergent outcomes and unexpected results may at times be the most important when it comes to transformation (I'll return to this discussion in the Section *Key Insights*).

## RESEARCH ETHICS

I have joined the opportunity of participating in all workshops with an attentive, respectful and convivial approach. Although I was focused in achieving academic 'results' that could be reported and translated into scientific papers, I kept an awareness that what was being discussed in these spaces were people's lives and real stories. In my experience, there is not a contradiction in participation and observation.

The studies in Kenya, Mozambique, Spain and Portugal build on long-term engagements of other members of the team. In Kenya and Mozambique in particular, our processes were likely to have been seen by participants within a broader landscape of projects engaged with coastal development in the region. Although workshop organizers communicated clearly the goals and scope of the workshops, I personally have experienced at very limited instances, expectations of participants from us (researchers) as providers of 'solutions', or even of economic resources. Whenever relevant and necessary, I clarified that these workshops were not about concrete interventions, but rather processes of knowledge generation that could hopefully be beneficial if not in the short-term, perhaps in the long-run. Given the fact that participants were made aware of the scope of the project before their participations I do not think this meant that expectations were not met nor that it has affected the data collected to the extent of compromising the conclusions drawn from these studies.

A significant amount of resources and energy was reserved in these projects to establish a relationship with local actors, and to maintain an open channel of communication so that the interaction would grow and be fruitful also for participants. I think this is an important aspect of any transdisciplinary effort, and should be emphasized. The balance between co-design with local participants and theory driven research is not something I have explored in detail here. From my perspective however, I see ways in which local concerns can be taken on-board and help shape research, but that also means scientific protocols need to provide that flexibility.

Working with the arts comes with unique ethical dimensions (Leavy 2015). First, engaging with the arts means dealing directly with the emotional terrain. This is challenging for both facilitators and participants. The way I went about this was to leave the analysis aside while interacting with participants. This was also a way to privilege the participants' voices rather than my views during the process. Again, here I found it important to be transparent with the intentions and ensure that people felt invited, and with the freedom to step back in case they felt like it.

Secondly, issues of misrepresentation, both of participants' views and of scientific material are also worth mentioning when working with scientific material in the terrain of aesthetics and with artistic goals. While striving to maintain integrity of scientific facts, when working as an artist I strived to create a coherent experience for participants. The 'truth' in artistic research is not solely about facts of an objective reality. It is about creating a world that yields an experience. I experienced this process of working with scientific findings as part of artistic development as highly inspirational. As Norwegian artist Tone Bjordam discusses in her work with scientist Marten Scheffer, arts are about finding an "essence" – a way of synthesizing and concentrating on the most central elements of a phenomenon – and making that 'essence' available to others through experience. Similarly (Ellingson 2011) speaks of 'crystallization' as a way to reach a deepened understanding of a topic.

In terms of formal ethical procedures *Pmowtick* and *Spaces* projects were reviewed and approved by the University of East Anglia International Research Ethics Community. Project *Impressions* followed the Ethical principles elaborated within the European 7<sup>th</sup> Framework Programme. All participants were provided with the opportunity not to consent with the research, upon the conditions that all data would be anonymous and that withdraw could be requested at any time. The agreement was that all audio and text could be utilized in the research as long as it did not contain names of persons or organizations.

## RESEARCH PAPERS AND KEY FINDINGS

In this chapter I provide an overview of the four research papers that compose this thesis and their findings. The second part of the chapter is dedicated to key insights that emerged from the research as a whole.

The first two research papers were conducted in coastal Kenya (**Papers I-II**) and Mozambique (**Paper II**). Both are empirical analysis of iterative transdisciplinary processes of knowledge co-creation between scientists (local and international) and local participants including community representatives, government officials, local scientists and members of NGOs. These processes were designed around practices of participatory modelling, scenarios and systems interventions. The purpose of these transdisciplinary processes was first, to improve the (local and scientific) understanding of the interdependencies between coastal communities' well-being and their ecosystems. Second, to explore how particular trajectories of social-ecological change could affect the lives of coastal dwellers, including possible synergies and trade-offs. I studied these processes to understand how they may have influenced participants imagination of system interdependences and trade-off dynamics (**Paper I**) and participant's ability to co-develop novel social-ecological narratives (**Paper II**).

**Paper III** is an empirical study of a three years long iterative art-based process in the context of high-end climate change in the Iberian Peninsula. It included the practices of performances, visual methods and an art installation in Spain and Portugal. The overall goal of the transdisciplinary process was to support the development of transformative solutions and visions. I studied this process to assess how artistic practices can support visioning. **Paper IV** reviews academic literature to make a systematic assessment of the link between art practices, transformations and the engagement of the climate-arts.

## PAPER I - LEARNING ABOUT SOCIAL-ECOLOGICAL TRADE-OFFS

**Paper I** focuses on the challenges of addressing social-ecological trade-offs. It departs from the notion that changes in ecological realities can affect the lives of some for the better and others for the worse (Daw et al. 2011; Daw et al. 2015). Our case-study is in a local coastal area in Kenya where this tight interweaving of human wellbeing and ecosystems is particularly evident (Abunge et al. 2013) – the case is focused on fisheries. Grappling with the dynamics of trade-offs is an important part of developing robust and equitable development interventions.

We open **Paper I** by outlining the key challenges of perception and practice posed by social-ecological trade-offs. We then study the potential of a transdisciplinary process in fostering individual and collective capacities to perceive and address these trade-offs.

In addressing *Research Question #1 “how can participatory practices foster sensibilities towards social-ecological interdependencies and trade-offs?”*, **Paper I** focuses on participatory modelling, scenarios and dialogue. Through participant observation and interviews, we found that the process led to an increased awareness and appreciation of interdependences between social and ecological change. Participants demonstrated an enhanced perception of how interventions, due to these interdependences, can affect different social groups differently. The interactive systems model was central to the creation of a tacit and dynamic understanding of these trade-offs. We suggest that participants developed a “trade-off lens” that may be useful for addressing other kinds of trade-offs in the future. Our analysis also shows that the process provoked a revision of some of the knowledge assumptions that participants had. These assumptions included the dynamics of ecological processes in the seascape, and a reflection on the management goals for the coastal system (e.g. who wins and who loses in the context of ecosystem conservation?).

There are two reasons why this sensibility towards interdependences and trade-offs can be seen as a transformative capacity of the imagination – as opposed as an adaptive capacity. First, the difficult choices implied by dilemmas and dynamics of trade-offs can be psychologically uncomfortable, or even taboo (Höijer et al. 2006; Schoemaker and Tetlock 2012). Therefore decision- and policy-making may ignore trade-offs, which in turn can potentially suppress alternative pathways of development (Daw et al. 2015). Second, our paper demonstrates that novel ideas can emerge when considering these trade-offs explicitly. Although the ‘toy-model’ included ‘hard-wired’

trade-offs that could not be transformed, participants were quick to generate ideas that would transform the current system, and eliminate the modelled trade-off dynamic. This seems to suggest that when participants become aware of the challenges caused by current assumptions and arrangements, they re-imagine them.

## PAPER II - STORIES IN SOCIAL-ECOLOGICAL KNOWLEDGE CO-CREATION

The way in which societies narrate poverty and its dynamics within social-ecological realities matters for how interventions are imagined and implemented. There are many views about what constitutes necessary interventions for poverty alleviation. Therefore building shared narratives that negotiate and integrate various perspectives can be seen as a key imaginative capacity to open up novel and just social-ecological trajectories. *Research Question #2* frames **Paper II**, “*how can participatory practices support the development of social-ecological narratives?*”. In **Paper II** we define narrative as articulated causal understandings between different aspects of a social-ecological system that frame problems and solutions. Stories, we define, as particular accounts of participants’ lived experiences.

The workshops for **Paper II** were conducted in Kenya and Mozambique and dealt with coastal change at large. The ultimate aim of the process was to generate ideas for interventions that could improve both well-being and ecosystems integrity. We conducted a detailed analysis of conversations between participants, supported by practices of system diagrams and scenario planning. Our goal was to gain insight about how participants come to develop shared meanings and form a ‘shared conceptual repertoire’ (Newell 2012). We then explored how these shared meanings were (or not) used to question assumptions, to trigger new ways of thinking, and to help create social-ecological narratives which address poverty alleviation and ecosystem degradation.

We conducted interviews before the workshops to understand the various narratives that shaped participants’ imagination of key challenges along the coast, as well as views on possible solutions that should be pursued. We did not find a significant shift in narratives throughout the duration of the workshops. For instance, the narrative that education of communities is central for halting ecosystem degradation in Mozambique was prevalent in the same form before and after the workshops.

We discuss two potential reasons for this in the paper. The first relates to the apparent difficulties that practices such as systems diagrams encounter in supporting the creation of shared meaning around key concepts. To be more precise, systems diagrams tend to sustain conversations at a high level of abstraction, distant from concrete lived experiences. We observed that participants instead created shared concepts by sharing lived experiences through stories.

The second reason for the apparent limited novelty, relates to the difficulties of scenario practices in challenging underlying assumptions of how participants imagine the future. Even when exploring new futures, we observed a tendency to imagine incremental change in existing systems, rather than fundamentally new systems. Participants also very seldom questioned underlying knowledge assumptions. For instance, groups would discuss future “improvement of education” without discussion what ‘education’ means in a given context, for whom? and through what means it should be pursued. The absence of these in-depth dialogues might be caused by the high level of abstraction in conversations thereby hindering the exploration of underlying assumptions.

There are several caveats to these observations, amongst them the fact that we cannot assert if this is a common quality of the practices studied, or if there is something in the specific context that has shaped this kind of outcome (e.g. facilitation style or mix of participants).

Although transformations studies have shown the importance of novel social-ecological narratives in the early phases of transformations (Olsson et al. 2006; Huitema et al. 2009; Goldstein et al. 2013), **Paper II** describes the difficulties of breaking away from existing ways of imagining social-ecological interventions.

### **PAPER III – FOSTERING IMAGINATIVE CAPACITIES THROUGH ARTS**

**Papers III** and **IV** are grounded in the theme of climate change transformations and the arts. In particular they respond to the calls for climate research to expand its epistemological repertoire to better address cultural dimensions (values, beliefs, assumptions, identities) that are inherent in transformation processes (O’Brien 2009). These two papers attend to calls for increased involvement of humanities and the arts to support new ways of seeing, feeling and encountering the world as a means to support sustainability

transformations (Tàbara et al. 2017; Heras and Tàbara 2014; Wapner and Elver 2016; Hackmann et al. 2014).

In **Paper III** we construct and analyse an iterative art-based approach in the attempt to bolster transformative imagination and shared values for the development of transformative visions in the context of high-end climate change in Iberian Peninsula. We explore the interplay between arts, senses and imagination. The art-based approach comprised a range of practices including performances, visual and reflexive methods and an art installation. The paper addresses *Research Question #3*, “*how may an art-based approach support visioning in the context of transformations?*”

The art-based research supported the exploration of individual and collective imagination within a visioning process. The participatory artworks opened up a space of inquiry that supported sense-making and allowed participants to engage reflexively with values, motivations and strategies of action. These experiences reached out to more-than-rational elements (feelings, emotions, intuition, imagination) of climate change. They were also important to build trust in the group of participants in relatively short period of time. We found that artistic experiences such as these can elicit powerful experiences and emotions that are recognized as important by the participants themselves.

In a similar way as discussed in **Paper II**, some of the visual methods used in **Paper III** revealed the difficulties that participants face in imagining radically different futures. The resulting images from the visual dialogue (second year of the process) were either nostalgic, or improvements of current systems. However, for some participants the performances helped to explore new aspects of extreme climate change, and to reflect on their personal sense of purpose and actions towards climate change challenges.

This art-based inquiry helped us (researchers) also to see more up-close the process of visioning itself, and led us to revise our views of what a vision entails. Instead of seeing visions as fully formed images of the future, visioning was revealed to be a process of making the future *present* so that an embodied relation to alternative futures could be formed (**Paper III**). In imagining and being immersed in different conceptions of the future, participants drew from rational and more-than-rational elements to explore intuitively questions like “is this a future I would like to avoid, or to live in?”. We observed that by exploring imaginatively different aspects of alternative futures, participants could progressively clarify what a “desirable” future would be like. This was not an abstract image in the mind, but a felt *sense*. In the paper we discuss this as a process of imaginatively ‘making the future present’ in order to develop a



more-than-rational ‘sense of direction’ – i.e. an embodied constellation of meanings, ethics, values, images. Although clearly transformations hinge on much broader processes of multi-scale change, we hypothesize this ‘sense of direction’ as a possible source of guidance for actions in the present towards novel social-ecological trajectories.

## PAPER IV – ‘RAISING THE TEMPERATURE’: THE ARTS IN A WARMING PLANET

**Paper IV** addresses *Research Question #4*, “*how are the arts engaging with global climate change and how can it contribute to transformations?*”. We depart from the notion of climate change not only as a biophysical problem, but as a dynamic cultural and societal force capable of re-shaping humanity’s relationship to nature (see Hulme 2009).

We conducted a cross-disciplinary literature review focused on the perceived value of various forms of art and artistic practices in fostering cultural change in the context of climate change transformations. The paper describes various pathways through which the arts may influence transformative processes, including pre-figuring possible futures through direct action, as a space for disclosure, as fostering reflection and creative imagination and others (see Table 1 in **Paper IV**).

Furthermore, we created and analysed a database of 102 climate-art projects and networks and 199 climate-artworks to describe the evolution and current engagement of art with the topic of climate change. Results showed an increased engagement in recent years, particularly in narrative, visual and performing arts. Large international networks are forming such as *ClimArte* and *Cape Farewell* who is behind projects like ARTCOP21 that promoted cultural activities taking place during the United Nations Conference on Climate Change (COP21). Another pattern emerging from this analysis is that the arts are moving beyond awareness raising activities and entering the terrain of transdisciplinarity, and knowledge co-creation. This is done by either opening up new ways to encounter environmental change, or by supporting new forms of societal dialogue. **Paper IV** closes by suggesting that the climate-arts can contribute positively in fostering imagination and emotional predispositions for the development and implementation of transformations in the context of climate change.

## SUMMARY OF FINDINGS

There are four key overarching findings emerging from my research about the possibilities of fostering imagination through transdisciplinary processes. First, I have found that practices of participatory modelling combined with scenarios can promote the ability of transdisciplinary groups to grasp interconnectedness between multiple aspects of social-ecological realities and engage with tradeoff dynamics (**Paper I**). Second, I found that practices of system diagrams and scenarios can at times be limiting in fostering development of social-ecological narratives and inquiry into existing assumptions and narratives. I have seen knowledge co-creation as a process of ‘meshing’ and how opening up a broader space for stories may be a way to pursue the capacity of developing novel social-ecological narratives (**Paper II**). Third, art-based approaches helped participants to engage with more-than-rational elements in the creation of visions. The process also helped us (researchers) reframing the visioning process to one of making the future present in order to allow a sense for desirable futures to emerge (**Paper III**). Fourth, artistic engagement with global change has developed substantially over the past decade and it’s increasingly connected to processes of knowledge co-creation (**Paper IV**).

## KEY INSIGHTS

In this thesis I set out to explore imagination as a transformative capacity. I used a transdisciplinary approach to study three different features of the imagination: the ability of seeing interdependencies and trade-offs (**Paper I**); the ability to imagine novel social-ecological narrative (**Paper II**) and the ability to develop transformative visions (**Paper III**). I also explored how various art practices may and are contributing to re-imagining climate change (**Paper IV**).

Here I draw out cross-cutting insights in order to outline the contribution of the thesis to the transformation literature. **Insights 1** relates the role of transdisciplinary processes in fostering imaginative capacities. **Insights 2-4** discuss specific insights about the different practices studied (systems- and art-based approaches), their complementarities and uniqueness. I reflect on issues of evaluation and assessment in **Insight 5**. Finally, in **Insight 6** I discuss art practices as a way of conducting research on the dynamics and possibilities of life in the Anthropocene.

### **Insight 1: From knowledge production to fostering transformative capacities**

The transdisciplinary processes studied in this thesis are not *only* about producing knowledge in the form of new information that can be applied to solve specific well-defined problems. Also, these processes are not simply more sophisticated forms of interview or data collection (Tarr 2017). The various practices used offered participants certain ways of engaging with each other and with the world thereby potentially fostering their sensibilities and skills needed to navigate transformative change.

My empirical research suggests that some of the relevance of these transdisciplinary spaces is in fostering imaginative capacities rather than information acquisition. In **Paper I**, I found that participatory modelling enhanced participants' sensibilities towards interdependencies in social-ecological system. This in turn may lead to more robust ways of treating trade-offs dynamics that are likely to emerge in social-ecological transformations. In **Paper III** I discuss how "reconnecting to the senses" and incorporating more-

than-rational elements in the process of visioning can help participants to engage with richer conceptions of knowledge.

These transdisciplinary processes are opportunities for participants to join with others in the study the social-ecological realities they inhabit. Although I haven't discussed in the papers, at times facilitators also may take on some of the ways in which participants think, feel and attend to the world. These processes are opportunities to *unravel* current ways of understanding the world, to then *mesh* and develop new ways of thinking and feeling (see **Paper II** for a discussion on these terms).

This focus on development of individual and collective capacities within transdisciplinary processes is in line with current work in transformations literature. For instance, Moser (2016) summarizes in a recent special issue on "co-design"<sup>8</sup> that the very act of engaging with transdisciplinary processes can be a transformative experience for those engaging with the process. Page et. al. (2016) also calls for greater attention to personal transformations that engage people with emotions and values. There is however seemingly a trade-off in studying capacities within transdisciplinary processes. While we gain resolution on how these capacities are fostered or hindered by different dynamics, in the other hand, we cannot assert the ways in which these capacities play out in everyday practices and how they may affect transformations in the future.

### **Insight 2: On the complementarities of experiential and analytical ways of knowing**

The three transdisciplinary processes studied, include two broad families of practices: those based on systems thinking which have been widely used in sustainability science; and those from art-based research which only recently have been receiving attention within sustainability. Even though my studies do not allow for a systematic comparison between practices, I would argue that the papers together support the following.

Systems- and art-based are not at odds with one another. They are all practices that seek to foster an awareness of "patterns that connect" (Bateson 1972), i.e. both families of practices are ways of engaging the imagination to *see relations* (Kagan 2014).

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<sup>8</sup> Journal Current Opinion in Environmental Sustainability. Volume 20, Pages 1-116 (June 2016). Transformations and co-design, edited by Susanne C. Moser

There are however some striking differences. First is that practices based on systems thinking *tend to* restrict the search for patterns and relations within articulated knowledge claims. It sends participants in a search for “what affects what” and how, and therefore have a tendency towards analytical modes of reasoning. Participatory modelling (as explored in **Paper I**) for instance led to the creation of “a particular configuration” of the world – a collective imagination of how the world works at the moment. This is positive in that it stimulated participants to explicitly consider their own understandings of connections. Another positive aspect is that system approaches can be more readily integrated with other modelling exercises (such as ecological modelling in **Paper I**).

For art-based approaches, *seeing relations* goes beyond rational analysis, and welcomes emotions, feelings, thoughts, tacit knowledge, images, and intuition. Scenario planning also use these more-than-rational elements but art-based approaches make them a central focus. Art-based approaches are experiential and invite participants to draw from multiple sources in the process of discovering patterns and generating meaning. These practices provide greater freedom in thinking and feeling, and allow participants to approach knowledge in a more holistic manner. **Paper III** suggests that the performances allowed participants to reflect on cognitive, imaginative and affective links to the threats and possibilities of climate change. Art experiences brought participants to a contemplative mode and at times inquiring into existential and more profound questions. Participants would tend towards conversations about ‘the meaning of things’, ‘the big questions’ without being off-putting or needing ‘to find a final solution’.

Our findings seem to suggest, in agreement with (Vervoort et al. 2012), that there are complementarities between experiential and analytical modes of reasoning and that preceding analytical engagement with experiential is more effective. Findings from **Paper II** take that insight further by suggesting that this might be due to how experiential modes of engagement can help participants *unravel* various aspects of knowledge.

Another important difference between these approaches is that in systems practices, it was obvious for participants that they were engaged in a research process – i.e. they were aware and engaged in ‘creating knowledge’ or representing the world. Whereas in the art-based, even though it was in the context of a research project, participants experienced the performances as real social life encounters. They were performative and enact knowledge in a fuller expression. This is significant because performative spaces tend to be more accessible to a wider range of people – e.g. youth (Heras et al. 2016).

When seeking to develop transformative capacities, practices with a strong ‘representational’ character - i.e. focused on creating abstract representation of the world – thus need to be complemented with performative practices that enact and intensify participants’ engagement with the histories and dynamics of the social-ecological realities they inhabit (Gabrys and Yusoff 2012). These ‘process-oriented’ practices such as storytelling (**Paper II**) or other performative practices (**Paper III**) can support the exploration of embodied knowledge and imagination. In particular participatory modes of performance may enhance ownership and reflection about one’s role in giving rise to alternative futures.

All practices have their own constraints and limitations. Systems approaches (system diagrams in particular) are perhaps less suited to engaging with uncertainty, non-linear change and emergent properties. **Paper II** goes into some depth about the limitations of system diagrams and scenarios for developing shared meaning and re-imagine social-ecological realities.

The art-based approach also raised several challenges. First is scalability and difficulties of replicating performances. Although the art installation was open to the wide public, providing space for much larger engagement than selective spaces of knowledge co-creation, its logistical issues are not trivial. Another challenge is that artistic productions tend to be resource intensive and require particular sets of skills that may not be readily available to many projects.

A final critical issue about different practices is that they are not experienced in the same way by everyone. Participants have unique cultural backgrounds, histories, experiences, and ways of looking at and valuing the world (Cook-Greuter 2000). This is important because process designers have not only the responsibility of inviting a diverse group of participants, but also to open up expressive and communicative spaces that embrace rich forms of knowledge and experience.

### **Insight 3: Fostering metaphorical ways of knowing for knowledge synthesis**

In line with insights from embodied cognition, observations from **Papers I-II-III** show that developing shared meaning and values is a complex and nuanced process involving multiple sources of knowledge including scientific, experiential and aesthetic (Lakoff and Johnson 1999, Johnson 2008). **Paper I** and **Paper III** suggest that a shared vivid experience, such as a performance, or an interactive toy-model can offer participants the grounds to create shared meanings, at times multidimensional, i.e. multiple meanings can be held in tension around a particular concept.

An insight from the performances (**Paper III**) and participatory modelling (**Paper I**) is that participants can achieve knowledge synthesis and new insights by engaging in metaphorical ways of knowing. This is similar to what Bateson (1979) called *abduction* (term coined by C. S. Pierce) – in contrast to inductive or deductive ways of knowing. In this modality of knowing, for example observed in focus groups after performances (**Paper III**), participants were not analysing climate transformations by breaking them down into their components, but rather they were using elements of the performance to “think with”. For example, participants would relate the experience of disentangling the two actors on stage with the complex sets of challenges they encounter and the trade-offs that need to be addressed in their work on climate change (**Paper III**). In this sense, the elements from the performance helped participants to create new connections, to think and feel in different ways about aspects of a system they know well. In this ‘metaphorical’ way of relating artworks to their lives, participants may discover new ways of looking at values, knowledge or information.

Another example in **Paper I**, the toy-model also functioned as a metaphor, in that once people interacted with it, they were able to apply a ‘trade-off lens’ to other situations.

There are three unique contributions of this kind of knowing. First, these elements (the performance or the toy-model) are open to multiple meanings, which at times can be in tension with one another. This can bring attention to ‘qualitative complexity’ (Kagan 2013) of a particular issue – its qualities and contrasts. Hence, it provides the opportunity for participants to discuss and discover new meanings collectively. Second, the experiences with those elements may also be taken further by participants and be activated in different ways in another point in time. The third potential of metaphorical ways of knowing is that they more readily connect to the ways in which people already create meaning in daily life. It is based on this idea that (Newell 2012) calls for the creation of simple models as ways of grappling with complex systems. Metaphorical thinking, seems to be a powerful yet largely unexplored way of knowing within more conventional knowledge co-creation practices that give greater focus to analysis.

#### **Insight 4: On being moved: fostering imagination through powerful experiences**

Transformations are about opening up new trajectories of development. Some have argued that lock-in dynamics however can perpetuate existing dynamics and prevent transformations (Gunderson 2001). These lock-ins however may

not only be at the institutional or infrastructural levels but may also be in limiting ways of thinking (Essebo 2013). Lock-ins are most powerful in the stories and narratives we tell about the world we inhabit (Bennett et al. 2016; O'Brien 2017).

**Paper II** and **Paper III**, interestingly from different approaches (systems- and art-based), have demonstrated the difficulties that practitioners face in grasping assumptions of current trajectories and reimagining them. We observed participants displayed a tendency to imagine incremental change in existing systems rather than imagining new assumptions for fundamentally new systems. This was consistent across practices of systems diagrams, scenarios (**Paper II**) and some of the visual methods (**Paper III**).

Reflecting on leaps in understanding however, I noticed that the majority happened in “experience”. That is, through interactions with artefacts; whether a system visualization, a toy-model (**Paper I**), or an artistic performance (**Paper III**). For example, in **Paper I**, the moment participants saw a projection of the interconnected system that they had been working to create, the notion of interdependences became more vivid. These experiences seemingly generated new imaginative resources that allowed participants to connect to the complex challenges they face. One of the participants shared that the experience during one of the performances (**Paper III**) helped to consolidate “the reason why I’m doing the work that I’m doing with climate change”. This suggests an interesting relation between experiences, knowledge and imagination. Participants do not change their mind-sets only on the basis of information (Lorenzoni 2007, Stoknes 2015). These experiences seem to create the conditions for insights.

Staying with the metaphor, perhaps mind-shifts and breaking away from lock-ins means to be *moved*, i.e. an experience may provide perspective and free the mind from a limiting belief.

### **Insight 5: On assessment of transdisciplinary processes in transformations**

An intrinsic challenge of transdisciplinary sustainability science, common to both systems- and art-based approaches, is how to understand and trace effects in the world. All evidence presented in **Paper I-II-III** refer to changes in cognitive-emotional aspects within the scope of the project. Further research would be required to understand the way in which these changes unfold or are constrained by organizational cultures, time pressures.

Evaluating transdisciplinary processes in the context of transformations is difficult and researchers are still discussing productive ways to address it (Wiek 2012). In the course of this research I came across similar challenges. The



notion of transformations within transdisciplinary spaces requires practices that lead practitioners towards places that cannot be seen at the start. However, as noted by (Page et al. 2016), one of the key challenges is the discrepancy between incentives that researchers have to commit to the delivery of a specific research outcome at the start of the research project, versus the actual need of transformations research to focus on emergent outcomes and creativity. Long-term effects can be difficult to measure also due to research projects' structures and funding (Oteros-Rozas et al. 2015).

There is a need to include emergent aspects in assessments. Participants interact within these processes in an “improvisational” way, and many of the outcomes are emergent, so that what we observe are a kind of ‘live data’ (Savage 2013)– i.e. they are utterly contextual, improvisational and non-repeatable. Also, if some of the most important aspects are about creating capacities (**Insight 1**) and occur in experience (**Insight 4**), then participation itself – the fact of ‘being there’ – is important for analysis. For example, the performances in **Paper III** had to be experienced in order to generate the research they did. We would have not been able to interview participants for the same insights.

These factors challenge current social science methods that seek to establish causality. Also, current methods are based on direct observation or self-reporting (whether through interviews, surveys or other means) which can be limited in capturing the range of learnings that may unfold as a participant engages with the process. This suggests that transdisciplinary processes and in particular art-based approaches require thinking beyond simplistic measures of outcomes (Leavy 2015; Ellingson 2011). In knowledge co-creation, and certainly in art-based research, the main learnings may not be in terms of new information. They may rather consist in a renewed sense of belonging and commitment at the level of the emotions and attitudes (McNiff 1998, Boal 2009). Although to certain standards of evaluation these might not be seen as important knowledge, empowerment may be central in terms of deliberate transformations (Moore 2015). The urge and impulse to sustain the difficult and challenging collective action linked to transformation is a very common feature described in transformation literature (Olsson 2008, Moore 2015, Westley 2013).

Considering carefully then what constitutes data is an important part of these process (Tarr 2017). In particular performative practices of art-based research need to conceive as research the whole process, from the composition of the performance, through to the performative moment and onwards in the reflective part. All of these stages are part of the data assemblage and are

possible entry points for insights. In **Paper III** in fact we show how the very process of trying different practices helped us to reconceive visioning itself. This insight came not only from an analysis of the outputs, but from thinking through the actual process of how people engaged with the art-based processes.

### **Insight 6: Art and reflexivity of world-making**

Opening up new social-ecological trajectories involve developing new narratives, ways of looking and being in the world. This process involves the creation of new values, meaning and ethics around novel possible paths of development (Preiser et al. 2017). In this thesis I explored the creation of meaning not only as linguistic concepts and propositions, but also by their aesthetic and experiential dimensions. In particular I looked at how the arts can be a key ally in supporting the creation of embodied meaning around alternative configurations of the world. I found that artistic engagement with climate change has continuously expanded since early 2000's and increasingly artists are engaging and opening up new spaces for societal conversation (**Paper IV**). This is an interesting development as it suggests an expansion on the means through which citizens can engage with global change issues. One problem with this kind of platform for engagement, one might argue, is that art spaces are only visited and available to particular segments of society. This may be true for some forms of art and for aspects of the art-world. However, there are plenty of examples of arts engaging across all levels of societies. Films for example are widely distributed in societies. Another landmark example is Augusto Boal's Theatre of the Oppressed, a participatory form of theatre elaborated in the 1970s, conducted today in over 70 different countries as a way of generating knowledge, empowerment and critical analysis of societal structures. Sommer (2013) recounts in detail other examples of socially engaged art and their extensive influence in behaviour and social institutions. For instance, Bogota's ex-mayor work with artists to re-imagine in public spaces and tackle apparently intractable conditions in city living such as behaviour in traffic and violence. Importantly in the context of social-ecological transformations, **Paper IV** suggests the arts as a possible means to support reconnection of experiences, identities, values and emotions with the life of the biosphere (Folke et al. 2011; Hall and Folke 2014).

In **Paper III** I joined an emerging current of work within sustainability sciences to explore artistic practices as a way of conducting research on the dynamics and possibilities of life in the Anthropocene (Brown et al. 2017;

Heras et al. 2016; Bendor et al. 2017). Through the art-based approach presented in **Paper III**, participants explored climate change not only as a problem that requires planning for, but as a multi-faceted dynamic process, that can stimulate a deep inquiry into values, knowledge, emotions and motivations. Importantly, **Paper III** demonstrates the possibilities of art practices to provide an alternative (and complementary) way for engaging with a richer conception of knowledge relevant for visions in climate change.

There is great potential in the alliance between the artistic impulse to work with global change with the imperative of transformations towards sustainability. Facts and information have proven to fall short in achieving behaviour change (Moser 2016a; Moser 2010). Moreover, both **Papers II** and **III**, have demonstrated the difficulties that people face in imagining transformative visions and narratives. Seemingly, unaided discursive engagement tends towards incremental thinking or nostalgic images.

A key quality of the arts is not simply to communicate the challenges of global change. Instead of representing the world, artistic practices can be a way of encountering the world through embodied, visual and affective means, allowing knowledge about the world to grow from the inside of practical engagement (Fazey et al. 2005, Ingold 2016, Fazey et al. 2017). Artistic practices engage directly with human imagination, emotions, identities and subjective experiences.

Artists have developed sophisticated ways of merging imagination and experience, creating worlds that invite people to think and feel within another conception of reality. Be it in the form of a novel, a theatre piece or a performance, artists are experts in the craft of creating worlds. In that, art practices not only expand epistemologies of sustainability science but also provide opportunities for ‘ontological reflexivity’ (Dieleman 2008). World-making for sustainability is not a way out of the world. Quite to the opposite, it is a speculative exploration on alternative possibilities of inhabiting the world. This may support the development of meaning and values around novel social-ecological trajectories.

The performances and installation presented in **Paper III** are examples of world-making where people can think and feel and learn about the actual world they inhabit (Bendor et al. 2017). There is ample space to explore novel ways of fostering imagination and reflexivity through world-making practices. These may include experiential scenarios (Candy and Dunagan 2016; Janssen et al. 2017), speculative design (Jeremijenko 2016), cinema, science-fiction (Milkoiret 2017, Merrie et al. 2017) and many other forms that can bring the world in anticipation to people’s experiences. By making speculative futures

present, a sensibility and impetus to pursue novel trajectories may emerge (**Paper III**). The plural world we inhabit is always in the process of becoming (Escobar 2016). World-making practices may promote ways to engage with this unfolding and more fully embrace the uncertainty and creativity stemming from the search for novel pathways towards sustainability.

## CONCLUSION

In the course of this research, I have explored a range of participatory practices for their possibilities and limitations in fostering the interplay between the creative and the perceptual imagination for transformations. In seeking ways to move forward in the face of interconnected challenges of the Anthropocene people draw from various modes of reasoning that include more-than-rational (imagination, emotions, images, memories). I have focused on three features of imagination that can contribute to transformative capacity: the ability of seeing interdependencies and trade-offs (**Paper I**); the ability to imagine novel social-ecological narratives (**Paper II**); and transformative visioning (**Paper III**). I studied how various participatory practices may or may not foster these imaginative capacities. In exploring imagination as a transformative capacity, I turned first to knowledge co-creation constructed from a systems approach (**Paper I and II**) and then to the arts both as an art-based approach to knowledge co-creation (**Paper III**) and also as a societal force in support of transformative change in the context of climate change (**Paper IV**). This thesis then contributes to sustainability science and practices by further developing ways to understand transformative capacity.

### Transformations from the inside

In studying transdisciplinary action-research processes we see transformations from within, through the perspective of those who are directly engaged with unfolding changes. This is what Fazey et al. (2017b) called “second-order transformations research”. According to Fazey et al. (2017b), so far transformations research has mostly focused on “first-order research”, that studies transformations from the outside, analysing patterns and looking back. Second-order research engages with practice in action-research approaches to study transformations as they unfold, from the inside. While first-order transformations research has done great advances in understanding the role of entrepreneurs, strategies for changing systems dynamics and the relations to context (Westley 2013), there are large gaps in understanding *how* to bring about transformative change.

Researching transformations from the inside means to study *knowledge in the making* (Marchand 2011). It is to see research itself as opportunities for the

development of individual and collective skills of attention, imagination and abilities to respond and shape transformations. Rather than only focusing on general mechanisms of systems change, in second-order research the actual limits and capacities of those working in situated contexts come to the fore. As shown in this thesis, by revealing these limitations various practices can support their development. This perspective on transformations research can open up novel avenues for research and practice which are particularly fertile for collaborations across natural sciences, arts and humanities (Hackmann et al. 2014; ISSC 2013; O'Brien 2009).

The kinds of transdisciplinary processes I studied are outside the norm in societal knowledge creation. Opportunities that bring together a group of actors from across levels of a certain domain to spend two or three days together are rare. However, they are living laboratories that, as demonstrated in this thesis, can contribute positively to a range of processes that may progressively develop into societal capacities that are critical for humanity's future in an increasingly intertwined world. What is also needed are better conceptual frameworks to interpret these experiments.

In returning to the question used to frame this thesis, i.e. *how may participatory practices contribute to fostering imagination as a capacity for transformation?* this research led to the proposition that transformative imagination is a capacity central for deliberate transformations. I have so far summarized how I explored the possibilities of participatory practices for studying and fostering the transformative imagination. In the next and final section, I will expand on the notion of the transformative imagination.

## THE TRANSFORMATIVE IMAGINATION

Is crisis a necessary component of transformative change? The majority of empirical work on deliberate transformations within social-ecological systems has noted that often the development of new pathways is triggered by some form of crisis within existing structures which in turn provides an opportunity for transformation (Olsson et al. 2008; Westley et al. 2013; Huitema and Meijerink 2010; Olsson et al. 2008). Current frameworks for understanding transformations also tend to put 'disruption' or crisis at the source of transformative processes. Theory of panarchy for instance speaks of the "creative destruction" and "surprises" that may catalyse a reorganization of a system (Holling and Gunderson 2001). Could there be ways of arranging society so that transformation does not depend on crisis?

This is related to what Harvard political philosopher Roberto Unger Mangabeira (2014) suggested as a prevailing tendency across much of social sciences today. In his words:

*“The central idea of classical European social theory is that structures of social life are made and imagined. We should not think of these structures as natural objects; they are artefacts rather than natural phenomena. The central problem in contemporary social thought is the break of the vital link between the insight into the actual and imagination of the adjacent possible, of what can happen next. In other words, the central problem is the failure of structural imagination: the missing account of how structures are generated, and how they can be disrupted and how we can establish alternative structures.”*

Mangabeira (2014) is pointing to the basic realization that the structures of society are first and foremost products of the human imagination. With this thesis, I explored how imagination can be placed at the heart of social-ecological transformations – and transformations research. The process of creating a new system where the current is not tenable, is in part a journey of imaginative development. In expanding this proposition and drawing from the research I conducted, I suggest that the transformative imagination has two principal qualities: that of *widening* the range of possible actions in the present so that new pathways can be developed and that of *deepening* the scope of perception, meaning and correspondence with the world.

To understand the *widening* potential of the transformative imagination we can think of a hypothetical world where there is no imagination of alternatives. In such a world, all that can be done is to replicate current norms and established ways of doing and being. The range of possible futures is narrowed to what the current system of arrangements can give rise. Transformative imagination widens the range of possibilities by creating new possible directions (imaginative alternatives). It is about freeing established categories, recombining and synthesizing in new ways to perceive a new reality (Andrews 2014). As a result, imagination brings awareness to the assumptions and beliefs of existing arrangements and shapes a sensibility to the implications of these assumptions (Mangabeira 2014). Imagination is the creative impulse for speculative modification of current assumptions. In this, transformative imagination is about charting a path into the future, to feel and sense what that future is like and hence to make the future present in anticipation (**Paper III**). This is a movement in the pursuit of insights on the adjacent possible –

i.e. the range of future possibilities of change (Westley et al. 2014; Kauffman 2008). This may well up ideas of how the current arrangements can be altered to evolve a new pathway. In this way, transformative imagination is about expanding and widening the range of possible actions for opening fundamentally different pathways.

**Paper I** demonstrated how participatory modelling can help make assumptions explicit and hence offering the possibility of trying out alternative ways of thinking. The practices involved in the *Seeds of the good Anthropocene* (Bennett et al. 2016) and *Three-horizons* (Sharpe et al. 2016) featured in **Paper II**, are interesting directions for fostering this *widening* aspect of the transformative imagination. The theory of change of the '*seeds approach*' is based on positive elements of the present and a mash-up of existing initiatives and other 'blue-sky' ideas, to trigger creativity and insights about the adjacent possible. Art-based approaches may provide embodied ways of developing novel meaningful connections (**Paper III**) and afford experiences of 'alternative worlds' and configurations.

Transformative imagination I would suggest, also has a *deepening* function. If the *widening* movement is the creative ability of grasping a state of affairs by its possibilities, the *deepening* movement gives value and meaning to different alternatives (Boal 2009). It helps people to imagine themselves as active agents of the transformative process. In this *deepening* movement, people create and enrich meaning, values and purpose around new ways possible social-ecological trajectories, empathize and take the perspective of others, integrate and synthesize multiple forms of knowledge. As discussed already in the Section on *Imagination* (page 12), it is important to understand imagination not as disembodied process, 'purely mental'. It is a way of thinking and feeling and hence spans between lived experience, the perceptual origins of sensing and conceptual ideas. For instance, a social-ecological systems lens used in **Paper I** and **II**, brings into light notions of interdependent change and tipping points. As shown in **Paper III**, artistic experiences can hold in creative tension multiple meanings, images and metaphors and provide 'new resources' for thinking, feeling and encountering the world. As a way of sensing, imagination is central to our encounters with the world.

In sum, I suggest that the *transformative imagination gives rise to fundamentally new ways of seeing, sensing, thinking and dreaming that creates the conditions and sensibilities for material interventions to respond, anticipate and shape fundamental change towards sustainability*. Transformative imagination is about joining with the currents of the world and attuning human perceptions for the reconsideration of assumptions and frameworks of action that societies



take for granted. It is the ability to both be close in attention to the actual world, while nurturing the reach of the imagination of the possible and desirable. It is not only about re-imagining ‘systems’ but progressively changing how one looks at systems (O’Brien et al. 2013).

In widening and deepening insights into the present conditions by their adjacent possible, transformative imagination is about opening up novel possible social-ecological trajectories. Its primary power is not of creating mental representations of the future ahead of their material enactment, but rather it is the generative impulse of life towards new ways of being in the world (Ingold 2015). Imagination is tied to our bodily experiences and can transform our experience of the world, enlarge our concepts and create new ways of making sense of the world (Johnson 2008). Importantly, transformative imagination is not anchored solely in the cognition of individuals but it is largely dependent on the organization of society and culture (Mangabeira 2014, 109). How culture and society are organized (and their histories) propel or constrain the workings of the imagination.

In that, it blurs dualities such as mind-body, or individual-collective and offers novel ways of ‘reconnecting to the biosphere’ that pays attention to both the cognitive aspects and the material engagements with the world (Folke et al. 2011; Cooke et al. 2016).

### **Future research**

Research on transformative imagination speaks to several areas of sustainability science. First, it may be a way to conduct research related to ‘mindshifts’ and cognitive lock-ins, an area that has been mentioned by several academics but is largely unexplored yet (Scheffer and Westley 2007). Research on transformative imagination may help understanding process through which mind-sets change and evolve.

There are important next questions to understand how the transformative imagination is expressed, what are its features, how it relates to crisis, and to agency in different opportunity contexts (Westley et al. 2013).

The transformative imagination may be a notion where the emerging interest in arts and science initiatives for sustainability (Scheffer et al. 2015) can find ground for fruitful collaborations where scientists and artists can contribute with crucial insights and share practices. There is plenty of space to creatively expand and develop practices that can help study and foster the transformative imagination. Inventive and hybrid methods drawing from natural and social sciences and humanities are promising ways forward. For

instance taking further the combination of q-method and visual dialogue explored in **Paper III**, or others involving craft and dialogue (Wertheim and Wertheim 2015).

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This thesis drew together imagination, transformations and participatory practices. In that it has yielded a space of interplay between various modes of practice, including scientific, artistic and institutional. The novelty lies both in development of new angles of research on conventional participatory practices and in development of novel approaches within the emerging field of arts and sustainability. The analysis of participatory spaces presented in the research papers serves the purpose of improving understanding and supporting further development of practices that can engage and foster the transformative imagination. This research is a step toward understanding how human imagination – in its full embodied sense – can provide an alternative route for understanding and fostering transformations beyond crisis as catalyst.

Re-imagining the world towards sustainability is not a project only for scholars and visionaries, but can be within the reach of citizens – and transdisciplinary initiatives can facilitate that. In taking a participatory approach, as opposed to seeing people as undifferentiated receivers of “global change”, this kind of research affirms human agency and one’s ability to shape their own lives in the context of environmental change. Imagination is always situated, but not bounded to, the dynamics of a specific system. Like many other study objects pertaining to the Anthropocene trajectories, imagination is not only individual and not only collective. It is not only local and not only global, but both at the same time. In developing art-based approaches to work with transformative imagination, this thesis has contributed to the development of novel tools to grapple with the difficult objects of study that characterize our current world.

If the Anthropocene trajectory is in human hands and hearts, this research is a step towards forging new kinds of reflexive, imaginative, deliberative and open practices that can support the emergence of local arrangements of a sustainable world where life can carry on.

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## AFTERWORD

Global change scientists have called for an “upscaling” in the engagement with arts and humanities. One place to start is to open up wide conceptual spaces that can embrace the richness of experiences and practices from these fields of human endeavour. Failing to do so, there is a risk of circling around the familiar and perhaps defeating the original purpose of opening up new ways of conducting research. The notion of the transformative imagination may be a step towards a space where artistic practice and scientific practice can meet and productively collaborate in studying the possibilities of life in the Anthropocene.

Pushing the kayak for the first time into the water leads me inevitably to a submission: to the work put into its making and to the elements of the sea. For people inhabiting landscapes all over the world, transformations will involve moving into new ways of living and relating to the world. Like in any other transition in human life, choosing a new of being poses a major challenge: we cannot really know what that future will be like at its basic experiential level. Because of this fundamental uncertainty, we cannot take an informed decision as the model of rationality would expect – i.e. by comparing and weighting multiple possible alternatives. The transformative imagination embraces this fundamental not-knowing. It sinks us into the reality to better grasp it and how it can be transformed. The transformative imagination propels and sustains us into the next step with curiosity and openness, so that we may learn what comes next. Although we can’t see where we’ll land, we are filled in anticipation, for the worlds that are yet to be made.

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