




## ClimArtLab

# Evolving Futures: Owning our Mess

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Projektmitarbeiter\*innen und Autor\*innen des Berichts

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Universität für Bodenkultur, Department für Wasser – Atmosphäre – Umwelt  
Institut für Meteorologie und Klimatologie, Gregor-Mendel-Straße 33, 1190 Wien

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## I-1 Kurzfassung

Im Sommer 2020 haben das Konrad-Lorenz-Institut für Evolutions- und Kognitionsforschung (KLI) und der Think-Tank artEC/Oindustry das ClimArtLab gegründet - einen neuen Raum für transformativen Wandel, der transdisziplinäre kunst-wissenschaftliche Kooperationen mobilisiert. Das erste Projekt dieses transdisziplinären Labors war *Evolving Futures: Owning our Mess*. Das Projekt entstand aus einer Unzufriedenheit heraus bezüglich Mainstream-Ansätzen, die verwendet werden, um Verhaltens- und Kulturwandel sowohl in der Forschung als auch in der Politik zu fördern und zu verstehen. Oft wird ein Nudging-Paradigma verwendet, um eine Entscheidungsarchitektur zu formen, die das Verhalten von Gruppen und Einzelpersonen beeinflussen soll, wodurch die Menschen letztlich jedoch nicht motiviert werden, Verantwortung zu übernehmen und in ihrem eigenen Interesse zu handeln. In anderen Fällen wird ein Scaring-Paradigma verwendet, das Angst und Unsicherheit verstärkt, was zu Entmachtung und verminderter Handlungsfähigkeit führt. Unser Projekt hat sich vom Nudging und Scaring entfernt und untersucht positive Reize, die durch intrinsische Motivation und transformative Handlungsmacht innere Veränderung und Transformation bewirken können. Die Fragen, die *Evolving Futures* antreiben sind: Wie können wir als Individuen und Gesellschaft von der Angst Abstand nehmen und Verantwortung für unser Chaos übernehmen? Wie können wir intrinsische Motivation und Handlungsfähigkeit entwickeln, um Herausforderungen im Zusammenhang mit dem Klimawandel anzugehen? Wie können Künstler\*innen und Wissenschaftler\*innen zusammen auf das gemeinsame Ziel hinarbeiten, eine regenerative Zukunft in Zeiten des Klimanotstands zu unterstützen? Wir haben uns diesen Fragen durch kreative und offene Prozesse des gegenseitigen Lernens und Koproduzierens von Wissen gestellt und Theorien und Praktiken aus vielen wissenschaftlichen und künstlerischen Bereichen miteinander verwoben. Wir haben sowohl Theorien der intrinsischen Motivation und der verkörperten Kognition sowie Komplexitätstheorien und Nexus-Ansätze zum Klimawandel genutzt. Wir haben mit partizipativen künstlerischen Installationen und Performances experimentiert, um neue Wege der inneren Veränderung und Transformation zu erkunden. Durch gegenseitiges Lernen und Experimentieren haben wir neue Ansatzpunkte geschaffen, um über unser Leben inmitten des Klimanotstands nachzudenken und es zu ändern. Wir haben verkörperte Erfahrungen genutzt, um unser Hybrid-Cyborg-Leben zu gestalten und zu reflektieren. Wir haben das Digitale und das Analoge, das Virtuelle und das Reale, unseren Körper und unsere Laptop-Bildschirme, Textilien und QR-Codes durchkreuzt. *Evolving Futures* gipfelte in der kunstwissenschaftlichen Zusammenarbeit einer potenziell transformativen, partizipativen Intervention, welche am 11. Mai 2021 in einer virtuellen Ausstellung vorgestellt wurde.



## I-2 Abstract

In Summer of 2020, The Konrad Lorenz Institute for Evolution and Cognition Research (KLI) and the think-tank artEC/Oindustry created the ClimArtLab, a new space for transformative change that mobilize transdisciplinary arts-science collaborations that aim to contribute to the healing of our planet. The first project of this transdisciplinary laboratory was Evolving Futures: Owning our Mess. The project emerged from a dissatisfaction towards mainstream approaches used to foster and understand behavioral and cultural change both in research and in policy. Often, a nudging paradigm is used to shape choice architecture and to influence the behavior of groups and individuals failing to motivate people to take responsibility and to act on their own behalf. Other times, a paradigm of scaring is used which leverages fear and insecurity, resulting in disempowerment and diminished agency. Our project stepped away from nudging or scaring and investigates positive stimuli that can create inner change and transformation through intrinsic motivation and transformative agency. The questions driving Evolving Futures: Owning our Mess were: How can we as individuals and society step away from fear and take responsibility for our mess? How can we develop intrinsic motivation and agency to address challenges related to climate change? How can artists and scientists work together towards the shared goal of supporting regenerative futures in times of climate emergency? We addressed these questions through creative and open-ended mutual learning and knowledge co-creation processes and interwove theories and practices from many scientific and artistic fields. We made use of theories of intrinsic motivation and embodied cognition, mobilized complexity theories and nexus approaches to climate change, and experimented with participatory artistic installations and performances to explore new ways of creating inner change and transformation. Through mutual learning and experimentation we provided new entry points to think about and change the way in which we see our lives in the midst of the climate emergency. We used embodied experiences to shape and reflect upon our hybrid-cyborg lives. We intersected the digital and the analogue, the virtual and the real, our bodies and our laptop screens, textiles and QR codes. Evolving Futures: Owning our Mess culminated in the art-science co-creation of a potentially transformative, participatory interventions installed in an online exhibition on May 11, 2021.

## I-3 Introduction

Wicked problems, such as climate change, are immersed in complex networks of tensions and contradictions as well as local and global dependencies, which make decision-making processes challenging. Multi-dimensional approaches are needed for steering behavioral and cultural change at the individual and societal level. Art-science collaborations thus are increasingly tapped into as they can animate the articulation of environmental, social and cultural values, create visions, and mobilize embodied experiences to address climate change (Galafassi et al. 2018; Galafassi, Tàbara, and Heras 2018). Especially, the arts in collaboration with science, can generate knowledge and motivation for individual and collective change. Through collaboration between the natural, social, human, and cultural sciences, on the one hand, and the arts, on the other hand, it is possible to better understand how knowledge and action, theory and practice can be connected in addressing the climate emergency (Bentz and O'Brien 2019). Even more importantly it is possible to address change at deep leverage points occupying inner dimensions of individual and collective existence, such as mindsets, values, paradigms, and worldviews (Abson et al. 2017). That is art-science collaborations have the potential to create knowledge that support action and change towards more sustainable futures.

As Michael Hulme claimed: „But too infrequently is there any direct questioning of how knowledge does and should related to action. Instead, the implicit assumption too often still seems to be that: knowledge leads to action; more certain knowledge leads to more definite action; and more integrated knowledge leads to more joined-up action“ (Hulme 2018, 334). However, the problem is not often that we do not know enough, but on the contrary that our understanding needs thickening by deploying value-heavy concepts, by engaging with those dimensions of behavior, knowledge, and action that are difficult to express and address. We need to thicken our understanding of the multiplicity of relationships that connect the knowledge acquire, for instance, through climate science, the values that we have and that are connected to our social context, and the way we behave in our society and in the environment (Hulme 2014, 2016).

In our ClimArtLab, we mobilized arts-science collaborations with the goal to thicken our understanding of how change in messy and complex situations can be created. The ClimArtLab mobilizes a multiplicity of voices from the sciences and from the arts towards a shared goal: Contributing knowledge and actions to healing our planet and our societies in the midst of the climate emergency. In the ClimArtLab artists and scientists come together to explore new ways to generate intrinsic motivation and empower individuals and groups to deal with the messy and wicked realities of climate change. We did so in the midst of the COVID pandemic, which constituted a disruption not only in our daily lives and operations, but also more generally and more deeply in our sense of identity, in the way we deliberate or contest decisions, and in how we deal with diverging world-views and value systems. The first project of this transdisciplinary laboratory was *Evolving Futures: Owning our Mess*. The project emerged from a dissatisfaction towards mainstream approaches used to foster and understand behavioral and cultural change both in research and in policy. We created art-science interventions in a public digital sphere which could create spaces for contestation and collaboration. Being forced to work with a distance and online using digital technology to communicate and to collaborate deeply shaped the experience of ClimArtLab as well as the main questions and results, both in theory and in practice.



## I-4 Motivation

The project *Evolving Futures: Owning our Mess* in the ClimArtLab emerged especially from a dissatisfaction towards mainstream approaches used to foster behavioral and cultural change. Both in research and in policy, there is a prominence of approaches that rely either on *nudging* or on *scaring*.

Often, a *nudging* paradigm is used to shape choice architecture and to influence the behavior of groups and individuals failing to motivate people to take responsibility and to act on their own behalf. ... enabling pro-environmental or climate friendly behaviors through information. Monitoring and metering interventions ... Which means making it easier to do the right thing from the point of view of sustainability. A nudge is “an aspect of the choice architecture that alters people’s behavior in a predictable way without forbidding any options or significantly change in their economic incentives (Sunstein and Thaler 2014). Nudge theory focuses then on the choice architecture or on the environment in which such choices are made. Despite its wide use and some partial success, nudging has been criticized on different grounds. Some have claimed that it represents a rather neoliberal and soft paternalistic approach as it focuses on tricking people. Others have pointed out that despite being very impactful on the short term (e.g. when changing something in the household), the effects of nudging did not last. Also, nudging seems to be confined rather to simple contexts and situations. Many have indeed claimed that the best interventions will certainly be those that seek to change minds alongside changing contexts, as transformative change can only be achieved when deep paradigms and mindsets shift (Abson et al. 2017).

Other times, a paradigm of *scaring* is used which leverages fear and insecurity, resulting in disempowerment and diminished agency. Especially in the early days of behavioral and psychological research related to climate change through communication campaign, there was a tendency to make people scared about the future and to foster so-called climate anxiety. It has become increasingly clear though that “Climate anxiety can cause overwhelm, denial, and disavowal, which can lead to anger, paralysis and suspension of reality, which prevents people from acting creatively and engaging in problem-solving: something we have seen all too clearly in public debates about climate change and sustainability.” (Newell, Daley, and Twena 2021, 32). Also, “although shame and guilt were often invoked in environmental campaigns and advocacy, such strategies were likely to prove counterproductive in the long-term. While shaming may make investigators feel better about their own virtuous conduct ... it does not necessarily induce positive behavior change in the targets of shaming when used as an externally driven strategy” (Newell, Daley, and Twena 2021, 31).

Therefore, neither *nudging* nor *scaring* can foster the intrinsic motivation, inner changes, and transformative agency needed to address climate change (Sommer 2020). These approaches fail to connect to the deep inner level of human existence that are actually important to generate needed transformative change needed to be able to address the climate emergency. They cannot foster that „inner transformation“ which „relates to exploring and addressing people’s inner dimensions and their relation to sustainability to support individual, collective and systems change“ (Woiwode et al. 2021). It is instead to this dimension of inner transformation and the inner self that artists and scientists in *evolving future* engaged. Indeed, inspired by Anthony Giddens, we believe that consumption choices or pro-environmental behaviors in today’s complex world are not one-top and quick fire actions, but rather relate to deeper self of identity and represent decisions not only about how to act but also choices about how to be, especially in a world in a climate emergency (Giddens 1991).

In *Evolving Futures* we explored approaches to behavioral change in relation to climate change that go beyond nudging and scaring and that embrace the need to tap into inner dimensions of human existence, into our self-identity or inner self. We aimed to find ways to generate intrinsic motivation and agency for climate awareness and behavioral change while also relying on an understanding of the complex relationships connecting behaviors and climate, human society and the earth system. This is

why, to achieve this goal we combined and brought together in a mutual learning and co-production process artists and scientists from the natural sciences (especially Earth System Sciences and Glaciology) the social sciences and the humanities researchers (especially, sustainability sciences, cognitive sciences, and philosophy). Together, we aimed to create interventions and experiences that could tap into those inner dimensions which include various aspects of the human existence and interaction that include consciousness, mindsets, values, worldviews, belief, and spirituality. And they did so through by mobilizing the emotional and creative layers to create motivation and agency for change.

## I-5 Research questions and objectives

The final goal of *Evolving Futures: Owning our Mess* was to create potentially transformative interventions that can support “inner transformation” and change while being informed by the exchange between scientists and artists. The ClimArtLab is conceptually embedded in the contexts of so-called action-oriented or transformation-oriented and transdisciplinary sustainability research (Caniglia et al. 2020; Fazey et al. 2018). This kind of research assumes that the most critical question for climate research is no longer about the problem, but about how to facilitate the transformative changes necessary to avoid catastrophic climate-induced change. Addressing this question, however, will require upscaling of research that can rapidly enhance learning about transformations. Among the contributions that the research and science system has to go through, for instance, it will be important to openly focus on transformations to low-carbon, resilient life styles. Overall, there is more and more need to generate action-oriented knowledge to support sustainability transformations (Caniglia et al. 2020; Fazey et al. 2018). Also, it will be essential to work with normative aspects and seek to transcend current thinking.

Especially, the *Evolving Futures: Owning our Mess* follows attempts in transformation and action-oriented sustainability science to engage with arts-science collaborations in the attempt to create change and transformation (Bentz 2020; Bentz and O'Brien 2019; Galafassi et al. 2018; Galafassi, Tàbara, and Heras 2018). In *Evolving Futures: Owning our Mess*, focused on the role of art-science collaborations and the way they can support agency and motivation while capitalizing on nexus and complexity-based thinking to frame the connection between behavior and climate change. We ask:

**How can we as individuals and society step away from fear and take responsibility for our mess by developing intrinsic motivation and agency to address challenges related to climate change? And how can art-science interventions help in generating motivation and agency for change?**

We addressed these questions through creative and open-ended mutual learning and co-creation processes. We interwove theories and practices from many scientific and artistic fields. We made use of theories of intrinsic motivation and embodied cognition. We mobilized complexity theories and nexus approaches to climate change and in climate science. We experimented with artistic installations and performances to explore new ways of exploring the relationships that tie our lives to a warming climate. We used embodied experiences to shape and reflect upon our hybrid-cyborg lives and identities. We intersected the digital and the analogue, the virtual and the real, our bodies and our laptop screens, textiles and QR codes.

The specific objectives of the project were:

- Design, monitor, and assess a mutual learning and knowledge co-production process between artists and scientists on topics related to climate change
- To co-design and perform arts-science experimental interventions for climate change aiming to generate inner transformation (and inner transformation/inner motivation)
- Theory co-development emerging from transdisciplinary arts-science collaborations that aimed to create inner transformation
- Theory co-development of approaches to inner transformation (through arts-science collaboration) that go beyond nudging and scaring.
- Building capacity and competence for inter and transdisciplinary collaboration for climate change

## I-6 The theoretical space

The ClimArtLab had both a reflection, conceptual, and theory-oriented dimension and a design, practice, action-oriented dimension. Indeed, one of the unique features of this collaboration was the combination of the two. The overall theoretical space was clustered around three main topics and approaches connected to the main driving questions of the project, that is How can we as individuals and society step away from fear and take responsibility for our mess by developing intrinsic motivation and agency to address challenges related to climate change? And how can art-science interventions help in generating motivation and agency for change? The three main approaches were: (i) Climate change as a socio-cultural emergency; (ii) Inner transformation and behavioral change; (iii) Nexus thinking and climate change.

### I-6.1.1 A socio-cultural climate emergency: Messes and wicked problems

In our understanding of climate change, we relied on multiple perspectives from climate science and the humanities. Especially, we considered:

- **Climate science and earth system sciences:** We primarily engaged with an understanding of climate change as coming from climate and earth systems sciences. This meant to engage with key terms and concepts such as: planetary energy balance, greenhouse effect, coupled system, forcing and feedbacks, energy uptake, timescales, tipping points. We used especially concepts and examples from glaciology. We paid specific attention to how climate change affects sustainability of ecosystems and populations. As the scientific understanding becomes deeper, simplistic solutions seem less realistic and there is an increasing need to engage many interest groups to respond in the best possible way. We thus engaged with climate science, earth system science, and glaciology in relation to these discourses.
- **Climate change, societies, and cultures:** An important perspective in the discussion of how arts-science collaborations contribute to the understanding and addressing climate change comes from the humanities, which look at climate change as a systemic global risk which cannot be addressed through massive and deliberate geo-engineering of the planet (Hulme 2009, 2014, 2018). Rather, different kinds of knowledge are needed to be able to address climate change such as: scientific and social scientific knowledge, which is method-centered; local (or indigenous) knowledge, which is place-centered and holistic; tacit knowledge, which is implicit and hard to transfer; and self-knowledge, which is reflective and concerns inner dimensions (Caniglia et al. 2020; Hulme 2018). Engaging with these multiplicity of kinds of knowledge also implies embracing diversity of voices, de-emphasizing human exceptionalism in favor of multi-specism, and leverage connectedness and relationships (Haraway 2016).

### I-6.1.2 Inner transformation

In order to move beyond nudging and scaring, we mobilized theories and approaches from transformational sustainability science, cognitive science, and psychology:

- **Inner transformation:** These are theories that relate to various aspects of human existence and interactions such as consciousness, mindsets, values, worldviews, beliefs, spirituality, and human-nature connectedness. Approaches to inner transformation have increasingly been addressed in action-oriented and transformational sustainability science (Ives, Freeth, and Fischer 2020; Woiwode et al. 2021). It is indeed increasingly recognized that activating these dimensions is necessary to be able to generate change and transformation towards sustainability.
- **Intrinsic motivation:** Theories explaining how people can be motivated to do something without any obvious external rewards (Deci and Ryan 2004). These theories have recently been applied to understanding pro-environmental behaviors and how to foster them (Van Der

Linden 2015). SDT places its emphasis on people's inherent motivational propensities for learning and growing, and how they can be supported. Conditions supporting the individual's experience of autonomy, competence, and relatedness are argued to foster the most volitional and high quality forms of motivation and engagement for activities, including enhanced performance, persistence, and creativity.

- **Embedded and embodied cognition:** 4E cognition refers to an undertaking of mind as enacted, embodied, extended, and embedded (Newen, Gallagher, and Bruin 2018). In general terms, 4E cognition can be seen as an umbrella term for all those approaches to cognition which reject the duality between mind and matter. The rejection of such duality is linked to the claim that cognition and action are closely related, and that we cannot have a satisfactory model of cognition without, at the same time, having one for action. 4E cognition then, is a label for efforts coming from different disciplines, which share this basic commitment to collaborate in the reformulation of problems and the integration of interdisciplinary research efforts.

### **I-6.1.3 Nexus thinking, systems thinking: Sustainability perspective on climate change**

In mobilizing approaches from different branches of research, from climate science to cultural sciences, we emphasized the importance of relying on system and complexity-based understanding of reality. We made use of some conceptual tools from sustainability science, especially:

- **Nexus and systems thinking:** Using systems thinking approaches such as nexus thinking, we problematized the connections between social, ecological, and technological systems it is unclear to most that changing practices of living can have an impact on the global scale of climate change. In particular, we used the Water-Energy-Food Nexus approach to frame our understanding of the impacts of individual and collective behaviors on the climate (IPCC, 2019). The nexus provide a simple way, though non-linear and complexity-based, to understand human impact on climate. In our societies there is increasing awareness of the need to change our behaviors. However, we often do not think, for instance, about the fact that our water consumption practices are connected to energy consumption and the complex and globalized food system; or that household recycling contributes to emissions reductions by avoiding emissions associated with landfill and from substituting recycled materials for virgin feedstock. We mobilized these considerations when dealing with how to connect scientific knowledge and the need to generate inner transformations.
- **Leverage points for sustainability transformations:** When thinking about how to address climate change and generating inner and outer transformations, it is important to understand where to take action and engage with transformation. Drawing on ideas by Donella Meadows as well as on more recent works (Abson et al. 2017; Leventon, Abson, and Lang 2021), we mobilized ideas related to leverage points for sustainability transformations. Inspired by systems thinking, thinking in terms of leverage points focuses on transformational 'sustainability interventions', centered on three realms of leverage: reconnecting people to nature, restructuring institutions, and rethinking how knowledge is created and used in pursuit of sustainability. A leverage point perspective allows for focusing on less obvious but potentially far more powerful areas of intervention, such as inner transformation, within the context of climate change research (Woiwode et al. 2021).

## I-7 Research design: A Transdisciplinary collaboration

The overall process was designed by relying on frameworks and approaches from inter and transdisciplinary sustainability research (Bammer 2005, 2013). We especially made use of the approach expressed in the piece „Learning to collaborate while collaborating“ (Freeth and Caniglia 2020) in order to support the mutual learning and knowledge co-production process among those involved. The design of the overall transdisciplinary process was inspired mainly by „Transdisciplinary research in sustainability science: practice, principles, and challenges,“ (Lang et al. 2012).

### I-7.1 A collaborative project based on mutual learning and knowledge co-production

We conceptualized and fostered the collaborative space as comprising epistemic, social, symbolic, spatial, and temporal dimensions. Second, we interpreted the learning processes of the individual and of the group in terms of comfort and discomfort, which supported a systematic approach to address the collaborative challenges all along. It is by creating the conditions so that learning could take place that we organized activities and structured the encounter of different disciplines and kinds of knowledge, which implied: (i) creating conditions for learning to take place, which included paying attention to discomfort as a trigger for learning and (ii) engaging in collaborations in ways that strengthen individuals' collaborative capacities by cultivating particular orientations, knowledge and skills.

Together, the team reflected upon, discussed, mobilized, and merged different artistic and scientific practices, methods, and theories. The overall process was driven by our main questions and organized around some main theoretical axes. However, we did not put strict hypothesis or theory-testing processes and embraced the emergent nature of learning and co-production processes (Norström et al. 2020; Pereira et al. 2018). Especially, As often within arts-based research we followed a qualitative, inductive approach to data generation and analysis that could allow us to grasp the complexity and open-ended nature of the aesthetical experiences. Indeed, the insights generated are purposefully situated, context-sensitive, and multivocal in the sense that they contain and embody multiple perspectives (Galafassi, Tàbara, and Heras 2018).

### I-7.2 Main phases of the knowledge co-production and mutual learning process

- **Initiation:** In the summer of 2020, the Konrad Lorenz Institute for Evolution and Cognition Research (KLI) and the think-tank artEC/Oindustry created a new space for transformative and regenerative collaboration: the ClimArtLab. The processes was initiated by Dominika Glogowski and then further developed in collaboration with Guido Caniglia. The first project from the the ClimArtLab was: *Evolving Futures: Owning our Mess*. Dominika Glogowski introduced the question, if the arts can induce change, stimulate to proactive and pro-environmental behavior and motivate to creative solution finding.
- **Design of the collaboration and building of the team:** In the first steps of the collaboration, Guido Caniglia and Dominika Glogowski designed the framework of the project, established the activities and aims, and selected artists from an open call. Dominika Glogowski led the process of selection of two artists (Francesca Aldegani and Ida-Marie Corell), and coordinated the relationship between the artists and the KLI.
- **Co-framing of the topical area:** Through a series of online workshops (see below for the specific) topics related to climate change, climate science, inner change, intrinsic motivation, sustainability, interventions, solutions, art-science research, mutual learning were discussed by all participants.
- **Co-design of the art-science interventions:** The team of artists and scientists (see below section XXX for a description of team members) explored new at the intersection of arts and science of generating intrinsic motivation for pro-environmental behavior and empowering individuals and groups to deal with the messy and wicked realities of climate change. The

interventions were organized and performed mainly online, through co-design meetings (for the design of the interventions) and a final exhibit done via zoom.

- **Reflection of the process and theory building:** After the exhibition reflection about the collaboration as well as towards the theoretical development of the results of the ClimArtLab was performed.

### I-7.3 Studying a transdisciplinary arts-science collaboration

In the ClimArtLab, we also investigated how artists and scientists collaborated across their paradigmatically different backgrounds, thought styles, and ways of thinking and engaging with climate change and societal transformations. On the one side, in the social and natural sciences as well as often in the humanities, knowledge production is methods-driven and relies on techniques, rigor, experiment and (different versions of the) scientific method. On the other side, in the arts where its knowledge is a product elaborated from disruptive digressions generating counter-expressions in a nonlinear trajectory (Henke et al. 2020). While scientists' main tool is rational thinking, artists' main tool is creativity. Thus, another question emerges, how do scientists and artists merge both approaches in a heuristically successful way? How can they together achieve shared goals? An investigation of the arts-science collaboration in ClimArtLab can contribute to providing us with answers to these questions of transdisciplinary arts-science collaboration. A person in the team, Luana Polisei, was dedicated to assessing not only how artists and scientists collaborate to develop the ClimArtLab virtual exhibition, but also to understand how creativity and imagination can become heuristics tools for science to address environmental issues.

In a climate-change world, environmental aesthetics might turn out to be especially useful in providing insights on individuals' direct experiences with the natural, everyday environment that are beyond the reach of the dominant scientific framing (Auer 2019). Because aesthetics experience can bring insights that are frequently outside the scope of typical scientific inquiry (Berleant 2010), the ClimArtLab collaboration provides a privileged context to better understand the challenges transdisciplinary collaborations face in the transfer of scientific knowledge from scientific realms into formats of understanding that are more appealing and attractive to broader societal audiences. The ClimArtLab was thus also an experimental laboratory to find out how artists and scientists negotiate their approaches, sets of knowledge, and skills to generate environmental aesthetics experience based on scientific knowledge of Climate Change.

#### I-7.3.1 Specific methods

For data gathering and assessment, we used qualitative methods such as participant observation, semi-structured questionnaires and video recordings.

**Participant observation** is a qualitative method derived from traditional ethnographic research. It allows the researcher to use the sociocultural context of the observed environment to explain observed patterns of human behavior. This method is specially suitable to study social phenomena that are usually unknown and requires the researcher to be immersed, interact, and become a part of the group under investigation (Given 2008). The goal of participant observation is, first, to produce a dense description of these social interactions; and second, develop a deep understanding of a topic or a particular situation. The data is gathered by the researcher during his/her participation in these activities through observations alone or through a mix of observation and participation. The researcher can apply several overlapping strategies to collect data that are engaged with experiencing the social context while at the same time observing and speaking with the participants about what occurs (Patton 2010). For the ClimArtLab, it started with *descriptive observations*, where the observer searches for a general view or context of what is happening in the group. Afterwards, the observer starts a *focus observation*, and once back to his/her own field notes, delineates the need for a selective observation



focusing on those topics that are interesting for the research, in our case, the collaboration between artists and scientists (Spradley 1980).

In order to complement the data gathered from participant observation it is usual to apply **questionnaires and/or interviews** to the participants of the group being studied. For the ClimArtLab we have applied questionnaires in two distinct moments, before the collaboration starts and after the end of the collaboration. The goal of the first questionnaire was to consider (i) the amount of knowledge of the participants about Climate Change and Water-Food-Energy Nexus; (ii) what are the experiences of the participants in interdisciplinary collaborations, and (iii) their expectations of the collaboration and product in ClimArtLab (see Annex). The last questionnaire will be applied for the participants and aims to gather information about how the participants experienced and evaluate (i) this interdisciplinary collaboration in the ClimArtLab; (ii) the products displayed in the ClimArtLab exhibition; (iii) the relation of their aesthetics experiences to address environmental problems such as Climate Change and Water-Food-Energy Nexus (see Annex 3).

The assessment of the data gathered from both participant observation and questionnaires are under development, however preliminary discussions might be seen in section I 8.5. It is important to highlight that as with any usual qualitative research, the participants voluntarily accepted to join this research. And those who accepted, signed a consent form (see Annex 3).

#### **I-7.4 Phase 1: Building the transdisciplinary team**

The art-science team was selected through an open-call for artists as well as through the selection of academic researchers interested in participating to an art-science collaboration.

##### **I-7.4.1 Process designers and facilitators**

- **Dominika Glogowki** is artist, art historian, and art curator. She works in collaborative projects between industry, science and the arts to create participatory environments. She develops projects that enhance the arts as a transformative tool in different world regions to broaden the communication between the industry, nature and communities. Dominika initiated the whole idea of the ClimArtLab, drafted and distributed the open call, brought in questions and issues related to intrinsic motivation, coordinated the relationship between the artists and the KLI, contributed to the design of the interventions, designed the ClimArtLab website, co-produced the trailer, designed the 'word teaser,' and curated the online exhibition on May 11.
- **Guido Caniglia** is an interdisciplinary researcher trained in the history and philosophy of science as well as in evolutionary biology and sustainability science. Guido is currently the Scientific Director of the Konrad Lorenz Institute for Evolution and Cognition Research (KLI) in Klosterneuburg close to Vienna. His work focuses especially on: epistemology of transformational approaches in sustainability science; explanations of the functioning and evolution of complex bio-social systems in the history of science; internationalization and digitalization of higher education for sustainable development.

##### **I-7.4.2 Artists**

- **Francesca Aldegani** is an artist based in Vienna. According to Francesca, Art is alchemy. The artist in the Tarot is represented by the figure of the alchemist, through its acts learns to transform the Matter. The alchemist transforms materials into other materials, opening up hidden and invisible layers and bringing to light the unseen. Her work is developed on the possibility of showing stratifications of history, accumulation of energy, and hidden potentials contained into anything. It is a specific language that needs to be learnt in order to be understood and spoken: Art is the language of Soul.
- **Artist Ida-Marie Corell**, partially based in Lower Austria, Ida-Marie is I am a Berlin / Lower Austria / Finnøy based circular-disciplinary and \*synaesthetic\* artist, performer, composer and



researcher. She works at the intersection of music, painting, performance, drawing, collages, research and art and knowledge transfer. Ida-Marie made a splash with her interrogations on plastic bags. She is the co-founder of [Kunstraumretz](#).

#### I-7.4.3 Academic researchers

- **Luis Alejandro Villanueva Hernández** is a cognitive scientist and philosopher of science working on material culture evolution, cognitive ethnomusicology, cognitive archaeology, embodied music cognition & more. Alejandro is also an active musician, he plays traditional musical instruments from Mexico & South America. Alejandro is a Post-doc fellow at the KLI.
- **Lindsey Nicholson** is a climate scientist also interested in the power of the arts and Ass. Professor of glaciology at the University of Innsbruck. Lindsey's research focuses on understanding the relationship between glaciers and climate in order to better understand how the climate system works and how glaciers, and related earth systems, will change in the future. As the scientific understanding becomes deeper, simplistic solutions seem less realistic and there is an increasing need to engage many interest groups to respond in the best possible way.

#### I-7.4.4 Participatory observer

- **Luana Poliseli**, a philosopher of science at the KLI, collected data on #ClimArtLab to see how our ideas about solutions to climate change might change in the course of our interdisciplinary collaborations as well as how artistic and scientific creativity can be combined. She did so both through pre- and post-assessment questionnaires and through participatory observation all through the ClimArtLab process.



**Picture I- 2:** The team during the first online meeting together with keynote speaker Julia Bentz.

Upper row (left to right) Dominika Glogowski, Guido Caniglia, Julia Bentz; Middle row (left to right) Lindsey Nicholson, Francesca Aldegani, Ida-Amrie Corell; Lower row (left to right) Luana Poliseli, Alejandro Villanueva.

#### I-7.5 Phase 2: Co-framing the topic and co-designing the arts-science interventions

Over the whole course of the project, the team engaged with their differences and similarities. We learned about each other and how to think together about climate change as a messy, wicked problem through arts and science. We brought together and discussed different understandings and ways of thinking about climate, climate change, climate science, climate arts, climate activism (see I-6).

Multiple perspectives were mobilized and discussed from different academic fields, in the humanities, social sciences and cultural sciences as well as from different fields of artistic research. There was also space to openly explore the tangible and intangible, locutionary and illocutionary, constative and performative aspects of art-science relationships. This implied to learn how to inhabit tensions emerging from different terminologies, histories, languages, tools, and materials.

Before getting to the design phase of the experimental art-science interventions, we organized several workshops that aimed both (i) at the development of collaborative capacity and competence to works in inter and transdisciplinary collaboration and (ii) at addressing climate change in relation to behavioral change and inner transformation from multiple perspective in the arts, natural sciences, social sciences, and the humanities.

- **Kick-off meeting (Fe. 26, 2021):**
  - Julia Bentz presenting her work on Climate change and social change (Bentz 2020)
  - Getting to know each other and sharing experiences across participants
- **Mutual learning and knowledge co-production (March 11, 2021):**
  - We reflected on the hidden assumptions (e.g., about what is research and what is a valuable contribution) that underpin the work of the team members. We reflected on the dimensions of a transdisciplinary collaboration and on notions of comfort and discomfort.
- **Topic 1: Climate science and Nexus thinking (March 12, 2021):**
  - We learned about and discussed together issues and topics related to Glaciology and Earth System Science (Lindsey Nicholson)
  - We learned about and discussed together issues and topics related to action-oriented sustainability science: Transformative change, Transitions, Mitigation, Adaptation (Guido Caniglia)
- **Topic 2: Intrinsic Motivation and Embedded Cognition (March 18, 2021):**
  - We learned about and discussed together issues and topics related to theories of intrinsic motivation (Dominika Glogowski)
  - We learned about and discussed together issues and topics related to theories and practices of embedded cognition (Alejandro Villanueva)
- **Topic 3: Climate change, social transformation, and inner transformation (March 19, 2021):**
  - Climate change and social transformations (Guido Caniglia)
  - Arts and intrinsic motivation (Dominika Glogowski)

### **I-7.6 Phase 3: Co-design of arts-based interventions and the virtual exhibit**

The process of co-design of the arts interventions started in later March and took place over different online meetings as well as some in person meetings. The team decided to focus on two art-science interventions that would embed the conversations in Phase 2. Two main teams were created with Francesca Aldegani and Alejandro Villanueva working on what would then become HOMONEXUS (see: I-8.3 for a detailed description) and Ida-Marie Corell and Lindsey Nicholson working on GLACIER NEXUS (see: I-8.4 for a detailed description). Work on the two art-science interventions was complemented by the generation of [the ClimArtLab website](#) and the curation of ClimArtLab final exhibit (see: I-8.1 and I-8.2), both led by Dominika Glogowski.

### I-7.7 Phase 5: Reflection and theory co-development

The theory development accompanied the overall collaboration process. This process was also emergent and open-ended rather than predefined along some methodological priming through deduction or theory testing. Especially it followed a mutual learning approach based on cycles of inputs, interventions, and reflections. Four are the main phases in which the project from a theoretical perspective, which accompanied the 5 main phases of the overall transdisciplinary process:

- **Phase 1:** Inputs and discussions during the workshops
- **Phase 2:** Design and interventions
- **Phase 3:** Reflection questions
- **Phase 4:** *Theorissage*
- **Phase 5:** Discussing and integrating with the literature

Phase 1 and Phase 2 are described above in relation to the Workshop description and to the design and performance of the art-science interventions.

## I-8 Main Outputs

The main outputs of ClimArtLab align with the main objectives of the project. Especially in relation to the overall arts-science transdisciplinary collaboration as well as in relation to the specific aims of the project related to the main driving question of designing, monitoring, and implementing experimental interventions for climate change aiming to generate inner transformation (and inner transformation/inner motivation).

### I-8.1 Website, Trailers, and Word-video (by Dominika Glogowski)

A website was created to present digitally the main processes and results in ClimArtLab. A trailer summarizing the two main experimental art-science interventions of the project (HOMONEXUS and HOMO NEX US) can be seen here. The video captures the connections that took place across the different participants in the project and had many sources of inspiration beside the ClimArtLab Workshops, especially: R.D. Laing, *Knots*, 1970; Tim Ingold, *The Lines*, 2007; A.A. Milne, *Winnie the Pooh*. You can watch the video on the website. Importantly, the words used in the video by all participants were also re-used in the process of theoretical synthesis at the end of the project (see: I-8.6).



Picture I- 3: The team performing „ClimArtLab- in Sounds and Knots“ (by Dominika Glogowski)

### I-8.2 Virtual Exhibit (curated by Dominika Glogowski)

The final exhibition consisted of a participatory live interventions based on art-science encounters. One installation (HOMONEXUS) and one performance (HOMO NEX US) explored new ways of experiencing the intricate relationships that tie our lives to climate change through nexus thinking, especially through the lens of the water-energy-food nexus. They will also explore the impact of climate change on the nexus and consequently on human livelihoods. The embodied and digitally-mediated experiences aimed to create motivation and agency for critical engagement and action to address climate change and were situated in our hybrid-cyborg lives at the intersection of digital and analogue, virtual and real. The audience was invited to take part in experimental online sessions where we developed together new ways of understanding, inhabiting, dealing and working with climate change.





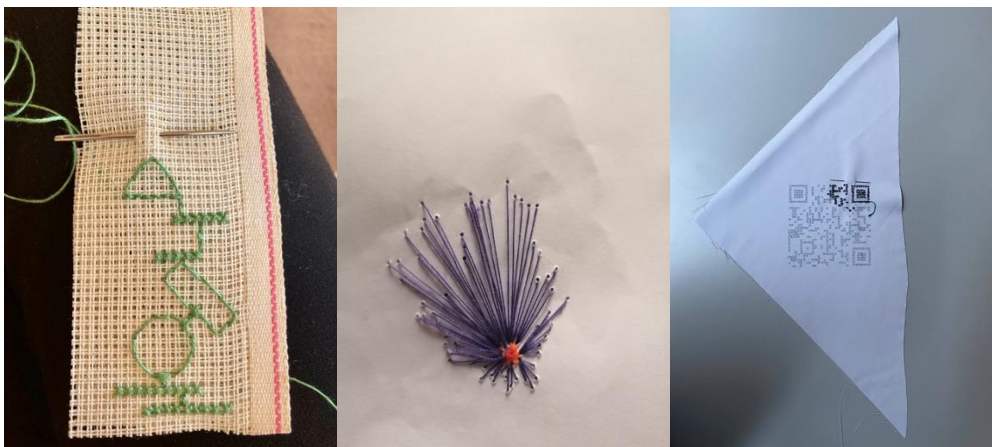
### I-8.3.2 The performance was accompanied by son jarocho (by Alejandro Villanueva)

Son jarocho music is embedded in a music and dance celebration (Fandango) from Southern Veracruz and neighboring regions in Mexico. It takes place in the context of local festivities such as weddings, birthdays, and celebrations of the Patron Saint. Every participant in fandango can join the ensemble of musicians who play son jarocho around a wooden platform on which participants dance. Participants usually play distinct roles during the whole celebration (e.g. playing a musical instrument, singing, dancing, cooking, distributing meals and drinks among the participants, etc.). Furthermore, this musical practice is mostly used, in an implicit manner, as a social device to promote intergenerational encounters among individuals, which in turn foster a strong feeling of social bonding among the participants.



**Picture I- 5:** Image of the online Homonexus installation (from May 11)

The audience was asked to participate to the performance by actively practicing the embroidery activity in a virtual and digital collective conversation. The audience could then send them to the organizers through the website.



**Picture I- 6:** Examples of embroidery from the audience

HOMONEXUS is formally made by all the conversations, exchanges and confrontations the team fronted during these three intense months. All these information were manually transferred on the

textile sculpture, through the use of different, collected, and recycled materials, sewing abbreviations and acronyms from the digital language (CYS, B4YKI) and creating what can be considered a kind of totem, in which beliefs, mistakes, methodologies, misjudgments, wishes and targets in relation to the complicated topic of climate change and water-energy-food nexus are included.



**Picture I- 7:** The textile sculpture HOMONEXUS at the Konrad Lorenz Institute for Evolution and Cognition Research (Francesca Aldegani)

#### **I-8.4 GLACIER NEX US: A performance by Ida-Marie Corell and Lindsey Nicholson**

GLACIER NEX US is an embodied glacier performance that critically engages and interweaves glaciology and climate sciences with themes of personal and zoom identity, pandemic technocracy, patriarchy, disturbance, and social change. In its central part the performance consisted in a dialogue between a glacier and a glaciologist.

##### **I-8.4.1 Description of the performance (by artist Ida-Marie Corell)**

This text was generated by artist Ida-Mari Corell during the process of the performance design.

*The ClimArtLab workshops inspired me to bring my focus to themes like - identity, glaciers, post pandemic technocratic characters and contemporary "material": such as nothing, zoom, isolation, climate change ... I usually observe a certain kind of ignorant behavior when it comes to art/culture and climate change and change in general: working with the same methods an artist is criticizing is counter productive - so here is my take on it.*

So I will continue to work with whatever is available for me right now, materialistic and philosophically and also bring the focus to the insanity of material usage (production and trash) in the traditional patriarchal art market. What is left for me right now for our project is: “zoom”, “disturbance” and “nothing”.

I developed a “just online Destructed Identity”... a character created by the zoom technical filter disturbance caused by using the background filter purposely wrong... pointing to the ever weak position of humans within their own developed (god-like) technology “I am not a cat”, “Your muted”, “Can you hear me?”, “Can you see me?”... I will “be” that Identity for the time of the colloquium and the online exhibition and also - if of interest - show my video which I am working on right now to my song “Born by the sea”. I will perform as this Identity using different glacier photos from Lindsay Nicholson to merge with as my virtual dress-mask as my “Disturbed zoom Identity” projected to a screen somewhere at the KLI - people can engage with me via zoom.

With this work I would like to philosophically tap into the questions of - who am I today? Who will I be tomorrow? Will I be tomorrow? Climate Change, pandemic withdraw from physical engagements, patriarchy, modern humanity for a pharmacistic safe Technocracy.



**Picture I- 8:** The GLACIER NEX US performance: Zoom dialogue between a glaciologist (Lindsey Nicholson on the left side) and a glacier (embodied via zoom by Ida-Marie Corell) during the exhibition.

#### I-8.4.2 A mantra for the glaciers

As important part of the performance consisted in singing a mantra that was also then performed online outside of the participatory experience of the exhibit. You can watch and experience the mantra [here](#). The script of the mantra is by Ida-Marie Corell using sanskrit words about the snow and cold of a glacier and is human experience:

śīna शीन (ice)

śītala शीतल (cold, cool, cooling)

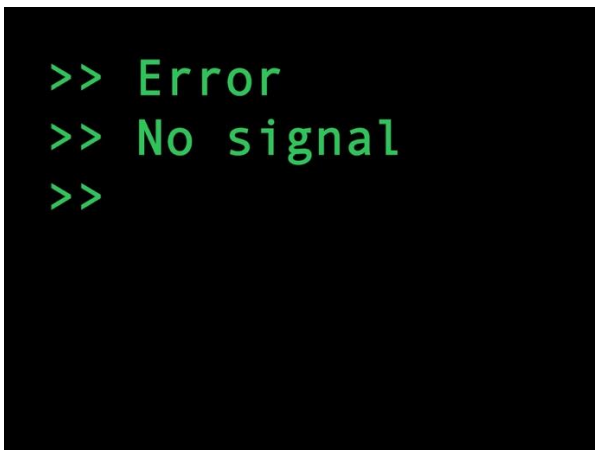
haimana हैमन (relating or belonging or suitable to winter, wintery, wintry, cold ...)

pruṣvā प्रुष्वा (a drop of water, hoar-frost, ice)





**Picture I- 9:** Images of the embodiment of a glacier through „virtual identity disruption“ (by Ida-Marie Corell)



**Picture I- 10:** The Glacier disappeared in a digital and technological world

#### **I-8.5 Preliminary insights from the Assessment of the transdisciplinary collaboration process**

The assessment of the transdisciplinary collaboration in ClimArtLab focused on four axes: (i) the collaboration process between artists and scientists; (ii) the conceptual aspects explored during this collaboration; (iii) the exhibitions that emerged from the art-science interaction; (iv) the technological aspects related to the isolation measures due to COVID-19, and; (v) the epistemological issues pertaining to the merge of distinct paradigmatic fields, such as imagination and creativity as heuristics for scientific understanding for climate change.

Although this assessment is still under development, some preliminary insights point us to the potentials of the aesthetic experience especially for the access and decolonization of scientific knowledge. In order for scientific knowledge to become accessible and foster actions for transformation and behavioral change, a paradigmatic shift is required. The study of the transdisciplinary collaboration in the ClimArtLab is contributing to a better understanding of ways in which scientific knowledge can be socially disseminated beyond the highly specialized propositional formats that are usually used by scientists, be it numbers or graphs, which are detached from the way individuals experience their daily

life. Rather, this assessment helps to find concepts and modalities to de-colonize the science-society interface to restore continuity between scientific data and information, on the one hand, and people's everyday experience, on the other hand. In a way, this assessment is currently shedding light on how scientific methods can be put back in touch with human daily life experiences through the arts in ways that make it internal and not external to such experience. In this sense, using experiential and embodied approaches to scientific knowledge has the potential to contribute to cultivating deeper and more meaningful relationships between science and society.

### I-8.6 Preliminary insights about theory building

The final event of ClimArtLab after the online exhibit was a *Theorissage*, say a structured process of reflection on the main theoretical contributions that had emerged throughout the whole co-production and mutual learning process. Before the meeting, all participants were asked to answer the following question in written form:

„Premise 1: Keeping in mind that: The questions that drive the ClimArtLab are: How can we as individuals and society step away from fear and take responsibility for our mess? How can we develop intrinsic motivation and agency to address challenges related to climate change? How can artists and scientists work together towards the shared goal of supporting regenerative futures in times of climate emergency?“ (ClimArtLab Website)

Premise 2: And also keeping in mind that: We made use of theories of intrinsic motivation and embodied cognition (mobilized complexity theories and nexus approaches (e.g. water-energy-food nexus), explored the relationships that tie our lives to a warming climate, and used embodied experiences to shape and reflect upon our hybrid-cyborg lives and intersected the digital and the analogue, the virtual and the real, our bodies and our laptop screens, textiles and QR codes.

Please, answer the questions: *What were the most revealing and eye-opening situations/moments/experiences/conversations you had in the preparation/design or in execution of your artwork? And what was the realization/eye-opener about (especially in relation to Premise 1 and 2)?“*

Relying on the answers, the topics that emerged during the course of the collaboration and that seemed to be essential in generating inner transformation in relation to climate change were presented and then briefly positioned spatially in relation to one another.

First, the main conceptual axes of the project were reminded in white-red clouds as the organizing conceptual axes of the collaboration, i.e. climate change, inner transformation and intrinsic motivation, and nexus thinking. Together with the main themes also the words used to come together through the shared video (see Script in Appendix) were used (green circles). Then the main insights emerged from the reflection exercise ( see white and light-blue circles in Image) were presented as well as some overarching clusters (orange and red circles) around which several of the insights had converged and intersected. The main clusters identified were:

- **Identity and gender** (e.g. fluidity of experiences, intersectionality; climate change affects different genders in different ways)
- **Identity and digital technology** (e.g. screen framed identity of the collaboration via zoom, feeling distant and close through the technology, gaps between real and virtual, virtual shared space for healing and reducing cognitive dissonance; slowing down)
- **Relationship science-society and especially science communication** (e.g. hypocrisy of scientific research using most of the spaces and tools that it aims to criticize; personification and anthropomorphisation of nature, such as glaciers; deadliness of fossil fuels; disconnection between scientific objectivity and personal passion that moves people)

- **Human interconnectedness, inner experience, responsibility** (e.g. difficulty to engage together towards a common goal; organizational capacity of the space; finding a shared common space; feeling the responsibility of what we have done does not imply being able to take responsibility and action; powerful and tricky dimensions of artistic performance; embodied experience can be used to promote different ways of addressing climate change)
- **From WEF nexus to nexus and interconnectedness of human and non-human beings** (e.g., nexus presenting humans as a connecting thread; macro of glaciers and nature and micro scales of human existence and society; slowing down)
- **Experiential knowledge and tacit knowledge**

New insights and clusters were added through the conversation, especially:

- Action-oriented collaboration
- Impact
- Nature
- Process
- Emotions
- Meditation
- Tacit knowledge and implicit motivation
- Reality – Constructs- concepts

Two emerging and central topics were emphasized and became central to a re-organization of the overall conceptual space. The two new organizing themes (in the yellow circles) were *learning and error embracer*. An existing theme emerging from the Word Video script *Bring the dirt back!* was reinforced and made red. A triangle was organized across the three new themes (through the white tape) representing a potentially new way of considering the dimensions that need to be embraced when addressing issues of climate change and inner transformation. Words were also discussed as the main sides of the triangle and written down, especially: *intuition, unlearning, experiencing*.



**Picture I- 11:** Image 1 shows the first report of the main themes emerged during the mutual learning process of ClimArtLab. The main conceptual axes of the whole process are presented in white-red clouds (i.e. climate change, inner transformation and intrinsic motivation, nexus thinking). White and light-blue circles present insights from the conversations and exchanges during the whole collaboration. Orange and red circles present some main conceptual clusters that emerged during the whole process (e.g. digital technologies and identity).

Image 2 shows the final elaboration from the group, including insights missing from the previous list (in white and blue), new clusters (in orange and red), overarching topics (in yellow), as well as an overarching and emerging connection (through the white tape).

Insights gained through these exercises are being integrated and discussed in view of a publication dealing with lessons learned about themes and topics that can be used to create inner change and transformation in relation to climate change beyond nudging and scaring.

## I-9 Recommendations

Our recommendations emerged from the workshops and discussions as well as from reflections following the art-science interventions. These recommendations are directed both to those leading institutions, from university and funding agencies to political bodies, that have as part of their mission the aspiration to contribute to addressing climate change also through research. Indeed, whereas we deem important to speak to the world of policy, we also think that in order to academic research to be relevant for our societies in addressing climate change, it is also important to make clear to research institutions, that it is important to reward and create the conditions for inter and transdisciplinary research, which is necessary to be able to tackle the complex climate emergency we are currently in.

### I-9.1 Create conditions for inter and transdisciplinary research on climate change

If we want our research institutions to contribute to addressing the climate emergency, it will be important to foster and support collaborative experimentation and mutual learning that involve multiple kinds of knowledge. A central mission of research institutions should be to contribute to creating the internal (inside academia) and external (within the broader society) conditions for collective processes of knowledge generation, learning and change. This might require to transform the governing principles of research institutions and careers while embracing the challenges of sustainability transformations not only outside, towards society, but also inside, within such institutions.

### I-9.2 Consider the arts and the sciences in plural on both sides

There is a tendency to privilege the knowledge on climate change generated in the natural sciences. Most arts-science collaborations engage with climate and earth-system sciences and neglect the potential of the social sciences and the humanities. However, our understanding of individuals and societies is fundamentally informed also by works from the humanities and from the social sciences. When thinking about art-science collaboration, these fields play an essential role also because they can help connect and modulate the way in which we can deal with different understandings and perspectives both within academic research and between the world of research and society. In our experience both cognitive science and philosophy, for instance, played a fundamental role in the creation of art-science performances and installations that could match the complexities of the challenge addressed in *Evolving Futures: Owning our Mess*, namely to learn how to engage with deep layers of human life and foster inner change and transformation.

### I-9.3 Do not use the arts, but engage with artists to unleash the potential of aesthetics

There is often a tendency to look at the arts instrumentally as means and approaches for communication of existing scientific results. However, this attitude relies on an underestimation of the potential of the arts to contribute to redirecting and inspiring further research as well as to creating societal change and transformations. Also, especially in the context of projects that aim to understand how to generate inner change and transformation and empower people to deal with the climate emergency, it will be essential to be able to conduct collaborations with arts-based practices that can engage deeper layers of people's life. It is only by engaging, for instance, with the emotional life of people, that intrinsic motivation can be triggered and fostered.

### I-9.4 Provide time and financial resources needed to include societal actors

If we want to contribute to generating change and transformations also by building societal capacities through inter and transdisciplinary research collaborations at the art-science interface, it will be important to provide adequate time and support for the development of such collaborations. The current time span of research funding is not adequate to support engagement of diverse actors using different kinds of knowledge and ways of knowledge as well as belonging to different value systems. Art-science collaborations could be extended to include other societal actors and stakeholders, for

instance from the industry or representatives from different communities and societal sectors, especially the most vulnerable and people more heavily affected by climate change. However, this would require to provide opportunities and funding that go beyond what is often currently supported through research funding lines.

## I-10 Conclusions

The questions motivating and driving the project *Evolving Futures: Owning our Mess in ClimArtLab* were: How can we as individuals and society step away from fear and take responsibility for our mess by developing intrinsic motivation and agency to address challenges related to climate change? And how can art-science interventions help in generating motivation and agency for change? Through the transdisciplinary collaboration we made use of theories and practices from many scientific and artistic fields in order to start elaborating an answer to this question. Through theories of intrinsic motivation and embodied cognition as well as through complexity theories and nexus approaches to climate change and in climate science, we generated artistic installations and performances to explore the relationships that tie people's lives, their motivations and habits, to a warming climate. The process of designing art-science interventions, the exhibition, and the reflections afterward generated insights about how to design and monitor mutual learning and knowledge co-production process between artists and scientists as well as about the complexities involved in any attempt to generate inner change towards sustainability. The work in ClimArtLab could be extended both on the research and on the societal side, in order to contribute to discourses and interventions related to climate change. On the research side, future work within the framework of a ClimArtLab could then engage with approaches, for instance, from environmental psychology to better understand whether or to what extent transformations is actually generated and what would be the conditions for the generation of this change in different sectors of the populations. On the societal side, the art-science collaboration could be extended to include other societal actors and stakeholders, for instance from the industry or representatives from different communities and societal sectors, especially the most vulnerable and people more heavily affected by climate change. In this way, it might be possible in the future to contribute to generating change and transformations also by building societal capacities through inter and transdisciplinary research collaborations at the art-science interface.



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## I-12 Appendix 1: Scripts

### I-12.1 Glacier Nex Us: Script

#### Introduction

- Glaciologist: Hello there! Thanks for joining us today. I'm Lindsey, I'm a glaciologist, which means my job is measuring glaciers and how they are changing. And as I can't exactly take you to a glacier, I'm just going to dial in to my glacier (my glacier!). Are you there? Can you hear me?
- Glacier: Hello - hiiii - thank you for inviting me!
- Glaciologist: Nice that you join us for a chat!

#### Act I

- Glaciologist: I remember the day when I first really heard you was a really warm one. I'd hiked up the valley with a heavy bag, probably head down, thinking of how to get all the things done in a day ...
- Glacier: Your red face, panting towards me... and that big back pack you always carrying... I was wondering what are you up to this time... I liked it to see you struggling to climb up the steep parts...
- Glaciologist: Ha! That's a bit mean! .. but anyway, when I got the first glance of you I was shocked, everything looks so different each time, and usually ... sorry to say ... not good.
- Glacier: ...when Lindsey is puffing up the hill she is always wondering what happened - every time. I can tell you what happened: we had some soft snow, then a heat wave, again, followed storms of biblical proportions (a human might say...) but she only comes when its nice weather of course
- Glaciologist: Well quite. And in the lovely sunshine I started measuring the stakes that are drilled into the ice to see how much it changed since last time, and at these first stakes it looked like a mess, more dirt left than ice ....  
Glacier: .... always looking at my scraggy edges. sometimes I really wonder what scientists are here for...
- Glaciologist:... I measured a thinning of about 4m since last time, which was only a month or so before ...
- Glacier: If she just could hear me, I thought, I could tell her how much really melted... like - 3,98m. As far as I have understood the scientists work, its all about nanometer, millimeters, centimeters....
- Glaciologist: I guess sometimes yes ... Like for example, on that day and that I was super focused on finding out how much ice was left at that part, when it would be lost completely ... I was using a radar device, and I was quite stressed laying out all the cables and setting up the battery and computer and all as I wasn't sure I could use all the gear correctly - I'd only been shown how to do it once before. Anyway it puts radio waves into the glacier, and they bounce back off the bed of the glacier and then you can calculate how thick the ice is from how long it takes the echo of the signal to return ...
- Glacier: These instruments are "cold" and tickling...
- Glaciologist: Ah yes sorry about that. Anyway the measurements showed you were super thin at that point, only 10m or so left, and I thought "That'll be bare ground by next year, or maybe almost by next visit". Although I know you're melting away, its still kind of startling to really measure you disappearing - and actually in this case I thought I might have made a mistake.
- Glacier: Ha, that's why you took so long there!, Fiddling around, you must have measured it over and over ... Crazy you measure poke and prod me to decide if its 5 years or 7. Makes little difference to me, if its going to be gone anyhow! And I remember thinking - what are you

even doing here? ... Isn't it counter productive? Your driving here "melts" me down, what are the numbers again?

- Glaciologist: Ah, yes that study I told you about .... that calculated that 1km driving in a car will ultimately melt 15kg of a glacier somewhere by the end of the century ...
- Glacier: Yes, so your drive here to measure the melt that you partly cause with your driving here ... I don't really get it. So, I thought what would you do with all the D\_A\_T\_A\_?? I got a little bored looking at her measuring over and over and I started to sing my mantra - its my Prayer for the cold... The Cold Mantra... or the Glacier Mantra.
- Glaciologist: ... and as I was sitting there doubting my measurements, suddenly I could hear you properly for the first time
- Glacier: Do you want me to sing it now? Together?
- Glaciologist: Okay, well I'm a bit embarrassed, but I'll do it for you.

### Act II

- Glacier: My words are sanskrit words about the snow and cold of it:  
 śīna शीन (ice)  
 śītala शीतल (cold, cool, cooling)  
 haimana हैमन (relating or belonging or suitable to winter, wintery, wintry, cold ...)  
 pruṣvā पृष्वा (a drop of water, hoar-frost, ice)

### Act III

- Glacier: Oh you ARE beautiful.
- Glaciologist: What, me??? Well thank you, but what is beautiful about me?
- Glacier: Your commitment, your tiny face, your interest...
- Glaciologist: I find that funny, I think you are so much more beautiful.
- And also, there is such an elegant patience to you glaciers.
- You've been here so long, and taken so long to shape this home of yours ...
- Glacier: It feels Long to you, but not so long to me honestly, but true, there have been many phases in constructing this "amphitheatre" of mine -
- Glaciologist: ... and now it seems humans are driving you out
- Glacier: But actually from my perspective everywhere is home to me, I just quite liked this spot for a while, so I won't say you are driving me out of my natural habitat, but you're pushing me to a different place, and maybe closing the door behind me.
- Glaciologist: So no coming back like the times before?
- Glacier: Ja all this burning of dead substances, which I absolutely don't get, why burning dead material when having so much living "technology"?? Yeah, push me out, but for a love of coal? Petroleum? But petroleum?? None of us would have guessed that you humans really started to dig out that slimy, black, kleepy mass of the dead...
- Glaciologist: But the thing is we, I mean us people, we always want more.
- And oil was a game changer: I read that 1 barrel is like 100 days of horsepower work, and now we burn close to 100 million barrels a day.
- So we took that chance and you're just the "collateral damage"
- Glacier: But instead one can harness Energy out of almost everything, out of living things par exemple you are Energy, I am Energy .....
- Glaciologist: I've heard people talk of oil as 'ancient buried sunshine', so burning it is a form of cheating the system: We burn in a day what might have taken millenia to make.
- I guess it seemed too good to be true, and maybe it is.
- Glacier: But you even have a title for this natural connectivity that you tend to ignore ... don't you call it now Nexus Thinking? To describe that water, food and energy, in fact all the things, are dependent on each other?
- Glaciologist: Well, yes, and it seems obvious when I'm observing you in your place, and how it all changes together over time, or co-evolves.

- Glacier: ... and then people also put all this emphasis on linear time and growth. If you want to give us a label of that kind, we are circular, in fact you folks could try thinking more in cycles, some giving back as well as taking. Look at all the things that cycle through me ...
- Glaciologist: That seems true about a lot of things - do you think we are getting better? I mean talk of the circular economy is getting to be a big deal no?...
- Glacier: Oh nooo - not this again - economy is already the problem - just circular... why adding this shady word?
- Glaciologist: But isn't it a step in the right direction? I know what you mean, but sometimes I don't know if I should be optimistic or pessimistic.

#### Act IV

- Glaciologist: What I do know is that, when I'm with you I always want to stay.
- Its very peaceful, but exhilarating at the same time.
- Why not, just do it. You people are always wishing for things but not doing...
- Glaciologist: But I always have to go back, theres all these things I'm supposed to do
- Glacier: Oh like what, does it matter so much? You should learn how to breathe ... when I was stationed in Ama Dablam, my home btw, many monks stayed with me for nights and days wearing not more then their red robes, just sitting with me ... a real visit.
- Glaciologist: I should definitely try this before you're gone.
- Glacier: There you go again, wishing I'd stay but not doing anything about it Anyway,
- I'll be snowing down in Kamchatka, or lapping the shores of a beach in Indonesia, I doubt you'll be thinking of me at all ... or if you are you can come and swim with me.
- Glaciologist: But seriously, I wonder what it will be like in your valley in 20, 50 years
- Glacier: Well I know that below my sister Pasterze is a green meadow waiting for future cows to come and graze ....
- Glaciologist: Nah, I don't mean that, I know that. But I mean I wonder how will it **feel** different, you know, without you? I see whats happening to you and I feel .... a kind of grief already, so what will it be like when you are finally gone?
- Glacier: Will you come here when I'm gone?

#### Act VI

- Camera OFF with 'no signal'
- Glaciologist: Looks like we've lost her. Hello, can you hear me? Hello? She's gone. Well, what a metaphor for the real world. So I guess we can go back to that main room ...

End

Francesca	Says	Normal 1 sec beat	Touching
Luana	Says	Normal 1 sec beat	Attaching
Lindsey	Says	Normal 1 sec beat	Connecting
Alejandro	Says	Normal 1 sec beat	Relating
Guido	Says	Normal 1 sec beat	Slowing

IM	Says	Normal 1 sec beat	Tying
Dominika	Says	Normal	The knot
		Pause 1 sec	
Speaker	Action	Pace	Text
Dominika	Says	Normal	A Thread
		Pause 1 sec	

## I-12.2 Word video script

Guido	Says	Normal	Piercing
IM	Says	punctuated	Stitch
Francesca	Says	Punctuated (accentuation on „Cross“)	Cross-Stitch
Alejandro	Says	Normal	Lines
Luana	Says	Normal	Straight lines
Lindsey	Says	Normal	Straight lines are ubiquitous
Dominika	Says	Normal	Pattern
IM	Exclaims	Exclamation	Curve the lines!
		Pause 1 sec	

IM	Says	Normal	Dissonance
Francesca	Says	Normal 1 sec beat	Rejecting
Lindsey	Says	Normal 1 sec beat	Abstracting
Luana	Says	Normal 1 sec beat	Disconnecting
Dominika	Says	Normal 1 sec beat	Fragmenting
Alejandro	Says	Normal 1 sec beat	Deducting
Guido	Reads	Normal in a 1 sec rhythm	Simplicity – complexity – simplicity – complexity
Lindsey	Exclaims	Exclamation Interruption	Feedback!

		Pause 1 sec	
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Francesca	Says	Normal 1 sec beat	Depending
Lindsey	Says	Normal 1 sec beat	Growing
Luana	Says	Normal 1 sec beat	Expanding
Guido	Says	Normal 1 sec beat	Expanding
Dominika	Says	Normal 1 sec beat	Expanding
Alejandro	Says	Normal 1 sec beat	Reflecting
IM	Exclaims	Exclamation	The heat!
		Pause 1 sec	

Luana	Says	Normal (slower)	Sensing
Guido	Says	Normal	Crackling
Francesca	Says	Normal	Melting
Alejandro	Says	Normal	Splash!
Lindsey	Says	Normal	Think it over, think it under!
Dominika	Says	Normal	Feel connected!
Francesca	Says	Normal	Feel effective!
Guido	Says	Normal	Feel the choice!
IM	Exclaims	Exclamation	Bring the dirt back!
IM	Inhales and exhales loudly	2 sec	--- no txt ---

## I-13 Appendix 2: Pre and post-assessment questions

### I-13.1 Pre-assessment questionnaire

Guiding lines: with this questionnaire we intend to learn how you are in the process of approaching the transdisciplinary collaboration in the ClimArtLab. There are no correct and incorrect answers. If you have any questions regarding the content and meaning of them please feel free to contact us.

- Do you identify your profession as: ... ..
- What are the methods and processes you usually work with?
- Have you had experiences with interdisciplinary collaboration before?
- If you answered yes in the previous question, can you give examples of these interdisciplinary collaborations?
- Have you ever engaged in art-science collaboration?
- If you answered yes in the previous question, can you describe your role in these collaborations?
- How would you describe your art-science collaboration experiences? (You can use 5 words to describe)
- Have you ever engaged in projects about climate change?
- If you answered yes in the previous question, can you give us examples of your experiences?
- When you think about climate change, what comes to your mind?
- When you think about good actions/strategies to address climate change, what comes to your mind?
- If possible, list 5 other issues that can be relate to the complexity of climate change.
- If you had to explain to someone what is climate change in one sentence, what would you say?
- What are your expectations for the ClimArtLab Collaboration?

### I-13.2 Post- assessment questionnaires

Guidelines: With this questionnaire we intend to know how was your experience in the ClimArtLab. The idea is to understand how your background and working processes were applied at the ClimArtLab. There are no correct and incorrect answers. If you have any questions regarding the content and meaning of them please feel free to contact us.

#### Collaboration process

- Can you give 5 words that describe the ClimArtLab for you?
- Do you think your expectations for the ClimArtLab collaboration were fulfilled?
- What would you say were the strong and weak aspects of this arts-science collaboration?
- Were there any challenges in communicating with/understanding the others? If yes, can you give examples and how did you overcome them?
- What are the lessons you learn from this art-science collaboration? List the three main important ones.
- Do you think you will use any lessons you learnt from this collaboration in your professional life? If yes, how? If not, why?
- If you have the opportunity to go through this exact same ClimArtLab once again, what would you like to do differently?
- What do you think were the positive and negative aspects of the fact that most of the ClimArtLab took place mainly online in virtual format? How did this affected the artwork you took part?

**Background knowledge and skills**

- About your skills and knowledge, did your working methods or processes had to change for this collaboration? If yes, can you describe to what extent and how?
- Did you need to make use of imagination for this collaboration? If yes, can you indicate when and why?
- Do you see yourself as a creative person? How is creativity part of your professional activities? In other words, how do you make use of creativity in your work? Do you have a strategy for using creativity?
- Were there any challenges for your creative process? If yes, can you give examples?
- It is usually said that there is a gap separating arts and science. How do you feel about it? Do you think there was a clash between the styles of thought in arts and in science in this interaction? Can you point them out and explain why?
- How do you think your skills and knowledge contributed to the art-science intervention (HOMONEXUS and GLACIER NEX US)?

**Artwork, aesthetics, and epistemology**

- Besides the inputs about Climate Change and Water-Food-Energy Nexus provided during the workshops, where do you think your inspiration came from? Or in other words, what inspired you in the arts-science intervention you were involved in (HOMONEXUS or GLACIER NEX US)?
- What was the experience (motivation/feelings/sensations) that you aimed to provide for those that took part in the arts-science intervention you were involved in?
- Do you think your way of looking at and conceiving of climate change has changed after this art-science collaboration? if answered yes, how do you think it changed? Can you give an example? If not, why do you think this is the case?
- In what ways do you think aesthetic experiences, in general, can give a better gras of scientific contents?
- Do you think people are more motivated to change behavior when having a positive aesthetics experience or a negative aesthetic experience? Why? Which one do you think your artwork provided?



## I-14 Appendix 3: Consent form

Consent form used by participants to allow for the use of data for the assessment of the transdisciplinary collaboration process.

### *Informed Consent Form to take Part in Research*

This informed consent form is for artists and scientists involved in the *ClimArtLab Evolving Futures: Owning our Mess*, who we are inviting to participate in this qualitative research that is part of the postdoctoral project titled *Ecological Understanding as key to Improve Sustainability Sciences*, developed by Dr. Luana Poliseli and supervised by Dr. Guido Caniglia.

#### **Part I: Information Sheet**

I am Luana Poliseli and I am a postdoctoral researcher at the Konrad Lorenz Institute for Evolution and Cognition Research. The purpose of the abovementioned research is to understand how different experts engage, interpret and communicate knowledge about the impacts of climate change and ways to address it locally. The findings of this project will inform ongoing debates about global challenges and new strategies to tackle such issues. You do not have to decide today whether or not you will participate. Before you decide, you can talk to anyone you feel comfortable with or get in contact to clarify further doubts through [luana.poliseli@kli.ac.at](mailto:luana.poliseli@kli.ac.at) or +43 2243 302740.

Climate change is one of the most challenging global problems nowadays. We want to find ways to address this issue and we believe that you can help us by telling us what you know both about climate change and about the scientific and non-scientific ways of tackling it. We want to learn what scientists and artists know, and how they can act and interact to develop strategies for dealing with this specific global challenge. We also want to know more about art and science processes and methods because this knowledge might help us to understand how new strategies can add into dealing with climate change.

This research may involve your participation by means of semi-structured interviews, questionnaires and group discussion. All of them recorded through audio, video and/or photographs. In addition, I will also be conducting participant observation. This means that with your consent I will be participating in activities while observing, if needed. This will include participating in the workshops and co-creation process as observer.

You are being invited to take part in this research because we feel that your experience as artist or scientist can contribute much to our understanding and knowledge of new strategies to deal with global challenges.

Your participation in this research is entirely voluntary. It is your choice whether to participate or not.

#### **Part II Certificate of Consent**

- I [*insert your name*] voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand the participations may occur through questionnaires, forms, interviews, video, audio and photograph recordings.
- I understand that I will not benefit directly from participating in this research neither receive any financial amount for this participation.
- I agree to have the workshops recorded through video, audio and photographs.

- I understand that my identity will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- I understand that disguised extracts from my interview/form/communication may be quoted in conference presentations and published papers.
- I understand that signed consent forms and original recordings will be retained in the server of Konrad Lorenz Institute with limited access by Luana Poliseli and Guido Caniglia until the results are academically published.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

Therefore, I have read the foregoing information and I consent to be a participant in this study.

*[insert date and City]*

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*[Participant's name]*

Klosterneuburg, AUSTRIA, 22.2.2021

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Luana Poliseli  
*Postdoctoral Fellow KLI*

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Guido Caniglia  
*Scientific Director KLI*