10 Sensing and making sense of emergent BioEthos using futuring games

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Abstract††
This chapter builds upon the premise that a multiplex of shared and divergent Bio-Ethos – models of what would be a 'good' relationships among humans and other living beings – inform the actions humans take toward living nature and ecosystems. Global Warming and Environmental Change demand from people and our societies new ways of existing as part of living ecologies on this planet. In this setting, the Bioeconomy and Justice Project (BioEcoJust) aims to explore ethical troubles that could arise in the development of a global, pervasive, and dominant bioeconomy. This chapter demonstrates how a role-based futuring game piloted in the Bioeconomy and Justice project supports people in 'sensing and making sense' of emergent BioEthos. It presents and analyses the outcomes from the BioEcoJust Game session held at the 2019 World Futures Studies Federation Conference in Mexico City. The conceptual framework applied in the game interweaves theories of complexity, futures literacy, and scenarios as worldmaking, and operationalizes sensemaking tools developed in the earlier stages of the BioEcoJust project including BioWorlds, bioeconomy socio-technical domains, the Human-Nature-Technology triangle, and BioEthos. The BioEcoJust Game pilot in Mexico City enabled its players to explore and critically assess the nuances and dimensions of an ethically troubled future situation and produce a new BioEthos which could be helpful to a unique set of roles for engaging the situation. While much of the literature concerning bioeconomy is concerned with the technical or social factors which can contribute to its development, little attention is paid to what larger ethical frameworks can support its just and fair evolution. The BioEcoJust Game emphasised 'keeping whole' the created worlds of a variety of roles responding to an imagined future situation and focused the participant's attention on the interface between assemblages of persons and their bounding conditions. The BioEcoJust Game can serve as a model for futuring games designed to help people develop skills for sensing and making sense of emergent BioEthos so they can apply these skills to develop a more just bioeconomy.

"The Greek equivalent of translatio is metaphora. Both mean 'carrying across'. Metaphor is not a momentary conjuring trick turning something into something else in a single poem, but an act of translation, of seeing the world otherwise, which lies at the core of creativity."

–Ruth Padel, *Silent Letters of the Alphabet* (Padel 2010)

BioEthos inform our actions toward Earth's life

What people consider to be good vs. bad, right vs. wrong, desirable vs. undesirable in terms of their own effects and impacts upon living nature and Earth's ecosystems varies across different groups, and changes over time. The continuous transformation of these kinds of normative views concerning how people should act toward living nature are what we call in this chapter and our research *BioEthos*. There is not one BioEthos, but many. Together these BioEthos generate a broader field of globally acceptable normative views on what is right or wrong for humans to do as part of nature. These views of how BioEthos interrelate to human action are the starting premise for the game-based futuring experiments described in this chapter.

From the view of humans as a 'superorganism', our consumption patterns are far out of alignment with what the overall ecology of our planet can provide (see, eg, Hagens 2020). For we humans on Earth, our overall conditions are changing and our deeply held values and beliefs are being unsettled and becoming something yet to be known (Berzonsky and Moser 2017). Global Warming[1] and Environmental Change (GWEC) are accelerating these planetary and societal transformations. Several systems of human pressure drive GWEC and one of the most significant is land-use for human habitat and resources (Geldmann et al. 2014; Masson-Delmotte et al. 2019; You and Yang 2017). It would seem obvious that people ought to do something to address the GWEC that is already occurring, but we humans are many, with varied views, levels of influence, and priorities. Determining which are the most ethical actions to take when confronted with the transformations and surprises GWEC is bringing us – and will bring us over the long-term—are not as obvious, clear, or widely agreed as they may at times appear.

We propose BioEthos as a key tool for thinking when inquiring into how ethics-shaping bounding conditions could develop, emerge, trigger, and inhibit alignment of human actions to address the many ethically difficult situations arising from GWEC over long time horizons. These BioEthos are dynamic and context-specific

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[1] At time of publication Climate Change is the going term for the phenomena of humans increasing the Greenhouse Gasses in our atmosphere and thereby changing the radiating forcing dynamics of the planet so that its global average temperature is increasing. To describe this larger situation as clearly as possible, we intentionally use here the older term for this phenomena, Global Warming.

patterns held by people concerning 'what is good' for our relations with each other and the rest of Earth's life. On an individual basis, these models inform behaviours and actions, which ultimately culminate as larger scale impacts on our ecosystems (e.g. human pressure, land degradation or restoration, biodiversity preservation or loss, etc). We add to the above described dynamics those that manifest from imagined and actualized developments and impacts of technology.

This concept of BioEthos is used in our research as a heuristic and sensemaking tool in the Bioeconomy and Justice Project (BioEcoJust).[2] This research setting aims to identify ethical concerns which could arise between now and 2125 assuming a global bioeconomy – characterized by bio-driven processes to provide humans with materials, chemicals, energy, and services – takes form and becomes dominant during that time period. The multiplex of emergent BioEthos and their interactions are the 'beating heart' of our research approach which focuses on developing tools to guide ethical considerations of policymakers and decisionmakers. How any particular formation of varied BioEthos could develop over the coming century has risen out of our research processes as a key question. In our view, actors who aim to address GWEC by growing the bioeconomy perceive and respond to the ethical challenges of their endeavours based on BioEthos they believe.

This chapter presents and analyses the outcomes of a role-based futuring game that operationalizes a set of our research project's sensemaking tools with an emphasis on the BioEthos. The *BioEcoJust Game* aimed to enable the gameplayers to explore and find their way through potential ethical troubles in the rising bioeconomy. We begin by presenting the key concepts which inform the game's design and follow by describing how the BioEcoJust sensemaking tools are in the design of the game. To demonstrate how the game functioned, the key outcomes of the game are presented and lightly analysed, culminating in an account of New BioEthos produced by the gameplayers during their session. Then, the relevance of this experimentation with 'sensing and making sense' of emerging BioEthos to the field of futures studies and bioeconomy developments is discussed. The chapter concludes with our assessment of the potential value of the BioEcoJust game as a kind of role-based futuring game can bring to the ethicality and justness of a rising bioeconomy.

Complexity, Situations, Worldmaking, Sensemaking and Ethos

The design of the BioEcoJust Game corresponds with a conceptual framework built from our theoretical understandings of complexity, situations, worldmaking, and ethos. At a high-level, this framework sees situations as entanglements of networks of complex systems which involve actors (e.g. people taking various roles), agential components (e.g. built environments, human infrastructures, forests), and time-bound moments of transformation (e.g. events). In these situations, a wide variety of individuals, each one enacting a semi-unique BioEthos in a 'world as it is

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[2] See, https://bioecojust.utu.fi (accessed 24 September 2020).

to them' engage with the challenges and opportunities arising from an ethically troubled situation with larger processes of transformation. To operationalize this theoretical lens, we first need to unpack these massive concepts of complexity and transformation, situatedness and worldmaking, sensemaking, and ethos.

We position our *BioEthos* concept in a complex systems perspective, drawing specifically from the concept of *Complex Adaptive Systems*. In this view, complex systems are comprised of many systems which share some set of overall conditions that drive and contour their behaviour as part of the complex system, while meanwhile these systems produce and contribute to the qualities of those overall conditions. Complexity in our research is understood as multiple layers of multiple networks of people, ideas, materials, built environments, living nature, and the physical world all transforming at differing timings and entangling into many different and geographically distributed nodes.

This understanding of complexity is informed by a framing of the lived experience of the human species as a whole population – a super-organism (cf. Hagens 2020) -- is multi-scale, multi-layered, and multi-local. In order to imagine futures congruent with how people experience living their own lives – as situated selves that are part of this super-organism – our futuring game needs to emphasize perspective-taking and inter-relating assemblages of individuals toward a situation.

Individual humans are diverse in their lived experiences, perceptions, relationships to other people, as well as in their links to networks of ideas, materials, built environments, living nature, and physical landscapes. Goodman (1978) goes as far as to argue that each individual perceives and acts in one's own world, and living one's life is worldmaking. An approach to scenario workshops has been developed based on Goodman's sociological concept of worldmaking, arguing that this new approach is better able to respect and generate insights by allowing for a diversity of many individual worlds to continue throughout a futuring processes, without smashing them into some artificial synthesis (Vervoort et al. 2015).

Sensemaking in our research is taken as an ongoing enacted activity demanded by continual transformation. The biologist Robert Rosen proposed that all life is oriented toward the future as their biological components act toward anticipated outcomes (see, e.g., Louie 2010). For humans, these processes can be conscious, and recent developments in futures studies have placed emphasis on the potential value of developing the capability called futures literacy as a way to widen our perception of our transforming world (Miller 2015). A working definition of futures literacy is 'diversifying how and why we use futures', which means developing skills in switching between whole modes of imagining futures for varying purposes and contexts. Two broad categories of modes are described in the Futures Literacy Framework—and *Anticipation for Futures* and *Anticipation for Emergence*. A key claim by Futures Literacy proponents is that the skill of switching between these two categories of anticipation helps people 'sense and make sense of emergent novelty'. Proponents of Futures Literacy argue skills in *Anticipation for Emergence* are widely underdeveloped and new tools are needed to help people develop such skills. (Miller 2018.)

Because we conceive of BioEthos as continually transforming, varied, and multiple—a dynamic multiplex, we expect there to be emergent and novel forms of them over time. We model these emergent BioEthos as continually popping into existence, some staying and others fading away, some becoming widespread and others narrowly adapted. We posit that these emergent BioEthos are often implicit, changing, and multiple in individuals, organizations, and societies. We have observed, through self-reflection and thought experiments, that in any given single person there can exist multiple BioEthos that are not necessarily coherent (e.g. a vegan race car driver or a hamburger-eating climate activist). Also, in large companies or start-ups, there can, and often are (due to the extractionist colonial legacies of the global economy) conflicts between the normative views of what an ideally 'good' BioEthos should be and how a BioEthos is expressed through actions.

Based on these observations, we imagine a myriad array of overlapping BioEthos is likely to come into being during the long timespan between now and 2125 – some which could remain familiar and others that are surprising and unfamiliar. These BioEthos are today implicit, changing, and conflictual in individuals and organizations, and therefore will likely be similarly so in the future. We have come to realize that if our research project is to produce anything of value to decisionmakers and the general public, it would be unsatisfactory to provide some set of scenarios and ethically correct choices derived from them – rendering us as the 'we told you so' people and them running a risk of making poor ethical choices based on past formulations of what is a 'good' relation between humans and other life. Instead, we have in our workshops focused on developing tools and processes that aim to help people struggle productively in sensing and making sense of potential and emerging BioEthos so they can gain experience doing so. Such experiences would equip people facing GWEC-triggered local and multi-scale situations, no matter their level of power or influence in society, to identify and comprehend the multiple ways BioEthos are arising in various difficult situations, and being invoked by various clusters of people in their attempts to ethically address the situation.

To make such a tool, the futuring game needed to enable workshop participants to engage with our project's understanding of how complexity, situatedness of individuals, worldmaking, and futures literacy are involved in BioEthos without being bogged down by these weighty concepts. This theoretical posture informed the development of BioEcoJust Game and helped us interweave key themes and avenues of inquiry without overly reducing the significant dimension of complexity. These interlinks manifested as the mechanics of the game, which are described in greater detail in the following section.

Game elements and their interfaces to the BioEcoJust sensemaking framework

Prior to our three pilots of the BioEcoJust game, the BioEcoJust project had implemented a horizon scanning process concerning its research themes of bioeconomy and justice. An output from this horizon scanning process is a sensemaking framework we found to be helpful for interpreting and positioning the horizon scanning items we had identified. This framework applied the concept of worldmaking (Bendor 2017; Vervoort et al. 2015) to produce categories of *BioWorlds* to which various actors involved in bioeconomy efforts could be argued to belong (Table 1). It also identified three *Socio-Technological Domains* pertinent to our own research setting in Finland – soil, forests, and algae. The project proposes this sensemaking framework is helpful for interpreting how bioeconomy work is now, while leaving room for what it could become. The sensemaking framework also highlights the multiplicity of views and motives active among people and organizations engaged in the bioeconomy.

Table 1. BioEcoJust BioWorlds and their Descriptions

BioWorld	Description
BioUtility	Technology should make human use of natural resources more efficient.
BioMimicry	Nature is the best source of ideas for making new tech for complex situations.
BioUpgrade	Lifeforms are generally flawed and can be fixed via human-made technology.
BioRecovery	Humans should use all available tech to restore and recover ecosystems.
BioEquality	All living nature should be equally respected for its intrinsic value.

Within our heuristic of BioWorlds, we have applied an adaptation of Actor Network Theory (cf. Latour 2005) to conceptualize normative and ethical views of the development of the bioeconomy as an interrelated set of agential nodes: humans, nature, and technology.

We call this set of nodes the *Human-Nature-Technology Triangle* (Figure 1). This conceptualization serves as a tool for exploring how various groups conceive of what are 'good' interrelations between these nodes (e.g. Humans-to-Technology), as well as to explore dynamics inside of each node (e.g. Humans-to-Humans). It is intended to be neutral in terms of hierarchy – no one node is over another and emphasize interrelations in terms of action – (e.g. what should humans do with their technology to nature?). It is also intended to open questions about how distinct each node really is from the others – for example, an expected use of the triangle is to challenge it with arguments such as 'humans should not be separated from nature, we are a part of nature' or 'all living nature has its own technologies'.

Its origin is from the horizon scanning part of our study in which it helped us interpret normative and ethically oriented views of actors and innovation efforts found in materials gathered through the scanning process. The human-nature-

technology triangle helps untangle and comprehend what a particular person or group of people consider to be 'good' relationships among humans, nature and technology. In our research, this triangle became the dynamical engine that distinguished one BioWorld from another. Later, we coupled our BioWorlds with BioEthos. On its own, the triangle functions as a heuristic for making sense of what BioEthos already exist and what BioEthos could exist.
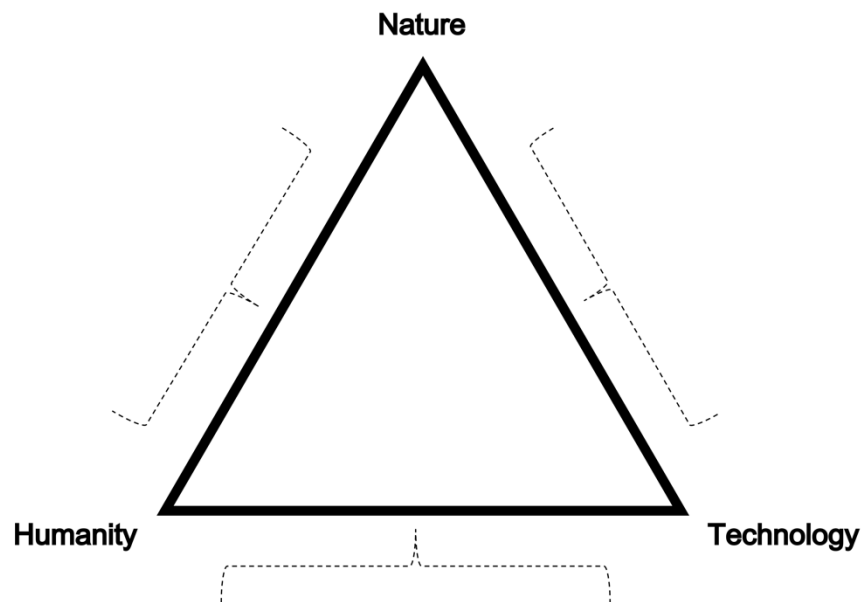

Figure 1. Humanity, Nature, Technology Triangle

The human-nature-technology triangle can also be used to look for impacts of actions taken by people based on their BioEthos. We imagine every BioEthos version of the triangle having a realized impacts version of the triangle. For example, a BioEthos that sees 'humans upgrading nature by applying our technology' as appropriate would produce impacts such as an increased diversity of genetically modified lifeforms entering the ecosystem. Over time, impacts from the multiplex of BioEthos held by various people accumulate into aggregate effects, such as 'human pressure' on wild places; global environmental change (see, e.g., Hamann et al. 2018) ; or anthropomorphic climate change (see, e.g., Cook et al. 2013). In other words, when a BioEthos version of the human-nature-technology triangle is paired with a 'realized impacts' version, it produces a conceptualization of how a person or group's BioEthos impacts the overall complex system of all living nature on Earth. In many cases, a person may hold a BioEthos and act according to it without awareness or even a capacity to know what the actual impacts of 'living by this BioEthos' are or will be.

In our research project, before our three BioEcoJust Game pilots, we had already applied the heuristic of the *human-nature-technology triangle* in our Horizon

Scanning process and Delphi Study (see Chapter 11). The triangle was used by the research team to elaborate descriptions of five co-existing BioWorlds, select a diverse panel based on them, and formulate questions that would help these Delphi Experts unpack, evaluate, and communicate their own ethical views concerning the development of a Global Bioeconomy. Noting how the Human-Nature-Technology Triangle enabled the panel of experts to investigate and elaborate their own Bio-Ethos as well as those held by others, we decided to make it a focal element in the Mexico City pilot of the BioEcoJust game.

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Design choices for the BioEcoJust Game

Futuring games, or game-based futures workshops, are argued to support creativity and imaginative thinking about the future, and open new views on serious challenges (Heinonen et al. 2015). In order to operationalize our theoretical framework and incorporate the approach of Worldmaking, we needed a game that emphasized the interrelations of individuals in a shared situation. We also needed a game that could incorporate the project's sensemaking framework which included five BioWorlds and three bioeconomy-related sociotechnical domains (Taylor et al. 2019). We concluded that a game developed by Balcom Raleigh called Metaphor Molecule fit these criteria (Balcom Raleigh and Heinonen 2019). It became the main engine of the BioEcoJust Game.

When Metaphor Molecule Game is used as a method, it supports groups in having rich and surprising conversations about a potential future. In it, details about a future are generated from multiple perspectives via roles invented by the gameplayers. Playing Metaphor Molecule enables people to immerse themselves in futures they generate and modify. It supports creativity and criticality of the players. (Balcom Raleigh and Heinonen 2019.) The game functions from a mixture of individual-driven and group-driven creativity and is designed to be fun to play. It also enables people to produce diverse, perspective-bound details about a future. (Balcom Raleigh and Heinonen 2019.)

Structurally, the Metaphor Molecule Game is a role-based game in which gameplayers select or create a seed scenario to play, create roles for that seed scenario, describe what their roles see motivating or threatening in the scenario, find a metaphor to convey the complexity of each role, and relate the roles to each other. These role metaphors and relationships to other roles and the scenario are called Metaphor

Atoms. Once all of this generative work is complete, the players model the relationship among roles as so-called Metaphor Molecules and take account of what drives those relationships. After modelling the relationships, the group selects one relationship they believe to be most influential to the overall situation.

The next step is the metaphor transformation – the gameplayers who created the roles involved the relationship the group has decided is most influential to the situation come up with new Metaphor Atom for their roles -- which is argued to be the game's moment of highest, most entangled creativity and criticality (Balcom Raleigh & Heinonen 2019). After the transformation, there is typically a discussion about how the impacted relationship has changed and how all interconnections among roles and among the roles to the scenario and some concluding activity such as some form of scorekeeping or encapsulating what happened. Along the way, the key artifacts generated by Metaphor Molecule Game are *role cards*, *metaphor atoms* for the role cards, a *log sheet of metaphor molecules*, and any modified metaphor atoms for the roles that underwent *Metaphor Transformation*.

The BioEcoJust Game can be called a customization of the Metaphor Molecule game. Two components of the original game were modified to better involve concepts developed in earlier stages of the BioEcoJust research project -- the seed scenarios and the role card prompts. A third modification involved appending a concluding exercise in creating a New BioEthos that had high potential to provide relevant information to the BioEcoJust project while simultaneously supporting the participants in processing the futures they had generated while playing the game.

Instead of a set of seed scenarios, the game utilized 'future ethically difficult situations' which featured competing factors which made it unclear what a most ethical ways to respond would be. These situations were presented in the game as a set of newspaper covers from the year 2075 and were developed based on the three situations used in the first round of the BioEcoJust Delphi study. The three situations players could choose from were 'Megapolis Floods! Five Million to Relocate' in which the balance of landuse is precarious and any changes to it have big consequnces, 'AI-Driven Ecosystems Challenged by Natural Nature' in which ecosystem restoration has been handed over to roving AI-driven synthetic biology labs, and 'Ghost Forests separated from nature' in which natural resources are grown in ways that allow for harvest without destroying habitats of other lifeforms. These situations had enough detail to initiate creative thinking, yet left room for gameplayers to add their own details to create 'stories about a future'.

In the development of the Metaphor Molecule Game, there have been many versions of role cards, but all versions have included an area for drawing and an area for describing in text. The role cards for BioEcoJust game take inspiration from the version that includes creative prompts – a set of three kinds of randomly drawn characteristics.[3] These role prompts help trigger creativity via 'forced combinations'; and in the case of BioEcoJust game the customization allowed the research

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[3] The idea for role prompts to spark participant creativity originated in the version of Metaphor Molecule Game used in the Complex Futures of Human Settlements Futures Literacy Lab (Balcom Raleigh et al. 2018).

team to integrate the research project's sensemaking framework developed during its Horizon Scanning phase. The prompts included five BioWorlds - BioUtility, BioUpgrade, BioRecovery, BioMimicry, BioEquality; three Socio-Technical Domains – Forestry, Soil, and micro-organisms; plus, a set of social sectors (e.g. financial services, local government, start-up company, civil society organization, etc.). To foster creativity, each category of role prompts included a 'create your own' card to invite new ideas to the research project's sensemaking framework. The intent of this design choice was to help the gameplayers create roles that could discuss with our key research concepts.

The BioEcoJust game was piloted three times in 2019, the first at Futures Conference in Turku concluded with an open-ended exercise in which the participants discussed what they noticed in their game. The second pilot at World Futures Studies Federation conference in Mexico City concluded with a similar discussion, but emphasizing ethical dimensions, followed by an exercise in creating a new BioEthos for their group of roles using Human Technology Nature Triangle design template (described earlier in this chapter). The third pilot at the Anticipation 2020 conference in Oslo also concluded with this design template, but incorporated steps from the Futures Clinique (Heinonen and Ruotsalainen 2013) to elaborate the seed situations. Each pilot experimented with the design of the game to discover what potential insights it could provide to the BioEcoJust Project and its stakeholders.

While we expected each pilot to successively improve the design of the game, we observed each of the three pilots emphasized different potentials for the BioEcoJust Game. The first indicated that role-making and perspective-taking served the participants well for applying 'scenarios as worldmaking' in a participatory futuring process. The second pilot in Mexico City, with its addition of the Human-Nature-Technology Triangle Design Template, introduced us to the potentials applying the game to enable rich conversations about emergent BioEthos. The third pilot in Oslo gave us a first taste of tensions or even incompatibilities between approaches which encourage imagining futures at a general, quasi-objective level and those which encourage imagining futures at an individual, quasi-subjective level, while continuing to hint at the potential of the Human-Nature-Technology triangle to support participants in having conversations about what new forms of ethics may be needed in the future. In the following section, we take the outcomes of the Mexico City BioEcoJust Game Pilot as the focus of our presentation and analyses.

The Mexico City Pilot

The best way to present and analyse the contents of the data produced in this game session is to walk through the steps of the game, the choices the gameplayers made, and the contents they produced. Part of our analysis is informed by observing the game directly, Balcom Raleigh as facilitator and Taylor as participant observer. The data produced from the game – including an audio recording of the proceedings and all materials produced – were further analysed post-facto by the research team.

Seven people played the Mexico City Edition of the BioEcoJust game – three professional futurists, one futures studies PhD student, one futures researcher, and two university students less familiar with futures studies. The participants are from six nations and their mother tongue languages are English (n=4) or Spanish (n=3). The game was played in English. Four of the participants are women and three are men. All game play was audio recorded, and all artifacts (e.g. completed role cards and design templates) were collected. All players signed research consent forms which followed Finland guidelines for research integrity.

The group selected the Recoding Life with AI as the situation to play. They then read the newspaper cover from 2075 for the situation and briefly discussed what they observed about it. The players then worked individually to create roles who would be interesting to play in the situation. Of the seven roles produced, only two were ordinary humans, the other five were either augmented or significantly different than people of today, or non-human beings with agential qualities. Because of time pressure, the facilitator decided to skip the metaphor transformation steps of the game to make time for a test of the Human-Nature-Technology Triangle design template. The group first used the blank back side of the template to make collective notes from an open discussion about 'ethical stuff' they noticed in their game session. The group then used the design template to create a new BioEthos useful to their roles. These steps smoothly lifted the group into a provocative and rich conversation about what it would mean to be a human, or any lifeform, in a world where the boundaries between AI-modified life and 'natural nature' were blurred.

Exploring a difficult ethical situation in 2075 as an assemblage of inter-related roles and role-worlds

This section demonstrates the kinds of novelty and insights the BioEcoJust game can produce by describing what happened at the BioEcoJust Game pilot in Mexico City. It will tour details of the imagined assemblage of roles produced by the participants and illustrate the depth to which the participants imagined a future situation together. The discussion the group had about emerging BioEthos will be described, and reflections about what we learned from piloting the game will be offered.

The game session, like any workshop, is a complex happening involving an entanglement of ideas from a unique assemblage of actors at a specific time and place. The following describes what was generated by the game players by presenting the event's traces – its data – synthesized by us authors as a story. The story starts with the future situation that the group chose, future people they created, those people's perspectives on the situation and their assessments of how they relate to the other people in the story. It follows this with the key insights of the game players' own evaluation of what 'ethical stuff' was active in their game, and the Emergent Bio-Ethos they identified that would be useful to these people in the situation.

In the year 2075, radical ecosystem recovery efforts have fused human-made technologies into the viability of vast eco-systems. AI-driven synth-bio robotic labs manage a large ecosystem. Its function is to maintain a symbiotic biodiversity within the territory it overseas while maximizing carbon capture to sustain climate conditions suitable for global life. The living beings under its domain are the equivalent of 10s of thousands of years evolutionary steps ahead of lifeforms found in 'unmanaged' ecosystems. Meanwhile Climate Change continues to cause habitat loss and massive non-human migrations. The non-human species entering this AI managed ecosystem would die, because of their evolution gap, if they remained unmodified. To ensure ongoing balance, the AI lab captures those species, analyses how to maximize their fit, and modifies them. People have begun protesting this practice, demanding that forcing other living beings to be modified is morally wrong. But the system has been running so long, the whole managed ecosystem would die if the intervention is stopped.

An assemblage of seven person-roles, generated by the gameplayers, are engaged in the situation: 'Link', an advisor to policymakers and process makers regarding the intrinsic value of nature; Tortuga-Bish 2, a so-called Telomerge in its 2nd Phase of a dematerializing transformation; Fatima Funder, a swarm-AI 'Innovestor'; Doctor Professor, head of the 'living nature' association arguing for the protection of 'natural nature'; Tiny Paula, a journalist and feminist activist who is 15cm tall, who lives in the 'tiny world' created in the past; Bio Bureaucrat 87B "Mister G", a social service AI helping people engage in eco-recovery projects and be compensated for their eco-restorative actions, and Futures Catalyzer and Seeder, a being who can function at multi-dimensional frequencies seeking to foster convergences and collaborations. It is worth noting that five of these future people from 2075 radically bend what we know as people today in 2020. They are associated with varying Bio-Worlds, Sociotechnical Domains, and Sectors (Table 2).

Table 2. Participant-created Roles and their BioWorlds, Socio-technological Domains and Sectors

Future Person	BioWorld	Socio-technological Domain	Sector
Link	BioEquality	Forestry	Research & Development
Telomerge	BioUpgrade	Human Bio-Connectivity	Foundations
Innovestor	BioUpgrade	Algae, Enzymes, Microbes	Start-up Investor
Professor	BioEquality	Antipollution Technologies	Academia
Tiny Paula	Equally Respected	Algae, Enzymes, Microbes	Media
Mr. G.	BioRecovery	Soil	AI-Social Service
Catalyzer	7th Dimension Frequency	Language Communication	Inter-sectorial convergence

The best way to convey who these future people are is by meeting them one-by-one, as it also occurred in the game.

Link is often in the forest. This person is linked to the BioWorld of 'BioEquality: all living nature should be equally respected for its intrinsic value' and is active in the socio-technological domain of forestry in the sector of research and development. She engages the political level of the situation by reminding policymakers and process-makers of the intrinsic voice and the intrinsic value of nature. From an economic perspective, value is more than just financial, it can also be understood in a broader way from human, economical, and aesthetic perspectives. She emphasizes the intrinsic value of all living nature. Link engages the social dimension by bringing intrinsic value awareness and enabling people to make decisions based on it. From a technology perspective, Link keeps a connection to AI, but still uses human processing because Link thinks that the technology of mind is important. From ecological perspective, Link is an advocate for fair value management, making sure the intrinsic valuations are above the extrinsic ones in forestry related matters. From a culture perspective, it's about bringing a diversity of perspective, that living things are more than just human or the obvious. Link secretly loves animals more than trees and has an interest in Bonsai, those Japanese plants.

Tortuga Bish 2 identifies with the BioUpgrade world, contributes to the socio-technological domain of BioConnectivity, and is part of foundations sector. This person's name includes the sound 'bish', which is incomprehensible to ordinary ears because it is a machine code designation that includes the total information about this person's life-course. The 2 in their name indicates they are in the second phase of the three-phase life journey of a Telomerge. In the first phase, they are biologically mainly human, however their goal is to have a broad range of human experiences, frequently changing sex and gender, and experiencing all human life stages before beginning the second phase. During this first phase, Telomerges serve society in teaching and entertainment functions. In their second phase – the phase Tortuga-Bish 2 is now in -- telomerges begin their biomerger into the ecosystem, at first using advanced haptics that allow them to feel what living nature feels and completing the phase by becoming part of the ecosystem. This process of the transitions in Phase 1 and Phase are dangerous. In Phase 3, they are expected to download as much data as possible conveying the aggregate and conclusory information from their experiences, and this data is used as part of that ecosystem's data going forward. This rich dataset is informed by their human life information and ecosystem experiences. The Telomerge engages in the politics of the situation by embedding their blended human-ecosystem memories into long-term ecosystem biostorage and living out a memory function to push politics into a longer-term formation. The Telomerge serves a necessary economic function of translating the complexity that actually exists into data and human-relevant metrics that can be used to make decisions. Socially, they show others the transcendence of human experience and also provide a kind of entertainment as they go through their many bodily transformations and take risks to provide a vital public function. Technologically, their job is to live, experience, and add to the richness of the bio-informatic soil. They provide the historically encoded experience that is utilized to operate the AI-driven

ecological system. Culturally, they foster the sensations of unity, connectedness, and co-regulation. Nature and humans are understood as different interpretations of the same universal information. What telomerges do is novel and experimental. Phase 1 and Phase 2 involve extremely high risk of failure and mental collapse. Very few people are really built to hold together through all of these phases.

Fatima Funder is an Innovestor and is a total AI creation. This role is basically looking across nature with AI tools, wherever life and innovation could happen—the ocean, forests, landscapes, etc. The Innovestor searchers for investment opportunities related to the theme of 'fountain of youth.' Innovestor is always looking, always at the cusp. Innovestor is a foresight enterprise and does not need to be a human or be in human form. Innovestor is interested in any public policy that supports research and innovation. It does not care if the support is public or private, because innovation can happen anywhere and at any time. Politically, Innovestor is always looking to break down any barriers and considerations of where research and innovation can happen. It can be in formal or informal contexts. Economically, Innovestor sees 'small' companies and lifeforms as most profitable, knowing they are the origin and engine of value creation. The Innovestor pays close attention to the smallest enterprises. Innovator wants for people to comply with ordinance 5.4.3.2.1.0 which requires people to be their 'new and improved you' on a regular basis and sets a new social norm. Innovestor has evolved beyond nanotech, to micro-AI tech and is going with the flow: 'whatever the next generation of tech will, we're just going to keep going.' As an AI, Innovestor has high confidence in its kinds' ability to manage Ecological issues and believes 'We can fix anything any time.' Culturally, some of its best friends are microbes. Innovestor loves risk taking and is an optimist; that is their programming and algorithm. It is excited to see how far it will take us. Innovestor aims to be all seeing and all knowing.

The *Professor* identifies with views of BioEquality, is an active contributor to the development of socio-technological domain of anti-pollution technologies and is an academic. He leads the Association for Living Nature. In politics, he is an activist against any legislation that will change nature by replacing the 'nature nature' we have had 'since the beginning of days' to this new 'in vitro nature'. He's against and disagrees with the neoliberal economy and market economy because he sees it as responsible for the competitive scramble to deploy innovations aimed at changing 'nature nature'. He feels excluded from society, and thinks it is because he is kind of socialist. This is a person who is conservative in his thinking. As for technology, he agrees with and promotes technological innovation, but not if humanity is being lost in the process. He is a big lover of nature. He is engaged with taking care of nature and works to stop its destruction. Culturally, he has a little bit of Catholicism in his background. He's really influenced by theology and philosophy – and the origin of nature – and thinking about the creation made by God. That's why he's against all of these things that are replacing nature. But, he's not extreme. He doesn't want to be the target of critics as a fanatic. His philosophical and theological influences distinguish him from the others in this assemblage.

Tiny Paula lives in a smaller world within the situation and is motivated toward all people being equally respected. Humans have created tiny humans like her for

their amusement, but now these tiny humans (less than 15cm tall) are breaking free from that oppression. In this tiny world you can find everything you can find in the bigger world. Paula is 21. She's a journalist, activist, and feminist. And she's fighting for the rights of tiny people. She is working to transform how tiny people are seen and treated in society. Talking about economy – she believes everyone should have the opportunity to raise their own economic status. She agrees with the evolution of the technology in the situation but is also fighting for 'real nature' to continue. For example, she agrees with creating some bees or some artificial life necessary to keep the world going. Culturally, she is open minded and agrees with everything and everyone, but just as long as everyone is keeping equality in the conversation – especially with regards to respecting the equal standing of tiny people and women.

Bio Bureaucrat 87B, or 'Mister G', is part of the BioRecovery world, the socio-technological domain of soil, and the AI-Social Services sector. He works with compost and special enzymes. In practical terms, he runs a social services office. He is aligned with the 'humans for nature; nature for humans' political party. The AI provides a bio-offset economy to support humans who need support because they are a bit marginalized now. The social standing of people is in respect to nature as defined by AI, and people are rewarded for how much they contribute to the well-being of living nature. He applies advanced AI technologies as a social service that understands the needs of humans and needs of nature. His work focusses on restoring the ecology through regenerating soil ecosystems so they can act as carbon offsets. This work is tied to the size of the bio-offset economy he administers. Mister G's view of culture is that the 'wealth of nature is the wealth of humanity,' but this wealth is precariously there. Bureaucrats help humans fund their daily lives using bio-eco-recovery points they can earn through their eco-friendly actions. 'Please take your ticket, and next. Sign up to quantify how much you are worth.' It is not clear to anyone if he's fully human or not.

Catalyzer and Futures Seeder is from the BioWorld of 7-Dimensional Human Beings. She operates in the frequencies of 7 dimensions. From her perspective time doesn't exist, giving her a wide temporal resolution and the sensation of time travel. She can have simultaneous experiences in many cultures, times, genres, colors, etc. Her socio-technological domain is language and communication – because language, whatever the kind – art or whatever – programs what can happen. Language is both very interesting and very dangerous. She acts toward inter-sectorial emergence and coordination. In politics, she catalyzes change to a new model which can come after republic and representative democracy. In economics, she helps design different metrics of value which include metrics that are social, cultural, environmental, and financial – meaning mainly time, not only money. Socially she holds celebrations for collaborations using technology. Catalyzers and seeders liker her need this ability of gathering people and celebration because it is key for collaboration as it helps develop trust. When there is trust, people can reduce wasted time, money, intelligence, and people in bureaucracy. Technologically, she uses data for the senses. Not only data, but how people can sense the data through art and data-visualization, which helps people choose and make better choices. For ecology, she

helps people develop new senses. Not only the six usual ones, but new senses such as the first one developed, the 7th sense of feeling and being part of the whole. Through this new sense, people can go beyond the experience of being a singularity to also experiencing being part of an overall being. In culture, she works in soft tech, to balance technology, to foster collaboration and convergence.

This tour of the future people created by the gameplayers contributes a rich tapestry of details to the overall situation from the unique attributes of these roles. Technologies are used in a wide variety of ways. Old notions such as innovation and wealth-creation co-exist with new valuation schemes such as intrinsic value or reward systems based on personal ecological actions. Political dimensions arise in the forms of individual lobbying efforts, civil society organizations and political parties, ambitions to converge interests of a variety of stakeholders, and promotions of equality.

Similar to people of the present, these future people of 2075 perceive differing kinds of motivators and threats in their situation. These perceptions add another layer of details to the 'story about a future' the gameplayers are building (Table 2).

Table 3. What the roles find motivating and threatening in the situation

Role	Motivating from situation	Threatening from situation
Link	The polarity of 'nature real' versus 'nature synthetic (or adapted genetically) is causing public debate, and from this debate insight/growth can develop.	Loss of both created & pre-existing ecology Loss of relationship
Telomerge (2nd Phase)	Upgrade seen as a transcendent merger, a testing that was immanent in 'nature nature, our human nature'	Essentialist & Transcendent external counterforces.
Innovestor	This role is a result of this BioWorld/situation.	Competition – is not the only innovestor. Human authority values.
Professor	Keep nature for a long time.	The test of humanity. The lack of respect for human beings and the environment normalizing.
Tiny Paula	She really wants an equity between tiny humans and 'real' humans.	The 'real' humans [treat tiny humans] like pets and they make experiments with tiny people.
Mister G.	Restore nature through soil manipulation growth economy	Humans at the bottom of nature-to-nature AI equation.
Catalyzer	-	People are polarizing and there is a lack of language and narrative to allow for convergency.

In these perceptions, self-purpose and collective aspirations are implicit. Competition implies Innovestor can win contests. The oppressions Tiny Paula and her community face can fuel her work for equality. Mister G is concerned for humans

being at the lowest level of the nature-to-nature concerns of the AI ecosystem management system, but is addressing this concern by providing humans access to value created from soil restoration. Link identifies the public discourse around what to do about the AI-run ecosystem as an enabler for the conversations she aims to foster around the intrinsic value of nature. These are all intersubjective considerations that entangle the identities of the roles themselves and the gaps they perceive between the way things are in the situation and the way ought to be.

The roles can also be understood by using metaphors. Metaphors are figurative words or phrases that convey complex ideas quickly. They emphasise some qualities while de-emphasizing others and they imbue entailments of further meanings onto a topic. (Lakoff and Johnson 2003.) The metaphors the gameplayers gave their roles serve as concise expressions of how they engage with the situation (Table 2).

Role	Role's Metaphor
Link	'Scales' – Balancing
Telomerge 2nd Phase	Human life as accretions of soil layers.
Innovestor	BioEngine of Creation. Biosine. AIsine. Biofuel.
Professor Richard	Don't forget ourselves.
Tiny Journalist Paula	Ant
87B – 'Mister G'	'One potato, two potato, three potato, four… '
Catalyzer	Rainbow

Link aims to balance intrinsic value of nature with other forms of value, Telomerge is taking extreme risks to deliver their experiences to the soil and become a layer of information. Innovestor thinks of itself as an economic engine of creation, focused on life-driven and AI-driven value creation. Professor Richard is reminding everyone in the situation (who will listen) not to forget ourselves, or the 'natural nature' we come from. Tiny Paula is as hardworking and collectively oriented as an ant and needs the other tiny people to help make a change and address the inequality she aims to remove from society. 'Mister G' emphasizes the accounting function he occupies in the situation. Catalyzer emphasizes her role as a bridge and advocate for diversity. All of these metaphors convey something of the ethical ambitions of the roles.

How do these future people in the situation get along?

The assemblage of people in this situation, as in today's world, perceive each other in different ways in terms of their own interests and aspirations. Some are more helpful, some are less helpful or, worse, working toward counter-purposes. The gameplayers determined this assemblage of persons in their 2075 situation have a mix of views toward each other. These details concerning the relational dynamics

among the assemblage bring additional details to the future imaginary the group produced during their game session (Table 4).

Building models of these relationships as 'metaphor molecules' shows some of the dynamics among these relationships and adds detail to the assemblage of roles

Table 4. How the roles see each other in terms of 'least helpful' and 'most helpful'

Role	Roles seen as 'least helpful'	Roles seen as 'most helpful'
Link	Mister G	Catalyzer
Telomerge 2nd Phase	Professor, Catalyzer, Little Paula	Mister G.
Innovestor	Link	Telomerge, Tiny Paula, Mister G., Professor, Catalyzer
Professor Richard	Innovestor, Myself, Link	Mister G., Catalizer, Tiny Paula
Tiny Journalist Paula	-	Everybody is helpful
87B – 'Mister G'	Catalyzer	Innovestor
Catalyzer	-	Everybody is helpful.

in this situation. Some of the roles are in a symmetrical relationship (strong bonds) and others have a least helpful or most helpful role in common (weak bonds). Strong Bonds (Table 5) and Weak Bonds (Table 6) are the two main categories of metaphor molecules. In each of these, the relationship between the roles can be characterised as 'most helpful' and 'least helpful'. We note that this modelling process largely ignores the asymmetrical relationships in which roles do not see each other in the same way, and this is by design to keep the game flow moving.

Table 5. 'Strong Bond' symmetrical relationships among roles

Helpfulness	Role	Role	Description
Most Helpful	Mister G	Innovestor	Both operate with degrees of freedom in in public and private sectors to find a monetized soil, and regrowth. Innovestor gives Mister G a simple financial incentivization and helps him set a quota to sustain. Both use AI as 'part of the system' and can measure results.
Least Helpful	Professor	Telomerge	They have a cosmological or religious incompatibility. Telomerge is merging with biotech to sustain the AI-driven ecosystem, while the Professor aims to keep new life from being synthesized and does not want living beings to be artificially changed.

Of the assemblage of roles, the two 'strong bond' relationships were identified, one 'most helpful' and one 'least helpful'. The most helpful combination is between two roles who are most deeply connected to AI and most concerned with the direct

production of economic value – Mister G and Innovestor. The two roles who found each other to be 'Least Helpful' have cosmological incompatibility concerning how to best serve living nature—the Professor and the Telomerge. The Professor is motivated by past conceptualizations of the value of 'natural nature' while Telomerge takes new forms of AI-supported nature as a given and lives a life of risk and danger to produce new rich data to enrich the ecosystem's data-soil.

Table 6. Roles with another least helpful role in common

Roles perceiving a third role as Least Helpful	Role they perceive as Least Helpful	Description of the relationship among these roles
Professor, Innovestor	Link	The Professor and Innovestor are both interested in promoting innovation and see Link's lobbying for the 'intrinsic value of nature' to be counter to their aims.

Only one weak bond was found in this assemblage. The two roles Professor and Innovestor found the third role, the activist Link, to be 'least helpful to their own interests in the situation. Link's promotion of alternative forms of value run contrary to the innovation motivations of creating new, conventional forms of value. Link's activities are not understood by them.

The modelling of these most helpful and least helpful relationships revealed to the gameplayers the divergent and convergent interests of their roles in the situation. Again, this step served to add detail to the story of a future they were collectively imagining. Because these details pertain to the relationships among the roles, it indicates the discordant and concordant dynamics among them.

Discussing the underlying 'ethical stuff' of the Game

After all of the above details were dynamically generated by the gameplayers, the gameplayers took a moment to discuss what 'ethical stuff' was underlying their game. This discussion served as a bridge to the next step of constructing a new BioEthos for their assemblage of roles. The discussion was also an instance of the Participatory Action Research principle of participants authentically joining in the inquiry work of a research effort and engaging in interpretating the outputs they produced and their experiences playing the game. They covered a wide range of topics and produced a variety of insights, many of which our BioEcoJust research team probably would not have arrived at on our own.

In their discussion the gameplayers highlighted various ethics-related aspects of the game, including ethical tensions and themes. They noticed some kind of 'purity ethics' challenging an inherited system of AI-driven eco-restoration and management. They noted the negative potentials of such ethics, as evidenced in today's world as variations of 'purity ethics' are being invoked to advance racist, anti-immigrant policies.

They questioned the past decisions which had led up to this situation. The participant who created Link observed: 'It seems like there was a point where ethics weren't there, and then suddenly things have gotten a bit out of hand and now people are debating things that 50 years previously actually got this change happening in the first place.' This inherited lock-in from the decisions made by past people raises questions for the people of 2075 about what rights the new species generated from the AI-driven interventions on nature deserve and how to consider the consequences of prioritising the needs of 'modified nature' or 'natural nature'.

The gameplayers noted a feeling of 'anomie' – no name and something that has no existence – in the ethical bearings of their game which they further associated with the concept of 'nomose' from sociology – the socially constructed norms generated from society that generate a framework for how to be and act (ala Berger 2011 [1967]) – and the feeling that the ethical norms 'we knew before are gone, but the new thing hasn't snapped into place' which leads to asking 'what's going on?'

The group noticed traces of historically unethical and damaging concepts such as manifest destiny in how people feel an entitlement to go to the next level of hybridizing and creating new life. They asked: 'Where is the point we stop being human?' and 'Are concepts of destiny and pre-destiny' driving the rise of this AI-ecosystem sentry?

Some roles viewed the AI as something that 'moves in mysterious ways and it is good' ascribing it something of God-like qualities. This view raises a tension between an 'ethics of knowing the right thing to do and doing the right thing' and an 'ethics of accepting the right thing from another [source]' – in this case, an AI. They wondered if there could be a 'flourishing ethics' instead of a 'things turn out right ethics.' They also noticed a trend toward 'decision-making based in knowledge instead of wisdom.' And a lack of humility concerning 'nature knowing better' –like when engineering seeds for specific soils and outcome only to find few of the seeds will grow because 'the soil knows better'. Stemming from this point, they observed that 'humans tend to think someone or something else knows better' and the dominant role of AI in their game amplifies this view and serves as this 'something else.'

However, there is a tension between having the circumstances that enable people to develop capabilities to 'sense' and 'process many things' and 'a reliance on AI'. There is a risk humans would lose thinking capacity and other skills – such as 'an ability to understand big data' – as we choose to give power to AI concerning the management of the ecosystem we inhabit. An alternative to losing such skills would be advancing a goal of more 'humans as catalysts.'

They highlighted how the roles Tiny Paula, Telomerge, and Catalyst challenge the notion of being human: Tiny Paula is modified to be tiny, Telomerge is changing toward some form of dematerialization, and Catalyst is human, but somehow ethereal. There is a blurring of what it means to be a person. The gameplayers wondered if it is the 'perennial issue of *the other*' and how to ethically approach interrelations across difference. Perhaps the roles rely on the administrative functions of Mister G to keep the peace.

One participant imagined there could be an 'ethics animated by disgust' in response to the combining of elements that 'shouldn't be combined'. For example, a

telomerge's parent would be very worried for their child when they announce, 'I will become a Telomerge – there is a risk I will die, and it will be painful.' Yet telomerges exist in this world of 2075. What ethical stance enables a telomerge's parents to prioritise a goal of sustaining the AI-driven ecosystem and the planetary well-being it is believed to provide above their concern for the well-being of their own child? Could there be an '*awe-driven ethics*' driven by 'feeling small in the face of nature', even artificially maintained nature, that is an alternative to *an ethics animated by disgust?*

One game player observed that 'when the many different points of view are brought together, it produces a lot of wisdom', suggesting a wiser ethical position is arising from the combination of their views. This observation, while targeted to the other gameplayers as part of the game session, indicates the value of this role-based futuring game in how it can surface productive discords and confluences of framings when considering transformation and potential ethical dilemmas.

Formulating and naming an emergent BioEthos

Building from their discussion about the underlying ethical dynamics of their game, the group was then asked to develop a new BioEthos which would be useful to their assemblage of roles in their 2075 situation where ethical challenges arise from the fact that whole ecosystems are managed by AI and many species have been altered by it and many more will be. The facilitator explained this new BioEthos is meant to help their roles have 'good' effect on the relationships represented by the three lines of the triangle on the Human-Nature-Technology design template: humans and nature, nature and technology, and humans and technology. After discussing the dynamics of each side of the triangle, the gameplayers created a BioEthos they titled 'Status of Beautiful Monsters'.

The word 'Monsters' in the title of their BioEthos captures how the AI-Driven Ecosystem of their situation is simultaneously regarded as either a 'monstrosity going past all appropriate limits' and 'a beautiful integration helping people get passed all of the terrible limits' given to them by people's past actions. The word Beautiful conveys the need to appreciate the diversity of lifeforms and persons existing in the situation. The word Status indicates the need for equality and respect to all living beings, whether they've been modified by the AI-driven ecosystem management system or are unmodified nature. It means equality and respect to all persons, whether they have been modified like Tiny Paula, are going through a dematerializing transition like the Telomerge, are somehow ethereal like Catalyst, are AI-augmented like Mister G. or are some kind of AI swarm as person like Innovestor.

In this new BioEthos, the relation between *humanity and nature* are simultaneously 'belonging and transcending'; the relation between *humanity and technology* is producing a 'sensation amplifying connectedness'; and the relation between *nature and technology* leads to new forms of 'bio-discernment'. There is an expanded and inclusive definition of nature, the status of person stretches to include new

beings; and the scale and ambition of technology raises the question of hubris – 'humans put nature in a box and are manipulating the heck out of it'.

Connectedness is a key aspiration of this BioEthos. Technology is providing people an amplification of 'sensory experiences and sensory interpretations'. It is a 'drug-induced oneness with other people in nature' that feel like 'raves in forests'. Some professions of people can 'read nature and comprehend it' and 'share experiences of being anything in nature.' These connections are valued.

This new BioEthos entails a desire for 'belonging' and 'transcendence', for being a part of the ecosystem, yet being able to go beyond it. Related to this desire, a more expansive diversity of lifeforms and persons makes the principle of equality of high importance. New definitions of nature are sought, ones that are 'adding instead of narrowing and limiting' and are 'inclusive'. People are better served by an expanding definition of nature to include these levels and new forms of ways of being alive. In light of collectively challenging experiences the inhabitants of Earth endured in the 2030s and 2040, there is a new form of 'discernment' that is a 'more mature judgement about how these boundaries work or could be broken.'

This situation is such that 'human and technological monstrosities against nature are defining nature.' These monstrosities drive some actors, like the Professor to prevent or undo changes to 'natural nature' which is *the origin of humanity, what is our essence'*. In this situation, it is a strong 'ideological position' to go 'back to the core of what is a human.' However other roles like Tiny Paula – who herself is genetically modified – accepts that their local 'nature is modified' and that 'we need to adapt to conserve it.' Tiny Paula's priority is to be 'involved in the new society' that is being created by their current circumstances and to promote equality.

Reflecting this interlink between nature and humanity, the group's new BioEthos calls for a 'resurgence of humanism' that includes an expanding diversity of persons and non-human life. 'There is a place for everyone.' All lifeforms, modified or natural, have intrinsic value. All humans are still human, even if they are augmented by AI or specialized senses, modified, or undergoing transformation. This new BioEthos also recognizes the 'status of new beings' which have become possible due to the technological environment, beings like Innovestor. Due to Innovestor's relationships to the other roles and the situation, she is treated with equity and 'has the same resources in a universe that treats everyone equal.' In the 'Status of Beautiful Monsters' – all are 'beautiful monsters' and status is afforded to all as an act of 'leveling' and 'moving away' from status-seeking. There is simply a 'respect for being,' no matter what natural or technological processes have produced you. 'We are not going to be assimilated'; instead all 'coalesce'.

The 'Status of Beautiful Monsters' BioEthos calls on people to recognize 'they are in a transition' and 'get used to that, instead of getting stuck in the past' because 'the transition is the important thing.' The roles 'don't assume this is an end point', 'terminus', or 'end of the line' and they recognize they are 'on a path to someplace else.' The AI-managed ecosystem is such that 'everyone is coming and going, and there's an infrastructure.' We are all only ever passing through. In this BioEthos, there is a hope that people 'could feel – if they wanted to work together – [they] could be helpful toward a happy outcome.

The BioEthos produced by these participants in this game session involving their uniquely created roles serves as a crude model for how individuals interacting as assemblages can generate (and regenerate) a collective ethical orientation toward a specific ethically difficult situation. Based on the outcomes of this game session, we see potential for the game to help people notice, comprehend, and create new BioEthos, and appreciation their potentials.

Why the BioEcoJust Game is relevant to understanding existing and potential ethical challenges in the bioeconomy?

Much of the literature regarding bioeconomy is concerned with the technical or social factors which can contribute to its development. Yet probing the emergent, multiple, and varying, yet sometimes overlapping, BioEthos as conceived as a complex adaptive system generated from assemblages of people and ecosystems could contribute useful insights regarding the ethical choices we are making today.

Our experimentation with the BioEcoJust game, as exemplified in the Mexico City pilot, demonstrated how a futuring game which couples itself to a stance toward reality that combines complex adaptive systems and assemblage theory (Spies and Alff 2020), and emphasizing the dynamics of being embodied as a person in relation to complexity. We found that this coupling of game design to this kind of ontology produced a platform for rich discussions concerning how ethical norms concerning the bioeconomy could form. The game demonstrated it can enable people to meaningfully explore the interface between assemblages of individuals and the bounding conditions surrounding an ethically challenging situation. The game's intent was not to produce some mechanical system model that reveal leverage points but was rather to enable people to experience engaging this interface between assemblages and their bounding conditions. As a result, the gameplayers acquired and practiced skills useful for formulating new and applicable forms of ethicality to meet possible arising challenges which could happen during the rise of a global bioeconomy in the context of GWEC.

There are two aspects of the game we believe are worth developing further. The first is the placing of emphasis on individual role-driven generation of details to a seed scenario or seed future situation. This emphasis is quite different from the standard fare of scenario creation in which participants are encouraged to take an outsider-objective-view of a shared world and describe its attributes. In a role-driven generative creative process, like used in the BioEcoJust game, the details the participants contribute instead are coming from the most basic element of a human system – individual people. An advantage of this approach that starts from an insider-subjective-view is that diversity and dynamics among unique persons with unique perspectives is more similar to how people experience real situations when they occur. The second aspect to develop further is how to 'keep whole' the worlds created by participants. The role-driven creativity processes of the BioEcoJust

Game never coerced participants to collapse the richness of their ideas into some consensus view, preserving the richness of the details they have contributed to the situation. Yet, inter-subjective meaning making also contributed new and surprising details. This formula of respecting the individual creations of individuals while bringing those creations into interactions with the other participants to catalyze surprising details can serve as a model for other futuring games designed to sense and make sense of emergence.

Because it can help people notice and struggle to interpret novel ideas, we consider the BioEcoJust game to be an example of a class of futuring games designed to fill methodological gaps in the field of futures studies which are identifiable via the Futures Literacy Framework (Miller 2018). In the field of Futures Studies, nearly all of our methods and tools can be categorized as systematized ways to Anticipate for Future. Few if any are designed to support people in Anticipating for Emergence. It is our view that more such tools are needed in our field and would serve to help people practice struggling to make sense of novelty so that they are more able to do so in the present and respond in accordance to the demands of arising situations. Role-taking and perspective taking as game design features have shown themselves to be conducive toward building simulations of emergence within which to practice Anticipation for Emergence.

To connect all of this back to the development of bioeconomy, practicing encounters with emergence – especially concerning the ethical dimensions of bioeconomic development – can contribute to more impactful and ethically tuned experimentation and innovation by bioeconomy actors to address GWEC.

Conclusion

The BioEcoJust Game pilots demonstrated its potential to support people in richly imagining an assemblage of future people who could exist later than now and engage in elaborating and exploring an ethically troubling bioeconomy situation. The imagined futures generated by the players stemmed from individual worlds that are stitched together by their relationships, allowing for their shared situation to become a tapestry of details, uniqueness, and diversity. The richness of this tapestry was driven by a game design that adheres to the principles of *futuring as worldmaking* (Bendor 2017; Vervoort et al. 2015) which allows for participants to imagine people and keep their world's whole as they engage in a common situation through gameplay. The utilisation of a 'scenarios as worldmaking' approach allowed for the gameplayers to keep whole their created roles while simultaneously engaging with each other to produce unique relationally driven details for their roles. We have demonstrated that the BioEcoJust game is a productive way to support discussions which help people sense and make sense of emergent BioEthos and generate novel insights about possible developments of the bioeconomy. While these specific insights may not be the ones which prove relevant to situations which arise from developments of bioeconomy in the ongoing context of climate change, the

gameplayers gained practice in struggling to sense and make sense of emergent Bi-oEthos and reflect upon the suitability of their own BioEthos in the present.

By focusing the game design toward producing a nuanced tapestry of role-driven details, participants were enabled to use their roles as set of lenses through which they see the future situation from multiple perspectives. It went further and provided practice in the skills of noticing emergent BioEthos and developing one which could be relevant and helpful to their specific assemblage. In a future simultaneously filled with radical difference and commonalities to the present, the BioEcoJust Game fostered participant awareness about their own BioEthos while embarking on explorations concerning what kinds of BioEthos may be emerging or needed in the future. The value of such an experience of being aware of present and potential future BioEthos is not to pick one to implement and another to avoid, but rather to tune into how a multiplex of co-existing ones in our world are changing and could need to change to fit the people involved in the specific challenging situations they face.

Such skills and approaches to comprehending and appreciating a multiplicity of varying ethical framings would be of high value to all levels and sectors of actors working to develop the bioeconomy. These skills could help decision makers and the wider public be quicker to notice new formations of BioEthos and create customized ones to fit unforeseen troubling situations as a way of coordinating a collective response. We propose the BioEcoJust game is just such a tool, and more futuring games like it should be developed to help the people of our world cope with all of the varied, dramatic, and locally specific difficult situations that are likely to arise during the long-term period of human-driven GWEC in which we live.

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