Eco-art for a transformative climate culture

by

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Declaration

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

(Signature of candidate)

26th day of October 2022 at Johannesburg

ABSTRACT

Human"'development" since the industrial revolution has unequivocally attributed to a code red of climate disasters, according to the recent IPCC Sixth Assessment Report of the Intergovernmental Panel on Climate Change report (IPCC, 2022a). To selectively unlearn or de-grow the unsustainable industrial culture crisis, humanity needs seriously to consider and act to transform (e.g., through eco-citizenship) in support of governments, scientists, and other civic actions in our journey to sustainable futures. Using a transdisciplinary praxis approach, artists can provide various forms of transformative possibilities, including transgressive interventions at a grassroots level, deliberately designed to provoke and inspire change. This research interrogates how eco-art deeply engages audiences to identify the key characteristics of such potentially radically transformative artworks.

Humans have a narrowing window to transform our relationship to the Earth's resources and reverse or slow temperature rise. The 'near term' (2022 – 2030) will determine and define the extent of various climate transformation pathways (IPCC, 2022, p. 7). Relational eco-art creates spaces for meaningful dialogue to design opportunities for transcendence to ecological citizenship. Art also holds a potential revolutionary connection tool that can unite science and society in incidences of immersion and change to spur further creations and change. These works, which visually articulate diverse types of knowledge, are described in the literature as situated in the fecund middle, a hidden third zone in which components are rhizomatically connected. Here I use fecundity to refer to intellectual productivity.

The study aimed to establish which characteristics in eco-art can contribute significantly more to sustainable eco-cultural development and what form and opportunities such transformative interventions manifest. The ways in which artists position their work to contribute to cultural climate change adaptation is interrogated in transdisciplinary *praxis.* In doing so, I interrogate previously published work of a select group of artists. This is not an inquiry into the methodology of transdisciplinary research, but, drawing on the artists' praxis, I argue and expand on how the value of collaboration of scholars and artists working in these liminal spaces can reach new audiences.

Two datasets are interrogated to analyse the approaches in art related to the environment, one eco-art characteristic derived from the author's public art praxis, and the second, a broader interrogation of 50 international eco-artworks. By comparing and contrasting the two datasets, characteristics of intentionality, often built into the artworks, were identified. Six key characteristics were isolated, described and further interrogated to discover how they may create opportunities for society to build and foster potential cultural climate change solutions.

Dedication

This study is dedicated to my wife, Reney Warrington-Coetzee my rock, my sanity, and my greatest critic.

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Thank you to all the artists whose work I interrogated; I hope to meet you in person one day.

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Glossary of terms frequently used

Adaptation

Different definitions for human and natural systems' adaptations currently exist (IPCC, 2022a). Human adaptation refers to the process of adjustment to moderate harm or to find opportunities advantageous for humans whereas natural systems adapt to actual climate and its effects (IPCC, 2022a). In this study, I define humans as part of the natural system and through this connection, we should learn how nature adapts. Therefore, my work is transformation focussed and not an adaptation focus. We need fundamental systems change.

Culture

Human culture in this dissertation is defined in a climate change context. By culture I mean it refers to the social behaviour of groups of people, their ideas of the world and values, customs and world views passed down from generation to generation. As a young adult, I started unlearning the culture I was brought up in because conservative Afrikaners, who were the architects of apartheid, were the evil that damaged our country's people. During this unlearning process, I started re-learning how to unlearn and I am now applying these unlearning skills to another humanity evil namely, climate change. Humanity and collective and individual cultures need to adapt to a warming world. How does one do this? Currently, science is often disconnected from culture. Eco-art can be a unifier if shared cultural adaptation strategies are applied. Culture in this study therefore specifically refers to the visual arts, as a necessary condition for meeting the aims of sustainable development of people (Soini and Birkeland, 2014).

Eco-art

Eco-art, short for ecological art, is described as experimental, exploratory inquiries that 'test the limits of art's tolerance for change' (Weintraub, 2012, p. 5). Eco-art is often indistinguishable from researching, gardening, farming, engineering or other activities because it engages the human spirit in pursuit of a sustainable planet (Weintraub, 2012). There is no elusive power to art. Artists offer modest efforts to seek social and political change through their role as passive commentators or enquiring researchers and as visionary innovators or active interventionists (Brown, 2014). Eco-art's ideas are defined by the work's material, the interconnections between the work and its context; it emphasises actions over objects and its eco-centric theme guides decisions regarding the resources and waste produced in making the artwork (Weintraub, 2012). Eco-art is not communicating science to assembled public (Born and Barry, 2010) but acts as a middle space filled with interpellation, an internalisation process of *how* culture can be more environmentally friendly.

Eco-cultural

Eco-cultural in urban infrastructure development is defined as a cultural change toward strengthening local networks, in other words, a strengthening of specific cultures. Eco-cultural innovation contributes to the 'resilience of a city (the "eco") or a place which implies contributing to multilevel governance, greener urban forms, infrastructure and technologies, innovativeness and inclusion of the economy as, well as contributing to human connectedness and capacity of self-reliance (Dieleman, 2013).

Eco-social

Eco-social artists aim to live well with nature (Fitzgerald, 2018). Eco-socialists provide contours of eco-modernisation with visions of post-capitalist futures. Eco-socialist industrial strategies can include nature-based solutions (NBS), where the invention is not detrimental to nature but sustainable from an ecological perspective. Climate science informs us that there is no going back, we have transformed the planet too much to recover, and now we need new creative ecologies and opportunities to flourish (White et al., 2017). This study interrogates how eco-artists can help untie communities from fossil fuel-dependent industries to eco-activists, scientists, governments, and civic society.

Mitigation

Mitigation, in the most recent IPCC (2022a) report, refers to how resilience is implemented, along with adaptation measures.

Public art

In this study, art in a public space is defined as publicly accessible and most often free of charge. Public exhibitions and artworks with restricted access or where an entrance fee is charged exclude our non-art-going audiences and are not defined as public art in this study. Public art in Johannesburg must be vandal proof and made of materials of little value for upcycling. Public art is often consumed by the city soon after it is made, so its purpose might be short-lived. When I started the study, I separated the characteristics public/private and outdoors/indoors but because of this definition, public also means outdoors and not freely accessible, which might apply in many developed world cities.

Transcend

Transdisciplinary research brings disciplines together to transcend their constructed limitations and is usually inquiry-based rather than discipline-based (Tempelhoff, 2013). Transdisciplinarity enables transcendence between academic disciplines and between science and society (Bernstein, 2015; Athayde et al., 2017). It does not mean ignoring the prevailing context, conditions, contradictions, and grievances, nor does it mean to accommodate the status quo but going beyond the usual conceptual understanding.

Transdisciplinary research and praxis

Transdisciplinarity is disciplines combined, making new things (Rosenfield, 1992) with praxis. Transdisciplinary research *and* praxis transcend siloed disciplinary approaches and have developed in an attempt to practice complex science approaches and methods that are not overly constrained by specialisation (Bernstein, 2015). Transdisciplinarity is a relatively new way of critical reflexive inquiry (Rosenfield, 1992; Russell et al., 2015). In this study, art and the humanities not only support the role that ecological science can play in transformation (Pigott, 2020) but extends and deepens this science by enabling a disciplinary and wider mix of knowledges to create a potential, rigorous platform for radical transformation through the engagement of real-world problems (Brown, 2014; Fazey et al., 2018).

Transformation

'Transformation refers to a change in the fundamental attributes of change required in human and natural systems' (IPCC, 2022a, p.6).

Transgress

'Transgressive refers to actions that involve a violation of moral or social boundaries, and they include a disruptive element that recognizes the many ways that most contemporary systems' (Vogel and O'Brien, 2021, p. 3).

List of Acronyms

GEC	Global Environmental Change Sciences
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystems Services
IPCC	Intergovernmental Panel on Climate Change
SDGs	Sustainability Development Goal

CHAPTER 1: The mess we are in

1.1 Code red

The IPCC (2022a, p. 36) assessment report prioritises transformation of human societies, not only focusing on the scientific findings, as was mainly the case in previous assessments. 'Near term' risk reduction, code red, is emphasised as an utmost priority for human culture, recognising the interdependence of natural, social, and ecological knowledge integration. The possibility of people's adaptation successfully addressing climate change (Doria et al., 2009) is now becoming a central component of the broader climate change discourse (CAS Summit, 2021) in all sectors of humanity. Humans have disrupted the connection with the natural world, and we need to restore this relationship urgently.

These challenges cannot be addressed by scientists alone because of the political, economic and social ramifications of the measures of adaptation (Saltelli and Funtowicz, 2017). Adaptation of people to climate change is defined as ecologic, social or economic systems adjustments, a technical challenge requiring expertise in practise, process and structure (O'Brien, 2012). Humans are, however, often not treated as an intimate part of the natural system. In this research, I focused more fully on potential transformative change supporting systemic change that treats people as an intimate part of the natural system. Adaptation challenges can address climate change effectively and feasibly but not with the urgency of transforming systems. Lessons from precautionary large-scale geo-engineering experiments (Steffen et al., 2011; Bai et al., 2016) need to be complemented with an increasing focus on a broader and more diverse range of knowledge forms (IPCC 2022a), including those offered by the arts and humanities (Fazey et al., 2018).

Deeply engaged, transgressive artists and activist-researchers have the potential to expand academic diligence that can offer political rigour (Temper et al., 2019). Such practitioners are described as relational artists or activist-researchers who develop ecological citizenship through connective aesthetics, which shifts away from artists' mythical status as autonomous individuals (Gablik, 1992).

In this dissertation, I add value to various belief systems and norms about how people *see their world*, by using an arts-based approach. I read the latest Intergovernmental Panel on Climate Change (IPCC) report (IPCC, 2022a) reflexively at the end of this study and found it emergent, with many opportunities where this study's findings can help the transition to greener futures.

As indicated in Figure 1.1, a visual summary of the cultural adaptation strategy I propose in this study, various approaches all acting in synergy and "movement" can enable action on our various pathways to enhance adaption and transformation to climate change (Doria et al., 2009; Nixon, 2011; Pröpper,

2017; O'Brien, 2020). Transdisciplinary[1] (combining disciplines to make new things) praxis art-based cases, that attempt to address "wicked" challenges such as climate change, all provide examples to illustrate how different types of knowledge systems already exist through practice and can be developed to enhance theory. Healthier futures, it is argued, can be designed through mindful artistic interventions (Warrington-Coetzee, 2021). The world changes when our perspective on the world evolves through pedagogical processes (Nicolescu, 2014). Relational eco-artists do not make objects to be noticed as commercial artists do, rather we use art as an instrument of developing consciousness (Mcgarry, 2013).

Figure 1.1: Transdisciplinarity – At the bottom of this drawing, I show the heavy burden humans carry with different disciplines (from left to right – mathematics, other types of knowledge, music, linguistics, and nature etc.) independently trying to design transformative interventions. My suggestion with this study is to form transdisciplinary inquiries combining disciplines to build new "creatures", to effectively, rapidly and in a more streamlined way build new futures that can transform systems. (Image by the author – © Hannelie Warrington-Coetzee)

As a practicing artist and a mature student undertaking a Master of Science, I share my lived experience in arts-based praxis as another type of knowledge. I embody this approach in my daily work. The artworks I have made in the past decade that relate to the literature demonstrate how I learn through

[1] More detailed definitions of terms specific to this study and how I understand and apply it are hyperlinked when they first appear in the text and elaborated upon in the glossary on page 10.

"making" various artworks. The making provides space for pro-active thinking, and in the process, contemporary conceptual artworks are made that, like written texts, can safely "hold", carry and project this knowledge. I will weave these examples into the text that follows, in addition to presenting artworks made by peers, to examine how the challenges of climate change and potential action can be augmented by art in praxis.

Such expressions of art-based praxis and transdisciplinary theory are not easy to undertake and implement. The process of praxis and design takes time, sometimes years, to learn and know something from doing it. Transgressive disruptive action (Vogel and O'Brien, 2021), through transdisciplinary learning in praxis, is also required for significant sustainable transformations to emerge (Lotz-Sisitka et al., 2016). Climate action is more urgent now than in the previous assessment. (IPCC 2022a; 2022b). I also argue that contemporary eco-art, produced transversely, innovatively, and effectively can take the form of new knowledge rooted in complexity. Using a conceptual interpretive framework, I build an argument of how eco-arts can strategically and comprehensively contribute to addressing "wicked problems" such as climate change in ways that serve humanity (Davis et al., 2015; Hawkins et al., 2015; Pigott, 2020).

The **first chapter** explores literature dealing with eco-cultural adaptation strategies (Soini and Birkeland, 2014) that can help people address "wicked" challenges through active experimentation. Much research has been done to describe transformation. I contextualise the transformation literature to show how artists build agency and create opportunities for new audiences to participate and, in so doing, learn to live more sustainable lives.

The research aimed to identify and analyse the key characteristics used by climate change-focused eco-artists in their praxis. One key question that is probed to attain the aim, and an overall focus of this work, was: What shapes potential transformative opportunities embedded in such eco-art interventions? Specific questions explored include:

Question 1.

What are the key characteristics climate change-focused eco-artists use in their praxis?

Question 2:

What form does the transformative opportunity in such interventions manifest as?

Chapter 1 situates transdisciplinarity as a complex problem-solving approach from an eco-cultural adaptation perspective, both in sustainability research and in praxis. This study interrogates how artists'

transdisciplinary praxis works; it does not interrogate the methodology of transdisciplinary research. The introductory sections contextualise the scope, limitations, and gaps in the field.

In **Chapter 2,** I use two theories, Deleuze and Guattari's Rhizome Theory (1980) and Nicolescu's Hidden Third Theory (Nicolescu, 1985, 2014) to investigate the fecund space between disciplines that enables the design of a conceptual interpretive framework to anchor this transdisciplinary research in praxis. I focus on the idea of the ripe middle ground's interconnections between humans and non-humans alike (Deleuze and Guattari, 1980). Section 2.3 expands on this space by deepening the assessment to examine transdisciplinarity's transgressive potential, as can be used to deliberately design radical transformative opportunities to transition to a sustainable future (Section 2.4). In Section 2.5, the building of agency is examined; this is followed by examples of active experimentation to test new ideas in Section 2.6.

Using a mixed-methods approach, I present 50 eco-artworks with two data streams, one qualitative and one quantitative in **Chapter 3**. I describe how I compared and contrasted these datasets in a phased approach, including a pilot round (Phase 1). In Phase 2, these data streams were further interrogated to enable me to move towards an interim synthesis. Phase 3 was the final interrogation of the eco-art characteristics, which enabled me to compare and contrast the findings against the overarching research aim. The process is illustrated in detail in Appendix A.

In **Chapter 4,** the results of the research aim are presented to answer, address and ground the research questions. In **Chapter 5,** the findings are contextualised and compared to the conceptual framework presented in **Chapter 2** and are synthesised with eco-art examples in praxis. In **Chapter 6**, the conclusions and implications of the study are articulated.

With this broad overview of the research, attention now turns to describing climate change as a complex, "wicked" challenge (Section 1.2), which is impossible to solve in the traditional disciplinary sense. In Section 1.3, the contribution of eco-cultural roles is presented as examples of ways to understand better this urgent dilemma that humanity has caused. The scope of the study is detailed in Section 1.4, followed by the limitations and gaps of this field.

1.2 Wicked challenges

Problems are referred to as "wicked" because they defy easy solutions; their solutions are open-ended because the problems are broad and complex, they are also intersectoral, and there may not be a consensus regarding appropriate responses to them (Rittel and Webber, 1973; Roberts, 2000). The complex problems we urgently need to address cannot be solved using existing modes of inquiry. We need additional creative solutions that rely on meaningful engagement with people to address complex "wicked" problems such as poverty, inequality, food insecurity, war, genocide, how to live sustainably,

and problems of climate change (McGregor, 2014; Bernstein, 2015). “Climate change invites humanity to play god with time” (Jasanoff, 2010, p. 241).

Climate change is so complex that it often feels distant, intangible, and removed from people. It usually takes 17 years of data to detect a warming trend, which often cannot be felt in real-time (Lewandowsky and Whitmarsh, 2018). Climate change is often only observable when a “natural” disaster strikes and is often confused with the precarity of weather. Often it is too late to take preventative or constructive action to address the risks and impacts associated with such events. The public’s lack of engagement is exacerbated by how the media reports on disasters, record-breaking droughts, and floods. One resolution for this conundrum lies in emotionally engaging with helping people to “see” the dimensions of the challenge by creating immersive educational moments for people about the warming world; opportunities are created for people to appreciate the problem, participate at a grassroots level with preventative measures (Lewandowsky and Whitmarsh, 2018) and develop their creative response to specific challenges.

Grassroots changes in attitudes and behaviours can shift pressure on local ecologies and support long-term systems changes. In this research, given these challenges, eco-art’s radical persuasive qualities are interrogated, as an intended and deliberative strategy to help shift unsustainable habits. In the sections that follow, the rationale for adopting an eco-cultural approach is explained. I argue that such an approach is an authentic “hook” that, through engaging with different publics (their world views, values, and beliefs), is necessary to guide effective transformations to address the climate change challenge.

1.3 Eco-cultural adaptation

No concrete or currently measurable link to art interventions to address the climate change problem is readily available nor published. In this and subsequent chapters, I examine how art might contribute to eco-cultural awareness and possible adaptation and discuss the opportunities art interventions can bring to transformation strategies. Science research is required to reveal and explain environmental controversies, but the inaccessibility of such information can often lead to global facts being detached from local value (Jasanoff, 2010). Art, on the other hand, motivates people; it mobilises, explains, contextualises and can break down multiple types of knowledge (Watts, 2014; Marks et al., 2016; Pröpper, 2017). In this study, I interrogate the characteristics used to build such artworks. Allied to such investigations is the ever-pressing sustainable development challenges of our time.

Sustainable development consists of four pillars: ecological, economic, social, and cultural. Culture, is anthropologically defined as a combination of “values, beliefs, symbols, practices and rationalities that organize a worldview in a society” (Kagan, 2013, p. 95). Culture in this research refers to material and creative processes (linked to art and art praxis) within given societies (or cultures) which would include art. Art is often not systematically included in current discourse about climate change adaptation.

Alternatively, artefacts of culture have been subsumed with the social pillar, and culture as a local connector has often been under-emphasised in research. In this study, I sought to redress this and argue for the value of creative processes and products that can contribute to the development of actions that will enable transition to build a sustainable climate culture (Soini and Birkeland, 2014).

Culture, as a fourth pillar, is organised around 'seven storylines: heritage, vitality, economic viability, diversity, locality, eco-cultural resilience, and eco-cultural civilization' (Soini and Birkeland, 2014, p. 213). This fourth pillar was developed by policymakers to 'distinguish the meaning of cultural sustainability from social sustainability', but the differences between these have not been thoroughly explored (Soini and Birkeland, 2014). The connections between cultural and social sustainability, as will be shown in this research, can be blended and co-mingled to create a stronger and catalysing creative space for greater engagement and potential transformative change.

An eco-cultural approach is defined here as that being used by ecologically minded human beings: building a climate-sensitive culture. The method I use in Chapter 3 aimed to identify like-minded eco-culturally orientated artists making eco-art. Art practitioners understand that art can contribute to and intersect with climate change research and provide cultural relevance (Howden- and Cunnane, 2015).

This emergent space, where science and society can intersect through art, further helps to contextualise the complex information alluded to above to build a diverse climate culture. Art that reaches out to people who are ecologically minded, or art that builds awareness of this, can be presented as radically divergent public experiments (Section 2.6, Born and Barry, 2010). The central theme in this research is that eco-art does not simply 'communicate science to assembled publics' (Born and Barry, 2010). Rather, ***eco-art is an interpellation that may enable people to become more environmentally attuned***.

In this research, the localised interventions of various artists are carefully examined and interrogated with the aim of beginning to assemble a deeper understanding of some of the main characteristics and features of effective eco-based art. This can then be re-assembled and re-defined to develop cultural sustainability by understanding and re-learning the role of eco-art's potential functionality. Over the past decade, the focus has shifted from 'if we should adapt (O'Brien, 2012) to how we could transform (Fazey et al., 2018; Vogel and O'Brien, 2021). In particular, the Covid-19 pandemic forced us to reconsider our relation to nature. The pandemic can arguably be seen as a gateway between our old ways of doing business as usual, to incremental tweaks in processes and activities, to more radical and transformative ways of 'living in harmony with nature'.[2] We learnt how quickly we could adapt in the face of a frightening pandemic when specific changes were mandated. The 'great pause'[3] created by the pandemic made

[2]'The pandemic is a portal', an article on what the world should do next, by novelist Arundhati Roy in the Financial Times, 3 April 2020 https://www.ft.com/content/10d8f5e8-74eb-11ea-95fe-fcd274e920ca

[3] The term surfaced through multiple social media platforms to describe the lull created by the pandemic; see related articles here https://weall.org/the-great-pause and https://www.behance.net/gallery/97467001/Recording-the-Great-Pause-Social-Media-Campaign (accessed 12 January 2022)

space for nature to be reimagined and appreciated in our cities and allowed people to quantify our impact on nature (Rutz et al., 2020) whilst reconsidering our priorities as we move forward. The pandemic also prompted us to take better care of each other, our communities, and our surroundings. Covid-19 is arguably an analogy to the ongoing climate crisis (Gössling et al., 2020). Biodiversity benefited in certain areas from reduced human activity, resulting in cleaner air and water, and wildlife reclaimed contested habitats (Corlett et al., 2020). Nature, including natural species, indeed "bounced back" in some parts of the world during the anthropause (Rutz et al., 2020).

How can we now build on a growing sense of awareness among societies that Covid-19 and other current climate change stresses are highlighting about the possibility of change, ensuring overall human and environmental wellbeing? Science and technology alone need not be the only resources to be used for change; science and technology combined with an eco-cultural shift have a better chance to achieve sustainability. Other ways of knowing and taking care can improve the social reach of the work of established sustainability theorists (van Meer, 2016). Lay knowledge, indigenous knowledge, multi-perspective knowledge and knowledge derived from an open-ended learning curve with human and non-human interconnections (Latour, 2017) can help to bring about wide insight (McGregor, 2015) to knowledge embedded in the everyday (Pigott, 2020; Zidny et al., 2021). In this dissertation, I argue that eco-cultural art-based work can add to this plurality of knowledge and approaches by presenting praxis' characteristics as used by various eco-artists. These knowledges and approaches inform various artworks, including my own (Chapter 3). With this as background, I now shift to describe the scope of the study.

1.4 Scope of the study

In 2018, forty environmental researchers, many of them focusing on climate change adaptation, from various institutions around the globe, set out to describe the 'ten essentials for action-orientated and second-order transformation and climate research'. The reason for the activity was to contribute to the shift from identifying problems for research questions to facilitating transformative changes (Fazey et al., 2018, p.1). The ten essentials are described as a second-order science, which aims to move science to action and implementation. The approach extends beyond theorising about "wicked" challenges and problems. Building on such an action-based approach, I use my own praxis-based artworks, and those of others, to investigate cultural transformation to climate change. As a transdisciplinary artist who uses environmental science in public art, there is a strong parallel between theoretical research and the characteristics in praxis, as set out in Figure 1.2.

Figure 1.2: Ten essentials for second-order transformation research (Fazey et al., 2018, p. 60).

The essentials identified by Fazey, and colleagues (2018) align strongly with my art-based praxis. These include the focus on transformation (no.1) and solutions-orientated approaches (no.2) including practical knowledge (no.3), and transcendental current thinking (no. 6), wearing multiple hats or having many collaborators (no.7) and creating reflexive (no.10) spaces. Using these essentials, the difference between research and art, for me is that as an artist, my output is an artwork or intervention. In research, the output would have been a written paper that talks about output without necessarily implementing actions directly in society (experiments and lab work might not benefit society if it was not rolled out into society). This places those who work with these ten essentials in an ideal position to practice second-order transformation, to let it roll out or into society as it happens. Transdisciplinarity and deliberate eco-based art praxis, moreover, could be used to optimise time, given that climate change is upon us.

With these essentials for transformation research, I take a critical look at art-based praxis' opportunity in building sustainable futures. As a mid-career artist, I learn constantly from the artworks I make. Artists consistently reinvent themselves to hone their work, understanding subjects and the world better. Praxis

reflects this commitment, to make things better every time. Intended outcomes are key in such applied research.

My art praxis can be defined as practice-led research (no. 3, Figure 1.2). Practice-led research is 'bursting at the seams' (Hope, 2016, p. 74). In the arts, this prolific other kind of knowledge is described as 'research-creation' (Manning, 2016, p.133), where the act of practice itself becomes the research. Artists always look for more opportunities to make sense (Warrington-Coetzee, 2021) and find purpose by embracing the non-linguistic (Manning, 2016). Artists in the academy validate practising rigorous resolutions (Hope, 2016). Critical artists' act of making is a thinking in itself, constituting new processes with new values, articulated visually (Manning, 2016).

The enquiry in this context is about thinking through making artwork (Hope, 2016, citing Ingold, 2013). In practice-led research or research-creation, 'the emphasis is more towards developing the practice rather than the epistemic knowledge about that practice' (Fazey et al., 2018, p. 62). Thinking is then embedded in the artefact or intervention that is made. Artist Simon Starling, for example, describes his art practice as a 'physical manifestation of a thought process' (Brown, 2014, p.192). Research creation is thus not lacking in the arts (Fazey et al., 2018). Questions that arise from such approaches include: Can we develop applied sustainability science to make science as we make art, radically transformative? and Do we have a choice (O'Brien, 2012, p. 668)? These questions emerge as sub-questions to the central question posed: ***What form does the transformative opportunity in such interventions manifest as?***

1.5 Limitations

Preparing interventions for eco-cultural sustainability is complex because of the extra care needed in culturally specific contexts. Site-specific responses are an artistic approach similar to place-based research (de Vos et al., 2019), where the site where the intervention will be realised is intentionally considered. This causes limitations in broad transformation design, as each intervention needs to be tweaked to be site responsive. Site-sensitive public artists are well situated to tweak adaptation strategies, which makes sense from a grassroots perspective. These artists and transformation practitioners are described as relational interventionists, such as the social-ecological systems framework practitioners who aim to understand connections between social and environmental interactions (de Vos et al., 2019). The study presented here is thus very specifically pointing out the ripe opportunity for environmental science and art in society to address complex problems in context-specific and sensitive ways, but that needs to be tweaked in local contexts.

This research is limited and does not provide a comprehensive summary of resilience – defined as a system's ability to cope with disturbance arguably to maintain essential function) (IPCC, 2022a) but also transforming constantly (Folke *et al.*, 2016), broadscale mitigation and adaptation measures in climate science. These approaches, in several cases, do not always create a sense of urgency that radical

transformation, such as eco-art interventions, can offer (O'Brien, 2012) and are thus not the focus of this study. In this dissertation, I am concerned with current responses that can be leveraged for future sustainability actions. Transdisciplinarity, as elaborated in the next chapter, utilises pluralistic knowledge inquiries at the outset (Tempelhoff, 2013). Pluralism, including using different fields such as the arts and collaboration (Brand and Jax, 2007), are brought together to address complex problems such as the impacts of climate change (Olsson et al., 2015, Pigott, 2020, p. 202). Working with such opposites takes time and patience to synergise amongst disciplines; this, in turn, requires trust between collaborators.

1.6 Gaps and disconnection in current science – action

Earth science research is mainly required to reveal and explain environmental controversies, and in this context, global facts are often detached from local value, creating '*the* pressing problem for humanity in our era' (Jasanoff, 2010, p. 235). Over the past three decades, international global environmental change (GEC) science has been arranged around existing academic disciplines and current societal norms of economics, development, and progress, largely as articulated by the global north. Some of the international frameworks that direct GEC science include Intergovernmental Science-Policy Platform on Biodiversity and Ecosystems Services (IPBES), IPCC and Sendai Frameworks.[4] Creative disciplines are rarely (if ever) featured in these frameworks.

Increasingly there has been a move from science agendas to those closely coupled with action research agendas. Scientists, policymakers, and activists have therefore developed several protocols and spurred action in environmental awareness over recent decades through active media campaigns to achieve global consensus on development priorities and agree on shared environmental values. This represents a remarkable achievement by the United Nations. The 17 Sustainable Development Goals (SDGs) developed from these meetings provide substantive support and capacity building for all nations who participate.[5] The targeted participatory eco-arts approach presented in this research complements the work done in the sustainability sciences and offers a focussed approach to work with more artists as co-problem solvers. This research attempts to unify the fragmentation of knowledge (Figure 1.1) that ultimately compartmentalise humans into silos and reduces the very collective responses we need to live sustainably (Nicolescu, 2013).

Science research has also turned to more humanistic and systemic approaches, moving from a reductionist and often divisive approaches (e.g., between the biophysical and social sciences, between

[4] IPBES Framework https://www.ipbes.net/visited accessed on 5 May 2021 - The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is the intergovernmental body that assesses the state of biodiversity and of the ecosystem services it provides to society, in response to requests from decision-makers.
IPCC Framework https://www.ipcc.ch/ accessed on 4 May 2021 - The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.
SENDAI Framework https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030 accessed on 10 May 2021 - Working hand-in-hand with the 2030 Agenda, the Sendai Framework for Disaster Risk Reduction 2015-2030 is the roadmap for how we make our communities safer and more resilient to disasters.

[5] The United Nations SDGs https://sdgs.un.org/goals accessed 6 January 2022.

facts and values) to one that transcends dichotomies (Funtowicz and Ravetz, 1995). The climate crisis, because it is caused primarily by humans, is not only a technical crisis but is also a cultural crisis, a global emergency, and is well suited to be addressed through cultural interventions (Figueira et al., 2021). Using visual and arts derived materials to *only* communicate climate change – of starving polar bears or parched landscapes, for instance – can be counterproductive if only fear-inducing images are used (O'Neill and Nicholson-Cole, 2009). These visually communicated examples may not fully capture the multiple drivers shaping climate change, nor their intersectionalities, and are thus often inaccurate or limited scientific depictions of a warming world. **This research is therefore not positioned as science communication, with attention to translating science, but as a transdisciplinary, eco-art praxis effort highlighting the transformative potentiality of how other types of knowledge can serve humanity and Earth's sustainability**.

Expanding on the notions of transdisciplinarity and eco-art praxis, I elaborate in Chapter 5 on how targeted audiences are reached through cultural practitioners and elaborate on different forms of communication and outreach. With this introduction of existing climate change adaptation challenges and limitations, the literature reviewed in Chapter 2 describes what GEC and artists have done in praxis over the past decade to bridge the gap.

CHAPTER 2: Enabling transformative climate change actions

The complexity of “wicked” challenges needs creative solutions. The central argument presented here is that artists who want have a worthy purpose (Gablik, 2004) have found creative ways to reveal such hidden gems of grassroots solutions. Eco-cultural adaptation is not a technicality that can be corrected with notions of grandeur. Building sustainable futures needs people’s buy-in. Environmental sciences provide a solid basis for action, but arguably there needs to be more than imagining scenarios or building resilience and mitigation strategies to reach populations and governments. Eco-arts, as a radical transformation tool used with deliberate interventions (O’Brien, 2012), is well-positioned to reach new audiences.

This chapter unpacks and examines the various literatures used to inform this research. I examine climate change from a grassroots perspective, showing how multi-dimensional lenses (Sections 2.1 and 2.2) are needed for transformative change, including the spaces in between, where artists often find meaning (Sections 2.3 and 2.4). The literature explains the potential of such transgressions, transcending humanity with radical transformation to show how agency is built (Section 2.5) with active experimentation (Section 2.6).

Various theories and approaches related to this work’s transdisciplinary nature are also examined in this chapter. Two prolific theories describing the prolific “fecund space” (Figure 2.1) between internal and external worlds are reviewed in Sections 2.1 and 2.2 to situate the dynamic contribution cultural interventions can make to climate change transformation. The theory selected for this conceptual framework builds an argument about radical environmental transformation, arranged in a way that shows a possible pathway for practitioners. Transdisciplinary thinking as a strategy, explained with these two theories in mind, is discussed in Section 2.3, illustrating how transdisciplinarity can help to transcend disciplinary limitations. Section 2.4 describes radical transformation and the emergent qualities it fosters to build agency (Section 2.5). The ideas in the reviewed literature show how concerns can be combined to develop new active experimentation to design transformative opportunities for society (Section 2.6). This theoretical thread brings us to my approach to interrogating artworks with such qualities in the following chapters.

2.1 Hidden Third Theory

Working as a transdisciplinary researcher and practitioner requires diverse thinking, combining many streams of thought. The Hidden Third Theory is an educative process, a methodology for creating new knowledge basis in current complex plurality, which have various levels and dimensions (Bernstein, 2015). More specifically called Nicolescuian transdisciplinarity, it is a dynamic theory that aims to lubricate movement between internal and external worlds, as illustrated in Figure 2.1. Fecund spaces are kindled here where contradictions and opposite viewpoints can surface and may be unified, while preserving their difference (Nicolescu, 2013). Such an approach allows for the integration of new

knowledge, mediating science, and society on various levels, to create new potential because contradictions can be held for a moment, or in a specific intervention. An example of this juxtaposition is elaborated in the discussion (Chapter 5), with examples of what form this juxtaposition might take. This theory offers a method of abundant ways to make sense of complexities that are emergent and embodied (McGregor, 2015). The theory unifies knowledge (Nicolescu, 2013) as a new field of transdisciplinary practice of complex problem solving (Figure 3).

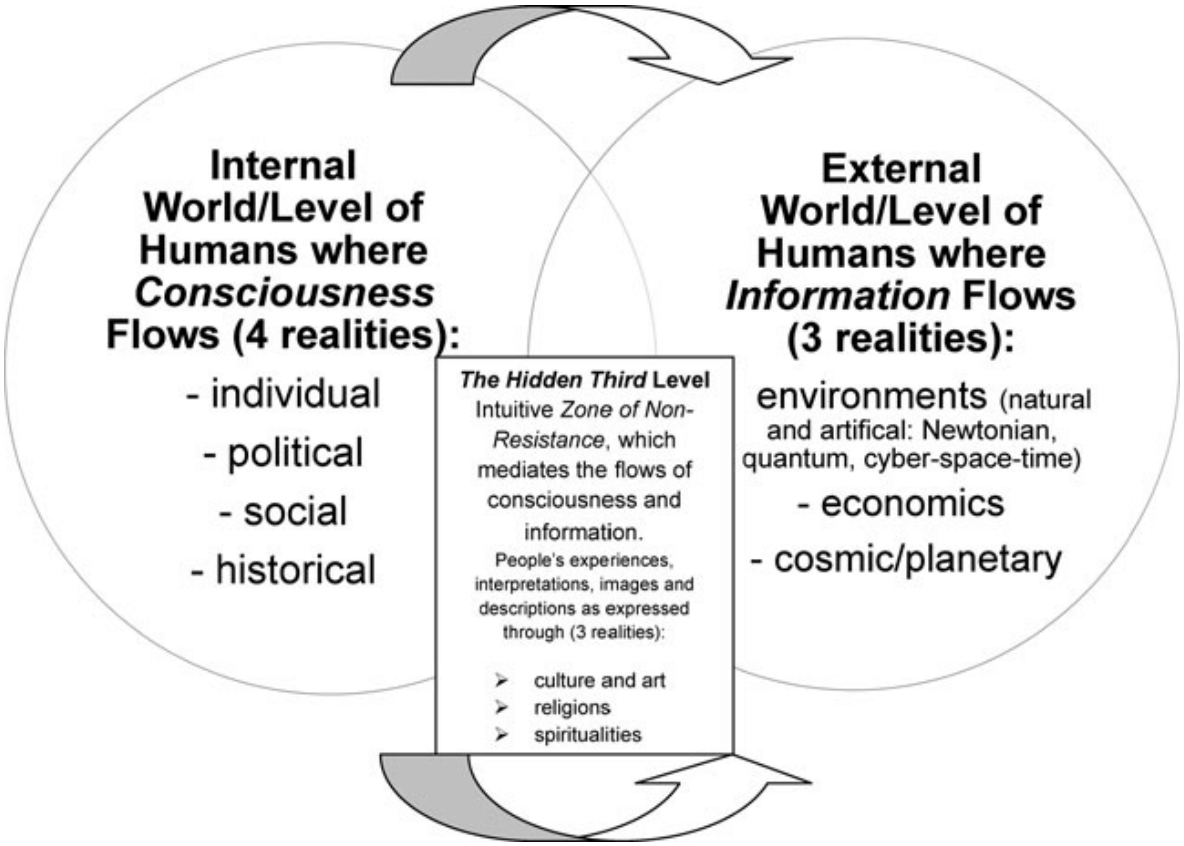

Figure 2.1: Hidden Third Theory creates space for a level of non-resistance, which mediates consciousness (political/social) and information (economics/planetary) (McGregor, 2014, p. 218).

The first level of the Hidden Third Theory is the transdisciplinary subject (internal realities or dimensions: individual, political, social, historical) where consciousness and perspective flow (Figure 2.1). In level two, on the right-hand side, information flows from other diverse types of knowledge, which together constitute the object (external realities: environment, economics and cosmic). Dynamic interactions between these realities are mediated in the hidden third level, a more intuitive third level shown in the central box between internal and external realities (McGregor, 2015, p. 15). This is where relational art can connect environmental science to society, for instance (Figure 1.1). I have elaborated the focus – bulging in the fecund middle – to reflect what is happening in praxis. In this third space, the subject and object are included, which defies the Aristotelian axiom where the middle was excluded (Bernstein, 2015). Complex "wicked" transdisciplinary problem-solving include the middle, the space between the disciplines.

Co-generating new transdisciplinary fields of practice can address complex problems collaboratively (McGregor, 2015). Creative practice, situated between the internal and external worlds (Figures 1.1 and 2.1), shows us how to take new knowledge on board that can help break through prejudice, apathy and blind spots (Pröpper, 2017). The artist's norm is to think outside the box, question the status quo, be strategically radical and stimulate revolutionary approaches to problems (Westley and Folke, 2018). 'Eco-artists are attuned to lead the revolution toward a sustainable future' (Weintraub, 2012, p. 4).

In exploring these notions, the concepts derived from biology can also be useful. The term ecotone, for example, is the biologists' term to describe the border zone between adjacent ecospheres of vegetation, where, for example, grassland and wetlands meet and interact or threaten each other (Nixon, 2011). These are transitional areas with different edge effects, which open up new possibilities, enabling different flora to grow in the middle (McGregor, 2014). Nicolescuian transdisciplinarity can thus be viewed as situated in the 'scholarly ecotone' (Nixon, 2011, p. 47) 'where solutions emerge in the fecund middle' (McGregor, 2015, p. 18). The consequence of a transdisciplinary approach, in such a scholarly ecotone zone, interacts in the middle whilst preserving the opposite disciplines' difference in a zone of non-resistance (Nicolescu, 2013, p. 13).[6]

2.2 Rhizome Theory

Expanding the notion of ecotones, "habitat" in ecotone zones have different dynamic flora combinations, with diversity in species. The same goes for bringing disciplines together, as proposed in Rhizome Theory, and how this creates different dynamics. Transdisciplinarity is similar to the notion of such edge "habitats" where various disciplines are combined, making new approaches and findings possible (Rosenfield, 1992), in Section 2.3. As an exercise to understand my transdisciplinary praxis, I started illustrating my network in 2019, systematically classifying my praxis (Figure 2.2[7]), matching developments with specific artworks that I had produced in the past decade. In this illustration, I identify the diverse interconnected people in my network whose engagement enabled the artworks that were made. This is illustrated on the enlarged right-hand side lens in ways that are reminiscent of how the natural world strategises in ecotone zones: finding new nuanced opportunities for growth.

[6] A seminal artwork working which works between such opposing ecological zones are artists pair, The Harrisons' Lagoon Cycle 1974-1984, which will be elaborated upon in Chapter 6. The Lagoon Cycle, in ecology is the place where salt and freshwater mix in a fragile and adventurous space as described by the artists. https://theharrisonstudio.net/the-lagoon-cycle-1974-1984-2 accessed 21 January 2022. Appendix A, characteristic #29 in the dataset.

[7] I started drawing the typology of my praxis 2019 (ongoing) to reshape my perception and to focus my attention. A typology is a systematic classification according to their common characteristics, which aligned completely at the outset of this study. An enlarged version of this detailed drawing can be viewed here: http://www.hanneliecoetzee.com/wp-content/uploads/2022/03/Topology-fin-2010-2020-ligter-vir-Msc-presentation.pdf

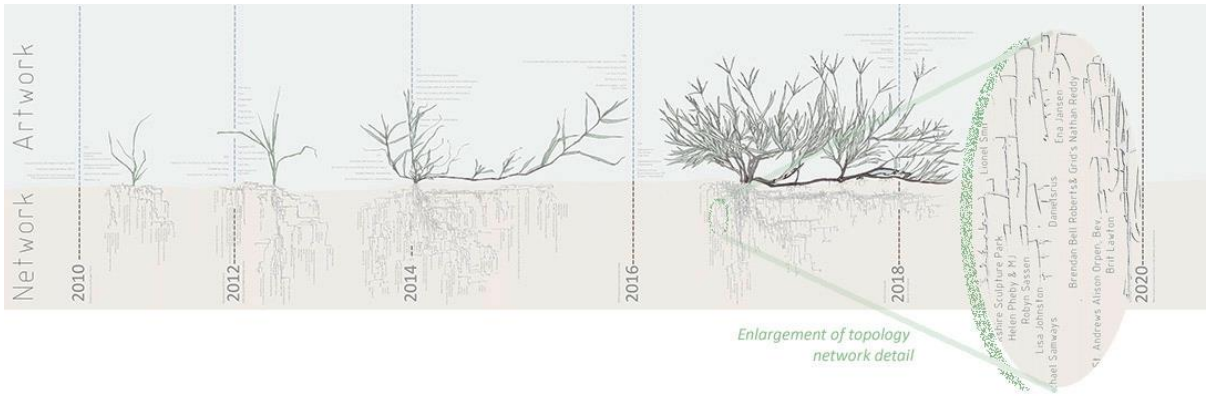

Figure 2.2: Typology of artworks (2019 to ongoing) drawn by the author. Note how the rhizomatic roots system of the Cynodon dactylon grass expands horizontally below the ground and resurfaces (2018) growing a strong matt of grass, which prevents erosion in nature. The full detail of the drawing can be seen here. (Image by the author – © Hannelie Warrington-Coetzee)

The architecture of *Cynodon dactylon* grass, as sketched in Figure 2.2, is a complex network of roots made up of the network beneath the ground "holding" the artworks above. Such rhizomatic grass can tolerate heavy grazing by growing root systems that offer a more palatable pasture later in winter (Van Oudtshoorn, 2014). When this indigenous African grass is heavily grazed, its growth strategy is different to when it is not grazed. Short grass maintains a dense rhizome system to prevent erosion, while non-grazed grass competes with other tall grasses, and so looks very different in the landscape (Archibald, S. *pers. comm,* 2020). The grass's strategies for survival have many parallels with the body of work I have produced in the past decade and thus provide an appropriate metaphor for my scope of work, work methodology and oeuvre. For instance, when an art project goes into a hiatus, the network communications become dormant too. During the "drought", the strategy of the grass is to adapt; likewise, as an artist, I transformed my art practice and individual works during the current pandemic whilst the world was on pause – regrouping, recuperating, grasping, grass-ping.

Rhizome Theory is also a key "theory" that brings together the biological notions of a complex ecosystem. The concept of Rhizome Theory is based on the botanical rhizome system, with its twisty, non-linear network rather than a linear structure, as illustrated in Figure 2.3. In this theory, an "image of thought" was developed by Gilles Deleuze and Félix Guattari in their work in *Capitalism and Schizophrenia* (1972–1980). The theory weaves biological terms into written language.

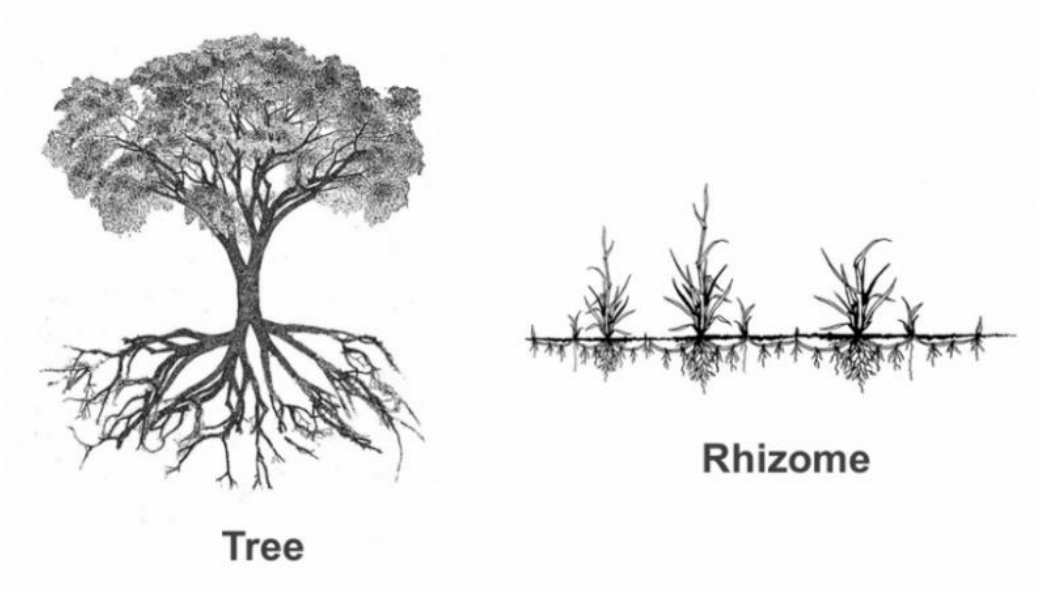

Figure 2.3: Rhizome root; a growth strategy operates with its subterranean interconnected root system (on the right-hand side) instead of an authoritarian trunk (left-hand side)[8].

Figure 2.3 shows the single hierarchy of the linear monologic root model and the rhizome root system, in which the growth strategy is radically decentralised. Here, other types of knowledge and belief statements appear whenever connections are made within the rhizome, producing rich, fecund, optimal opportunities for growth (Deleuze and Guattari, 1980) and de-growth.

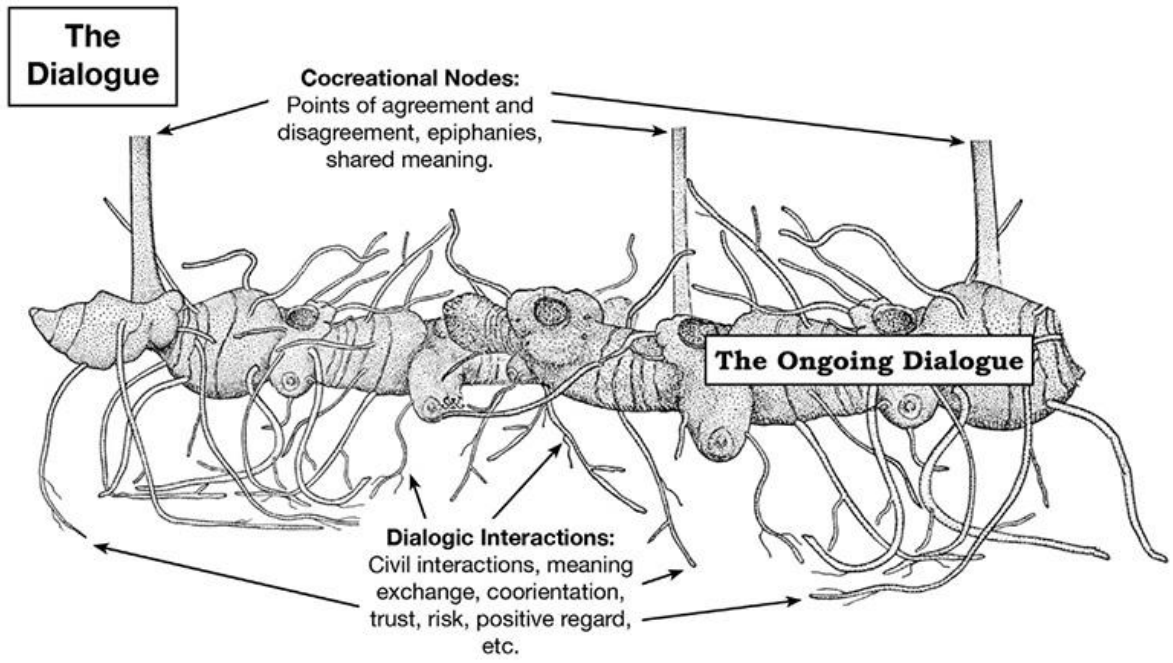

Figure 2.4: The dialogic rhizome model. (Kent and Lane, 2017, p. 7)

[8] Article by A. Lee, 12 October 2020, Section 2., para 9: "Understanding the work of Gilles Deleuze" Illustration accessed here https://medium.com/complexicated-assemblage/understanding-the-work-of-gilles-deleuze-ab51428f7006 on 1 May 2022

Instead of thinking of knowledge and creativity as dependent on transcendental truths and ideas, Deleuze claims that what is of interest is not of *extra-social origin* but that everything interesting happens 'in the middle' amid the chaos of the daily slog (Styhre and Sundgren, citing Deleuze, 2003, p. 430), notions echoing the "fecund middle" (McGregor, 2015). Rhizome Theory does not take for granted that creativity is not removed from daily life because of its ability to make connections. Creativity is stimulated 'between resources and events' (Styhre and Sundgren, 2003, p. 429). Relational artists are interested in bringing ideas to people, connecting with the world and leaving remnants of the thinking process in the world as artworks, as opposed to making art for art's sake (Gablik, 1992). Therefore relational, transdisciplinary eco-art in public space is well suited to help people adapt to climate change. These kinds of interventions are more about the conversation and the process than the object. If I produce art objects during this process it is a remnant of the conversation.

Ongoing dialogue introduced me to the work of botanist Ernst van Jaarsveld, who taught me about this growth strategy in February 2020, while I was undertaking a field trip for my WildWall Tiles. Succulent plants access water and nutrition in the most arid crevices; their resourcefulness hit home, figuratively and in praxis. Often when I make new work, the constraints help me find more creative solutions. I thrive when I must consider meaningful constraints like rock succulents finding immensely creative growth strategies in their architecture.

Co-creational nodes and interactions, as shown in Figure 2.4, also enable productive ongoing dialogue because the rhizome roots system has more growth points than a tap root (Kent and Lane, 2017, p. 7). It resonates strongly with the same lush place as Nicolescu in the Hidden Third Theory, identifies the middle, what others have termed getting to the 'heart' of radical transformation (Vogel and O'Brien, 2021, p.9). Artists find their stride during their careers, somewhere during an ongoing praxis.

Rhizome Theory's image turns the so-called knowledge-for-action tree upside down (Figure 2.4). Instead of focusing on authoritarian trunks (Kent and Lane, 2017), we look at the subterranean connections, which are unique and follow no specific pattern. This theory is adaptive, just as rhizome root systems grow. More deliberate transformation (O'Brien, 2012) includes experimentation and is an area where second-order science can grow rhizomatically, with non-signifying roots to test radical transgressive ideas with critically thinking artists and transdisciplinary designers.

The adaptability of Rhizome Theory in this research grounds the notion of creativity in a coherent ontological and epistemological model; it deciphers the creative processes. This study is assembled in environmental sciences because the method used to understand eco-artworks' contribution to climate change adaptation is interrogated with a scientific mixed method in the next chapter. The critical thinking that goes into preparing meaningful art interventions and the process of reaching new audiences with novel ideas are techniques that environmental sciences can recruit to reach society through promoting environmental behaviour change. Systematic description and rigorous comparison of the characteristics used to design such art interventions are extracted and then grouped, *attuning* the ecology of my praxis,

in ways reminiscent of those described by artist Joseph Beuys. He started making social sculpture and countless intentional drawings after World War ll to find his way out of the oppression of history in Germany. Artists proactively drawing to work through trauma or complexity is a continual form of understanding relationships, questioning interconnection through dialogue (Kruger, 2012). Conversation, confrontation (contradiction) or immersion in ongoing conscious art interventions or happenings are already 'the bedrock of what happens' in praxis (Pigott, 2020, p. 878).

The Wildebeest I drew *en plein 'car'*[9] in Kruger National Park last year (Figure 2.5) is an example of how such repetitive drawing, to work through something fluid or complex, settles the understanding of something difficult. Eco-social theorist Felix Guattari advocated for alternative co-created actions to overcome our environmental crisis he describes as a 'mental' ecology (Fitzgerald, describing Guattari's ecosophy ideas, 2018. p.71). During the mark making *en plein 'car',* I experimented with alternative ways of being closer to nature. I studied the movement with the subject in full view. Movement of the ink and water on paper, the movement of the animal, the movement of the car and the wind through the car were all premeditated circumstances to capture a dynamic environment while capturing my inner turmoil when the conditions out of my control let the ink run out of the drawings' outlines. The drawing complete. In fact, the fluid running out of the eyes in Figure 2.5 are reminiscent of the San's rock art markings, usually running from the nose of animals, which indicated shamans altered state of consciousness in southern African cave paintings (Lewis-Williams, 2002, p.117). When I sent the drawing out to my email database, artist and curator, Karel Nel[10] responded: 'Hello Joseph Beuys' and this whole study started to feel comfortable[11].

[9] In art, artists drawing situated in the landscape being drawn is called 'en plein air'. It is done *in situ*, as opposed to studio-based work. I call this way of drawing *en plein 'car'* to put a contemporary spin on the phrase: being in the car to be safe from the wild animals with the wind in my hair and the many variables intentionally creating the drawing with me, collaborating with nature to get closer to it and make sense of it.

[10] Karel Nel, established artist, collector and curator is immensely influential in the international art scene because of the connection he makes. He mainly draws the richness between art and science. He first introduced me to science in art when I worked as a photographer in the Wits University Art Department (1995 to 1997). His response means the world to me.

[11] Joseph Beuys's work is significant here because he critiqued culture in his work and found deep ecological resonance to move out of the darkness the WWll caused with an approach to draw mindfully, shamanistically, intended to understand and theorise.

Figure 2.5: Wildebeest movement study ll, Ink on paper (A2 size), Kruger National Park, South Africa, 2021. Prepared for the drawings in this series to capture a moment in the wild whilst looking at the animal. The drawings were done within seconds, with the animal in view, the water outline on the paper and then dripping ink into the shadow areas of the creature. (Image and artwork by the author – © Hannelie Warrington-Coetzee)

Studying the frequency of eco-art characteristics through a biological metaphor, Rhizome Theory can create opportunity for the results to be summarised and described in an environmental studies vernacular focussed on more strategic future intervention design and communication (Figure 1.1, Chapter 1). The Hidden Third Theory and the Rhizome Theory thus emerge as viable analytical instruments for transdisciplinary creativity studies (Styhre and Sundgren, 2003) and will be particularised in the methods chapter.

2.3 Transdisciplinarity, transgressions, transcendence

Using the Hidden Third idea (Section 2.1) and Rhizome Theory (Section 2.2), the mapping and description of complex issues are enabled by exploring areas of synergy and contradictions (Deleuze and Guattari, 1980). Rhizome Theory, for example, is particularly useful here for it is based on the lexicon of biological systems, woven into dissertation semantics, and thus shows how interlinked fields of study, viewing a problem from various angles, strengthens interventions.

The current code of conduct in the world is not sustainable, as described in Chapter 1. Disciplinary science can at times prevent interconnections, causing atrophied links that cannot address complex human problems (McGregor, 2015). Thought-provoking transgressions, which the arts offer, violate imposed disciplinary boundaries in a constructive way, unlocking new potential because of fuller enquiry from various perspectives (Rosenfield, 1992). Transdisciplinary research *and* praxis refute initial siloed categorisation (Manning, 2016), and could develop an attempt to practice complexity science while avoiding the pitfalls of specialisation (Bernstein, 2015). Nicolescuian transdisciplinary rigour, in addition, goes deeper than scientific rigour because it considers more than 'things, but also [considers] beings and their relations to other beings and things' (Temper et al., 2019 quoting Nicolescu, 2002, p.219)). Transdisciplinarians have a different more systemic way of seeing the world holistically as a *way of being*, 'embedded in an evolutionary approach to consciousness' (Rigolot, 2020, p. 4).

When transdisciplinary practitioners find ways to test new radical ideas, they either work across disciplines (transgress) or collaborate with other disciplines; the latter is a relatively new way of critical reflexive inquiry (Rosenfield, 1992; Russell et al., 2008; Bernstein, 2015). Art and the humanities support the role of ecological science in transformation (Pigott, 2020), but can also question the inquiries prioritised by ecological science. This disciplinary mix creates a rigorous platform for radical transformation through engagement with real-world problems (Brown, 2014; Fazey et al., 2018).

Transgressive qualities of transdisciplinary work, thinking in a complex manner, working outside one's own discipline, engaging in new modes of thinking and taking action, are all key to understanding and developing responses to "wicked" problems (Bernstein, 2015). Transgressive approaches to transform and challenge the status quo whilst reimagining it with humility are useful additions in our quest for sustainability (Vogel and O'Brien, 2021). Transdisciplinarity combines the discourse of transgression with problem-solving and breaks free of 'reductionist assumptions about the way things are related, how systems operate, and the expectation that science delivers a single "best" solution or final answers' (Klein, 2014 p. 14). Transdisciplinary interventions with transgressive approaches can be co-designed with caution, to be culturally sensitive amongst participants (Lotz-Sisitka et al., 2016), by including disruptive elements that work with nature rather than against it.

An example of the transgressive quality of transdisciplinary work is well documented by the South African historian, Johann Tempelhoff, who found it enlightening to listen to music with his team whilst reflecting on complex environmental and social issues, including before a field trip to a water-stressed community in Mpumalanga Province (Tempelhoff, 2013). *Listening* to music prepared the team to listen intently to the community without water, and to gain an understanding of the community's lived experience of acid mine drainage into water sources. He argues that the researchers comprehended the problem on a much deeper level and gave insight into the resilience of the people under such hardship by listening to music in preparation for the field trip (Tempelhoff, 2013).

Transgressive transdisciplinarity can also enable transcendence between academic disciplines and between science and society (Bernstein, 2015; Athayde et al., 2017; Rigolot, 2020) and is usually inquiry-based rather than discipline-based (Tempelhoff, 2013). Transcendence goes beyond current perspectives, enabling emergent endeavours, which are currently called for to enable transformation (Vogel and O'Brien, 2021).

2.4 Radical transformation

Transgressive and more radical transformation, as opposed to a focus on one-dimensional business as usual approaches to change, according to Arshad-Ayaz et al. (2017), Rana et al. (2020) and Vogel and O'Brien (2021), are needed to avoid dangerous climate change disasters. Transgressive transformation, which aims to align contemporary systems sustainably (Vogel and O'Brien, 2021), can be fostered through integral adaptation strategies from various disciplines and praxis, consciously created through behavioural and systemic lenses aligned with targeted community worldviews (Hochachka and O'Brien, 2017).

I prioritise transgressive climate interventions over adaptation, mitigation, and resilience (these limitations are discussed in Section 1.5) because with transgression one can apply possible grassroots solutions in which publics can participate to adapt eco-culturally. The intervention thus becomes a public experiment, which can be more transparent, iterative, and can roll out in shorter timelines (Born and Barry, 2010; Lorimer, 2012; Srnicek and Williams, 2015; Jasanoff, 2020) than is often embedded in more traditional science-based approaches. Current environmental policymakers and engineers designing future systems (Jasanoff, 2020) are often not sensitised to attract new audiences to ideas of those who think outside of the usual *technocratic* modes of thinking. I interrogate and describe how artists' fertile talents are a key to radical transformation (McGregor, 2015), set against the short history of building agency for climate change awareness. Radical transformation, transcending the status quo, rises above the current approach of scientific specialisation.

2.5 Building agency

Transdisciplinary research that is arts-led and practised-based can also help to illuminate and co-build dynamic forms of knowledge. Post-disciplinarity, the antithesis of disciplinarity, was originally conceived by the artist duo Helen Mayer Harrison and Newton Harrison, with all disciplines participating equally (Brady, 2016). Throughout their shared career, "the Harrisons", as they were known, proposed to allow space for the emergence of possible solutions in their experimental interventions (Ryan, 2008). Examples of their work are discussed in Chapter 6.

Understanding whole ecosystems, as seen in Section 2.2, is essential for resolving environmental problems (Rosenfield, 1992). When these new ways of working emerge, it means that the whole is greater than the sum of the parts (Bernstein, 2015). Transdisciplinarity creates an emergent space for

real-world problems to be solved in ways that are not possible through discipline-based inquiry (Tempelhoff, 2013).

Allied to notions of transdisciplinary are critical concepts of agency and *who* are enabled to take action. The concept of agency varies from discipline to discipline and is often vaguely defined in contradictory and overlapping ways (Emirbayer and Mische, 1998). In this research, human agency emerges through participation in public art interventions. Agency unfolds when emergent humans mobilise sets of actions to create meaning (Zylinska, 2019). These planned actions are the more deliberate components (O'Brien, 2012) that arts' practice can build into radical adaptation by linking scientific representation with more localised social meaning (Jasanoff, 2010).

Artists and other agents of change, in turn, once they have sparked the imagination and inspired policy makers to think differently, can educate publics to reconnect the global facts of local communities. They can, in turn, and in various ways, influence policy, for example through advocating personal relations, and with collectives and governments (see how artists influenced funding policy in *Liberate Tate* below). Once mobilised, activists can do the advocacy work that builds agency with policymakers to change government actions.

Art can thus help to open up unlabelled discourses, and humanise complex political factions, according to eco-related artist Tue Greenfort (Greenfort cited in Brown, 2014). Transgressive interventions cautiously prepared with care (Klein, 2014; Lotz-Sisitka et al., 2016), to transcend the status quo, took place when artists undertook 16 unsanctioned *Liberate Tate* performances inside London's Tate Modern and Tate Britain Museums intended to put pressure on the institutions to stop accepting funding from the fossil fuel industry.

The artists influenced the institution's sponsorship relationship with oil giant, BP, with the utmost eloquence. The Tate museum's funding came from petroleum, wrote Mel Evans in *Frieze Magazine*.[12] Their 16 transgressive guerrilla interventions took six years to transform the Tate, which was paradoxically inoffensive and crucial for sustainable futures. Whilst trespassing, they performed *Time Piece* (Figure 2.6 and 2.7), drawing climate and fossil fuel facts on the museum floor with charcoal, a respected arts material, which also once powered the Turbine Hall. The talented artists and activists lead a thought-provoking and meaningful series of interventions, even taking portable toilets with them for overnight stays, showing how systemic change can come about when released from fossil-fuel dependency. These types of breakthroughs, artists demonstrating to museums that it is time to change, show us we can transform our future (United Nations, 2012), through deliberate radical interventions,

[12] https://www.frieze.com/article/how-activists-made-art-world-wake-climate-crisis

rather than how bad we are going to let it become.[13] A top museum like the Tate taking the lead on weening financially from fossil fuel dependency inspires the rest of the arts industry to follow suit.

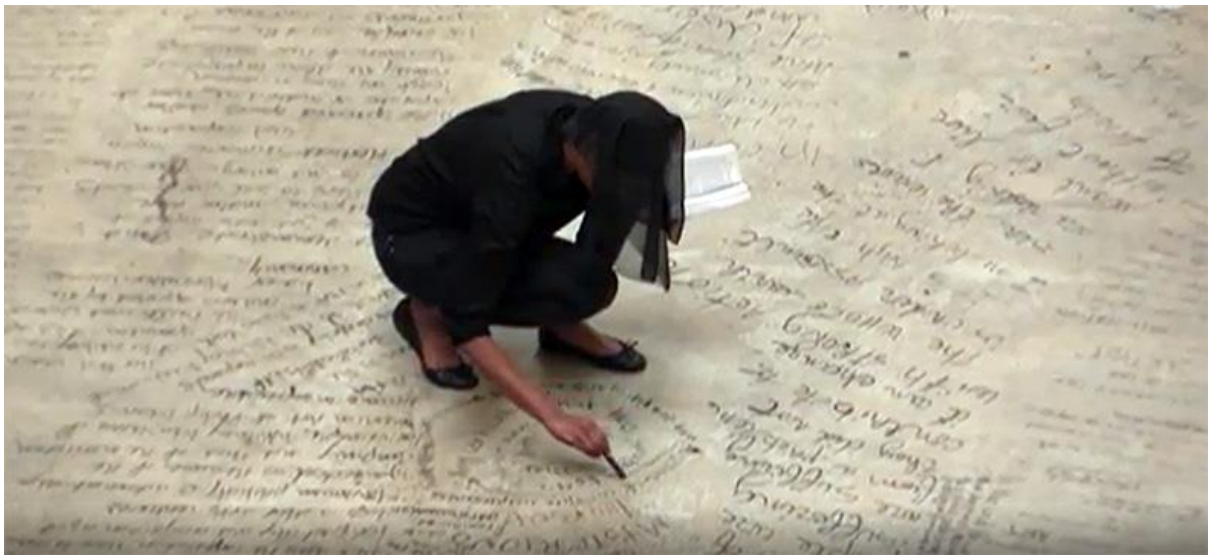

Figure 2.6: Time Piece, Liberate Tate 2015

Figure 2.7: Time Piece, Liberate Tate 2015

2.6 Active experimentation

Building agency with environmentally orientated eco-art interventions and experimentation, as shown above, could create opportunities for environmental science to test more radical ideas about adaptation in society. New transdisciplinary alternatives can be created to address solutions more intentionally. Deliberate transformations are also described as 'directional transformations' (O'Brien, 2012, quoting Chapin et al., 2009, p. 670) or 'purposive transformations' (O'Brien, 2012, quoting Berkhout, 2002, p.

[13] https://www.thewire.org.au/story/art-plus-climate-change/, Guy Abrahams the co-founder of ClimArte, argued, in a The Wire radio interview 2015.

670). These transformation designers recognise that some ‘fundamental shifts are necessary to enable desirable futures to emerge’ (O’Brien, 2012, quoting Miller, 2007, p. 670).

Shadow networks, operating as small groups of committed individuals, can often create and enhance such active experimentations while preparing communities for transitions (Olsson et al., 2006). Artists operate in shadow networks and make a focussed contribution to education in climate-vulnerable communities, where extensive teams are not always essential for transdisciplinary inquiry (Bernstein, 2015). Nature-based solutions or more human-nature eco-systems based adaptation (IPCC, 2022a) can also address problems with nature’s logic by creating enabling conditions for eco-systems for sustainable development (Faivre et al., 2017; Nesshöver et al., 2017). Much more work is needed to help society adapt fairly (Rana et al., 2020) and build capacity through co-learning (IPCC, 2022a; 2022b). The commitment to making consistent decisions about what the impact would be in the future makes us more human, while reconnecting with nature (Gowdy, 2020). To adapt to nature, we need to be part of it (O’Brien, 2020, p. 27). These are active transgressive experimental approaches with adaptation as one root but with a transformational outreach and more sustainable intention.

Remediation scientists and environmental students worked with artist Frances Whitehead in an intradisciplinary approach called SLOW Clean-up where artists’ “work” is examined from geography’s interest in ‘active experimentations and anticipatory interventions’ (Hawkins et al., 2015, quoting Lorimer, 2012, p. 332). Together they explored how art can enable forms of socio-ecological transformation. The intradisciplinary work of geographers in collaboration with artists and publics catalyses the development of creative solutions. A range of scientists and publics develop alternatives that provide an environmentalism that need not make recourse to nature (Lorimer, 2012).

Intentionally designed interventions can transform art, science and the public ‘rather than translating science for an assembled public’ (Hawkins et al., 2015, p. 334, quoting Born and Barry 2010). Potentiality is thus influenced by our *attention to intention* (emphasis added) (O’Brien, 2020). When publics participate in art interventions aimed to influence physical behaviour, free will needs to stay intentional (as O’Brien describes, drawing on a statement by physicist Henry Stapp 2020, p. 71). During co-design processes, transformative opportunities emerge intentionally because the platform is dynamic and nests ideas, as I discussed in Section 2.1 (Marin et al., 2016; Moser, 2016; Parsons et al., 2016). Co-designing approaches are agents of transformation itself because the process is required for the new inquiries to emerge through dialogue (Moser, 2016). The diversity of the context of co-inquiry allows for a more complex understanding of the problem *in situ* (Lotz-Sisitka et al., 2016). Exploring local contexts with core groups is critical to preparing interventions that resonate locally, building trust respectfully (Vogel et al., 2021).

Artists’ work (Pigott, 2020) actively experiments as a ‘technology of connection’ (Hawkins et al., 2015, p. 333). Co-design approaches build relationships between academic researchers and other knowledge holders during co-defining processes (Marin et al., 2016). Relationships between people, organisations

and the dynamics of deliberate interventions designed between them benefit transformation because a shared understanding evolves from these slow processes (O'Brien, 2012). Artists use innovative and inclusive ways to 'provoke those working within the conventions of contemporary science', finding transgressive pathways with shared goals (Manderson, 2019, p. 11). Classic leverage points have largely disappeared, necessitating new rounds of experimentation and strategic reflection (Srnicek and Williams, 2015). Artists address this 'relationship crisis' dynamically between disciplines and with personal responsibility – or 'response-ability' (O'Brien, 2020, p. 23). The quality of our relationships, being respectful of diverse ways, is held in transdisciplinarity (Vogel and O'Brien, 2021) and can be radically transformative, building agency during the process. Human consciousness evolves during co-design transdisciplinary workgroup processes (Rigolot, 2020).

How artists go about building such dynamic and targeted interventions are interrogated in the methodology in Chapter 3. Fifty artworks were interrogated with twenty-eight eco-art characteristics to establish how artists work and where the intention to contribute to solving "wicked" challenges of our time lies.

CHAPTER 3: Method in the madness – eco-art's opportunity

As shown in Chapters 1 and 2, the focus of this research was to explore how art and artworks can be used to engage with various people to re-think and re-imagine ways in which we can change our actions and ultimately influence our sustainability journey. The central research question is to determine which characteristics eco-artists most often use to build artwork that can reach and inspire new audiences. Subsidiary questions include:

Question 1.

What are the key characteristics climate change-focused eco-artists use in their praxis?

and,

Question 2:

What form does the transformative opportunity in such interventions manifest as?

A more reflective question asked while answering these subsidiary questions is: where does the potential to reach new audiences lie, and how does it form physically? To answer these questions a mixed-methods and phased approach, as explained below, was used in this study.

In Phase 1 (Figure 3.1), a baseline was constructed with two datasets. Dataset A is a qualitative list of characteristics that, as an artist, I privilege in my eco-arts praxis. I often work outside of the art scene, so the characteristics I privilege are opposing traits to those often used in the gallery-based visual arts scene. My traits are juxtaposed with the traits I do not often use. This list shows how my praxis developed over the past decade[14] and tested and identified the components I value when making artworks.

Dataset B (Appendix A) was compiled by accessing fifty artworks as they were presented online (Phase 1b in Figure 3.1). I could only focus the study on the online representation of the works due to travel restrictions during the Covid-19 pandemic. I was looking for artworks that had a strong climate change message in environmental art. Initially, I selected the artworks widely and randomly; many artists around the world are working with sustainability subjects. The selection process became more focussed as I learnt how such praxis is described in the literature, combined with my interest to determine how the arts contribute to sustainability.

[14] Also, topologically

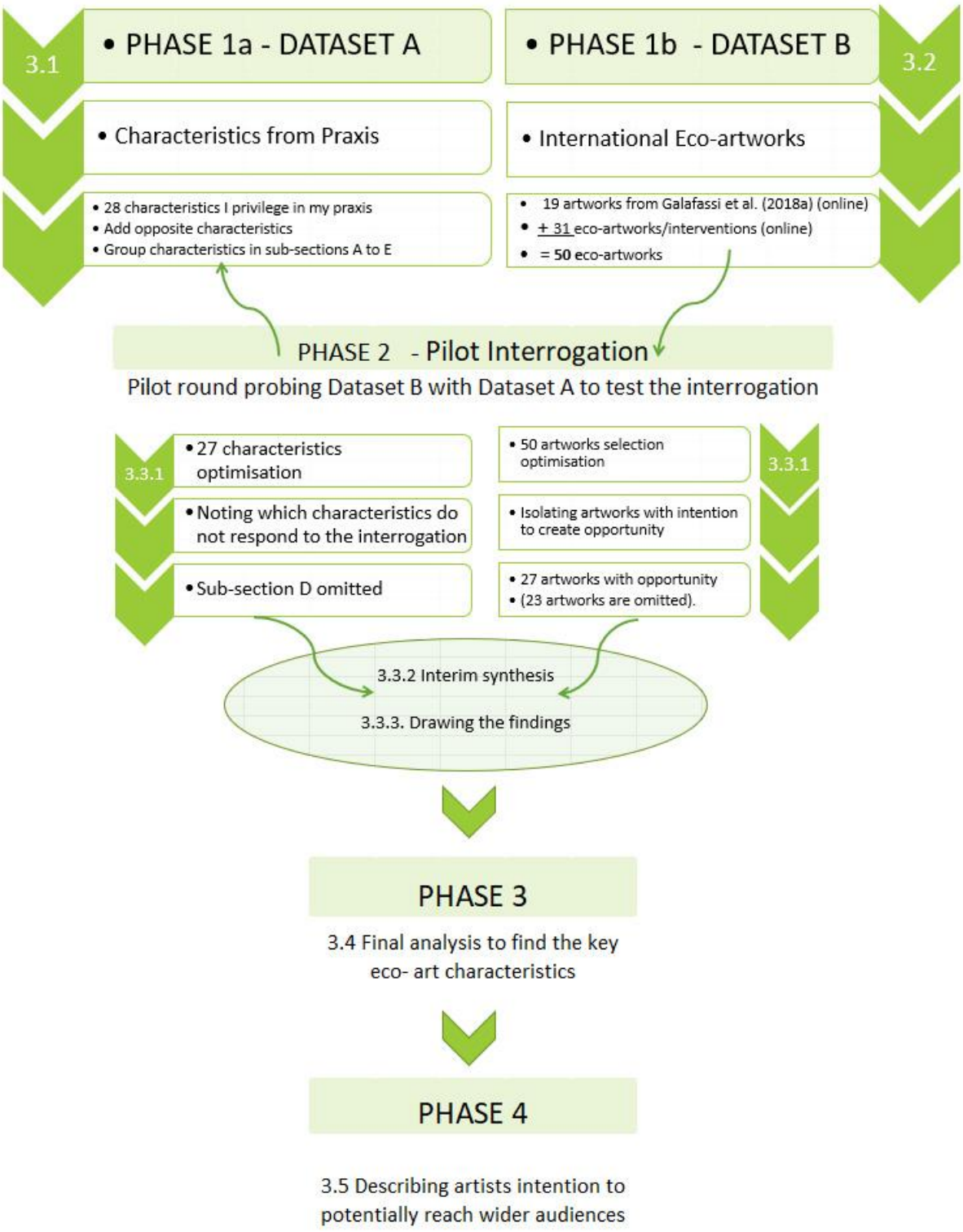

Figure 3.1: Transdisciplinary interrogation approach to find key eco-art characteristics with outreach intention

The two data streams (Datasets A and B) operated concurrently in developing the research, as set out in Figure 3.1. In Phase 2, a pilot round of interrogation tested the datasets to optimise and refine the

datasets. After the pilot round, artworks that did not intentionally address the particular issue through an opportunity for audiences to contribute to the climate change cause were eliminated. *I don't believe in global warming* (Figure 3.2), an artwork by the famous graffiti artist Banksy in 2010, is an example of an artwork stating the problem aesthetically **only.** He wrote a provocative, ironic line, *I don't believe in global warming*, on the wall above the waterline just touching the water as if the words are drowning. The work stops viewers in their tracks it is so clever but does not offer an opportunity to address the problem. These are great artworks, but they are not prioritised in this study because the artist has not created any potential for deeper engagement to contribute to the climate cause. Even viewing the artwork online, the impact is profound. However, this artwork does not create any opportunity for the viewer to assist with this conundrum. My interest in this study is more specific than just purely profound thought-provoking artworks, both inside galleries and in public space, such as this one. My interest lies deeper in how one can inspire and create opportunity for viewers, deeply moved by artworks, to contribute to the problem that the artwork profiles. I am interested in how artists take responsibility for the critique they voice.

Figure 3.2: "I don't believe in global warming", Banksy, 2010, Regent's canal, Camden, London

Characteristics (Dataset A) that do not respond to the interrogation were elaborated in the conclusion (Section 6.5). After the elimination process in Phase 2, the datasets were finally interrogated to identify and synthesise the key characteristics of the eco-artists' work in Phase 3. After identifying the key characteristics, I returned to the artworks and determined which had most of the key characteristics in Phase 4. The artworks with the characteristics most often found in this study are described in Chapter 4 to answer the research aim and question: *What form does the transformative opportunity in such interventions manifest as?*

3.1 Phase 1a: Dataset A - listing eco-art characteristics I privilege in my praxis

When I started this study during the Covid-19 pandemic anthropause (Rutz et al., 2020), I listed the characteristics that are top of mind when I prepare for new artworks or interventions designed to reach new audiences. I then added opposing traits often used in the broader art scene (Table 3.1 – Dataset A). I have often wondered which characteristics in my praxis reach audiences optimally because I want to contribute meaningfully to the environment and to humanity. Which traits build local agency better and consider the footprint the artwork leaves behind to make climate change matter (O'Brien, 2020)

because art can engage with more-than-rational experiences (Galafassi et al., 2018). Which ideas engage people and move audiences into active participation?

The list is quite fluid as I use the opposing traits in my own work from time to time. I have carefully tested these traits in my artworks (highlighted on the right-hand side in Table 3.1), formulating, selecting, juxtaposing, and honing them with regards to audience reaction, accessibility, ecological functionality of the artwork, and so forth. These characteristics I privilege have become my preferred way of working overtime.

The traits listed in the highlighted green column in Table 3.1 are in public (characteristic # 4) or outside (characteristic # 3), preferably free of charge, for anyone to view, especially non-art going audiences. The artworks often have a regenerative component (characteristic # 6), which means the artworks contributes to the ecology it is made in. The artworks are often not permanent (characteristic # 8), which means the artwork uses the natural elements for it to decay or draw attention to seasons or other earth systems. The artworks being made with such elements explains why non-traditional arts material are often used, which will be elaborated upon below. Conceptually, the artwork being made with material that embeds the idea as a story (characteristic # 11), so it is not a single concept, like the Banksy artwork (Figure 3.2). The artworks I make with natural elements have a sensory component (characteristic # 12), which could immerse audiences (characteristic # 13). Often when artists find an artwork that works, it gets done multiple times (characteristic # 14). Ephemeral works are often very intuitive and done without planning or permission (characteristic # 15), often done with movement either of the person or the surrounding elements (characteristic # 17). When it works well, I share this finding by building participatory opportunity into future iterations (characteristic # 18).The opposing characteristic in # 18 would mean it's an artwork that can only be viewed, intellectually engaged but no physical participation is possible for the viewer.

The characteristics are also interrogated from a network perspective is it a single artist or not (characteristic # 19). What is the gender mix (characteristic # 20)? Is the work commissioned or self-initiated (characteristic # 21)? Commissioned works might have different expectations and more benefits for the artist, and different audiences (characteristic # 22) are attracted through these approaches. The climate science characteristics (# 24 to # 27) could not be established other than in my work and will be elaborated in Phase 4. Educational components (characteristic # 28) take many forms and are described in Chapter 4. I set out to find the key characteristics listed in Table 3.1 where intentionality to contribute to the cause sits.

Table 3.1: DATASET A. Eco-art characteristics I privilege in my praxis and opposing traits

Characteristics Except #1 and #2[15]	**Traits I do not often use**	**Traits I privilege**	**Earliest artwork in my typology (Figure 2.1)**	**Year**
Section A	**Physical form of the artwork**			
Characteristic # 3	Inside	Outside	Uitpak/Unpacking	2010
Characteristic # 4	Private	Public	Oumagrootjie	2010
Characteristic # 5	Rural	Urban/online	Vreemdeling	2012
Characteristic # 6	Aesthetic only	Ecologically functional or regenerative/remediationary	Muse II	2020
Characteristic # 7	Human or text based	Nature based or abstract	Family Portrait	2011
Characteristic # 8	Permanent	Temporary	Old Sow between the trees	2015
Characteristic # 9	Not seasonal	Seasonal	Eland en Benko	2015
Characteristic # 10	Traditional arts media	Non-traditional arts media	Hover	2012
Section B	**Conceptual approach to the artwork**			
Characteristic # 11	Single concept	Narrative concept	Traditional Medicinal portraits, Nirox	2014
Characteristic # 12	Intellectual only	Visceral (sensory)	Family Portrait	2011
Characteristic # 13	Prescriptive	Immersive/exploratory/relational	Family Portrait	2011
Characteristic # 14	Single iteration	Multiple iterations	Eland en Benko, Nirox	2015
Characteristic # 15	With permission	Without permission	Treading lightly/Trapsuutjies	2012
Characteristic # 16	Still standing/static	Moving – Nature or walking etc.	Eland en Benko, Nirox	2015
Characteristic # 17	Gallery/online	Public	Uitpak/Unpacking	2010
Characteristic # 18	Observer	Engagement – Participatory	Locust and Grasshopper	2017
Section C	**Networks which the artist/s used**			
Characteristic #19	Sole artist	Network	Something that rolls up	2011
Characteristic #20	Male	Female/mix	Something that rolls up	2011
Characteristic #21	Commission based	Grassroots/self-initiated	Uitpak/Unpacking	2010
Characteristic #22	Predetermined	Unexpected/incidental audience	Oumagrootjie	2010
Characteristic #23	Actors	Real people in audience	Buigkrag	2012
Section D	**Climate science characteristics**			
Characteristic #24	Illustrate science	New knowledge	Do tash this do	2013
Characteristic #25	No study science	Study science	Traditional Medicinal	2014
Characteristic #26	Scientific knowledge	Indigenous knowledge	Cultural leader portraits	2014
Characteristic #27	Study science	Study nature	Forest entrance	2014
Section E	**Pedagogy**			
Characteristic #28	No educational component online	Added education component, workshops, outreach, publication	Old Sow between the trees	2015

[15] The first columns describe the work in Dataset B and are thus not characteristics as such.

The hyperlinked examples of my artworks (right-hand column in Table 3.1) illustrate the traits I used since 2010, before this study[16]. Academics may not always appreciate that practitioners have similar insight, creating knowledge, particularly by "making". Praxis can develop knowledge just as theory does; it just might be described differently or take a different form.

The 26 characteristics in Table 3.1 were grouped into five sub-sections according to themes that link closer together: sub-section A) the physical form of the artwork-type characteristics; sub-section B) the conceptual approach to making the artwork; sub-section C) the networking I needed to undertake for it to take form and sub-section D) what scientific partnership or research and thinking I had to do to understand the context and how it relates to the other sub-sections. Characteristic # 28, the educational components, was an outlier. This characteristic fit in all the sub-sections and will thus be treated as a separate sub-section (E), education.

Table 3.2: Sub-sections of eco-arts characteristics in my praxis

Sub-section	Description
A	Physical form of the artwork
B	Conceptual approach to the artwork
C	Networks which the artist/s used to prepare for/make the artwork
D	Climate science characteristics
E	Educational component present

When I work on new interventions in praxis, I do not work in any specific order (i.e., from A to E), but I aim to have all sub-sections present. This may not be possible if the work is constrained by budget, or by hosts or partners. The sub-sections in Table 3.2 created order to the long list of traits, to make the transdisciplinary approach more accessible and visible in the study. It shows how I segregated the traits to interrogate them and subsequently reassemble them. The derived list of arts-based praxis characteristics (Table 3.1) complements the ten essentials arrived at through the more theoretical interrogation of scientists (Fazey et al., 2018).

I then compared the ten essentials (Figure 1.2) with my praxis. These align well with the transformative focus of my work (no.1) and being solutions orientated or implementable, more specifically (no.2) the more ecologically functional work, which invites ecological growth in urban contexts, creates micro-ecosystems in the concrete jungle, which contribute to cooling down cities. Relational artists have applied critical problem solving to resonate with audiences, and accordingly, their work allows solutions to emerge (Ryan, 2008). Both my praxis and the ten essentials focus on practical knowledge (no.3), transcending current thinking (no.6), and are reflexive (no.10), or what I call iterative: building on earlier learning. Every time an intervention is reconsidered for another iteration, it is optimised and honed to contribute to the solution in even more effective ways. The ten essentials from Fazey et al. (2018) and my five sub-sections, were, however, two very different lists. My list has a logic practitioners can follow,

[16] By reflexively reading the literature, I learnt how to recognise the traits being used and thus further describe my work, but the traits were already used in praxis long before I started enquiring into purpose and praxis.

whereas the ten essentials are more theoretical qualities transdisciplinarians should consider in research. These theoretical descriptions of second-order science were nonetheless immensely informative to apply, and the parallels will be discussed further in Chapter 5.

I do not describe all characteristics at this point, because I will elaborate on the higher-ranking ones in the discussion in Chapter 5. But I do want to make a few points on the characteristics in Table 2.1 that science researchers did not include in the ten essentials. In more recent artworks, such as *Muse II, 2020* (Figure 5.2), I aimed to make work more ecologically functional (characteristic # 6's example is *Muse II*) or generative, which is an indication of how my praxis is maturing. Regenerative work needs many partners and because it physically grows, it needs care and commitment as can be seen caring for the rock succulents making up the pixelated image in *Muse II*., I do not prefer permanent or temporary works (characteristic # 8) so my work could be either of the opposing traits, but I was interested to see if this trait somehow made a difference in art in public spaces. I am particularly interested in the use of non-traditional arts material (characteristic # 10) because there is so much material wasted globally, and because regenerative work such as *Muse II* needs to physically grow to stay visible. Being from Johannesburg and always trying to draw attention to industrial waste, how other artists upcycle or re-appropriate material and find meaning in the medium they are using was also key to interrogating other artists' work at the start of this study. This trait's opposite is traditional arts materials – oil paint, for instance. As soon as the material was classified as waste or a found object with a past "purpose", I would identify it as a non-traditional arts material because the decision to use that particular material adds to the idea of ecological intent. The artwork form was informed by the material used in the artwork.

Figure 3.3: Familie Portret (Family portrait), Plettenberg Bay, South Africa (artwork and image by the author – © Hannelie Warrington-Coetzee)

In sub-section B, I listed conceptual traits about the artworks that could also be in sub-section A, showing the porousness of these traits. The sub-sections were a guide to summarise findings, not to

restrict traits. I wanted to establish if there was a narrative basis (a story as opposed to a single idea) (characteristic # 11), in the work; something I have considered since my photo-essayist days in my first career. I also explored if the artwork had a sensory component (characteristic # 12) other than visual, such as smell, touch, or texture, which made it more interactive or immersive for audiences. An early example of such a sensory component can be found in *Family Portrait, 2011* (Table 3.1 characteristic # 12).

Multi-sensory memories connect the audience in unexpected ways. In *Family Portrait*, (Figure 3.3) I stacked 13 stone cairns in low tide every day for a week as part of the Site-Specific Land Art Biennale, Plettenberg Bay, South Africa, to mentally connect to frail family relations, only to topple over in high tide and re-stack when the next low tide came in. Conceptual traits of artworks embed the work to the meaning of the moment and stacking and re-stacking these cairns gave me time to physically experience the hard time my family is giving me for being "otherwise" with the way I identify in the world. Was the artwork moving or mobile or stagnant (characteristic # 16), as opposed to a viewer moving through a gallery to view stationary artworks? Does mobilising audiences through participation or immersion create opportunity for change? Did a given artwork have any participatory characteristics or was it purely made for observation (characteristic # 18)? This latter characteristic is closely linked to characteristic # 12, but sensory immersion is not necessarily participatory for the audience.

Sub-section C is network related and linked to Rhizome Theory's growth strategies (Figure 2.1): Was it a single artist who made the work? Or was it executed by a collective or a network (characteristic # 19) of people? If artworks were conceptualised by one artist, did a team make it, or was it made by the solo artist? I was interested to see which artists made their work collaboratively. An early work I produced with fellow artist, Usha Seejarim for COP 17 (Climate of the Parties meeting held in Durban in 2011) titled *Something that rolls up* (Figure 3.4) was made with traits from this sub-section. Usha and I started the non-governmental organisation Such Initiative[17] with a tagline *changing perceptions through eco-conscious public art* at this time*. Something that rolls up* is a beaded animation of a pangolin protecting itself by rolling up, made with 1.6 million glass beads woven by 52 beaders. The work is on exhibition at the Origins Museum at Wits University and the animation can be viewed here.

[17] We ran Such Initiative from 2009 to 2011 with various projects rolling out at the time and can be viewed here http://www.suchinitiative.org/

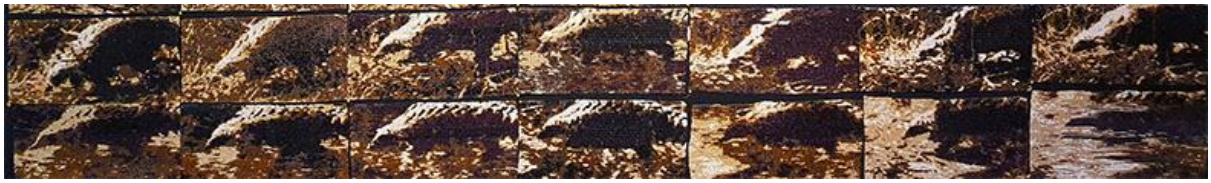

Figure 3.4: Something that rolls up, 2011, created by Usha Seejarim and Hannelie Coetzee together with 52 beaders from the Valley of a Thousand Hills from Woza Moya established by the Hillcrest Aids Centre Trust, KwaZulu Natal. The work was commissioned by the South African Department of Environmental Affairs for the COP 17 meetings in Durban. [18] (Image by the author – © Hannelie Warrington-Coetzee)

Artists often initiate projects themselves and then when it is exhibited and attracts wide audiences, new iterations of these works are shown (characteristic # 21). Incidental or unexpected audiences were also of interest, to compare how other artists develop new audiences (characteristic # 22) as opposed to predetermined audiences in galleries and museums.

Climate-science related characteristics in sub-section D were considered, including how such artists study science, or are just immersed in nature when they make the work. The characteristics did not perform well in this interrogation, because most artists did not disclose their research methods from a technical perspective. I would have had to reach out to artists to ask them about this and owing to Covid-19 pandemic travel constraints and the need to consult more in a face-to-face manner with international artists to derive maximum sharing in this process I chose to focus on other elements as described here. Thus, I prepared the list of characteristics based on my praxis and this set of characteristics was based on how I work. Therefore, I could not legitimately and credibly establish how other artists work *with* science.

Sub-section E focused on how artists work with educational components (characteristic # 28). The online description of the artwork had to state that workshops were attached to the artwork or other pedagogical supplements were available. There might have been other artworks with this component, but only those artists who stated online where the artwork was presented, were included (see hyperlinks in Appendix A). I elaborate on this in the discussion in Chapter 5 (Section 5.6).

3.2 Phase 1b: Worldwide artworks as a means to explore issues of climate change.

In Phase 1b, I interrogated my praxis methodically and isolated the key characteristics of other like-minded artists. Dataset B (Table 3.3 (a-c) and full dataset in Appendix A and online here) focuses on environmentally focussed artworks located online on various artists' and eco-initiative websites. I did not contact any artists directly for more detail for reasons expanded on in Section 3.1. I thus only interrogated what the artists made available to online audiences.

[18] The Something that rolls up animation can be viewed here

The mixed-methods approach brings these dichotomous approaches together in the way that both Nicolescuian Hidden Third Theory and Rhizome Theory bring a multiplicity of various disciplines and diverse types of knowledge to research subjects (Honan, 2007). The material and the way I describe it developed from two published studies that considered how creative praxis facilitates climate change transformation (Galafassi et al., 2018a; Fazey et al., 2020). These form the basis of my rigorous methodology in this study, with the conceptual framework described in the literature review contextualising it.

The characteristics in the top row of Table 3.3 (a-c) (except sub-section D, eliminated in Phase 1a) and all 50 artworks are interrogated in the left-hand column. I divided the full dataset into the various sub-sections to make it legible in this dissertation format, the artist's details are consistent, but the sub-sections change:

- Table 3.3 (a): Dataset B – sub-section A – Physical form of the artwork
- Table 3.3 (b): Dataset B – sub-section B – Conceptual approach
- Table 3.3 (c): Dataset B – sub-section C and E – Network and educational component

The full dataset is available online in one Table here.

Table 3.3 (a): DATASET B – Sub-section A eco-art dataset extract (full dataset in Appendix A and online here)

Q1			Q2		Q3 anc Q4 - 9x		Q5 - 1x	Q6 - 17 of 2	Q7	Q8 - 11	Q9 - 4	Q10 - 23 of 27
					A. Physical Form							
Number	Artists name	Year	Artwork name	Galafassi catalogue no.	In public, free vs inside/private		Urban/rural/peri-urban/virtual/global	Aesthetic only/ aesthetically and ecologically functional and regenerrative	Human/text/movement or abstract	Temporary (ephemeral) / permanent	Seasonal/not seasonal	Traditional arts media/materiality considered
1	Tue Greenfort	2007	Exceeding 2°C, 2007/2014	1	inside	private	urban	aesthetic	abstract	temporary	not seasonal	materiality
2	Sarah Cameron Sunde	2013 ongoin	36,5	4	public	public	rural	ecologic	human	temporary	seasonal	materiality
3	Banksy	2009	I don't believe in global warming	9	public	public	urban	aesthetic	text	permanent	not seasonal	traditional arts media
4	Isaac Cordal	2013	Waiting for Climate	10	public	public	urban	aesthetic	human	temporary	not seasonal	traditional arts media
5	Fintan Magee	2016	Glass half full	11	public	public	urban	aesthetic	human	permanent	not seasonal	traditional arts media
6	Aichner & Huber	2013	Powerwalk	8	public	private	virtual	ecologic	movement	temporary	seasonal	traditional arts media
7	Gluesociety	2006	Hot with the Chance of a Late Stor	12	public	public	urban	aesthetic	abstract	permanent	not seasonal	traditional arts media
8	Gluesociety - James Di	2012	I wish you hadn't asked	no	inside	public	urban	ecologic	abstract	temporary	seasonal	materiality
9	ASAN	2017	Look at that, you son of a bitch.	14	public	public	rural	aesthetic	abstract	temporary	not seasonal	traditional arts media
10	Hehe	2008	Nuart vert	no	public	public	urban	ecologic	abstract	temporary	not seasonal	materiality
11	Hehe	2016	Cloud crash	15	inside	public	urban	aesthetic	movement	permanent	seasonal	materiality
12	Takeshi Kawano	2011	Plus 2 degrees	17	inside	private	urban	aesthetic	movement	permanent	not seasonal	materiality
13	Katie Peterson	2007	Deap breathing	18	inside	private	urban	ecologic	abstract	temporary	seasonal	materiality
14	Katie Peterson	2014	Future Library	no	public	public	rural	ecologic	abstract	permanent	not seasonal	materiality
15	Olafur Eliason	2014	Ice watch	21	public	public	urban	aesthetic	movement	temporary	seasonal	materiality
16	Gideon Mendel	2007 ongoin	Drowning world	24	inside	private	urban	aesthetic	human	permanent	seasonal	traditional arts media
17	Michaelangelo Pistolett	2003 ongoin	Third Paradise	26	public	public	both	aesthetic	abstract	temporary	not seasonal	materiality
18	Marc Coreth	2009	Ice bear project	32	public	public	urban	ecologic	movement	permanent	seasonal	materiality
19	Joaquin Fargas	2007	Sunflower	38	public	public	urban	ecologic	movement	permanent	seasonal	traditional arts media
20	Joaquin Fargas	2015	Space for purification	no	public	public	rural	ecologic	movement	temporary	not seasonal	materiality
21	Liberate Tate	2000-2017	Liberate Tate	49	inside	public	urban	aesthetic	text	temporary	not seasonal	traditional arts media
22	Ackroyd&Harvey	2009	Polar diamond	52	inside	private	urban	ecologic	abstract	permanent	not seasonal	materiality
23	Ackroyd&Harvey	2019	Beuys's acorns	no	public	public	urban	ecologic	movement	temporary	seasonal	materiality
24	Ackroyd&Harvey	2018-2020	The Ash project	no	public	public	rural	ecologic	movement	permanent	not seasonal	traditional arts media
25	Bambi	2017	The pope gives us hope	54	public	public	urban	aesthetic	human	permanent	not seasonal	traditional arts media
26	Lucia Monge	2010 - onwar	Planton Movil	no	public	public	urban	ecologic	human and	temporary	not seasonal	materiality
27	Janet Laurence	2016	Novartis	no	public	public	urban	ecologic	movement	permanent	seasonal	materiality
28	Janet Laurence	2017	IGA Berlin	no	inside	public	urban	aesthetic	movement	temporary	seasonal	materiality
29	The Harrisons	1974 - 1984	The Lagoon Cycle	no	public	public	both	ecologic	movement	permanent	seasonal	materiality
30	The Harrisons	2007-2009	Greenhouse Britain	no	public	private	rural	aesthetic	movement	permanent	seasonal	materiality
31	The Harrisons	1995 ongoin	Future garden	no	public	private	urban	aesthetic	movement	permanent	seasonal	materiality
32	Banksy (suspected)	2019	From here on	no	public	public	urban	aesthetic	human	permanent	not seasonal	traditional arts media
33	Tue Greenfort	2018	Light-vented Bulbul	no	public	private	urban	ecologic	movement	temporary	not seasonal	materiality
34	Strijdom van der	2018	The Earth	no	public	public	rural	ecologic	abstract	temporary	seasonal	materiality
35	Dear Climate	2012 ongoin	Open source posters to agitate	no	public	public	all	aesthetic	text posters	permanent	not seasonal	traditional arts media
36	Marie Velardi	2014 - 2017	Atlas des isles perdues (atlas of Ic	no	inside	private	rural	aesthetic c	movement	permanent	not seasonal	traditional arts media
37	Jason deCaires Taylor	2010	Underocean sculpture	no	public	public	rural	aesthetic	human	permanent	not seasonal	materiality
38	Shrinking Space	2019	WildflowerMeadow	no	public	public	rural	ecologic	movement	temporary	seasonal	materiality
39	GASP	2009	Swimmable	no	public	public	urban	ecologic	movement	temporary	not seasonal	materiality
40	Dan Perjovschi	2015	Cli Mate	no	inside	private	urban	aesthetic	drawing	temporary	not seasonal	traditional arts media
41	Špela Petrič	2015	Confronting Vegetal Otherness: S	no	inside	private	urban	ecologic	movement	temporary	not seasonal	non-traditional arts mat
42	Michael Pinskey	2018	Pollution pods - cape farewell	no	public	public	urban	ecologic	abstract	temporary	not seasonal	materiality
43	Berntnaut Smilde	2012	Nimbus	no	inside	private	urban	ecologic	movement	temporary	not seasonal	materiality
44	Michael Wang	2017	Extinct in the wild	no	inside	private	urban	ecologic	movement	temporary	not seasonal	materiality
45	Eve Mosher	2007	High waterline	no	public	public	urban	ecologic	abstract	temporary	not seasonal	materiality
46	Studio Roosegaarde	2015	Waterlicht	no	public	public	urban	ecologic	abstract	temporary	not seasonal	traditional arts media
47	Studio Roosegaarde	2017	Gates of light	no	public	public	urban	ecologic	abstract	permanent	not seasonal	materiality
48	Agnes Denes	1982	Wheatfield	no	public	public	urban	ecologic	movement	temporary	seasonal	materiality
49	Agnes Denes	1996	Tree Mountain	no	public	public	rural	ecologic	movement	permanent	seasonal	materiality
50	Tomas Saraceno	2018	On Air	no	public	private	urban	ecologic	movement	temporary	not seasonal	materiality

Table 3.3 (b): DATASET B – Sub-section B eco-art dataset extract (full dataset in Appendix A and online here)

Q1			Q2		Q11 - 8x	Q12 - 13x	Q13 -17x	Q14 10x	Q15	Q16 - 20 of 27	Q17 x9	Q18 - 17 of 27
					B. Conceptual Approach							
Number	Artists name	Year	Artwork name	Galafassi catalogue no.	Single concept / narrative Concept	Intellectual only/visceral (sensory)/functional	Prescriptive/Immersive/exploratory	Single iteration /multiple iterations/movement	With permission / without Permission	Stillstanding vs movement in audience/artwork/artist	Community project/ public/gallery/online audience	Observer / participatory - participatory
1	Tue Greenfort	2007	Exceeding 2°C, 2007/2014	1	single concept	sensory	immersive	single iteration	with permission	still standing	public	observe
2	Sarah Cameron Sunde	2013 ongoin	36,5	4	single concept	sensory	immersive	multiple iterations	with permission	movement	community	participatory
3	Banksy	2009	I don't believe in global warming	9	single concept	intellectual	prescriptive	single iteration	without Permissior	movement	public	observer
4	Isaac Cordal	2013	Waiting for Climate	10	narrative concept	intellectual	prescriptive	multiple iterations	with permission	movement	public	observer
5	Fintan Magee	2016	Glass half full	11	single concept	intellectual	prescriptive	single	permission	still standing	public	observer
6	Aichner & Huber	2013	Powerwalk	8	single concept	intelectual	immersive	multiple iterations	with permission	movement	online	observer
7	Gluesociety	2006	Hot with the Chance of a Late Sto	12	single concept	viceral	prescriptive	single iteration	with permission	still standing	public	observer
8	Gluesociety - James D	2012	I wish you hadn't asked	no	single concept	visceral	immersive	multiple iteration	with permission	movement	gallery	participatory
9	ASAN	2017	Look at that, you son of a bitch.	14	single concept	visceral	prescriptive	single iteration	with permission	movement	public	observer
10	Hehe	2008	Nuart vert	no	single	visceral	exploratory	single iteration	with permission	movement	public	participatory
11	Hehe	2016	Cloud crash	15	single concept	visceral	prescriptive	single iteration	with permission	still standing	gallery	observer
12	Takeshi Kawano	2011	Plus 2 degrees	17	single concept	visceral	prescriptive	single iteration	with permission	still standing	gallery	observer
13	Katie Peterson	2007	Deap breathing	18	single	visceral	prescriptive	single iteration	with permission	movement	gallery	observer
14	Katie Peterson	2014	Future Library	no	narrative concept	visceral	exploratory	multiple iterations	with permission	movement	public	participatory
15	Olafur Eliason	2014	Ice watch	21	narrative concept	visceral	immersive	multiple iterations	with permission	movement	public	participatory
16	Gideon Mendel	2007 ongoin	Drowning world	24	narrative concept	intellectual	prescriptive	multiple iterations	with permission	still standing	gallery	observer
17	Michaelangelo Pistolet	2003 ongoin	Third Paradise	26	narrative concept	visceral	exploratory	movement	with permission	movement	community	participatory
18	Marc Coreth	2009	Ice bear project	32	single concept	visceral	prescriptive	multiple iterations	with permission	still standing	public	observer
19	Joaquin Fargas	2007	Sunflower	38	single concept	functional	prescriptive	single iteration	with permission	movement	community	participatory
20	Joaquin Fargas	2015	Space for purification	no	single	functional	immersive	single	with permision	movement	community	participatory
21	Liberate Tate	2000-2017	Liberate Tate	49	narrative concept	visceral	prescriptive	multiple iterations	without permissior	movement	community	observe
22	Ackroyd&Harvey	2009	Polar diamond	52	single concept	functional	prescriptive	single iteration	with permission	still standing	online	observer
23	Ackroyd&Harvey	2019	Beuys's acorns	no	narrative concept	functional	exploratory	multiple	with permission	movement	public	observer
24	Ackroyd&Harvey	2018-2020	The Ash project	no	single	visceral	exploratory	single	with permission	movement	community	participatory
25	Bambi	2017	The pope gives us hope	54	single concept	intellectual	prescriptive	single iteration	without permissior	still standing	public	observer
26	Lucia Monge	2010 - onwa	Planton Movil	no	narrative concept	visceral	exploratory	multiple iterations	with permission	movement	community	participatory
27	Janet Laurence	2016	Novartis	no	narrative concept	functional	immersive	single iteration	with permission	movement	public	participatory
28	Janet Laurence	2017	IGA Berlin	no	narrative concept	functional	prescriptive	single iteration	with permission	still standing	gallery	observer
29	The Harrisons	1974 - 1984	The Lagoon Cycle	no	narrative concept	viceral	immersive	multiple iterations	with permission	movement	community	participatory
30	The Harrisons	2007-2009	Greenhouse Britain	no	narrative concept	visceral	immersive	multiple iteration	with permission	still standing	community	observe
31	The Harrisons	1995 ongoin	Future garden	no	narrative concept	visceral	immersive	multiple iteration	with permission	still standing	community	observe
32	Banksy (suspected)	2019	From here on	no	single	intellectual	prescriptive	single	without Permissior	still standing	public	observer
33	Tue Greenfort	2018	Light-vented Bulbul	no	sinlgle	visceral	immersive	single	with	movement	gallery	observer
34	Strijdom van der	2018	The Earth	no	single	visceral	immersive	single	with permission	movement	community	observer
35	Dear Climate	2012 ongoin	Open source posters to agitate	no	narrative concept	visceral	prescriptive	multiple	with permision	still standing	online and publi	observe
36	Marie Velardi	2014 - 2017	Atlas des isles perdues (atlas of	no	sinlgle	intellectual	prescriptive	single	with permission	still standing	gallery	observer
37	Jason deCaires Taylor	2010	Underocean sculpture	no	narrative concept	visceral	immersive	multiple	with permission	still standing	community	participatory
38	Shrinking Space	2019	WildflowerMeadow	no	single	visceral	immersive	single	with permission	movement	community	participatory
39	GASP	2009	Swimmable	no	narrative concept	visceral	immersive	multiple	with permission	movement	community	participatory
40	Dan Perjovschi	2015	Cli Mate	no	narrative concept	intellectual	immersive	multiple	with permission	movement	public	observer
41	Špela Petrič	2015	Confronting Vegetal Otherness:	no	single	visceral	prescriptive	single	with permission	movement	gallery	observe
42	Michael Pinskey	2018	Pollution pods - cape farewell	no	narrative concept	visceral	immersive	multiple	with permission	movement	public	observe
43	Berntnaut Smilde	2012	Nimbus	no	narrative concept	visceral	prescriptive	multi	with permission	movement	gallery	observer
44	Michael Wang	2017	Extinct in the wild	no	narrative concept	intelectual	prescriptive	multi	with permission	still standing	gallery	observer
45	Eve Mosher	2007	High waterline	no	narrative concept	visceral	immersive	multiple	without Permissior	movement	public	participatory
46	Studio Roosegaarde	2015	Waterlicht	no	single	visceral	immersive	single	with permission	movement	public	observer
47	Studio Roosegaarde	2017	Gates of light	no	single	visceral	immersive	single	with permission	movement	public	participatory
48	Agnes Denes	1982	Wheatfield	no	single	functional	prescriptive	single	with permission	movement	public	observer
49	Agnes Denes	1996	Tree Mountain	no	single	functional	immersive	single	with permission	movement	public	participatory
50	Tomas Saraceno	2018	On Air	no	single	functional	immersive	single	with permission	movement	gallery	participatory

Table 3.3 (c): DATASET B – Sub-section C and E eco-art dataset extract (full dataset in Appendix A and online here)

Q1			Q2		Q19 - 10x	Q20 14x	Q21 - x6	Q22 - x11	Q23	Q28 16x
					C. Network					E. Pedagogy
Number	Artists name	Year	Artwork name	Galafassi catalogue no.	Sole artist / network	Male/female/non binary/mix	comission based project /non-affluent - grassroots/self initiated	Unexpected or incidental audience/ predetermined audience/ gallery audience	Actors/real people in audience and participation	Added Education component - intentional or no educational intention other than the artwork itself
1	Tue Greenfort	2007	Exceeding 2°C, 2007/2014	1	sole artist	male	self initiated	predetermined	real people	educational
2	Sarah Cameron Sunde	2013 ongoin	36,5	4	sole artist	female	self initiated	unexpected particip	real people	educational
3	Banksy	2009	I don't believe in global warming	9	sole artist	male	self initiated	incidental audience	real people	not educational
4	Isaac Cordal	2013	Waiting for Climate	10	sole artist	male	self initiated	unexpected	real people	not educational
5	Fintan Magee	2016	Glass half full	11	sole artist	male	comission	predetermined	real people	not educational
6	Aichner & Huber	2013	Powerwalk	8	network	male	sponsored	predetermined	real people	educational
7	Gluesociety	2006	Hot with the Chance of a Late Sto	12	network	mix	comission	incidental	real people	not educational
8	Gluesociety - James D	2012	I wish you hadn't asked	no	network	male	self initiated	predetermined	real people	not educational
9	ASAN	2017	Look at that, you son of a bitch.	14	network	mix	comission	undetermined	real people	educational
10	Hehe	2008	Nuart vert	no	network	mix	self initiated	unexpected	real people	educational
11	Hehe	2016	Cloud crash	15	network	mix	comission	predetermined	real people	educational
12	Takeshi Kawano	2011	Plus 2 degrees	17	sole artist	male	self initiated	predetermined	real people	not educational
13	Katie Peterson	2007	Deap breathing	18	sole artist	female	self initiated	predetermined	real people	educational
14	Katie Peterson	2014	Future Library	no	sole artist	female	self initiated	unexpected audien	real people	educational
15	Olafur Eliason	2014	Ice watch	21	sole artist	male	self initiated	incidental	real people	not educational
16	Gideon Mendel	2007 ongoin	Drowning world	24	sole artist	male	self initiated	predetermined	real people	educational
17	Michaelangelo Pistolet	2003 ongoin	Third Paradise	26	sole artist	male	self initiated	incidental	real people	educational
18	Marc Coreth	2009	Ice bear project	32	sole artist	male	comission	predetermined	real people	not educational
19	Joaquin Fargas	2007	Sunflower	38	sole artist	male	comission	predetermined	real people	educational
20	Joaquin Fargas	2015	Space for purification	no	sole	male	self initiated	predetermined	real people	educational
21	Liberate Tate	2000-2017	Liberate Tate	49	network	mix	grassroots	unexpected	real people	educational
22	Ackroyd&Harvey	2009	Polar diamond	52	network	mix	self initiated	predetermined	real people	not educational
23	Ackroyd&Harvey	2019	Beuys's acorns	no	network	mix	self initiated	unexpected	real people	not educational
24	Ackroyd&Harvey	2018-2020	The Ash project	no	network	mix	comissioned	unexpected	real people	educational
25	Bambi	2017	The pope gives us hope	54	sole artist	female	self initiated	predetermined	real people	not educational
26	Lucia Monge	2010 - onwa	Planton Movil	no	sole artist	female	self initiated	predetermined	real people	educational
27	Janet Laurence	2016	Novartis	no	sole artist	female	comission	predetermined	real people	educational
28	Janet Laurence	2017	IGA Berlin	no	sole artist	female	grassroots	predetermined	real people	educational
29	The Harrisons	1974 - 1984	The Lagoon Cycle	no	network	mix	self initiatited	incidental	real people	educational
30	The Harrisons	2007-2009	Greenhouse Britain	no	network	mix	grant	predetermined	real people	educational
31	The Harrisons	1995 ongoin	Future garden	no	network	mix	self initiated	unexpected	real people	educational
32	Banksy (suspected)	2019	From here on	no	sole	male	self initiated	unexpected	real people	not educational
33	Tue Greenfort	2018	Light-vented Bulbul	no	sole	male	self initiated	predetermined	real people	educational
34	Strijdom van der	2018	The Earth	no	sole	male	comissioned	predetermined	real people	educational
35	Dear Climate	2012 ongoin	Open source posters to agitate	no	network	mix	self initiated	incidental	real people	educational
36	Marie Velardi	2014 - 2017	Atlas des isles perdues (atlas of	no	sole	female	self initiated	predetermined	real world	educational
37	Jason deCaires Taylor	2010	Underocean sculpture	no	network	male	comission	unexpected	real people	educational
38	Shrinking Space	2019	WildflowerMeadow	no	network	mix	self initiated	unexpected	real people	educational
39	GASP	2009	Swimmable	no	network	miix	grassroots	predetermined	real people	not educatonal
40	Dan Perjovschi	2015	Cli Mate	no	sole	male	self initiated	predetermined	real people	educational
41	Špela Petrič	2015	Confronting Vegetal Otherness:	no	sole	female	self initiated	unexpected	real people	educational
42	Michael Pinskey	2018	Pollution pods - cape farewell	no	sole	male	self initiated	predetermined	real people	educational
43	Berntnaut Smilde	2012	Nimbus	no	sole	male	self initiated	predetermined	real people	not educational
44	Michael Wang	2017	Extinct in the wild	no	sole	male	self initiated	predetermined	real people	educational
45	Eve Mosher	2007	High waterline	no	sole	female	self initiated	unexpected	real people	educational
46	Studio Roosegaarde	2015	Waterlicht	no	sole	male	self initiated	prescriptive	real people	educational
47	Studio Roosegaarde	2017	Gates of light	no	sole	male	comission	incidental	real people	educational
48	Agnes Denes	1982	Wheatfield	no	sole	female	self initiated	incidental	real people	educational
49	Agnes Denes	1996	Tree Mountain	no	sole	female	comissioned	incidental	real people	educational
50	Tomas Saraceno	2018	On Air	no	sole	male	self initiated	incidental	real people	educational

3.2.1 **Selection process**

Diego Galafassi and colleagues selected artworks based on a catalogue and an online search, using the phrases such as 'climate change' and 'art' (2018a, p. 74). They selected climate-related artworks in search of a humanistic climate response because, they argued, in the past, artists have played major roles in societal transformation. Based on an online survey of climate art produced between 2000 and 2016, they compiled a catalogue of 199 artworks from around the world to reveal the role of art in global environmental change science. Diego Galafassi provided me with the Excel spreadsheet of 199 artworks via email[19] (Appendix B). The artworks provided a good start for me to construct a dataset for this study, because they had already been analysed in a published article. However, only 19 artworks from the Galafassi's study were used to form the baseline for Dataset B, using the criteria I had developed in Table 3.3. This was because some of the cases in Galafassi's study related to the aim of that study to establish the "*perceived role of the arts* in fostering climate transformation" (Galafassi et al., 2018a, p. 71, emphasis added), as identified primarily by a team of scientists interrogating the artworks. My study presented here and based on eco-cultural arts as *praxis* takes this a step further to establish *how* artists prepare for such work, specifically interrogating the characteristics privileged in their praxis. This included my work.

I conducted a quantitative exploratory analysis to answer my research questions. The sample consisted of 50 artists, systematically selected from a population of artists with an ecological focus with websites or active social media pages. Using standard (frequentist) statistical methods a sample size of 50 would return an error rate of 10% at the 90% confidence interval. This means that any estimate derived from the sample is likely to be within 10% of the true population value 90% of the time (Neyman, 1977). The interrogation is purely exploratory and my praxis in this field forms the basis for informed speculation.

Dataset B consists of the 19 artworks selected from the Galafassi et al. study (2018a) and an additional 31 artworks that had the criteria set out above to get to a dataset sample size of 50 (Appendix A). [20]

The ten essentials Fazey *et al* (2018) synthesised in an elaborate effort coordinating 40 scholars' transformation research's main priorities, from a practitioner's perspective, was also a valuable summary of the factors that should be present in transformation work. However, none of these scholars were from Africa, or had official affiliation on the continent. What I found lacking, however, was: Focusing on praxis, how do these artists or creative problem solvers **work**?

[19] Galafassi emailed me the dataset (Appendix B) - a Climate Arts catalogue on the 2nd of February 2020 from his current research position in the Stockholm Resilience Institute at Lund University.

[20] The dataset collection became extremely interesting. Some of the works were so thought provoking I doubted whether my own "rules" to separate still-standing work in galleries from relational public artworks were valid. My experience of museum and galleries are limited because I don't live in a city or country with a thriving visual arts scene. My perception of how moving gallery work can be developed during the study, with some work almost a physical manifestation of inspiration. This realisation of the permeability of the arts is for another kind of philosophical interrogation though; I will stick to the ecologically functional artworks I set out to interrogate. For example, artist, Spela Petric's *Confronting Vegetal Otherness: Skotopoiesis*, which the artist performs over 12 hours while grass growth happens in her own shadow https://www.spelapetric.org/#/scotopoiesis/

My selection of the artworks was not as automated as that conducted by Galafassi and colleagues, who began with a Google search. During my selection process, I omitted film and theatre artworks because, in this study, my focus is on visual arts. Dramatic arts, performance-based works with actors, and other rehearsed works are often oriented to anticipated observers.[21] The visual art component was less than 25% (50 visual artworks) of 199 artworks. Among the 50 visual artworks, 12 works were prepared to be shown to coincide with the Paris Climate Change Conference in November 2015, but the terrorist attacks in Paris in that year, immediately before the conference, most likely prevented their installation, and the final artworks are not available online. In addition, some of the websites were no longer active and the artworks were not available online and were thus omitted. I wished only to include artworks in a dataset that were installed or available online. The artworks selected for the Paris Conference in 2015 went through a curatorial process, were not-available now, either because the work was never executed, never posted online, or because the work had since been removed. I became increasingly selective, looking for relational artists creating opportunities for audiences to participate.

Both datasets A and B were elaborate and specific enough to test in a pilot study, comparing and contrasting praxis with my list of characteristics. This process is described below.

3.3 Phase 2: Pilot interrogation

To check how my datasets responded to this inquiry, I tested them with a pilot interrogation. Dataset B (the eco-artworks) were interrogated with the characteristics in Dataset A. The opposing characteristics were either present or not, creating a binary; the full dataset and pilot results are in Appendix A (and online for more detail here) but for quick reference, see an extract in Table 3.3 (a-c). The artists and their artworks I selected are listed on the left, and the characteristics are listed at the top (Dataset A). Each of the artworks was checked for the opposing characteristics, and this was noted as a description.

My focus during the pilot phase was to optimise the datasets, look for areas that did not respond to the study and eliminate them.

While marking the qualitative characteristics, I noticed that the science-related questions, sub-section D of Dataset A, could not be determined. The information to answer the GEC science-type questions was not available online. Artists in my dataset also did not disclose how they accessed the environmental science-related information online. Given these gaps, I could interrogate this in my praxis but not in other artists' praxis. With these gaps, I became more alert to these oversights, and I started taking note of some very low-frequency characteristics in the selected eco-artworks.

[21] I am not familiar enough with the work processes of dramatic to include it in this study, so I kept to visual arts only.

3.3.1 Optimising the study, realigning it with theoretical findings of intentionality

Deliberately planned (O'Brien, 2012) eco-cultural interventions (Section 1.2) can transform the social reach of established sustainability theorists (van Meer, 2016) and practitioners (Warrington-Coetzee, 2021). Transdisciplinary practitioners usually ask different questions in the fecund middle space biologists also call the ecotone (Nixon, 2011). This kind of diversity of insight can serve humanity (McGregor, 2015). In these spaces, various interventions can be co-designed and aim to address the complex "wicked" challenges we face today, first so described because these problems are not "tame" (Rittel and Webber, 1973).

To assist environmental science's overall crises in public trust (Saltelli and Funtowicz, 2017), the interrogation approach outlined in Figure 3.1 complements existing adaptation and mitigation strategies by adding a potentially transformative approach through the arts. Nicolescuian transdisciplinarity, I argue and suggest here, can lubricate dialogue between dichotomies that exist in science and society, where contradiction can be mediated to create new potentiality for complex problem solving (McGregor, 2015).

The consequence of engaging with a transdisciplinary approach can preserve, surface and enable the resolution of disciplinary differences (Nicolescu, 2013), creating unique dynamics while also creating new potentialities for engagement (Rosenfield, 1992). The non-linearity of Rhizome Theory further decentralises hierarchical structures and monologic disciplinary silos, producing potential optimal opportunities for growth (Deleuze and Guattari, 1980). When artists network rhizomatically with the intent to make a difference, they work in an innovative way, making new connections and co-creating ongoing nodes of interactions (Kent and Lane, 2017). The adaptability of these two theories is a viable analytical instrument that could decipher creative processes (Styhre and Sundgren, 2003), creating synthesis when ideas meet across many entities.

3.3.2 Interim synthesis

Having outlined the broad canvas used to begin this deep dive into eco-transdisciplinarity, I began to focus on refining and finessing the datasets. Twenty-three artworks had no obvious intent to contribute to the "wicked" challenges it was critiquing (these 23 artworks are not highlighted in Table 3.3 a, b, and c and in Appendix A). I eliminated these 23 artworks from the datasets because I set out to study *how* artists create opportunity for change in the second research question: ***What form does the transformative opportunity in such interventions manifest as?*** Because I did not have details on how the artists designed these interventions, I drew on my experience in praxis, always mindful that the artworks I want to leave in the world should have a purpose. When I make a work that is very large or difficult to move, I make sure I have somewhere to place it after I have made it because I do not keep any large artworks in storage given the environmental footprint of doing so. This creates ongoing conversations and adds responsibility. It means that I intentionally make artworks that I think would move audiences into participation. If the artwork does not **work** in this way, I make sure I made it in

such a way that it can then be upcycled or decay after the work is made. The life cycle of the artwork becomes my responsibility to not leave a trace on Earth if it was unsuccessful. If it is successful, it should grow and contribute to the ecosystem it is placed in. It means that every bit of material that goes into an artwork's 'afterlife' is considered.

By considering intent, I could separate the artworks with intent to contribute to the cause from those without intent. Twenty-seven of the original 50 artworks in my dataset had various kinds of intent. My summary of the identified intention is recorded in the last column in Table 3.3 (and in Dataset B Appendix A). The final phase of the interrogation process was to only analyse the artworks where intent could be established online and where they addressed the second research question. The original research question in the proposal stage of this study was: Which characteristics in socio-ecological artists' climate change themed interventions are more prone to inspire action in a warming world? The question developed as I learnt how to describe my own work better to: ***Identify the key characteristics climate change-focused eco-artists use in their praxis.*** (The results follow in Chapter 4). A follow-up question was about how these works were made. ***What form does the transformative opportunity in such interventions manifest as?***

The second research question is addressed with the artworks, which had intentionality to contribute to the cause. Thus, my final interrogation only included 27 artworks – those that had potentiality to intentionally and deliberately inspired transformation (listed in Table 3.4) (O'Brien, 2020). But first, whilst learning all these articulate ways to describe transdisciplinary praxis, I took some time to draw my findings with various data drawing techniques to reflect on interim findings.

3.3.3 Drawing the findings

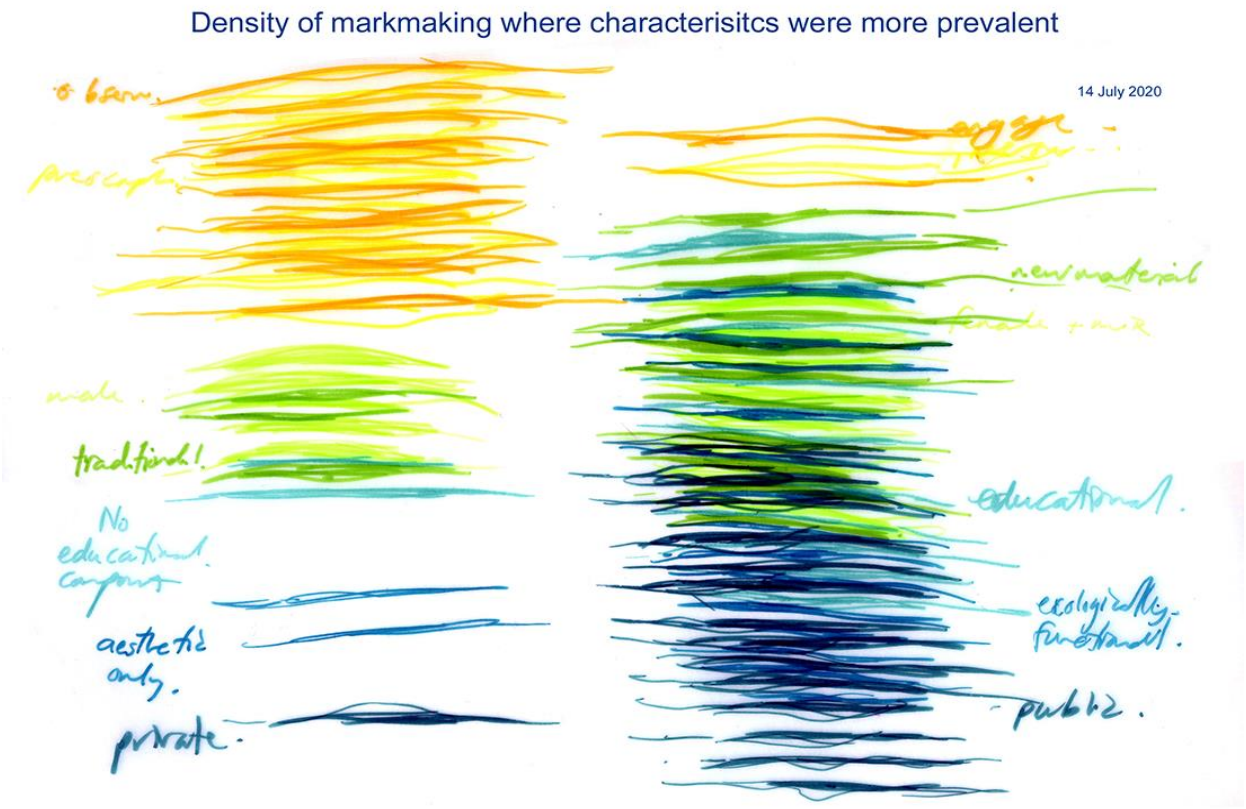

Figure 3.5: An early drawing of the condensed mark making in green and blues on the right-hand, with notes on characteristics shows the artists preferred characteristics in eco-art, such as public, ecologically functional, educational, new materials etc. (Image by the author – © Hannelie Warrington-Coetzee).

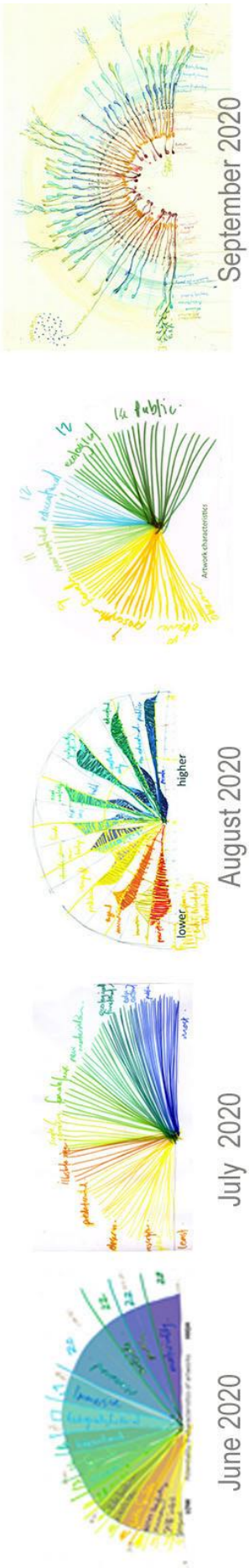

Figure 3.6: Sundial drawings progression drawings, starting with June 2020 sundial drawings at the bottom to more detailed drawing in September 2020 at the top. (Image by the author – © Hannelie Warrington-Coetzee)

By first hand drawing the findings as a mark-making exercise (Figures 3.5 to 3.8) in data drawing techniques, the full eco-art dataset (Appendix A) took form visually. This drawing exercise reiterated the findings with the familiarity of my praxis, to draw and make notes as I am learning.

Drawing a sundial by hand with the results of the interrogation process, rather than using an automated process on Excel, allowed me to see if I could find emerging patterns visually. The iterative drawing exercise of various data science drawing techniques also showed the development of the study by arranging earlier sketches of the initial findings in June and July 2020 at the bottom of Figure 3.6 and later more confident diagrams at the top. The tone of the colour changes from red/yellows on the left to greens/blues to arrange the findings. I was looking for patterns to emerge in the early drawings because I often work with embroidery patterns, pixelations and patterns that reflect light.

While I drew these diagrams of the findings, I considered each line's colour, thickness, and length. Each stroke is done mindfully in light of the rigorous interrogation and is thus an intentional drawing; each stroke represents something specific in the findings. For example, the number of blue strokes in the July 2020 sundial drawing (Figure 3.6) represents the number of times I counted those characteristics in my dataset.

Using such artistic analytical approaches could provide another form of frequentist analysis (Neyman, 1977) in which the quality of the method reveals the answers by counting the reoccurrence of the eco-art traits.

The final colour coding organised the findings, but I could not interpret it through only drawing. Some characteristics were obviously more present in the artworks isolated in the synthesis.

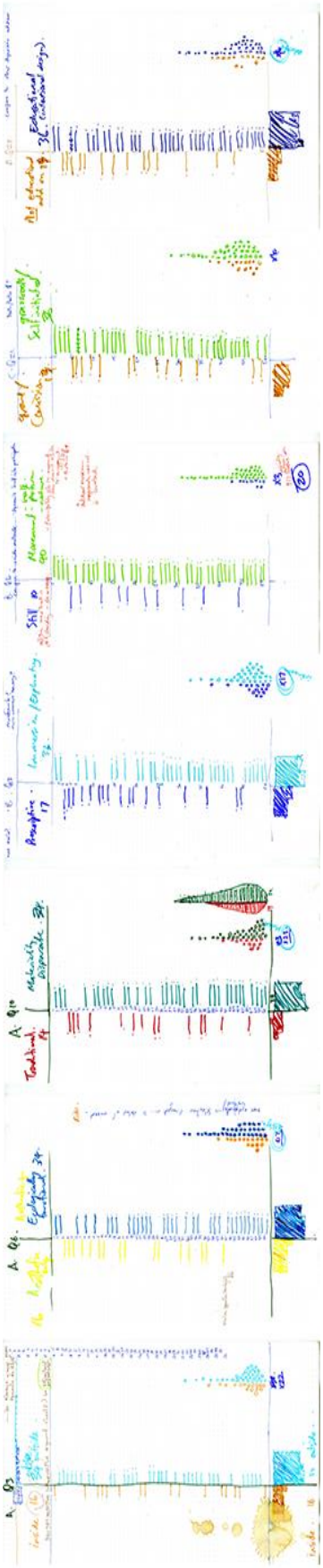

Figure 3.7: Violin plot and box plot drawings interrogation of Dataset A with Dataset B (Appendix A).

From the bottom to the top, each characteristic was drawn with each line representing an artwork's traits. (Image by the author – © Hannelie Warrington-Coetzee).

I found violin and box data drawings good for visual presentation, a different approach to the sundial drawings. I drew each characteristic on a separate sheet as seen in Figure 3.7.

The harder I tried to find patterns the less they emerged. I had to learn to do my analysis more methodically and not artistically. I had some more unlearning to do. I stopped looking for patterns. I reached out to discuss this dilemma with colleagues and learnt that although I had been looking for patterns, I have also been counting the frequency of the characteristics. I had been counting the number of times the characteristics occurred in the artworks whilst doing the data science drawings.

Figure 3.8 is the most detailed drawing I did before I learnt how to do a more statistical approach. The intricate amount of detail in this drawing shows the richness of the eco-arts space visually. It bulges in the middle, (Nicolescu, 2013) bursting its seams with creative solutions (Hope, 2016).

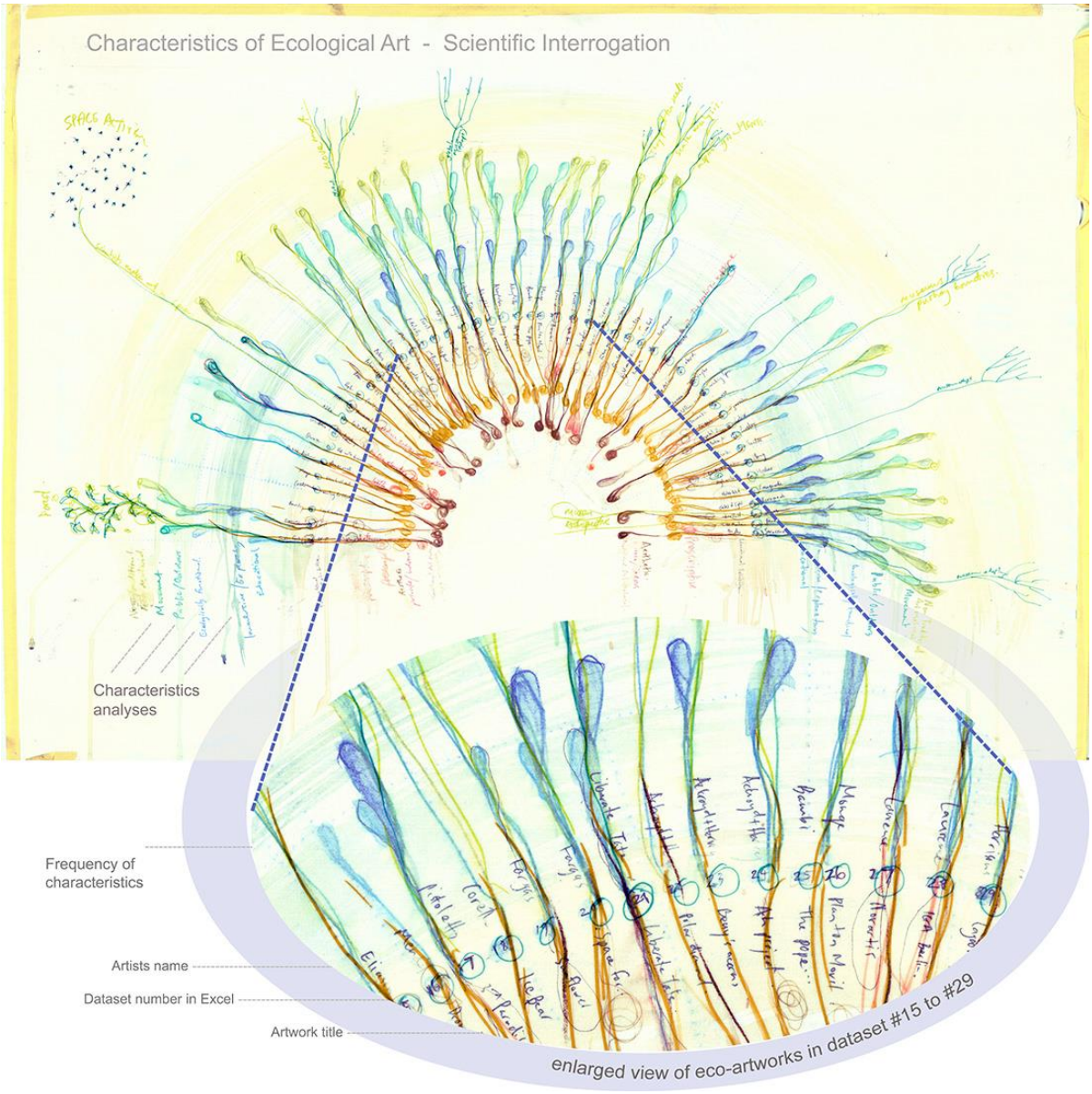

Figure 3.8: The final hand drawing of the interrogation before a more statistical method was followed. The close-up window shows the findings visually; the artists name, the number from the dataset and the title of the artwork is noted. Each colour represents a characteristic for each of the artworks interrogated.(Image by the author – © Hannelie Warrington-Coetzee)

3.4 Phase 3: Final interrogation of characteristics

In the final interrogation of the characteristics, Phase 3, my assembled list of opposing characteristics (Dataset A in Table 3.1) was probed in an optimised eco-artworks Dataset B as set out in Phase 2, which had artworks with intent to address the cause the works were critiquing (Table 3.4 shows these 27 artworks and the notes I made on the artist's intention are accessible in full in Appendix A). In other words, the artists or their partners stated some kind of participatory component for audiences, or an educational component or workshops, for instance, as discussed in Phase 2.

Twenty-eight characteristics as well as their opposing traits were counted in the 27 eco-artworks to find the final key characteristics used by artists who intentionally built artworks or interventions for participation and possible transformative opportunities. The mixed-method of interrogation brought together the strengths of the qualitative and quantitative methods (Morgan, 2018). The qualitative dataset (Table 3.1) produced the words describing the characteristics of my praxis with its opposing traits. Posing these characteristics to Dataset B resulted in numbers, summing up which artworks had which characteristics. This classifies as a more quantitative interrogation supporting a more mixed-method approach to anchor the study.

Table 3.4: The artist's intention to reach wider audiences noted and described for 27 artworks. These notes are from my experience working in the field.

number	Artists Name	Year	Artwork Name	Galatea Dataset	TOP 27 artists of 27 artworks with NOTES on INTENTION of the artists to reach wider audiences
1	Tue Greenfort	2007	Exceeding 2°C, 2007/2014	1	Top 27	Not a stagnant work – indoors so it did not score all the traits, but like Liberate Tate – the difference in temperature makes this an immersive experience for the audience who can feel the difference in tempterature in UAE. Participants could contribute to buying cheap forest for conservation in Equador, lLittle detail about the roll out of this great idea. What size was puchased and is it still under conservation? Any idea how many people visited the exhibition? What is the current status of the conserved area Participants could contribute to buying cheap forest for conservation in Equador, what size was puchased? Museum entry excludes non art audiences (local?)
2	Sarah Cameron Sunde	2013 – ongoing	36,5	4	All 6	Participation in the performance, standing in the tide waiting to feel the tide move up or down over the indivitiduals body is a meditative commitment. Tide creates opportunity for learning, immersed. The artist have community projects running concurrent to performances following the first one which ranks this as eco-art with intent
10	Hehe	2008	Nuart vert	no	All 6	Participation brings the energy usage down. The reduction in energy use was made public, visually in realtime, participants lower energy use and it reflected in the projection on the pollution. The right partners who shared the vision after years of communication and then repeated performances ranks this artwork as eco-art with intent
11	Hehe	2016	Cloud crash	15	Top 27	functional on micro scale teaches the audience about the abstract side. Making climate science visible in this lifetime makes it tangible but no active opportunity created as in #10
14	Katie Peterson	2014	Future Library	no	All 6	future thinking, invited authors take it further while audiences imagine what they would write about. An immersive opportunity to walk in the future in ones mind. Ecological slowness is aparent when you visit, slowing oneself down? It is a public museum, ongoing for a century, each year with events activating new wicked issues.
15	Olafur Eliason	2014	Ice watch	21	Top	Meliting the ice performativelyis the irony of the work. The participants touch melts the ice quicker. Immersion warms
17	Michaelangelo Pistoletto	ongoing	Third Paradise	26	Top 27	Conceptual intent to activate audience in a manifesto and numerous symbolic activations.
19	Joaquin Fargas	2007	Sunflower	38	all 6	the viewers access the weather station? No indication. Ecologically functional weather station in urban context. If the data is accesible it has a lot of potential to inspire action
20	Joaquin Fargas	2015	Space for purification	no	all 6	More engineering – conceptually the works are not contemporary art. Artists/engineering stimulates eco art thinking in public to address environmental problems. More innovation orientated
21	Liberate Tate	2000–2017	Liberate Tate	49	Top 27	The artists/activists intention was not to activate audiences (no incidental audience participation visible online) but to change the museum's dependancy of BP funding. It changed society's relation to oil in the arts most poignantly.
23	Ackroyd&Harvey	2019	Beuys's acorns	no	Top 27	its seems self initiated (from online information) but in #24 it is comissioned and aligned with multiple activations by the comisioning agent> The partners in #24 changes the viewers experience exponentially, using the artists research and thought process to widen the reach.
24	Ackroyd&Harvey	2018–2020	The Ash project	no	All 6	the artists. As in #23 above, #24 the network and reach changes. In #23 its seems self initiated (from online information) but in #24 it is comissioned and aligned with multiple activations by the comisioning agent. The partners in #24 changes the viewers experience exponentially, using the artists research and thought process to widen the reach.
26	Lucia Monge	onwards	Planton Movil	no	All 6	Intent and opportunity is spot on combination of sharing the slowness of plants with artist and audience marching with plants and then planting it, repeated multiple times
2	Janet Laurence	2016	Novartis	no	All 6	Intent to create opportunity for activation of the purpose of plants, through a comission which is publically
2	Janet Laurence	2017	IGA Berlin	no	Top	Intent to activate audience is reduced in temporary museum exhibitions without educational components.
29	The Harrisons	1974 – 1984	The Lagoon Cycle	no	All 6	of their praxis, it was exhibited widely indoors, but the impact of the work infuenced city and environmental planning. It is the artwork/ artists thus far closests to what I am trying to do in 10 years. They did 50 years of this, conceptuall working on a scale so large and wide that it was often not seen as an art praxis. Their work was tricky to plot characteristically because I had to keep reminding myself that the work in the museum was just a small fraction of the actual work they did outside the museums where these pieces were shown.
30	The Harrisons	2007–2009	Greenhouse Britain	no	Top 27	Exhibition only from online reading althought their work always had a wider reach the example in the previous work is interrogated in more detail.
31	The Harrisons	1995 ongoing	Future garden	no	Top 27	Outdoor exhibition only, the first work Newton did after Helen's passing. From the Harrison studio a video mentions planting a green belt through the Saharah. Where did this research get done? African savannah ecologists are concerned about the long term logic of changing eco systems in such a fundemental way.
35	Dear Climate	2012 – ongoing	Open source posters to agitate	no	Top 27	It is mainly thought provoking posters online but they take the posters outdoors marches as well.
37	Jason deCaires Taylor	2010	Underocean sculpture	no	Top 27	Intent to activate select ocean diving audiences
38	Shrinking Space	2019	WildflowerMeadow	no	Top 27	Intent to activate audience with community walks and growing biodiverse meadows.
41	Špela Petrič	2015	Confronting Vegetal Otherness: Skotopoiesis	no	Top 27	Intent to activate audience through performance interrogating the ethical relation to plants, slow movement of a person standing for so long – her shadow shrinks vs plant growing, an educational component is not linked but she publishes as a researcher.
45	Eve Mosher	2007	High waterline	no	All 6 –	living close to the high waterline, by walking it. An educational booklet was made available to children to participate in it.
47	Studio Roosegaarde	2017	Gates of light	no	Top 27	attention to its purpose and could be a great partner to have a wider reach. Or is it more about the innovation than the awareness?
48	Agnes Denes	1982	Wheatfield	no	Top 27	The regenerative qualities of the work, a wheatfield in the city is ground breaking but not enough information available about intent to reach new audiences through participation.
49	Agnes Denes	1996	Tree Mountain	no	Top 27	Intent in earlier regenerative works are very interesting because the climate issues were not as pressing yet. A participatory certificates of authenticity was issued, but not clear what their comitment was. which is not sustainable. Then climate change hit the work and large areas died. The artists statement about this in an interview says the government has to look after it. It ticks all the boxes but it is not immune to climate change itself.
50	Tomas Saraceno	2018	On Air	no	Top 27	museum space. Participants can mimic movement in a sonic sense, to learn from spiders and their habitat. Social spiders don't exist in cold places – he comes out of hibernation when he is in a warmer place – originally from Buenos Aires.

3.5 Phase 4: Interrogation of the artists' intent

Once I identified the key characteristics in more deliberate eco-art, I then re-interrogated Dataset B of the international artist's work to find out which artworks had all the traits (Table 3.5). The artists who had intentions to contributed to the cause they are criticising had all the key characteristics I identified in this interrogation. The interventions with intent had to create an opportunity for the "wicked" problem to be addressed, rather than simply critique the issue, as I will discuss further in Chapter 5. Changes in behaviour needs encouragement, and as scientific evidence shows, these changes need incentives and initiative to reach the public (Duxbury, 2010).

Table 3.5: These 8 artworks in Dataset B (Appendix A) had all six key eco-art characteristics (Figure 14)

Dataset number	Artist name or collective name	Year/s	Artwork name	Galafassi Catalogue number	Q20 sex
2	Sarah Cameron Sunde	2013 - onwards	*36,5*	#4	Female
10	Hehe	2008 - onwards	*Nuage vert*	no	Mix
14	Katie Peterson	2014	*Future Library*	no	Female
24	Ackroyd and Harvey	2018 - 2020	*The Ash Project*	no	Mix
26	Lucia Monge	2010 - onwards	*Planton Movil*	no	Female
27	Janet Laurence	2016	*Novartis*	no	Female
29	The Harrisons	1974 - 1984	*The Lagoon Cycle*	no	Mix
45	Eve Mosher	2007	*High waterline*	no	Female

The artists either took the initiative themselves to build on the opportunity to take part in the solution into the intervention, or they had partners who did so (see detailed examples in Chapter 5). An example where intention to shift perception is built into the process of commissioning a major new public artwork is the Ash Project (# 24 in Appendix A). Artists Ackroy and Hardy were commissioned to build a sculpture *Ash to Ash, 2017*. Ash tree dieback is widely accepted as being untreatable, with the projected demise of over 140 million ash trees in the next decade. Since it was discovered in England in 2012, dieback has spread rapidly, decimating ash trees in English woodlands. Multiple participatory opportunities were designed to extend the experience of the cause, including a downloadable primary school arts education program resource,[22] an Outdoors Studios schools programme, which created memories of the tree through drawing workshops in 15 local schools. Students mapped the environment reflecting their hopes for the future through exploration of the information about the trees. The artists' research components in the wider programme inspired activities for audiences to understand why the ash trees are dying and what else could be done. The project has a website explaining the Ash dieback in detail as a resource that compliments participatory programmes that ran simultaneously to the sculpture commission.[23] The public could immerse themselves in an urgent cultural response to create an enduring legacy for future generations or online audiences can learn about the details of the interventions after the project concluded.

[22] https://www.theashproject.org.uk/teaching-resource/

[23] https://www.theashproject.org.uk/sculpture/research-and-development/

The phased, mixed method in this chapter explained my approach to find the key characteristics in eco-art that hold artists intention (Table 3.5) to reach wider audiences to create opportunity for participation and systemic change. This was done by preparing the datasets and then synthesising and testing them before a final interrogation was done in Phase 3. During the interrogation process, I was able to isolate the characteristics that held artist's intention to work outside of the existing arts scene because I have experience in praxis in such transformation design as a practitioner. I extracted the artworks that had all the key characteristics and listed the artists with these artworks that hold intent (Table 3.5), to interrogate the second research question; to understand what intention looks like. I will elaborate on artists' intention and potentiality in the next chapter, answering the research questions by describing the study's key results.

Reflecting on this chapter, "learning" how to interrogate the characteristics as an artist conducting such a methodical analysis is in itself a "complex wicked challenge", involving multiple iterations, adjustments, and interrogations. The first round of interrogation was more organic, learning about different ways to describe eco-art and the different forms it takes; the way analysis includes or eliminates characteristics developed with each iteration. In the process, extraneous and non-transformative characteristics and contradictory characteristics were identified. Features of these methods are explained in the next chapter where results of these steps are knitted together.

CHAPTER 4: Results: Interrogating eco-art

As described in Chapter 3, two datasets were prepared for this study and piloted to extract data to address the research aim and questions:

Question 1. ***What are the key characteristics climate change-focused eco-artists use in their praxis?*** I calculated these features by methodically counting the frequency of the characteristics present in the 27 artworks with intent to draw wider audiences in Sections 4.1 and 4.2 in this chapter.

Question 2 follows, focusing on the intentions of the artist's outreach strategies: ***What form does the transformative opportunity in such interventions manifest as?*** I revisit the last column in Dataset B to describe why I selected 27 of the 50 artworks with intent. Why I thought these works had deliberate transformational eco-cultural intent to reach wider audiences and are framed as the opportunity transdisciplinary approaches can have in eco-art follows in Section 4.3.

4.1 Research question 1

What are the key characteristics climate change-focused eco-artists use in their praxis?

After multiple interrogations, as discussed in Chapter 3 (plotting the findings in Appendix A), the next step was to calculate which characteristics were more frequently used by artists in their artworks with intent to contribute to the cause of their topic. I present the results as percentages below. Counting the frequency of the characteristics present in artworks (Dataset B) is a basic qualitative research tool that separates the key characteristics eco-artists use from the ones less frequently used.

4.2 Threshold calculation

I set a threshold of characteristics that ranked above average at 55%. Characteristics above 55% were considered to be confidently higher than the median and below 55% were below this threshold (Figure 4.1).The threshold percentage of 55% also consciously excludes the characteristic about gender (Characteristic # 20 in Dataset A): If the artists were female, male, other or mixed because masculine and feminine traits fall outside the scope of this study but warrants further research. This threshold calculation identified the six key characteristics the 27 eco-artworks in Dataset B according to the frequency. Figure 4.1 shows a hand-drawn threshold graph. Percentage thresholds are presented in Table 4.

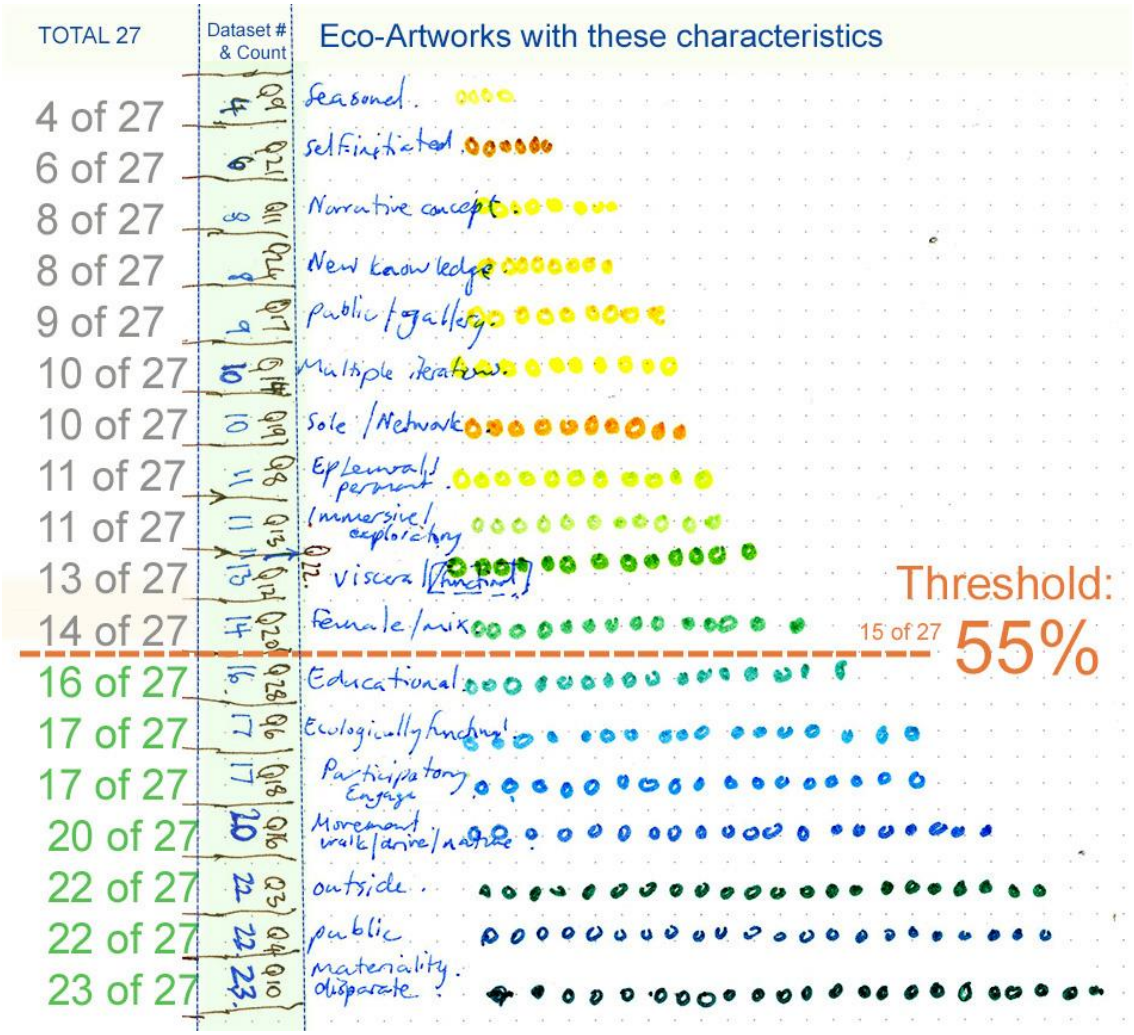

Figure 4.1: Threshold of key characteristics above and below 55%. The threshold is set confidently above the median consciously excluding the gender (Characteristic # 20) because it falls outside the scope of this study (Image by the author – © Hannelie Warrington-Coetzee).

The key artwork characteristics could now be grouped according to frequency above and below 55%. Six of the 28 original characteristics from Dataset A were above the 55% threshold. These highest-ranking characteristics in the final interrogation are described in Table 4.1. These six key characteristics are arranged from the highest to the lowest percentage. For instance, non-traditional arts materials were present in 24 of the final 27 artworks. This means that 88.8% of the selected 27 artworks considered the material used in the work as a key component to make the artwork.

All six key characteristics are present in the hyperlinked eco-art examples in Table 4.1. I selected these examples to show the porousness of the traits and to illustrate what eco-art with intention to reach new or wider audiences may look like. The characteristics will be elaborated in the discussion in Chapter 5. Although each characteristic has one artwork that related to its best, all traits were present in all these interventions.

Table 4.1: The six highest-ranking traits with examples of artworks from Dataset A

Final Interrogation Questions

Traits less frequently used in my praxis	Traits I privilege in my praxis with hyperlinked eco-art examples with all **six key characteristics** present.
	88.8% Ranked 1st x24 of 27 artworks had this characteristic
Traditional arts material	Non-traditional arts material/materiality
Are the materials used in the artwork traditional arts material such as paint, sculpture, photography etc.	Or is the environmental message also present in the materials selection (Hehe's Nuage Vert laser work at a powerplant reduced consumption)
	84.2% Ranked 2nd x23 of 27 artworks had this characteristic
Still	Movement
Is the artwork standing still, or the viewer standing still viewing the work, moved in the Earth only	Does the artwork or the participant move, like the wind, walking, driving, performance (Monge's Plant Movil walks with plants)
	77.7% Ranked 3rd x21 of 27 artworks had this characteristic
Indoors/private	Outdoors public
Is it inside, like a gallery or museum	Is it outside, like a public space (Peterson's Future Library growing for a 100 years)
	70% Ranked 4th x19 of 27 artworks had this characteristic
Aesthetic work only	Ecologically functional/regenerative
Does the viewer only view the work	Does the artwork grow, physically, is it alive like nature is (Laurence, Novartis grew a medicinal garden, The Harrisons seminal Lagoon Cycle)
	70% Ranked 4th x19 of 27 artworks had this characteristic
Prescriptive	Immersive or exploratory/participatory/relational
Could the viewer only view it and be moved by it intrinsically, such as conceptually prescriptive work	Could the viewer immerse themselves physically through participation, other than just viewing it, like touched or smelled or got nurtured (Sunde's 36.5) participants could join the changing tide)
	55.5% Ranked 5th x15 of 27 artworks had this characteristic
Non-educational	Educational/pedagogy
Was the artwork exhibited only, with no additional educational materials linked to it?	Is there an added outreach type educational component to educate the audience to combat the climate cause it is addressing (Eve Mosher's High Waterline had a whole action guide) (Watts, 2014)

Thresholds in terms of the earth system are 'independent of human actions or desires' (Steffen, 2011, p. 860). The six key characteristics, which visual artists prioritised were found in this rigorous study. These highest-ranking characteristics in eco-art are something transformation intervention designers, I strongly suggest, can consider in their work. Having identified the top six key characteristics in eco-art, the follow-up research question: ***What form does the transformative opportunity in such interventions manifest as?*** can now be addressed. This allows me to revisit the reason why I thought the 27 artworks had intent to build more deliberate artworks.

4.3 Research question 2

What form does the transformative opportunity in such interventions manifest as?

Public participation and other educational components create opportunity for transformative experiences if these dimensions are built into immersive public arts interventions. I know this from my own praxis, but learning about such active experimentation in this study (Section 2.6) allowed me to further identify and describe such radical transformations embedded in eco-art.

Isolating the 27 artworks with intent (Phase 2, Chapter 3), the artworks that create opportunity for humanity to change by participating in the artwork led to further interrogation in Phase 4. The second research question hinged on the intention of the artist, and what these opportunities for participation to address the climate cause looked like. I revisited my reasons why I thought these artists had intentions to create such moments for transformation to emerge. In what form does such new potentiality take in transdisciplinary praxis (Rosenfield, 1992) that draw on so much knowledge into one artwork? Or more specifically, as the second research questions states: What form does the transformative opportunity in such interventions manifest as?

Intention has many layers, and the characteristics complement each other. Next, in each case, I marked which of the six key characteristics was the main characteristic holding the artist's outreach intentions; each of the 27 artworks had a deliberate component to transform the audience in different ways (see last column of Dataset B (Appendix A)). I plotted which artworks held which key characteristics in a Radar Chart to show which of the key characteristics held intentionality (Figure 4.2).

Participation, regeneration, and education were more often key characteristics in the 27 artworks with intent. The top 27 artworks in this study all had more than half of these characteristics and so the intent was not purely from one characteristic. It could be a combination of traits that create the intention for artists to have a broader reach than the existing arts industry.

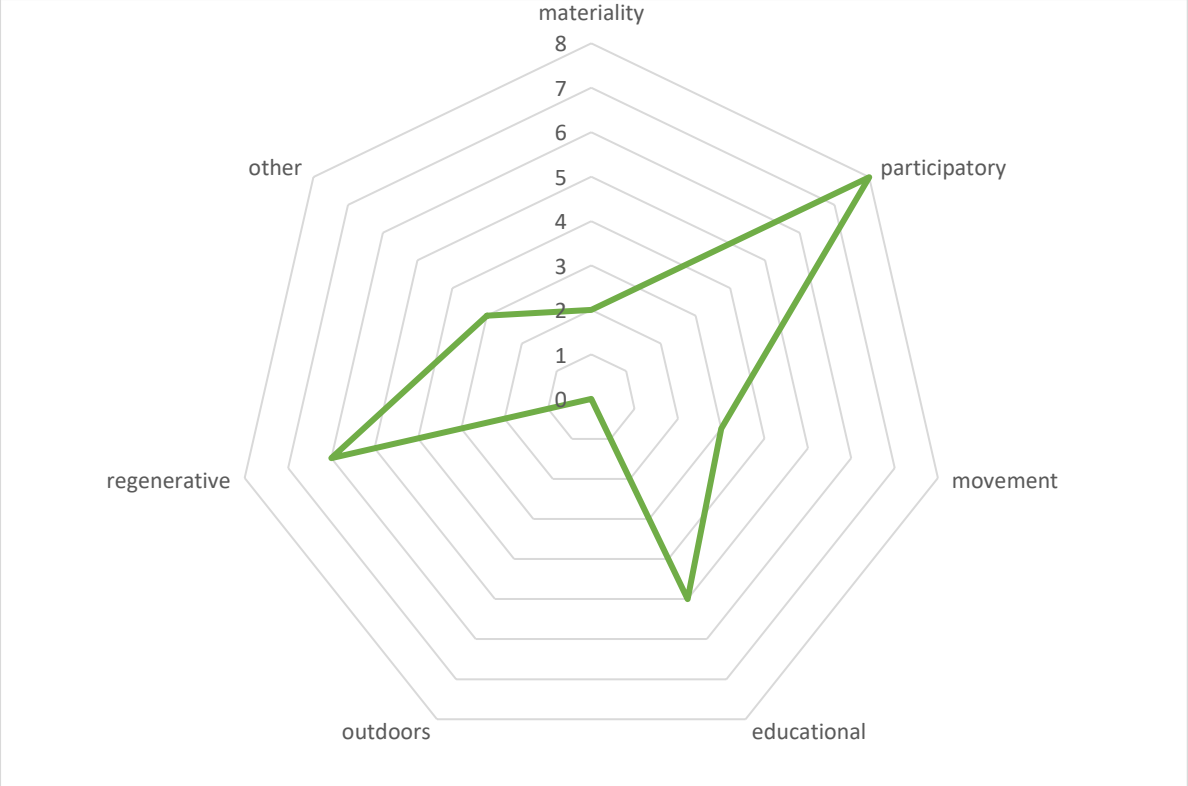

Figure 4.2: Eco-art characteristics deliberately creating opportunity for transformation, which holds more intention are embedded in transdisciplinarity. The participatory opportunity artists create, as well as in the regenerative qualities of the eco-artwork, plus educational components extend the reach of eco-artworks building context specific understanding and awareness (Image by the author – © Hannelie Warrington-Coetzee).

4.4 Key results

The 27 eco-artworks with outreach orientated intentions in the final interrogation (Phase 3) had the following six key characteristics (Figure 4.2):

- The **material** used to make the artwork was not traditional arts material, e.g., Hehe's Nuage Vert.
- The artists included a type of **movement** in the artwork or the audience, e.g., Monge's Plant Movil.
- The work was anchored in **public** space, usually outdoors, enabling free public access, e.g. Peterson's Future Library growing for a 100 years.
- The work had **regenerative** or ecologically functional qualities, e.g., Laurence, Novartis.
- The work included **participatory** opportunities for both intended and incidental audiences, e.g., Sunde's 36.5.
- An **educational** component complemented the reach and awareness of the artwork, e.g., Eve Mosher's High Waterline.

These key characteristics were further interrogated to check which artworks had all six key traits (Phase 4 in Chapter 3) and in which of these traits' intention was considered most present. The results indicate the characteristics of opportunity for transformation in transdisciplinary praxis.

From the above list, participation, regeneration, and educational components were the main areas where the artists built in most intention to reach wider audiences (Figure 4.2) into their eco-artworks. According to the eco-art interrogated, these three traits in deliberate climate change adaptation design created opportunities for audiences to transgress into more sustainable habits. These processes will be discussed in Chapter 5.

Reflecting on this chapter, the key characteristics eco-artists use in arts interventions that intend to build relationships with new audiences and the natural world were identified. Considering the **material** used as part of the conceptual development of the artwork draws unsuspecting audiences in **public** spaces. **Movement** of the artwork such as moving in the wind or tidal movement of the ocean or people walking through the artwork creates site-specific contexts along with materiality and public traits to create place-based interventions, which makes sense at a grassroots level. These three traits create contexts for artists to draw the public to eco-artworks. The results from the deeper research question that followed were present in participatory opportunity for audiences, regenerative qualities of the artworks and educational components added to the artworks. These key characteristics will be discussed in Chapter 5 with examples to describe the form such artworks take.

CHAPTER 5: Transformative intention in eco-art – how, where, and why?

Artists' attention to intention (O'Brien, 2020), including mine, has ways to create transformative opportunities through transdisciplinary praxis deliberately; they are discussed in this chapter. As described in Chapter 3, a phased approach identified the key characteristics in more deliberate eco-artworks with the intention to contribute to the cause of its subject, which resulted in identifying six key characteristics from Dataset A in eight eco-art works from Dataset B. The following synthesis describes what form the interventions in these eco-artworks with these characteristics may manifest as and what transformative potential they may hold.

5.1 Transdisciplinary Praxis Examples– a deeper dive into science-society interactions.

Synthesising the interrogation method in Chapter 3 and the results in Chapter 4 enables one to surface and reveal the transgressive qualities of thinking in complexity (Bernstein, 2015). Such qualities, when undertaken with deliberate intent as an artist, I suggest and argue here, can create rigorous platforms for radical climate change and systems transformation. The six traits that were arrived at after the various phases of analysis (see Chapter 4) are 1. materiality, 2. movement, 3. public, 4. regenerative, 5. participatory and 6. educational. These results address the first research inquiry to: Identify the key characteristics climate change-focused eco-artists use in their praxis.

Examples of those eco-artworks that revealed an inferred intent to be transformative change for climate change drawn from my Dataset B (Appendix A) are discussed below, with reference also to the literature reviewed. I also elaborate on the intention of the artworks to ensure wider reach.

5.1.1 Materiality or non-traditional arts materials used in artworks
Characteristics # 10 in Table 3.1 is most present at 88.8% (24 of 27 artworks)

Traditional arts material has been used in art making for its archival qualities, which is why it is often costly, and (in theory) lasts forever, hence its value for collectors investing in cultural objects representing the times we live in. When artists consider a meaningful conceptual contribution the material brought into an artwork, I categorised it as non-traditional arts materials, such as when plants, water or discarded objects are used. The artwork is thus more about conveying the idea than about the object's value.

The desire to make experimental and meaningful artwork with limited resources in this cash-strapped environment initially forced me to consider working with waste and obsolete objects. In my practice, such elements are central to my creations. This focused my attention on our unjust relationship with materiality in the world. I keep a tab, for example, on odd and interesting material, industrial waste, and old archives. Working with waste teaches me which materials are desirable for upcycling and which materials change over time as innovation upcycles more materials. In a country with high unemployment

and in a city such as Johannesburg that *literally* sits on an exploited goldmine, many resourceful entrepreneurs are looking for opportunities to make money. The city's waste streams are constantly used, materials gathered and given new purpose, and what is used for what purpose changes all the time (Blaauw et al., 2018; Makhubele et al., 2019).

The discarded waste lying around is often natural materials, such as stone and wood. Artists have traditionally used wood and stone but not from dumpsites. In fact, the earliest carving that shows cognitive ability (intent) was carved in stone in the Blombos cave in South Africa 77 000 years ago, which gives insight into when the potentiality of human creativity and transformative capability began (Henshilwood et al., 2002). Working with found objects, the material already carries a "memory" of its previous purpose; the artwork "holds" this history in the material. Such objects have an existing meaning and connect people to these objects even if they do not know anything about art. The repurposed material can attract unlikely audiences. This is a powerful way of generating information about transformation to live in a warming world.

Waste materials that do not have a recycling value or are too heavy to move or are only burnt as fuel or used for cooking or heating in winter are also less prone to be vandalised in public spaces. The top-ranking characteristic of materials used by artists in eco-art is materials that convey critical thought. Using found and discarded materials in public artworks has an inherent familiarity of the everyday, attracting new audiences to consider the original and upcycled use of found objects. *When we plant new plants in dumpsite areas on the corner near my studio, the dumpsite moved. People seem not to dump waste on top of freshly planted guerrilla gardens.*[24]

For example, transformative industry climate change adaptation opportunities were created by the art collective Hehe (# 10 in Appendix A) for a whole city (Helsinki) to adapt to using less electricity, using illumination as artistic material. Their first of multiple interventions was a project called *Nuage Vert* (2008, "Green Clouds"), which illuminated air pollution with a green laser light.

Hehe's first *NuageVert* projection in 2008 was the Salmisaari coal-burning power plant. The laser drew an outline of the moving cloud onto the cloud itself, colouring it green, turning it into a city-scale neon sign, which varied in size as residents began to take control and consume less electricity (Figure 5.1). The artists collective worked for years to prepare for this intervention to show the public that they can directly influence fuel consumption and reduce pollution. Together with a critical mass of partners, including environmental activists and a governmental think tank, they alerted the public, generated awareness, generated discussion, and persuaded people to change their patterns of consumption.

[24] Gardening in public space without permission is described as guerrilla gardening - an illicit act of a positive community building exercise, to contribute to greening the greater good such as these bloggers: http://www.guerrillagardening.org/.

They persuaded the energy company that it had become politically favourable for them to embrace the project.[25]

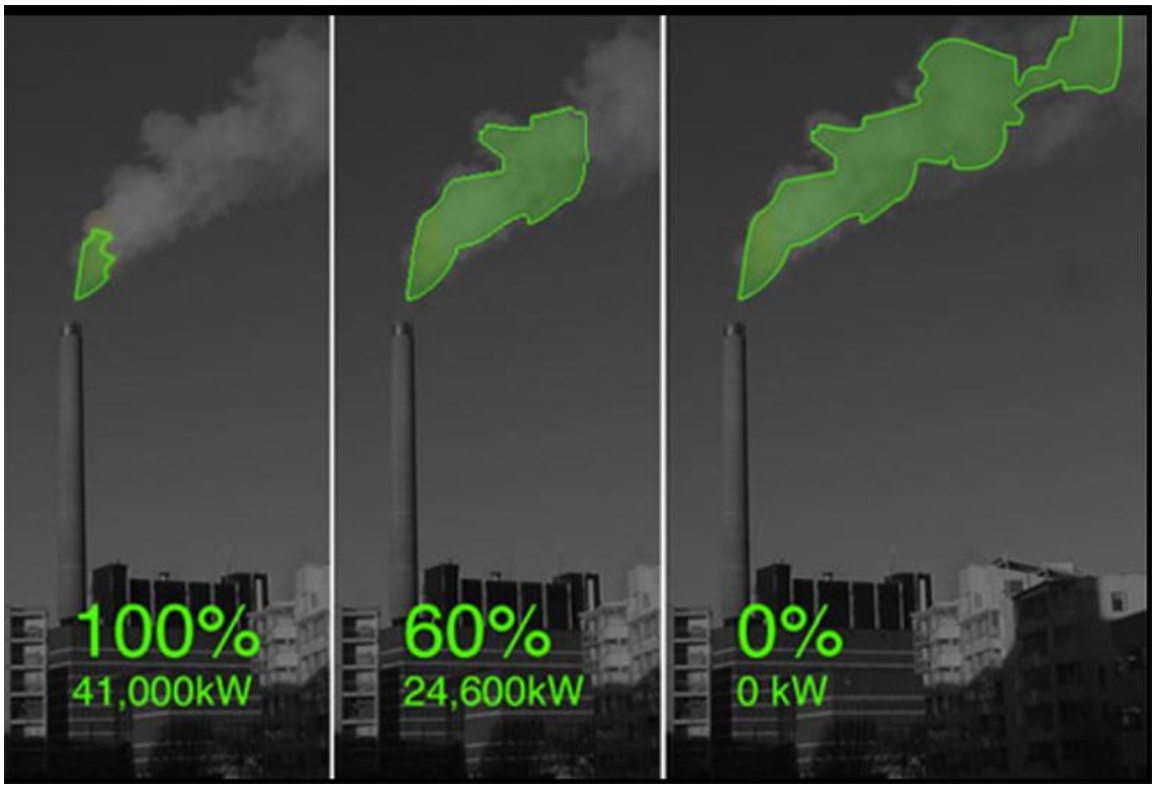

Figure 5.1: Nuage Vert (Green Cloud) Helsinki, Hehe, 2009

When the opportunity to work with industry and the private sector arises, I also focus the conversation with partners in preparation for new work on transformation challenges. For instance, in a room full of water experts, I asked why we do not open and examine sewage systems in our city. I thus bring nature-based solutions into the conversation as early as possible. With a recent commission for a mining company, Cabinet of curious creatures[26] (2021). I made the heads of the creatures out of the mine's obsolete archival objects. I visited the mining scrap yards to source the bodies of the creatures and found the discarded hangers used in the mining process (Figure 5.2). I thereby added this meaningful layer of materiality, bringing eco-art into the metal with the mining process remnants attached to it. *When audiences view this work in the company's new foyer of their corporate building, they respond well to the very contemporary creatures because of the familiarity of the materials; even if they do not care for art*, they can personally identify with the transformed objects they see. Seeing this helps lead people to reflect on issues of recycling, stimulate ideas about how to change their business design, and

[25] http://www.hehe.org/projets/nuage-ver-no-1-helsinki On Friday 29th February 2008 between 7-8pm, 4,000 local residents reduced their energy consumption by 800 kVA. http://www.nuagevert.org/

[26] Cabinet of curious creatures, 2021 https://www.hanneliecoetzee.com/portfolios/2021-cabinet-of-curious-creatures/

consider other transformations as can be seen in Figure 5.3, which also depicts the movement, or the illusion of movement as discussed in the next section.

Figure 5.2: Cabinet of curious creatures (detail) 2021, the hangers from the platinum extraction process were used for the creatures' bodies, obsolete objects from the mines archive are used for the creatures' heads and old mining ledger books from the archive were used to complete the installation on the bottom shelf. (Artworks and image by the author – © Hannelie Warrington-Coetzee)

5.1.2 Movement present in the interventions
Characteristics # 16 in Table 3.1 is most present at 85.1 % (23 of 27 artworks)

When I interrogated movement in eco-art in Dataset B, I looked for active interventions that were not stationary in a gallery; they involved audiences walking or driving, or nature growing or blowing in the wind. Contemporary public eco-art draws on and presents concepts that connect audiences (Doria et al., 2009; Brown et al., 2017; Westley and Folke, 2018). Eco-art's attributes, such as interconnectedness, navigate in a similar way to ecology as set out in Chapter 2 (Nicolescu, 2013). When I make work in nature or about nature, I take interested parties on walks to see particular features central to the work. I work as an artist affiliated with galleries from time to time. This means that my audience is not arranged for me, they are new assembled audiences (Born and Barry, 2010) who can walk and hike with me (Lauwrens, 2019). A wealth of transdisciplinary work has been undertaken by

various artists and institutions to place climate change research into social, creative and community contexts on shared platforms. *Watershed*[27], a generative "art-science programme" curated and directed by Lenore Manderson in 2018, was one such platform. I walked the intercontinental watershed, which runs through Johannesburg with audiences as my participation in *Watershed* with my hyena sculptures. In a subsequent publication, I reflected on the iterative process showing participants which way water flows into both the Indian and the Atlantic oceans. Such activations often take years to settle into something tangible, connecting the 'thriving informal sector and formal systems, impoverished and wealthy publics' in urban contexts (Warrington-Coetzee, 2021, p. 560).

Eco-art as a technology of connection brings us closer to nature, which can make us more human. 'We are not fighting for nature. We are nature defending itself' (O'Brien, 2020, p. 27). Lucia Monge, a US-based Peruvian artist who began her ongoing work *Plantón Móvil* in 2010, creates an added dimension of nature-society interactions by lending our mobility to plants so that they are exposed to the speed and scale of human movement.

In *Plantón Móvil,* people march in various cities carrying plants through the street, and by doing so they draw attention to the plants' immobility. The plants are planted or donated after the walk to add nature to urban areas, which creates a deliberate contribution from the participants to transform their cities. In an energetic multidisciplinary magazine Elephant.art (Elephant,2016) Monge states: 'In return, we may momentarily borrow some of their slowness'. She does not see *Plantón Móvil* as a group of people carrying plants: at least for that period of time, the people *are* the forest, an urban forest that then grows locally. Monge's aim is to encourage a connection through movement with people and plants, in a way that does not feel abstract or foreign, as contemporary art often does.

Monge's first walk with plants in her hometown in Lima, 2010 (Figure 5.3) was self-initiated (characteristic #21 in Table 3.1) after she started putting herself into the city's plant life's shoes. She started thinking about the abuse the trees took being urinated on and taking strain from absorbing the city's smog. Participation went from 60 in 2010 to 200 in 2011 to 400 in 2012 after which she started getting invitations to perform the work in diverse places around the world. NGOs, private companies, and galleries have invited her to perform the work 'moving-with as a form of solidarity' Monge likes to think that participants in this work would run into the plants they walked with and say hi or share the experience empathically to perpetuate connection with individual plants as 'a means of cultivating a broader ecological consciousness' (Elephant, 2016, para 9; para15).

[27] The aim of the Watershed Programme at the University of the Witwatersrand was to facilitate conversations and build collaborations across creative arts practice and theory, the humanities, and the social, natural, and physical sciences. The teaching programs prepare future leaders to envision and build a just and sustainable world. The Hyena Sculptures were acquired by the Wits Origins Centre Museum on permanent display in their Spirit Room. https://www.wits.ac.za/watershed/

Figure 5.3: Lucia Monge's Plantón Móvil, 2011

The walkabouts that I have conducted for the past decade have less emphasis on altering people's behaviour immediately, instead they create conditions for participation in eco-social consciousness and futures consciousness (O'Brien, 2018). Herewith *I bring ideas about ecology to the public and have created opportunity for participation in transformation with found or waste materials, walking towards healthier futures.* Movement in artworks selected for Dataset B (Appendix A) were not only walking with participants, but also driving through artworks, or water or wind moving in an artwork or around participants. The movement immerses the public in the ideas.[28]

5.1.3 Public eco-artworks
Characteristics # 4 in Table 3.1 is most present at 77.7 % (21 of 27 artworks)

In a country like South Africa, despite its vibrant art communities, contemporary art is mostly not woven into the everyday; only a few schools teach art and museums are not as busy as they could be. Contemporary art is mainly shown in and confined to upmarket galleries and art fairs with very few institutional public art initiatives that artists can participate in available locally. Art in public spaces democratises such luxuries and grants access to the critical thinking it offers; contemporary eco-arts create memorable moments for more sustainable futures that environmental science is ill-equipped to address (Saltelli and Funtowicz, 2017). Socially and environmentally engaged public art reaches unintended passers-by and artists' initiatives sprout up in Johannesburg from time to time.

[28] Joyce Pomeroy Schwartz, a public art consultant who worked for Pace Gallery in the 1970s describes this kind of public art well as people who wanted to bring *ideas* into public, rather than steel and stone sculptors. Interview link here - https://theshed.org/program/6-agnes-denes-absolutes-and-intermediates?feed_item=185

When I drew up the list of characteristics (Table 3.1) for Dataset B (Appendix A), I separated Public/Private (# 4) and Outside/Inside (# 3). I soon realised that these two traits respond very similarly to the interrogation from my global southern perspective, and thus I grouped these together to optimise the study. This distinction of the two binaries might be different in countries with very active museum outreach programmes, and/or greater privatisation of outdoor spaces, in which context the distinct attributes of the two might be studied.

Working outside is also intentional for me because curious passers-by are attracted by the interventions and have free will to participate (O'Brien, 2020). An oppressive childhood has nurtured a fractious streak in me, drawing me to value and seek free will. I would imagine that collectively, our history of oppression in South Africa and elsewhere would lead people to value choice, and so to choose which causes to support and in what ways. I have always felt very uncomfortable and self-conscious when I am expected to participate in a performance. Hence even though some of my works have performative aspects, the performance is done by people who usually do that work on a daily basis, such as the firefighters doing a controlled burn into the savanna during *Locust and Grasshopper*, 2017 (Figure 6.1), elaborated below.

Hover (2012) was an early artwork I made in the city of Johannesburg. I engraved a figure into a burnt wall near my Maboneng art studio, in a largely derelict but rapidly "hip and happening" precinct. The wall was burnt because recyclers had burnt the plastic off electric wire to recycle the copper wire inside its encasing and this process had left the wall charred. The place reeked of urine, because neither the apartheid nor the post-apartheid regime provided enough public ablution facilities. I engraved a self-portrait hovering above the stench. The work was scratched into the city's surface: I was an urban archaeologist of sorts. I engraved the figure, which looked like it was urinating, with an embroidery pattern. I needed to return to the studio, and when I returned, my pattern had been taken, recycled. I left the figure hovering, incomplete, suspended. Just being out on the street taught me a lot more about my city than making this kind of work indoors.

When I ramped my bakkie (pick-up truck) up the curb with a generator on the back to power my grinder to do the gravure, I did so without permission. When I make these engravings in walls, I wallpaper an embroidery pattern to the wall and grind through the paper into the plaster or stone to leave a mark on the wall, which makes the artwork[29]. A week earlier my laptop had been stolen from my studio by two con artists who pretended to buy art from me. The police came to take a statement and were deeply moved by the arts precinct's energy. So, when I was midway through illegally gravuring in the middle of the day, the police drove by and waved to me to wish me well. I learnt that day that transparency can be unifying with the right intent, even making artworks without permission. *Hover* was soon tagged in the middle of the night by a graffiti artist who told me he was as high as a kite, when I confronted him about tagging my work, and so the city consumed the work again. I make work to figure things out; this artwork was a product of a learning process. Learning in public keeps me on my toes and encourages

[29] The engraving process is explained elaboratively another work, *Oupa Florie* 2012.

transparency. Transdisciplinarity, transgressions, transcendence, transience, transformative, 'trans'- in the middle of it all.

Public artwork, therefore, as seen in my praxis case above, takes many forms, and only 15 of the 50 artworks in the original Dataset B (Appendix A) were indoor installations. One artwork, which is both indoors and outdoors and blurs all the lines of my study, is a work by Scottish artist Katie Paterson *Future Library* (2014) (# 14 in Appendix A). The work manifests a fascination for growth. Every year from 2014 until (it is projected) 2114, an established writer (Margaret Atwood was the first) is commissioned to write an unread and unpublished text while a small forest of 1000 newly planted trees grow. An anthology is printed annually on paper made from the trees, which one can visit outside Oslo. The work transgresses the life span of the individual visitors (Myrvold and Wergeland, 2018). It connects affect to fact when one imagines what the authors may write about in 100 years' time. Who will make the paper in 100 years' time? How will their stories age and compare? How will it reflect what we are thinking now regarding sustainability? Tsitsi Dangarembga, a Zimbabwean writer is the next Future Library author, and her headspace is completely aligned with this study. She stated that she yearns 'for a human culture that centres the Earth's sustainability' in an interview in The Guardian. Her novel, *Nervous Condition* (1988) helped shape the world, according to Future Library artist, Katie Paterson, communicating vital truths as a voice of hope[30].

Being out in public making work to make sense transparently, transgressively, has connected me to my loaded history and to my city and all its insanity.

5.1.4 Regenerative artworks with ecologically functional components
Characteristics # 6 in Table 3.1 is most present at 70% (19 of 27 artworks)

As the study progressed, I learnt how other artists describe their work. Patricia Johansen is a "remediationist" artist, one of several whose practices set out to "heal" the planet through projects that remediate polluted areas. Johansen's work is an example of intentional remediation. For example, *Fair Park Lagoon* (1981-1986), in Dallas, Texas, illustrates the complexity and casualness of many public art projects.[31] She shares the belief that art is more than an object to look at and think about.

When I built the ten-storey high Nzunza/Ndzundza (2018), located on Jorrisen Street in Braamfontein, with pottery seconds and discarded shards with a team of mainly female mosaic artists (Figure 5.4), I had a deep hankering of working on this scale with media that can grow and cool the city down. Working on such a large scale over the ten weeks it took to produce this work gives one time to think and imagine better living conditions. From my artist's statement online[32]: 'The Ndzundza/Nzunza Ndebele lived in the Highveld from the 1630s until the late 1600s'. Like the spirit of Johannesburg today they embraced a cultural

[30] https://www.theguardian.com/books/2021/aug/25/tsitsi-dangarembgas-next-work-wont-be-read-by-anyone-until-2114-future-library The Guardian Interview with Alison Flood accessed 26 January 2022.
[31] https://patriciajohanson.com/archive/ecovention.html accessed 23 December 2021
[32] https://www.hanneliecoetzee.com/2018-nzunza-ndundza-portrait-braamfontein/

inclusivity which often welcomed other ethnicities, such as Swazi and Zulu (Delius et al., 2016, p. 46). Traces of this inclusive lifestyle were discovered on pottery that dated from the 17th century and through oral history research. That explains the use of crockery as the medium and Braamfontein as the perfect location.

Figure 5.4: The Nzunza/Ndzundza portrait 2018 artwork by the author on corner Melle and Jorrisen streets, Braamfontein, Johannesburg was commissioned by City Property (Artwork and Image by the author – © Hannelie Warrington-Coetzee)

Since my WildWall tile invention in 2016, such a work slowly developed, with the aim to filter air whilst growing rock succulents in small cavities. I made a prototype for the PPC Cement Imaginarium competition and started testing such a micro-ecological system based on harsh African rock ecology. A progressive property developer bought into the idea and commissioned a large-scale regenerative eco-artwork, *Muse II* in 2019 (Figure 5.5). This is one of my artworks that I can add to the list of eco-art

(Table 3.5) with all six key characteristics identified in this study: materiality, movement, public, regenerative, participatory, and I am working on an educational component elaborated below.

Figure 5.5: Muse II, Sandton Gate, Johannesburg 2020, is an image of a person's eyes, made up of rock succulents growing in 6000 of my WildWall Tiles (Artwork by the author – © Hannelie Warrington-Coetzee and image by Thomas Pretorius).

In this eco-artwork, we worked straight through the summer holidays to install 6000 hand-cast pot tiles, pixelating a portrait slowly growing into full form. Shortly after we finished the installation, a full level 5 Covid-19 lockdown hit South Africa, and we could not water the intricate new artwork. Untested on this scale and exposed to the elements after the rainy season, after six weeks of being unable to water the wall, the plants had survived, stressed but not dead like many other vertical garden systems around Johannesburg. The rock succulents' survival strategies had kicked in, and they reproduced in their shade in late Johannesburg summer and autumn. Nature's drought-tolerant strategies were tested during the "pause" the pandemic had caused, while I immersed myself in this study.

The invention has developed interest from a conservation perspective because precious plants can be grown vertically in small spaces. I collaborate and continue to engage with a conservation PhD candidate and sangoma[33] Nolwazi Mbongwa, to co-design interventions to grow medicinal plants in these pots in urban contexts with urban healers. *Many contradictions need to be resolved through dialogue before we can plant these rare plants that have been harvested from the wild*. Using climate change as a unifying adaptation strategy, we are working on an emergent space for healers, traders, growers, NGOs, socio-agriculturalists from government and medicinal healers. During our first

[33] Sangoma is a southern African traditional healer or diviner

workshop, an elder thought this space immensely progressive and invited us to select a suitable wall at the market in the city centre that he is engaged in.[34]

Creating green technologies as public art uses tactile knowledge that corresponds to human and planetary adaptation to a damaged planet, in a visceral sense familiar to the everyday (Pigott, 2020). Once the medicinal plants are growing well, large-scale rock-succulent urban farms could perhaps even grow them as public artwork but also as a supply to meet public demand. The healers were concerned about the theft of these rare plants. I suggested we install the pots just out of reach, which I learnt from making public art. It was during conversations with multiple stakeholders with a shared interest that these interventions were co-designed to build healthier futures.

Regenerative art, which has also been described as remediationist art (Section 3.3) and I called ecologically functional art, has been developing for decades. Two pioneering eco-artists, Helen Mayer Harrison and Newton Harrison, state that artists can withstand a far higher level of risk than scientists conducting typical scientific experiments. They can offer tools of reflection, discussion, awareness, and actions that bring about real change – sometimes deliberately, sometimes unintentionally. This kind of eco-focussed relational artist, who deals with environmental issues, is operating not only at the vanguard of art practice, but also 'at the radical edge of life itself'. Art has discovered a new sense of purpose (Brown, quoting Lucy Lippard, an early theorist of eco-art, 2014: 8).

The Harrisons started building agency (Section 2.5), a crucial component of adaptation to a warmer world, by research *through* art (Schroder, 2020), which contributed to meaningful new processes that could and were be implemented for future cultures. Their artistic research or research creations (Manning, 2016) addressed 'ethical issues of the human relationship with the environment' (Schroder, 2020, p. 73) through their seminal bioregional work in the 1970s: *The Lagoon Cycle* (Figure 5.6). The lagoon, a place of high biodiversity, is used to make artworks in an ecotone zone or more biodiverse zone, which they examined the nexus between watersheds and food production. Their findings, a portable multi-media mural (100 meters long) were mostly exhibited in museums from the online resources I could access, but more importantly, they had a wealth of internationally recognised encounters inside the museum and by the international community of ecologists, biologists and community planners (Schroder, 2020). Through collaboration on a complex problem, they turned their initiatives into independent community projects as guests and co-workers by bridging different kinds of knowledge. Their work centred on both cultures and ecologies, reshaping landscapes with improvisation and solving complex problems as early as 1984. They spoke about the societal necessity to radically adapt to change (Brady, 2016). They harnessed contradiction and inconsistencies as a generative force, symbiotically, that was at the core of their wider argument and at the heart of transformation (Vogel and O'Brien, 2021). These are the emergent spaces, between disciplines, where

[34] Kwa Mai market's first WildWall tile installation planted with medicinal rock succulents in March 2022 can be viewed here.

contradictory problems can be cogitated, experimented with, and ruminated over, as we strive for new equilibriums.

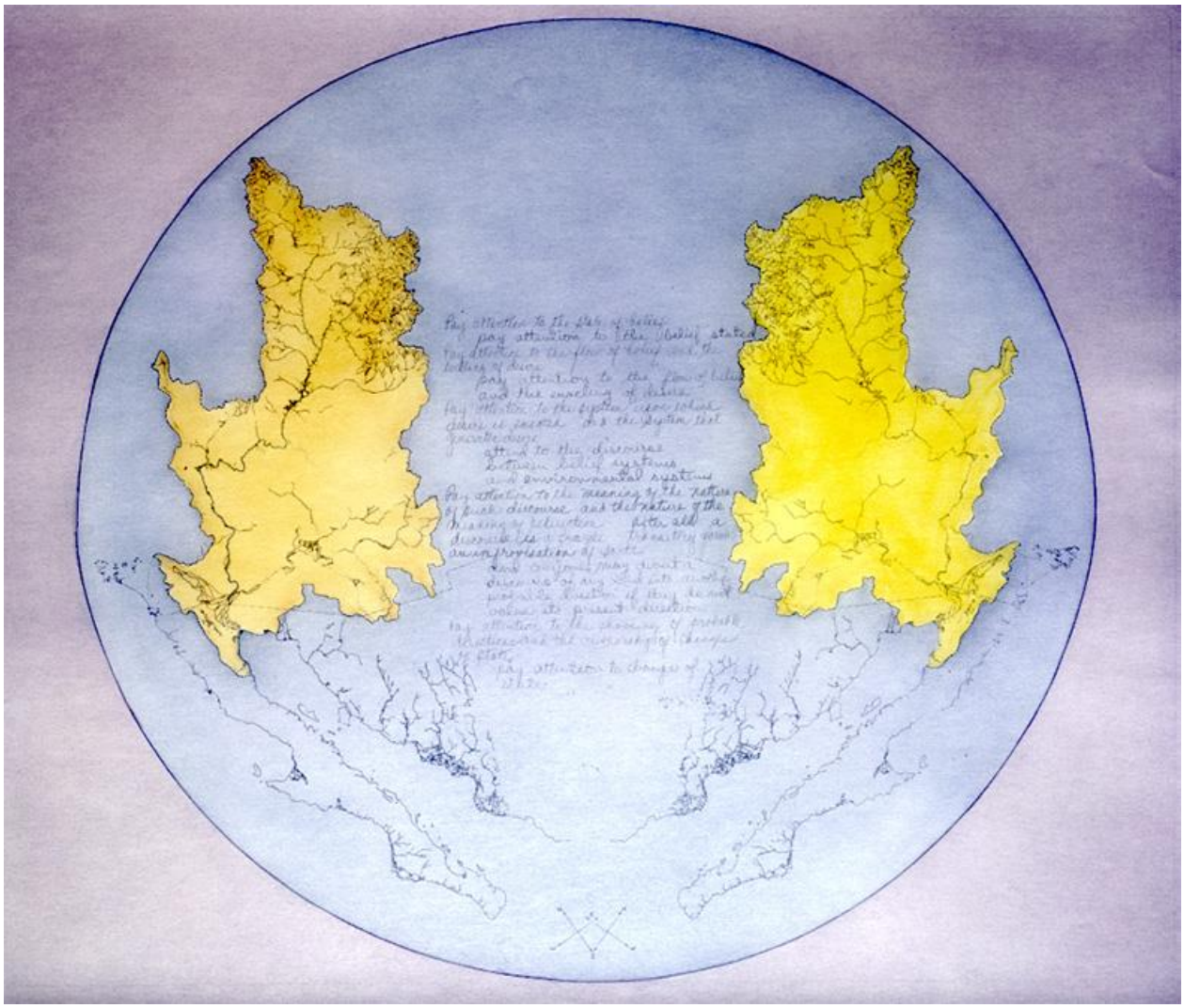

Figure 5.6: The Lagoon Cycle (1974 – 1986), The Sixth Lagoon on Metaphor and Discourse is one of hundreds of maps and texts that form part of a remarkable seven Lagoon Cycle text/image epic by artists Helen Mayer Harrison and Newton Harrison. They form a chronological narrative detailing with the growth of the Harrisons' awareness of crucial environmental issues.

5.1.5 Participatory interventions

Characteristics # 18 in Table 3.1 is most present at 70% (19 of 27 artworks)

In eco-art, which is intended to sway audiences to live more sustainable lives, ideas can be conveyed in original ways so that the work becomes memorable. Adding a participatory opportunity in this moment of memorability further embeds the thought and creates meaning for audiences to become part of the solution. These reflective moments open a window for the contemplation of behavioural change (Lewandowsky and Whitmarsh, 2018).

Sarah Cameron Sunde is a director in performance and an artist who did an impulsive performance after hurricane Sandy in 2013, where she stood in the Maine Harbour for 12 hours for a full tidal cycle 36.5 (Figure 5.7). She has continued these performances, building participatory audiences as she repeats them. The repetition of the performance in vulnerable sea level rise sites brings a gloomy thought of the future. Participants stay as long as they like but are advised to stay at least as long until they feel the water rise or drop over their bodies. Sunde's performance is a radical call for reconsideration of our relation to water. The performance grew into a project with multiple communities around the world. Eco-art thus can be shared with the public as a meaning-making method of making art (Pigott, 2020; O'Brien, and Vogel, 2021) to create opportunity for audiences to understand the purpose behind an artwork (Roosen et al., 2018). Such interventions between humans and non-humans transcend from cognitive meaning to an embodied experience of participation (Pigott, 2020).

Figure 5.7: Sarah Cameron Sunde, "36.5 / North Sea, (Audience Participation)" (2015), Katwijk aan Zee, The Netherlands (photo by Florian Braakman). The public can immerse themselves in the actual artwork by standing in the water with the artist, feeling the tide come in or go out over their bodies and can attend various community workshops to contextualise the oceans levels rise awareness intervention.

I experienced this embodiment in artwork for the first time when I re-stacked my *Family Portrait (2011)* daily for a week in the high tide line during the first South African Site_Specififc Landart Biennale (mentioned in Phase 1 of my methodology (Figure 3.3)). *Every time the high tide came in the stone stacks would succumb to the ocean's ebb and flow, metaphorically restacking the frail relations with my*

family over and over again.[35] It would have been a perfect opportunity to reach audiences in a more meaningful way if I created a participatory element in this work.

5.1.6 Educational component
Characteristics # 28 in Table 3.1 is most present at 55.5% (14 of 27)

To provoke and support action, climate change needs to be addressed in bite sizes (Vogel,2020, personal communication). Other types of knowledge production, such as eco-artworks and interventions can be used to create these bite sizes: knowledge has to be made, not just through the work of researchers, but through other institutions and professionals, citizens and publics (Born and Barry, 2010). Such diverse types of knowledge or indigenous knowledge on the ground are culturally embedded and can be unlearnt (Temper et al., 2019) if it's not a sustainable practice.

When artist Eve Mosher set out to walk 70 miles on the New York High Waterline in 2007, marking a chalk line ten feet above sea level to indicate possible future flooding, she created such an accessible intervention by distilling the big issue down (Watts, 2014). She provided tools that people can utilise themselves, to 'create the change themselves' (Brown, 2014, p. 225). She did not scare incidental participants but informed them as she walked to lay the chalk line down. A step-by-step action resource was developed as a self-help workshop for school groups, NGOs and all other participants (Watts, 2014). Climate change communication and the public engagement of it hinge on complex social and psychological mechanisms (Galafassi et al., 2018b). Inclusive processes and methods need to go beyond conventional science communication and fear-inducing representations (O'Neill and Nicholson-Cole, 2009) to make climate change adaptation meaningful for large numbers of people in the shared quest for transformation (Galafassi et al., 2018a).

The first time I experienced the difference an educational component can make in building audience agency and reach was when I built *The old sow between the trees* (2015). The landowners have practised sustainable forestry since 1850, which meant I was honoured to build a sculpture in a crown forest that has never been cut down. The Wånas Sculpture park curators and educational staff started discussions with me about the pedagogical component they add to their annual programs in 2014. We had a fascinating three-day meeting where I learnt so much about how supported European artists are in this idyllic park. Here in South Africa, I had to initiate everything myself. The Wånas workshops took wooden disks from trees, similar to the ones I used in my sculpture and designed a participatory workshop where 5000+ children from the surrounding Skåne province could learn about my work and the wider context of the exhibition. The exhibition title in 2015 was *Barriers*, themed around borders' ebb and flow opening and closing and the educational workshop was also designed around these ideas. *What stood out for me was the refugee children (up to 10% at the time) who took part in the workshops*

[35] https://www.hanneliecoetzee.com/wp-content/uploads/2012/09/WorksINstone_all.pdf page 2 -5

who had a platform in this programme to voice how scared they are of the woods, because of where they come from, which the Swedish children have never experienced.

Wånas has invited me to work on more workshops, which now, in post-pandemic times, are semi-online, and can be repeated in a recorded format. New workshops are made available thematically to teachers in the province. I am working on a portraiture workshop this year, drawing on my experience as a photographer, on how children present themselves to the world. We unpack selfies and more abstract ways to frame portraiture in these workshops. The workshop has a participatory element where children can either stencil or ink up their own portraits on wooden blocks, reminiscent of prints I have pulled from old scaffold planks such as *Vreemdeling* (Stranger) 2011.

5.2 Intention

Artists' work that has deliberate intention to contribute to the climate change cause is described in this section. Writing about artists' intentions, however, is subjective. I can count the key characteristics I identified in this study and have a good sense that the artists had intention to reach new audiences, by creating participatory opportunities with immersive components for memorability, and/or have educational components and/or regenerative qualities (Figure 4.2). In these characteristics, I discussed what transformational opportunity can look like in eco-art.

I have discussed many examples in the previous sections that have the key characteristics of transformative interventions I have identified in Chapter 4. I will unpack the opportunity these interventions create in more detail below because that is where I think the "heart" of eco-cultural transformation resides. The theories I describe in Chapter 2 have a fecund middle ground, which I also found in my interventions such as *Eland and Benko* (2015) in NIROX Sculpture Park near Johannesburg. In doing this research I can now describe my praxis more articulately and plan future interventions more deliberately. I will elaborate upon my intentions in praxis to try and answer the second research question: Question 2: ***What form does the transformative opportunity in such interventions manifest as?***

My art-making process while working on intricate large-scale interventions often happens multiple times, also with various outputs like The Harrison's multimedia artworks mentioned above. The output becomes remnants of the thinking process, while momentum builds, and deeper understanding develops. *Eland and Benko* were the first large-scale control burn work I made with many partners such as the University of the Witwatersrand savanna ecologists, food and safety partners, Working on Fire firefighters and surveyors, to name a few. I had many conversations with these partners and because we were working on the savanna, grass studies were constantly discussed. I drew parallels between the grasses' survival traits and my career growth strategies. One of the grasses I embossed was one of the scientist's favourite grasses because it had such an optimal rhizomatic growth strategy. I embossed *Cynodon dactylon* in 2015 (Figure 5.8), which also inspired the topological representation of

my network (Figure 2.2) because the drawing shows how my network connect and interacted over the past decade. When I started this study, my intention was to find parallels in praxis and while learning about Rhizome Theory I developed ways to describe these intentions.

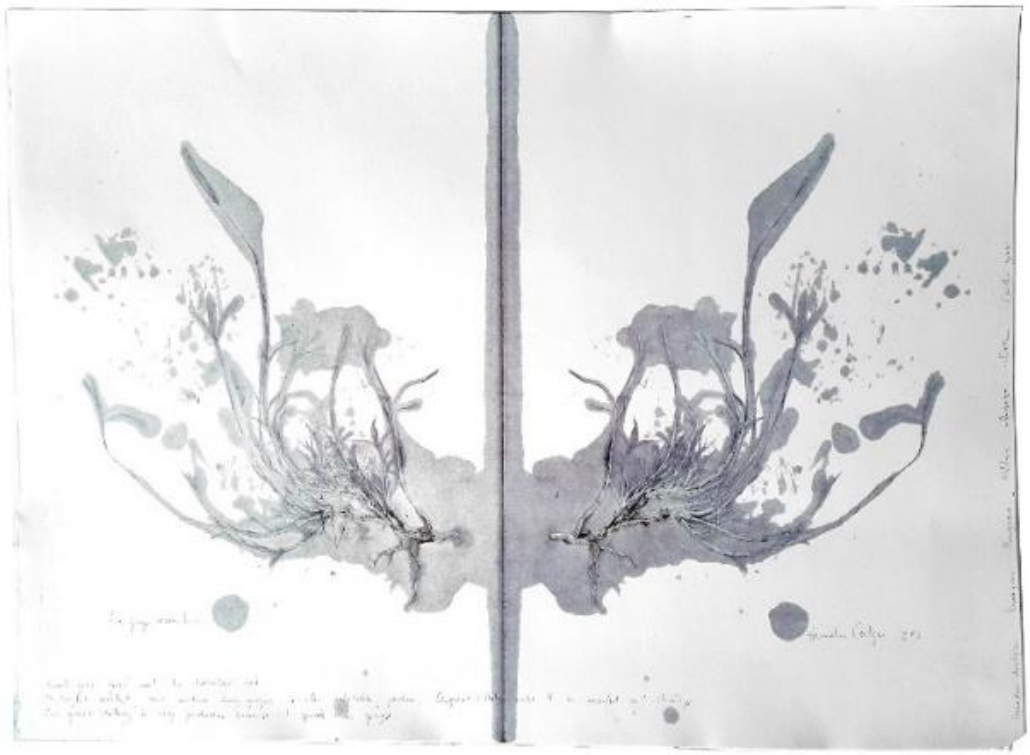

Figure 5.8: Cynodon dactylon 2 (Kweekgras) 2015, Watercolour and embossed grass on paper. This grass has a rhizomatic root system that prevents erosion in the African landscape (Artwork and image by the author – © Hannelie Warrington-Coetzee)

Eland and Benko were made in 2015, and then in 2017 I reburnt the same patch of land on top of the latent image with *Locust and Grasshopper* (Figure 5.9). Consulting with the scientists who study the post-burn site on both occasions, the 2017 artwork had to be carefully superimposed and surveyed on top of the 2015 artwork to make sure the exclosures (fenced areas to exclude animals grazing) from the transect in 2015 overlapped. This was to make sure that the exclosures could be studied in succession.

By connecting science and society immersed in the landscape I took audiences on walkabouts and hikes to the site where these artworks were made (Lauwrens, 2019). Many connections are made on these days and more artworks were germinated in the process. The savanna ecologists I worked with studied the post-burn site, resulting in Felix Skhosana's MSc in 2017[36] on building consensus on appropriate land management. Through the 'fecund' spaces and engagements, moments of

[36] Felix's study was under Prof. Sally Archibald's supervision, a long-term partner in the art/science partnership that have developed at NIROX Sculpture Park. https://www.wits.ac.za/news/sources/alumni-news/2017/the-art-of-grassland-management.html accessed 15 February 2022

togetherness hold the complex questions we have while I walk with curious audiences, creating space for dialogue (Warrington-Coetzee, 2021).

Figure 5.9: Locust and Grasshopper, 2017. (Artwork by the author – © Hannelie Warrington-Coetzee, Photo: Wits University). A five-hectare controlled burn by Working on Fire, at the NIROX Sculpture Park, Gauteng South Africa.

With full cogitation on how rhizomatic roots prevent erosion, I was invited to take part in an Anthropocene Visioning Workshop in 2016 (CST-GRAID, 2017), imagining positive sustainable and equitable futures (Hamann et al., 2020) at the time of pressing the rhizome grasses and the savanna artworks. Our group's scenario, at the multi-day workshop, was called "Rhiz(h)ome" engaging in the world's "wicked" problems (Fazey et al., 2018). Our Rhiz(h)ome scenario had 'decentralised interconnected green cities across southern Africa with empowered technocratic earth stewards with localised efficiency' (Hamann et al., 2020, p. 5).

The dual experience of thinking and working rhizomatically built agency (as set out in Section 2.5), in my praxis and in my audiences, working with open-ended explorations on climate transformations (Galafassi et al., 2018a), which also held space for elements of surprise. Several artworks with these disruptive or transcendental qualities demonstrate this reorientation, finding 'points of inflexion' (Davis et al., 2015, p. 174; O'Brien, 2020) in the midst of interventions such as the one discussed above. The

artworks I excluded in the synthesis in Phase 2 raise awareness only, but artistic interventions with the intention to deliberately participate in the cause it is critiquing, seek to integrate all types of knowledge (Galafassi et al., 2018a) and also create opportunities to take part in addressing the problem. Science in this way becomes a tool for the arts' radical transformation experiments to test such leverage points (Meadows, 1999). Transformative approaches connect the technical-scientific knowledge with the more generative work artists and activists do to nurture adaptive capacity (Vogel and O'Brien, 2021). Using the key characteristics, I identified in Chapters 3 and 4 and described in this chapter with intention to make a difference can create opportunities for radical cultural transformation.

The implications of such interventions are further described and summarised next with conclusions of the study. I also tie the results back to the theory answering the research questions. A few unanswered questions are discussed with final reflections on what I have learnt.

CHAPTER 6: Where to art, science, and society? Conclusions and implications

6.1 Theoretical summary

In this dissertation I interrogated new collaborative transdisciplinary and eco-cultural approaches, which are, some suggest, required for sustainable futures (Vogel and O'Brien, 2021). Climate change is a "wicked" challenge (Section 1.1) that needs radical transformation to address contemporary global challenges and work towards healthier futures. Such complex challenges carry with them a sense of urgency, particularly to move directly into the grassroots implementation space working both *with* and *for* humanity. Eco-cultural interventions (Section 1.2), involving eco-artists producing work with critical thought-provoking characteristics, are well suited to contribute other types of knowledge to reach new audiences. Eco-artists in this context are transformation designers and change agents, well suited to introduce and immerse new audiences in more deliberate adaptation strategies.

Researchers have worked on culturally focused adaptation strategies in parallel with artists' active experimentation, especially over the past decade (Section 1.3). Fazey et al. (2018) synthesised ten essential insights for action orientated transformation research (Section 1.4). Researchers partnering with artists could benefit from the overlap and parallels between the ten essentials and the key characteristics I identified in eco-art praxis to reach new audiences. The overlap between the ten essentials (Figure 1.2) and the six key characteristics I found (Figure 3.6) are:

- Second-order scientists/activists and artists/activists are solutions oriented (No. 2),
- we both have radical approaches including practical knowledge (No. 3),
- we transcend current thinking (no. 6),
- we wear multiple hats and have many collaborators (No. 7), and
- we create reflexive spaces (no.10).

Because of the urgency for climate change adaptation and the need to optimise time, there seems real potential for researchers who want to actively experiment with publics to partner with artists.[37]

Galafassi et al. (2018a) searched for decisive actions in their review of a range of literature and description of artworks, to synthesise the perceived role of arts in climate change transformation. Their dataset (Appendix B) was used to inform and help develop my own approach, as described in Chapter 3. But as I indicated, the study's selection process was not set up to find out *how artists create*

[37] Tips for researchers how to find and work with artists are in Section 6.6 below.

transformative opportunities for audiences. Only one of the artworks in the Galafassi dataset had all six top-ranking characteristics present (# 2 Sunde's work titled *36.5,* Appendix A).

The complexity of climate science and the increasing pace of global warming has tended to create a political and public paralysis (Section 1.5) (Duxbury, 2010; Srnicek and Williams, 2015; Victor, 2015). Rapidly changing weather patterns and environmental tipping points affect our comfort levels, our livelihoods and health, with a particularly harsh impact on the lives of those people who are most vulnerable (Steffen, 2011). While there have been several scientific forays into the global environmental transformative space (Fazey et al., 2018; O'Brien, 2018; Steelman et al., 2018; Hamann et al., 2020) few really dive into the depths of what this may mean, *specifically what it would look like in environmental science studies* and more critically *praxis space* (Moser, 2016).

The deep adaptation agenda, for example, is framed as 'post-sustainability', and focuses on keeping what we want to keep and letting go of what makes matters worse (Bendell citing Benson and Craig, 2018, p.10. Science communication, for example, translates science but does not usually stimulate transdisciplinary inquiry, nor does it create opportunities for people to take part and have agency to transgress and transform the challenges facing us. Climate change is still arguably very distant for the viewer – 2050 and beyond (Lewandowsky and Whitmarsh, 2018). Transparency between global environmental change science, the social sciences, humanities, and other disciplines, however, can create relations between researchers and users of the knowledge in ways that enable us to try and build change using more fluid boundaries (Jasanoff, 2010) between interests. The detachment that characterises much of science today can then hopefully be restored.

6.2 Thoughts to ponder for deliberative eco-art moving forward from the literature

In the literature section of this dissertation (Chapter 2), I reviewed theories that can hold contradiction, such as between GEC sciences and society. In both the Hidden Third Theory (Nicolescu, 2013) and Rhizome Theory (Deleuze and Guattari, 1980), **non-linear connections are made in the middle, a fertile, fecund space and field with new potential** (Section 2.2). Adopting such approaches, I argue, enables artists and scientists and others to reveal the productive nature of such dichotomies, when they are brought together through transdisciplinary problem-solving. These fecund spaces between disciplines have diversity with the potential to build new transdisciplinary solutions, as occurs in biodiverse ecotone zones in nature (Section 2.1). In Rhizome Theory, creativity is stimulated 'between resources and events' (Styhre and Sundgren, 2003, p. 429). Relational artists, working with human-nature relations, are interested in bringing ideas to people. Therefore relational, transdisciplinary eco-art in various public spaces is well suited to help society adapt to climate change.

6.3 Using various approaches collectively – transdisciplinarity and Rhizome Theory

In the focus on transdisciplinarity (Section 2.3), I show how this approach can enable one to view problems from multiple angles; the approach creates a rigorous platform because of its plurality in

inquiry. Using transdisciplinary problem solving, transformation can be deliberately designed and tested to handle the shocks that come with climate change (Pigott, 2020; Vogel and O'Brien, 2021). One radical transformative approach, which I explored in this research and have presented here, is used by, and related to eco-arts specifically – the work and praxis of artists (Duxbury, 2010).

Through a transdisciplinary informed eco-artist approach, collectives, and individuals (informed from networks and rhizomes) could contribute to the change through conscious transformation in participatory projects. This develops agency (Section 2.5) (Vogel and O'Brien, 2021). An emergent space, where science and art intersect, not only contextualises science but also marries radically divergent public experiments (Section 2.6) (Born and Barry, 2010). Climate change and conceptual art can feel abstract to many citizens (Smith-Nonini, 2016), but artists have an advantage in transmitting information about abstract subject matter to new audiences. Such deliberate contemporary interventions create unconventional ways to share and participate in abstract knowledge. Artists are inspired by passion and curiosity. This is the main driver in our work and people's response to it, thereby contextualising the work. We take personal responsibility to bring our ideas into the world.

6.4 Key reflections derived from the eco art methods

In this study, my artistic practise informed the methodology. This was complemented by a theoretical learning journey, which in turn informed my research on the work of other artists. The synthesis of the theories reviewed in Chapter 2 enabled the construction of a probing framework and approach to interrogate traits in my praxis. The two datasets I prepared informed my analysis of various artists' praxis and art. The mixed methodology I developed in Figure 3.1 describes the parallel transdisciplinary development in both theory and praxis. As noted, transdisciplinarity can contribute to complex problem solutions because it can hold contradictions, and this enabled me to view issues from various angles.

The methods used were divided into a number of phases because the **work was emergent and did not follow a predetermined linear approach**. Adopting such a phased and emergent approach is central when undertaking a transdisciplinary, eco-cultural assessment. Phase 1a details the qualitative characteristics I privilege in **my praxis (Dataset A)**. I used these characteristics and their opposites to count how frequently these are present in the eco-art (Dataset B) I prepared from works I found online (Phase 1b).

In Phase 2 of the study, the dataset interrogation was piloted through an interim synthesis. Artworks without intent to contribute to debates or action related to climate change were omitted through a carefully designed screening (Section 3.2). In the final phase, the eco-artworks of other artists were quantitatively categorised, as presented in Dataset B (Phase 3). The findings were synthesised in various ways (Section 3.3), in which course I had to unlearn the artistic approach and learn how to look at the findings more quantitatively.

As I was drawing, cautiously keeping each finding in mind, I also counted the frequency of the findings. I present the results of this, ranked methodically, in Chapter 4. The most frequently found characteristics in the eco-art Dataset B (Appendix A) were isolated, and the less-used characteristics were omitted from further inquiry allowing me to identify the most common characteristics of art as advocacy.

Research Question 1 of the study: **What are the key characteristics climate change-focused eco-artists use in their praxis?** was answered in Phases 1 to 3 of my research. Six characteristics performed higher than the median. These were the key characteristics I had found in eco-artists' work that they used with intent to stimulate engagement and concern about climate change (Figure 4.2).

Using these methods as a transdisciplinary and eco-cultural art approach, I then worked through the artists' works and compared these with my work, to deepen my understanding of the potentiality of deliberate eco-cultural to serve society's climate transformation. In these ways, I circled into and was able to address and answer my main research question in which I identified the key characteristics.

Research Question 2 was more subjective: ***What form does the transformative opportunity in such interventions manifest as?***

The characteristics present were calculated by analysing the artists' intention in Dataset B in Phase 4. Three characteristics were found to hold the greatest intentionality:

- Participation, Regeneration and Education.

These three characteristics were most often present in the 27 artworks that allowed audiences to participate (See Figure 4.2).

In Chapter 5, the more explicit forms in these key characteristics were further enhanced with examples drawn from artworks in Appendix A and my work. Having undertaken this international and personal reflexive research, the following conclusions, implications, and gaps emerge.

6.5 Findings – some principles for Global Environmental Science

Table 4.1 shows what characteristics and potentialities can be found in the **fecund middle ground of eco-cultural artists, scientists, policymakers, and citizens**. By engaging in a transdisciplinary active set of experiments (in this case, with art as a key focus), such actors can begin to ferment and grow the entanglements required to address the transformative challenges of sustainability. In this zone, a sense of the **fertile ground** is given life by deliberately designing active experiments with **participatory, regenerative, and educational components**. In countries like South Africa, preparing interventions that include movement of the audience, such as walking, in public space (free access), and the use of

non-traditional arts materials will hopefully resonate stronger and create memorable immersions for transformative change.

The more important findings emerging from this research, presented here, are how new connections are made by keeping an **eye on praxis, an ear on the ground and an open mind**.

Relational artists working in the global south, or in areas where the conventional studio-based art scene is not thriving, have to find innovative ways to work and make a living. These innovative ways could be opportunities to help build a transformative climate culture. Exchanges of goods or services, negotiation, saving on arts materials, and connecting with audiences, are all ways to keep overheads low. A lean approach leads to creative alternatives and healthy constraints to consider, like in nature.

During lockdown level 5, in response to the Covid-19 pandemic in South Africa, as I was starting this study, I selected my rock-succulents for *Muse II*, 2020 because they are drought resistant. Exposed to the elements at the end of summer, hardly settled in their new pockets and baked dry in the heat, they survived lockdown with no extra water for seven weeks. They have the most creative growth solutions inspiring us to continue surviving in the tough times with multiple challenges and “wicked” problems (Section 2.2).

New transdisciplinary connections are made when one idea is related to another, producing another synthesis (Deleuze and Guattari, 1980). **In a rhizomatic network, all nodes and entities can be connected, interlinked and re-linked**. Creativity is not an extraordinary quality innate to specific individuals or the effect of certain creative environments but is based on the ability to make connections and associations across a great number of entities and events (Deleuze and Guattari, 1980). **Relational eco-artists address humanities’ disconnect between science and society by building collective agency in the process**. The Harrisons (# 29, # 30 and # 31 in Appendix A) took pride in the ‘reproducibility’ of their work (Brady, 2016, p. 172), which became utilitarian solutions that were upscaled to build healthier futures.

Spontaneous active experimentations can become more anticipatory (Lorimer, 2012) if prepared more deliberately (O’Brien, 2012), with the flexibility for transgression with caution (Lotz-Sisitka et al., 2016) to build new climate “creatures” (Figure 6.1). These cases are described in Chapter 5, emphasising their key characteristics. The invisible is made visible (Kruger, 2012). Visual articulation is a type of knowledge that can inspire scientists as another way of seeing the world.

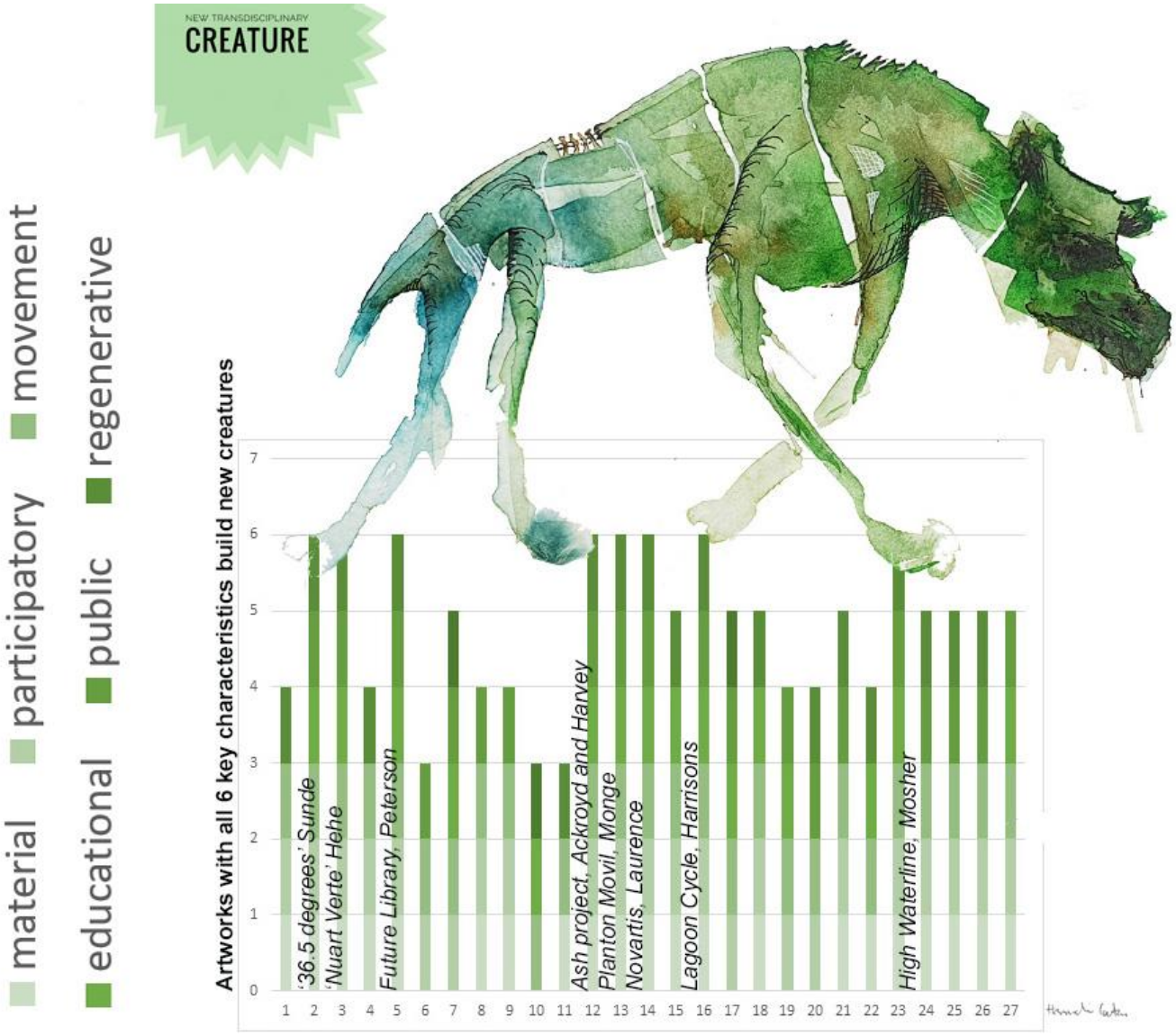

Figure 6.1: Transdisciplinary inquiries build new creatures, new solutions yet to be discovered. Artists with the intention to contribute to possible transformative solutions to climate change were found and described in these eight artworks with all six key characteristics in eco-art in this rigorous study (Image by the author – © Hannelie Warrington-Coetzee).

My reflexive process produced suggestions that other scholars and practitioners could consider reaching wider audiences.

6.6 Tips for transdisciplinary practitioners, relational artists, and transformation designers

I hope these brief reflections can be of use to those wishing to embark on similar journeys:

- The six key characteristics I found are site sensitive.
- Working in the global south might have a very different set of traits than elsewhere in the world.

- Three key characteristics are where intention lies: **participatory, regenerative, and educational** (Figure 6.1). Make sure you partner to add these attributes to your active experiments if you cannot do it yourself.
- The other three key characteristics create the context for intentionality: **in public, with movement and non-traditional arts materials**, which means something relating to the concept of the work.
- How artists present their work online might not show their intentions. If you want to collaborate to make a difference, make it known.

6.7. Tips for scientists to work with artists

- If you want to roll out your research and have no idea where to start, find an artist to work with.
- Use the **top-ranking characteristics** (Figure 6.1) from this transdisciplinary study as a point of departure.
- Be prepared that your research might take a different form in praxis than in your head.
- Arrange funding equal to your salaries to create transdisciplinary residency hubs for artists in your departments. Artists have bills to pay like everyone else. If they have to travel and stay away from home for this opportunity, keep the additional costs in mind.
- Once the transdisciplinary idea takes shape, the artist could and should insist on an artist's fee in addition to a residency fee.
- Send out open calls to relational artists, inviting them to come co-design radical transformative interventions.
- Find arts networks such as The Visual Arts Network of South Africa to send your call out. Be specific with what you expect from the artist.
- Is it just a residency to co-brainstorm ideas; artists will be more incentivised to test plans together and refine them?
- Relational artists are interested in conversation to connect to people as much as in making art.
- Partner with industry, **educational** and communication experts if the artists do not work with all these skills.
- Do not be prescriptive with artists whatsoever; the magic happens when you least expect it.

6.8 Final thoughts: Moving forward – from art to potential action

The critical question I interrogated in this study is how to facilitate the transformative changes we need so urgently in the current world, as reflected by Covid-19, climate change and geopolitical turmoil. Many action-orientated, inclusive, participatory research methods have evolved over the past three decades (Nixon, 2011; Faivre et al., 2017; Bendell, 2018; Fazey et al., 2018; Bradbury et al., 2019; Hamann et al., 2020). Global environmental science has produced volumes of sustainability studies. Likewise in a different form, the arts are filled to bursting with paradigms (Hope, 2016) and with visceral, intuitive approaches to sharing ideas (Weintraub, 2012). When people participate in art, they need to figure out

what it means, especially when art is conceptual or abstract. Relational eco-art as transdisciplinary praxis creates a riddle that stimulates critical thinking and can create participatory opportunity. It is complex but fun to take part in!

The researchers engaged in producing the ten 'mutually reinforcing essentials' argue that such work needs to enable incentives to test transdisciplinary and accelerate learning (Fazey et al., 2018, p.66. The six key characteristics identified in this study have similar enabling qualities that can be considered in more strategic transformation design think tanks. Artists grasp the meaning of their work when they purposively, reflexively, and consciously interrogate the repetition of themes recognised in their work (Brady, 2016).

Unintentional consequences of art interventions are often the **"magic of a moment"** or the ***aha*** moment, which occurs when the participant responds emotionally to artwork; the moment when intellect and affect converge (Brady, 2016; Pröpper, 2017; Vogel and O'Brien, 2021). Therefore, it is critical to partner with artists who create and celebrate these "aha" moments. Sarah Cameron Sunde did the first 36.5 performance intuitively and then built a whole movement reiterating the sense it makes by performing the work (like a global rockstar) again and again in ocean levels rise sites. Artists look out for these unintended moments because they do not expect predictability. Like the weather forecast, eco-artists are skilled in making sense of contradictions and unpredictability in these untamed times.

6.9 Unanswered questions

I am deeply motivated to align this study with the transformative opportunities the current Sixth Assessment Report of the IPCC assessment report describes, to co-design climate cultural interventions (IPCC, 2022a). During my interrogation, I came across many inspirational ideas to use art and art's impact to help this transition. I am interested in co-building new futures so that we do not bounce back to existing systems whose essential function is not ecologically attuned. Our current trajectory has multiple hazards but also opportunities that could interact simultaneously to help us navigate the complex cascading risks of the climate crises we face. Intervening in such complexity needs incremental experimentation but unfortunately, also leaves many unanswered issues and questions:

- "Near term" climate change risks need extrapolation and focus to be addressed urgently.

- What do the artists' networks reveal to create these deliberate interventions together?

- The top eight artworks with the six key traits are female artists or feminine and masculine artists groups. What does this mean for future interrogations of eco-art for climate change?[38]

- Participatory "hooks" could be studied further to understand the opportunities "transformation-for-a-cause" can create.

- I might have found very different results if the study had been done from an institutional museum focus.

- Artists were not forthcoming with how they work with science (Section D in Dataset B), which is a study that needs to be done with a different method. That being said then could also be interpreted that this interrogation could be adapted for any other "wicked" problems as well, not only global environmental sciences.[39]

- Artists as activists, as in Liberate Tate (Chapter 1), worked effectively as an activists' intervention in London because of its very active museum culture. Elsewhere, including in many countries in the global south, this kind of intervention might need to be conducted elsewhere, where people gather, not necessarily in a museum. It might be hiking in a protected area or an intervention on a sports field.[40]

6.10 Conclusion

Throughout the dissertation, the research questions were framed, scoping it with limitations and gaps and contextualised in enabling theories. A frequentist mixed method was designed to answer the first research question, identifying the key characteristics in 50 eco-artworks. The key characteristics provided a method to isolate the eight artworks with the intention to reach climate cultural audiences (Figure 5.5), which led to a follow-up research question: ***What form does the transformative opportunity in such interventions manifest as?*** This question was answered in the discussion by describing the characteristics in which the artist's intention to reach wider audiences lies.

[38] Setting the threshold at 55% excluded characteristics that will be important for more niche studies but were outside the scope of this research. For instance, 14 of the 27 artworks had female artists in the mix (at 51.8% in Figure 4.1). It is a very motivating statistical finding, indicating diversity in transdisciplinary teams. The original Dataset B (Appendix A) was made up of 22 (44%) solo male artists and only 9 (18%) solo female artists. The other 19 (38% of the dataset) were mixed gendered artists collectives. Most revealing is that the only 8 artworks of the original dataset of 50 eco-artworks had all six the top-ranking characteristics (Figure 6.1). All eight interventions were either made by female artists (5 solo) or had mixed sexes (3 artists collectives). An important follow-up question would be: How do feminine/masculine work approaches differ in transformation design, and how does the reach compare?

[39] Art reaches new audiences irrespective of its subject matter. More studies could be done on which characteristics in art would be more effective to help poverty alleviation, improve inequality, improve food insecurity, combat war and genocide (McGregor, 2014; Bernstein, 2015) and so forth.

[40] Such a performance in Johannesburg would have a very different reaction because artists do not have such busy institutions that attract massive audiences currently. It is the only reason why this work did not rank as one of the highest in my study, because interventions must be tailored site-specifically.

Collaborative action in transdisciplinary spaces is not the forte of conventional science. Producing conventional knowledge in the academic sense does not automatically inspire action or change (Bradbury et al., 2019). Creating change from within science could be more meaningful for humanity than the current status quo (Fazey et al., 2018). New interpretive sciences can ask more complex questions at the very outset, perhaps especially if partnered with researchers from markedly different disciplines (Jasanoff, 2020), and navigating in which contexts they may **co-inquire** and need to form useful questions.

The disconnect between science and society also needs to be addressed to engage the public and to reach and influence policy. Creating eco-cultural "creatures" or interventions (Figure 1.1 and Figure 6.1) can help close this gap through transdisciplinary problem-solving approaches. The hidden solutions of transdisciplinary praxis through eco-art provide a latent thread of non-verbal connections. Relational artists, however, working with more nuanced approaches, such as working with materials with meaning, outside, participatory elements, regenerational qualities and educational programmes, can attract new audiences and harmonise diverse opinions. Artists with deliberate global warming awareness strategies can create opportunities for revolutionary changes to happen.

Discoveries are made at intersections that keep evolving with their momentum (Weintraub, 2012). Eco-artists, as shown in this dissertation, setting out to transform the world with their research creations are no longer passive leaving the task to others to act. They have a determined strategy to improve the environment as the very purpose of their art. Like eco-activists operating within an art context and using creative means to achieve their environmental goals, their work goes beyond the aesthetic (Brown, 2014), because they have intention to reach new audiences hopefully igniting eco-citizenship.

Relational eco-artists are so-called because our praxis is based on relationships: of peers, environmental scientists and most importantly our relation to nature. Conversation (including disagreement) is pertinent in transdisciplinary praxis. The ecology of our praxis activates transformation. Art disrupts habitual thought (Kruger, 2021 quoting Suzie Gablik, 2012)

Six key characteristics in eco-art with intention emerged in this research: **1. Materiality, 2. Movement, 3. Public Access, 4. Regenerative, 5. Participatory, and 6. Educational** (Figures 3.6 and 5.5). The **aim** of the study was to find these key characteristics and describe them to show in what form potential transformative opportunities manifest. In summary, my reflections from the previous discussion chapter are:

1. *When audiences view or engage with this work, they respond well to the very contemporary "creatures" or artistic interventions because of the* ***familiarity of the materials,*** *even if they do not care for art. Working with material loaded with an intrinsic history of its focus participant on the de-growth of industrial culture should happen for sustainability to thrive in future.*

2. I bring ideas about ecology to the public and have created opportunities for participation in transformation with found or waste materials, walking with viewers/audiences towards healthier futures. ***Movement*** *of the artwork or audience is a physical motion that loosens dynamic participation in both inner turmoil and exterior worlds. Dynamic movement can hold contradictions and settle disagreements.*

3. *Being out in* ***public*** *and making artwork make sense transparently and transgressively has connected me to my city and all its insanity. Democratic spaces, outside, with incidental audiences, create space for self-reflection and catalyse questioning with free will.*

4. Many contradictions need to be resolved through dialogue before we can plant these "rare plants" and other materials, ***regeneratively,*** *which have been harvested from the wild*. *Artworks that are attuned to their environment need many partners to care for the work and commit to it like a garden. Artists have found new purpose in creating such relational artworks.*

5. *Every time the high tide came in, the stone stacks would succumb to the ocean's ebb and flow, metaphorically restacking the frail relations with my family over and over again. This taught me how* ***participation*** *could build agency with new audiences, mobilising systemic change.*

6. Art can create equitable and shared spaces for engagement. What stood out for me, for example, with Wånas ***educational*** *programmes was the refugee children (up to 10% at the time) had a platform to voice how scared they were of the woods, which bridged invisible barriers.*

Finally, the key characteristics found in this study require partnerships, because the complexity of the problem cannot be addressed by one artist alone. Transdisciplinary praxis needs networks, which means partners must participate in dialogue with each other, including other types of knowledge holders. Educational and industry partners can contribute to sustainability awareness not only for industry's sustainability but especially for humanity's future.

The Covid-19 pandemic anthropause affected the world (Rutz et al., 2020) in ways we are only starting to unravel now that the pandemic is becoming manageable. It caused unprecedented uncertainty. For a futurist like myself, re-imagining and actively experimenting with alternative futures is urgent and necessary. My learning here will be applied to future projects. It cannot be unlearnt. The implication of this study is that I will endeavour to create more transgressive spaces through art interventions in the future. In these transdisciplinary inquiries, potential solutions can be tested and hopefully emerge.

To create a thriving future, we may have to shift from looking at the world through our beliefs to looking at our beliefs about the world, including how they influence our relationships to self, others and nature through art and artworks (O'Brien, 2020). Reflexively reading the recent IPCC report (2022a) towards the end of this study, the scientific climate change experts worldwide have finally prioritised emergent grassroots experimentations, such as these eco-cultural interventionists, to help the transformation of an ecological climate culture.

The future is here. Our time to make ‘something fit for a new situation or use’ is now (O’Brien, 2012, p. 669). It forces us to consider what the French economic historian, Serge Latouche, first describes as 'selective degrowth’ to reduce consumption and production (Klein, 2014, p. 93) and shake up unsustainable habits (Strengers, 2012).

Recent climate change adaptation reports, strategies and biodiversity assessments state how deeply interconnected humans and nature are. To safeguard these links, we as humanity need to make up for the mess we have created in nature.

'Simply paying attention guarantees the transformation from a nature supposedly asleep to the work that displays nature’s strange vitality’ Michel De Certeau said of the Harrisons’ work, The Lagoon Cycle (Brady, 2016, p. 173).

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Appendix A (1 of 2)

Eco-art Dataset

Q1	Q2						Q3 and Q5	Q6 - 17 o	Q7	Q8	Q9	Q10 - 23 of	Q11 - Q12	Q13	Q14	Q1	Q16 - 20 of	Q1	Q18 - 17	Q1'	Q2	Q21	Q22	Q2	Q24	Q25	Q26 - Q27		Q28 16 of 27		
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20	Joaquin Fargas	env	Space for purification	wat	https	no	public	rur	ecologic	mo	ter	not	materiality	single	fun	imr	sin	wit	movement	co	participat	sol	ma	self	pre	rea	new	stu	indig	nat	pedagogy	all (	More e
21	Liberate Tate	clin	Liberate Tate	oil	https	49	inside	urb	aesthetic	te	ter	not	traditional	narrat	visc	pre	mu	wit	movement	co	observe	net	mi	gra	une	rea	new	stu	indig	stud	not	Top	The arti
22	Ackroyd&Harvey	clin	Polar diamond	oil	https	52	inside	urb	ecologic	ab	per	not	materiality	single	fun	pre	sin	wit	still standin	on	observer	net	mi	self	pre	rea	new	stu	scien	stud	not	No	No inte
23	Ackroyd&Harvey	clin	Beuys's acorns	tree	https	no	public	urb	ecologic	mo	ter	sea	materiality	narrat	fun	exp	mu	wit	movement	pu	observer	net	mi	self	une	rea	new	stu	scien	stud	not	Top	Intent t
24	Ackroyd&Harvey	env	The Ash project	tree	https	no	public	rur	ecologic	mo	per	not	traditional	single	visc	exp	sin	wit	movement	co	participat	net	mi	com	une	rea	new	stu	scien	stud	pedagogy	All (	Intent t
25	Bambi	clin	The pope gives us hop	relig	https	54	public	urb	aesthetic	hu	per	not	traditional	single	inte	pre	sin	wit	still standin	pu	observer	sol	fer	self	pre	rea	illus	do	scien	neit	not	No	No Inte

Appendix A (2 of 2)

Eco-art Dataset

Q1	Q2					Q3 and	Q5	Q6 - 17 o	Q7	Q8	Q9	Q10 - 23 of	Q11 -	Q1	Q1	Q1	Q1	Q16 - 20 of	Q1	Q18 - 17	Q1	Q2	Q21	Q22	Q2	Q24	Q2	Q26 - Q27		Q28 16 of 27		
	Research Question - Which traits hold intent to adapt?					A. Physical Form							B. Conceptual Approach								C. Network					D. Climate/Scienc				E. Pedago		
mber	Artists Name	mate Art /	Artwork Name	ps/floods/drou	eblink		In Public, free vs inside/private	ban/Rural/peri-	Aesthetic only/ Aesthetically and	ologically	man/Text/mov	mporary	asonal/Not	Traditional arts media/ materiality	nsidered	Single Concept / rrative	tellectual	escriptive/Imm	gle iteration	ith permission	Stillstanding vs Movement in audience/artwor artist	mmunity	Observer / participatory - rticipatory	le Artist /	ale/Female/No	oject /non-	cidental	tors / Real	New Knowledge	tist do not Scientific	owledge/indig	(what if	Pedagogy componenet added ot not	TOP 6 traits of 27	NOTES on INTENT
26	Lucia Monge	env	Planton Movil	plar	http	no	public	urb	ecologic	hu	ter	not	materiality	narrat	visc	exp	mu	wit	movement	cor	participat	sol	fen	self	pre	rea	new	stu	indig	stuc	pedagogy	All	Intent a
27	Janet Laurence	env	Novartis	plar	http	no	public	urb	ecologic	mc	per	sea	materiality	narrat	fun	imr	sin	wit	movement	pu	participat	sol	fen	con	pre	rea	illus	stu	indig	stuc	pedagogy	All	Intent to
28	Janet Laurence	env	IGA Berlin	plar	http	no	inside	urb	aesthetic	mc	ter	sea	materiality	narrat	fun	pre	sin	wit	still standin	gal	observer	sol	fen	gra	pre	rea	illus	stu	indig	stuc	pedagogy	Top	Intent to
29	The Harrisons	env	The Lagoon Cycle	tida	http	no	public	bot	ecologic	mc	per	sea	materiality	narrat	vice	imr	mu	wit	movement	cor	participat	net	mi	self	inci	rea	new	stu	indig	stuc	pedagogy	All	Intent to
30	The Harrisons	clin	Greenhouse Britain	tida	http	no	public	rur	aesthetic	mc	per	sea	materiality	narrat	visc	imr	mu	wit	still standin	cor	observe	net	mi	gra	pre	rea	new	stu	indig	stuc	pedagogy	Top	Exhibitio
31	The Harrisons	eco	Future garden	agri	http	no	public	urb	aesthetic	mc	per	sea	materiality	narrat	visc	imr	mu	wit	still standin	cor	observe	net	mi	self	une	rea	new	stu	indig	stuc	pedagogy	Top	Outdoor
32	Banksy (suspected)	clin	From here on	cap	http	no	public	urb	aesthetic	hu	per	not	traditional	single	inte	pre	sin	wit	still standin	pu	observer	sol	ma	self	une	rea	illus	do	neith	neit	not	No	No Inter
33	Tue Greenfort	eco	Light-vented Bulbul	bird	http	no	public	urb	ecologic	mc	ter	not	materiality	sinlgle	visc	imr	sin	wit	movement	gal	observer	sol	ma	self	pre	rea	illus	do	scien	stuc	pedagogy	No	No addi
34	Merwe	eco	The Earth	agri	http	no	public	rur	ecologic	ab	ter	sea	materiality	single	visc	imr	sin	wit	movement	cor	observer	sol	ma	com	pre	rea	illus	stu	agri	stuc	pedagogy	No	No inter
35	Dear Climate	clin	Open source posters t	wea	http	no	public	all	aesthetic	tex	per	not	traditional	narrat	visc	pre	mu	wit	still standin	on	observe	net	mi	self	inci	rea	new	do	medi	neit	pedagogy	Top	It is mai
36	Marie Velardi	clin	Atlas des isles perdues	sea	http	no	inside	rur	aesthetic	mc	per	not	traditional	sinlgle	inte	pre	sin	wit	still standin	gal	observer	sol	fen	self	pre	rea	illus	stu	scien	stuc	pedagogy	No	No inter
37	Jason deCaires Taylo	clin	Underocean sculpture	cora	http	no	public	rur	aesthetic	hu	per	not	materiality	narrat	visc	imr	mu	wit	still standin	cor	participat	net	ma	con	une	rea	illus	stu	indig	stuc	not	Top	Intent to
38	Shrinking Space	eco	WildflowerMeadow	bioc	http	no	public	rur	ecologic	mc	ter	sea	materiality	single	visc	imr	sin	wit	movement	cor	participat	net	mi	self	une	rea	illus	stu	indigeno		not	Top	Intent to
39	GASP	eco	Swimmable	wat	http	no	public	urb	ecologic	mc	ter	not	materiality	narrat	visc	imr	mu	wit	movement	cor	participat	net	mi	gra	pre	rea	illus	stu	indig	stuc	not	No	Intent to
40	Dan Perjovschi	clin	Cli Mate	new	http	no	inside	urb	aesthetic	dr	ter	not	traditional	narrat	inte	imr	mu	wit	movement	pu	observer	sol	ma	self	pre	rea	new	stu	indig	stuc	pedagogy	No	No - he
41	Špela Petrič	env	Confronting Vegetal Ot	plar	http	no	inside	urb	ecologic	mc	ter	not	non-traditi	single	visc	pre	sin	wit	movement	gal	observe	sol	fen	self	une	rea	new	stu	scien	stuc	not	Top	Intent to
42	Michael Pinskey	clin	Pollution pods - cape f	poll	http	no	public	urb	ecologic	ab	ter	not	materiality	narrat	visc	imr	mu	wit	movement	pu	observe	sol	ma	self	pre	rea	new	stu	scien	stuc	pedagogy	No	No inter
43	Berntnaut Smilde	clin	Nimbus	clou	http	no	inside	urb	ecologic	mc	ter	not	materiality	narrat	visc	pre	mu	wit	movement	gal	observer	sol	ma	self	pre	rea	new	stu	scien	stuc	not	No	No inter
44	Michael Wang	clin	Extinct in the wild	exct	http	no	inside	urb	ecologic	mc	ter	not	materiality	narrat	inte	pre	mu	wit	still standin	gal	observer	sol	ma	self	pre	rea	illus	stu	scien	stuc	pedagogy	No	No inter
45	Eve Mosher	clin	High waterline	sea	http	no	public	urb	ecologic	ab	ter	not	materiality	narrat	visc	imr	mu	wit	movement	pu	participat	sol	fen	self	une	rea	new	stu	indig	stuc	pedagogy	All	Yes, inte
46	Studio Roosegaarde	clin	Waterlicht	sea	http	no	public	urb	ecologic	ab	ter	not	traditional	single	visc	imr	sin	wit	movement	pu	observer	sol	ma	self	pre	rea	illus	stu	scien	stuc	pedagogy	No	No inter
47	Studio Roosegaarde	inn	Gates of light	save	http	no	public	urb	ecologic	ab	per	not	materiality	single	visc	imr	sin	wit	movement	pu	participat	sol	ma	com	inci	rea	new	stu	scien	stuc	not	Top	The wor
48	Agnes Denes	agr	Wheatfield	urb	http	no	public	urb	ecologic	mc	ter	sea	materiality	single	fun	pre	sin	wit	movement	pu	observer	sol	fen	self	inci	rea	new	stu	scien	stuc	not	Top	The rege
49	Agnes Denes	clin	Tree Mountain	fore	http	no	public	rur	ecologic	mc	per	sea	materiality	single	fun	imr	sin	wit	movement	pu	participat	sol	fen	con	inci	rea	new	stu	scien	stuc	not	Top	Intent in
50	Tomas Saraceno	inn	On Air	spic	http	no	public	urb	ecologic	mc	ter	not	materiality	single	fun	imr	sin	wit	movement	gal	participat	sol	ma	self	inci	rea	new	stu	scien	stuc	pedagogy	Top	The inte
							22 of 27		17 of 27				23 of 27						20 of 27		17 of 27									16 of 27		

Appendix B Galafassi et al. Dataset (2018)

	Artwork Name	Type (proj	K	Art form	Examples of	Climate-related theme	How m	tegr	Awaren	Behavic	ilization &	Countr	publish	as it	Web-link	Instigator/(	Dates	1996	19
1	Exceeding 2°C, 2007/2014	Artworks		Installation	Temperatur mai	Climate Nexus			1		1	Spain; United Emirates			http://tuegreenfort.net/post/		2007; 2014		
2	Paradise Vetoed – Stories of Clim	Artworks	"Chu	Theater		Exploring multiple futures	Not speci	1	1			Germany	No		http://scientifi	info@scientifi	May - July 2015		
3	The Climate Games WEBSITE DO	Artworks	"It's	Game		Exploring climate responses	214 actions by 124 teams				1	Global	No		https://www.facebook.com/p		2015		
4	36.5	Artworks	36.5	Performance	Durational Perfo	Visualizing planet's changing e	1 artist -		1			USA; Mexi	No		http://www.sai	1.646.325.70	2013-today		
5	How to Build a Forest	Artworks	How	Theater	hybrid of visual	Shifting perception of impacts/	3 artists & four p		1			USA	No		https://vimeo.	Shawn Hall (s	October 2015		
6	Phantom Limb - Memory Rings (tri	Artworks	"Cre	Theater	theatrical perfor	Visualizing different time scale	10 artists "creati		1			USA	No		http://www.oct	phantomlimbc	2013/2014-2016?		
7	The polar project	Artworks	shar	Multiple	Photography, a	Shifting perception of impacts/effects & risks; V			1			USA; Argentina			http://www.erikablumenfeld.(		2009		
8	Powerwalk	Artworks		Multiple	Performance; In	Climate Nexus			1			Germany; Iceland			http://www.powerwalk2013.c		2013		
9	"I DON'T BELIEVE IN GLOBAL WA	Artworks		Streetart (Graffiti)		Shifting perception of impacts/effects & risks; V			1			UK			https://www.theguardian.cor		2009-today		
10	Waiting for climate change	Artworks		Installation		Visualizing planet's changing ecosystems			1			France			http://cementeclipses.com/V		2013		
11	„Glass Half Full"	Artworks		Streetart (Graffiti)		Shifting perception of impacts/effects & risks			1			Puerto Rico			http://urbanshit.de/fintan-m		2016		
12	Hot with a chance of a late storm	Artworks		Installation		Shifting perception of impacts/effects & risks			1			Australia			http://gluesociety.com/sculp		2013		
13	ANOHNI - 4 degrees	Artworks		Music		Shifting perception of impacts/effects & risks			1			/			https://www.theguardian.cor		2016		
14	Look at that, you son of a bitch.	Artworks		Installation	Performance/ In	Shifting perception of impacts/effects & risks			1			Space			https://www.washingtonpost		2017		
15	CLOUD CRASH	Artworks		Installation		Shifting perception of impacts/effects & risks			1			UK			http://hehe.org.free.fr/ ; http		2016		
16	Energy renaissance	Artworks		Virtual Reality		Exploring climate responses			1		1	UK			http://www.capefarewell.com		2016-today		
17	+2°C	Artworks		Plastic arts		Shifting perception of impacts/effects & risks			1			?			http://www.environmentalart		?		
18	Ice Records	Artworks		Installation		Shifting perception of impacts/effects & risks			1			?			http://katiepaterson.org/icer		2009		
19	Deep Breathing – Resuscitation fo	Artworks		Installation		Visualizing planet's changing ecosystems			1			France			http://www.artists4climate.cc		16 October to 14 Decem		
20	Kumbh Mela #1 Haridwar	Artworks		Photography		Climate Nexus			1			France			http://www.artists4climate.cc		2015		
21	Ice Watch	Artworks		Installation		Connecting local-regional-global			1			France; Denmark			http://www.artists4climate.cc		26 to 29 October 2014 &		
22	You are a Tender History of Ice	Artworks		Collage	Collage on sma	?			1			USA			http://katieionecraney.com/\		2016		
23	Rheinbraun	Artworks		Photography		Climate Nexus			1			France			http://www.artists4climate.cc		2015		
24	Drowning world	Artworks		Photography		Shifting perception of impacts/effects & risks			1			France			http://www.artists4climate.cc		23 to 29 November 2015		
25	Climate Drawings	Artworks		Drawing		Exploring climate responses			1			France			http://www.artists4climate.cc		2015		
26	The Third Paradise	Artworks		Installation	Manifesto & inst	Reframing human-nature relations			1			Global (many places all ove			http://www.artists4climate.cc		2003; 2005-2016		
27	Illuminated Wind Turbine	Artworks		Installation		Climate Nexus			1			France			http://www.artists4climate.cc		2015		
28	Another glance at Seine Saint-Der	Artworks		Photography	Photography wc	Communicating local stories ; Exploring		1	1	1		France			http://www.artists4climate.cc		2015		
29	Unbearable	Artworks		Plastic arts					1			France			http://www.galschiot.com/wp		2015		
30	Human Energy	Artworks		Installation	Participative ligl	Climate Nexus			1		1	France			http://www.artists4climate.cc		2015		
31	Sky Puzzle	Artworks		Installation		Connecting local-regional-global			1			France			http://www.artists4climate.cc		2015		
32	Ice Bear Project	Artworks		Plastic arts		Shifting perception of impacts/effects & risks; V			1			Denmark, UK			http://theinspirationroom.co		2009		
33	Requiem for arctic ice	Artworks		Music		Visualizing planet's changing ecosystems			1			UK, Global (online)			https://soundcloud.com/gre		2016		
34	The sound of climate change from	Artworks		Music		Visualizing planet's changing ecosystems			1			USA; Global (online)			http://www.smithsonianmag.		2015		
35	Kyoto Now! -- Bad Religion	Artworks		Music		Shifting perception of impacts/effects & risks			1								2002		
36	A Matter Theater	Artworks		Performance	Performance &	?			1			Germany			http://hkw.de/en/programm/		2014		
37	eRRor - un juego con tra(d)ición	Artworks		Theater		Climate Nexus			1			Argentina			http://www.bineuralmonokul		2011-2014		
38	Sunflower, centinela del cambio cli	Artworks		Plastic arts	Sculpture; Insta	Climate Nexus			1			Argentina			http://www.sunflowerweb.co		2007		