

Algorithms and Environmental Concerns: From Game Design to Creative Resistance



Recent design projects critically explore the social deployment of algorithmic technologies in relation to pressing environmental concerns. This article analyses a selection of projects that explore more activist and investigative possibilities. Examples include games based on current climate models, workshops exploring alternative blockchain systems for food justice, and occupations targeting the expansion of tech industries. These projects are analyzed for the way they accommodate diverse strands of eco-literacy and activist awareness. It highlights how design can make use of interventionist tactics and contribute to social investigations. The paper contributes to the developing design criticism to guide (design) research towards actively countering the current devastating environmental impact of new technologies.

1. Introduction: environmental concerns, technology, design

When designers get to work with digital technologies, ecological and social issues will have to be addressed and critically investigated. The digital world has been exposed as costing the earth (Pitron 2023) and technological innovations of the last decades have negatively impacted ecologies and environments on a global scale (Cubitt 2017). More specifically, current applications of artificial intelligence have far reaching social, material and ecological consequences (Crawford 2021) so there is a need for rigorous scrutinizing of such technologies when aiming for any kind of more sustainable future (Dauverge 2020). The inherent abstraction, extraction and solutionism of the current complex techno-social systems reinforce “hegemonic approaches and necropolitical tendencies” (McQuillan 2022, 100). Countering this is a complex challenge only to be addressed collectively. Designers have to somehow navigate the current frenzy of accumulation, extraction, circulation, transport, global impacts, and also the “numbing conformity with the precepts and regulations of a system we know to be malign” (Crary 2022, 118).

Only by avoiding structures that promote inequality, epistemic violence, capitalist exploitation and environmental destruction, design can be offering possibilities to be part of, and support, ways of living

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beyond the error embedded in the current political system (Mareis and Paim 2021, 11). The gateway to structural renewal is “cooperative, horizontal, and non-coercive” resistance (McQuillan 2022, 147). Designers then need to develop such resistance, specifically against the systemic, persistent, ongoing forms of oppression under the “matrix of domination” which design so far often ends up reinforcing (Costanza-Chock 2020, 123) for example by working on adaptation, mitigation, or negotiation (Lamb et al. 2020). It also means opposing innovations and reforms which conform to the existing social logic and capitalist economics (Gelderloos 2022) as in the form of green capitalism in which “complex, ethically and socially fraught, and inherently political questions presented by ecological crisis” are transformed “from democratically contestable terrain to the private authority of markets, with outcomes ultimately driven by the self-interest of rational actors motivated by profit” (Buller 2022, 274). Designers will have to address “historically naive, imperialist views” (Staudenmeier 2022) and counter the vast arsenal of denial, fraud and misinformation surrounding environmental problems and technology (Delay 2024). Design today struggles to acknowledge the complex interplay of such mutually reinforcing social determinants and dynamics of power and privilege (Mareis and Paim 2021, 13).

Based on such critical perspectives, the question arises how design can meaningfully engage with the development of algorithmic technologies and the related ecological concerns in such a way that it fosters social resistance and investigate ways towards structural alternatives. Expanding designers’ eco-literacy and engaging with activist cultures are proposed as necessary to such efforts, as is the experimentation with more interventionist tactics. Specific reference projects are analysed as encompassing cases to better understand of this variegated contemporary field of creative investigation, which amounts to the development of a specific design critique for this type of creative work.

2. Developing design criticism

Design criticism has been asking questions for decades about the relationship between design and, for example, climate change and global warming, often already in relation to new technological developments (Twemlow 2017). Design criticism is precisely how to discuss and evaluate creative efforts and design choices in relation to such broader concerns and developments, and to determine additional directions for creative exploration for the design profession or design education. The focus of design criticism is on concrete design projects, which makes it into a heuristic and practical tool which

can keep the focus on concrete experimenting (Fischer and Riechers 2019). Analyzing specific (design) cases contributes to recognizing the stakes and map the contingencies of the developed creative work (Fox et al. 2020). Although sometimes operationalized through more limited ‘design critique methods’ (Alabood et al. 2023) design criticism can be elaborated towards a form of social critique for design (Petrina 2017) or critical fabulation around the history and possible futures of design (Rosner 2018). By criticizing, it can challenge the design discipline, for example calling out for redesigning design (Anastassakis 2021) or contributing to what can be called disciplinary disobedience (Abdullah 2021). Such more broad and challenging criticism is developed below in relation to recent creative efforts engaging with new technologies and environmental concerns.

2.1. Beyond discursive and critical design

The kind of creative projects that this design criticism focusses on are those that materialize some form of (design activist) counter-narrative (Fuad-Luke 2009). Such projects, more recently labeled discursive design, are made to work in opposition to or outside the usual commercial paradigm and instead offer ‘intellectual prostheses’ in the form of objects created and deployed with “the primary goal of affecting thinking about big, complicated, or contested issues” (Tharp and Tharp 2018, 8). This type of design practice stems from earlier critical and speculative design approaches that focused on problem finding and provocation in the service of society, most notably developed and theorized by Dunne and Raby (2013). It is also informed by adversarial design which puts emphasis on enabling productive contestation and dissensus (DiSalvo 2012). Altogether it constitutes a rich contemporary field of creative exploration for designers, especially when it incorporates artistic activist unhinging of usual ways of doing and thinking that embrace more experimental branches of political thought (Simoniti 2023). Recently, however, it has also been criticised for the abstract and ambiguous material practices it results in (Mareis et al. 2022) and the “fleeting experimental vision” it presents mostly at galleries or exhibitions (Simoniti 2023, 152). It is often produced in safe environments and risks offering only a passive affirmation of design, even to the point of fetishizing critique (Keshavarz 2019). In the following, design criticism is developed that aims to point towards and suggests opportunities to explore more provocative and bold directions beyond or in addition to the more regular critical and discursive design practices.

2.2. Eco-literacy and laboratories of learning

According to Boehnert in her seminal work on designs engagement with ecology and politics (2018) for such more bold projects designers will have to adopt an activist awareness of current dynamics that perpetuate ‘oppression, exploitation and ecocide’. This awareness is necessary for re-orienting the inherent politics of design towards explicitly embedding matters of care and processes of activation in the design process (Huybrechts et al. 2022). To do so, Boehnert suggested designers can make use of ideas like permaculture, social ecology, eco-socialism, food sovereignty, indigeneity or ecofeminism (Boehnert 2018). Such eco-literacy is not only necessary to come to systemic understandings of current dispersed networks and structures (Capra and Luisi 2014) but it is also fundamental to (re)direct critical design skills to engage with for example decolonial practices and alternative imaginations (Buck 2019). Only through such concepts it is possible to address the more structural aspects and root causes of climate change and propose alternative structurally transformative and systemic pathways for change (Morrison et al. 2022). For this paper we will analyse creative projects that explicitly develop such activist awareness through engaging with radical concepts of eco-literacy, to better understand how this is currently done or might be expanded.

Design can be understood as offering tools and spaces for collective exploration and actioning (Fuad-Luke 2009). In relation to new technologies and ecological concerns this can take the form of ‘climate investigations’ (CIC 2017), mapping of power (Dávila 2019), and creative forms of counter-forensics (Fuller and Weizman 2021). As such it can be more elaborative than just producing discursive objects, initiate “an ongoing reflexive dialogue, through making and use” for experimenting “with different histories and imaginaries” that enhances positive subversion and conversion (Leach and Wilson 2014, 242) that for example merge current academic research on more-than-human perspectives, regenerative approaches and AI, systems thinking and alternative (design) pedagogies (Poikolainen Rosén et al. 2025). Although always being at risk of academic institutionalization as part of the global knowledge economy (Holert 2020) it could take part in the development of (technological) infrastructural experiments (Vickers et al. 2020) that are integrating research and societal challenges as a lab for the public (Introna et al. 2024). As such design seems to work towards engaging in forms of ‘social investigation’ (CounterPower 2020, 18) where radical thought and practice form a nexus through which radically alternatives can emerge (Thatcher & Dalton 2022, 33).

Design and activism can then be inspiring each other (Bieling 2019) as for example happens in the mutual shaping of data practices and social movements (Treré 2022). Design could be understood as a way for mobilizing and prefiguring what has recently been called social movements' experiential laboratories of learning (Novelli et al. 2024). As grassroots networks of locally resisting communities realize promising responses to climate emergency and planetary destruction (Gelderloos 2022), design might want to find ways to genuinely participate in these social ecosystems of revolt and the ecological imaginations found there. After analysing creative projects below, the current ways such social investigation and possible participation in laboratories for learning will be discussed.

2.3. Interventionist tactics

More courageous experimentation and commitment might furthermore be developed by keeping a focus on, and explicitly take as design goal, the creation of interventions. Design interventions can be adopted to improve system thinking and help deal with “wicked issues” (Rygh et al. 2014). Design can make use of multiple concrete points of leverage, for example intervening in subsidies and taxes, gaining access to information, challenging the general mindset or paradigm, or even better, combining an “ecosystem of tactics” for devising interventions (Meadows 1999). By insisting this type of design should be aimed at interventions, it can make use of previous experimentation with interventionist tactics that have been used within art, and which already contributed tools, documented actions and tactics of disruption for socially engaged artists and other collectives (Thompson and Sholette, 2004). A rich tradition of ‘tactical media’ emphasized the possibilities of experimental media for such interventions (Raley 2009) which is echoed today in the wish for media tools that can decolonize, redistribute value, and conspire (Lovink 2022). Not wanting to rehearse here the “academic debates about short-term tactics versus strategic sustainability, and artistic instrumentality versus aesthetic value”, interventionism is predominantly understood here as developing experimental platforms for discourse and research-based practices for exploring conscious political resistance (Sholette 2017, 230). As designers work in this direction, they might be able to construct future spaces and (media) practices for imagining other worlds (Aikens and Crowley 2022). It might open the design discipline to intervention-oriented insurgent practices of subaltern ecological movements and the complementing militant and engaged forms of research including counterhegemonic practices of alliance and solidarity (Undisciplined Environments Collective,

2024). Analysing the type of intervention or kind of interventionist tactics thus seems a promising lens to discuss recent more bold creative investigation.

By developing design criticism that points at more radical forms of eco-literacy and interventionist tactics, this paper responds to a recent call to catalogue and evaluate (creative) interventions and strengthen these by “drawing together demonstration projects, more experimental designs and interdisciplinary perspectives” (Morrison et al. 2022). In the face of the hegemonic approaches and necropolitical tendencies of current malign techno-social systems, as described in the introduction, such better understanding of more committed and courageous experimentation and social investigation could prove essential for the field of design and beyond.

3. Analysing contemporary (design) projects

Four cases were chosen that were developed over the last years, that are well documented, and stand out in their different ways they engage with eco-literacy and activist cultures, building collaborations for social investigation towards possibilities for intervention. The cases are furthermore selected for the diverse materialisations and media used, corresponding to different subdomains or disciplines like game design, educational design, digital design, or architecture, to accommodate a great variety of practices and examples. The first case takes the ‘Half Earth Socialism’ game from 2022 as starting point and relates this to other recent developments within game simulations and critical forms of collective play. As second case the Algorithmic Food Justice workshops of 2019 was chosen, which is a more situated and embodied type of codesign or ‘commons in design’ project. The third case is the Solar Protocol platform developed in 2022 that relates to the design of different infrastructures and platforms based on alternative socio-technical principles, and finally the protest architecture of the ZAD de Notre-Dame-des-Landes, coming to prominence in 2018, is selected as a multifaceted and encompassing case that builds on earlier instances of occupation and (protest) architecture. This makes a broad and rich set of contemporary creative work to help understand how social resistance and investigation are currently deployed towards the development of algorithmic technologies and the related ecological concerns.

3.1. Half Earth Socialism and related game simulations

Half Earth Socialism (<https://play.half.earth/>) is a ‘planetary crisis planning game’ developed and designed by Francis Tseng and Son La Pham. The game simulates the effect of different changes in policy

and developments of technologies on the general ecological and environmental situation of the earth. In the game, different governance measures can be taken, like a change in energy production or the development of an alternative food industry. The game options are visualized as a deck of cards which can be “scanned”. Disrupting events can occur, like for example a flood, a forest that gets infested, or the return of a direct-action group called ‘Earth Liberation Front’. Political capital can be exhausted, different government factions develop throughout the game. It shows statistics for temperature, land use, population, and for example average habitability. Through all this, it is possible to play out different governance strategies, experiment with effects of for example alternative global infrastructures or biofuels. The options in the game are not restricted to actual political programs or predefined ideologies, so players can experiment with their own chosen combinations of new educational programs, the development of specific crops, or adopt policies like completely banning meat production. The game calculates emissions and different ratings using a real open-source climate model HECTOR, to work out the climate effects but also the state of the food system, the biodiversity, the general contentedness, and more, in cycles of years. To win you must keep people content and keep your political power, while getting to a world where global warming stays below 1°C, extinction rate is less than 20%, and emissions will have to return below 0, for which you have a maximum of 60 years.

Tseng discussed (2022) the design of the game at Trust, a platform for creatives, as being part of a lineage of scientifically accurate games from Crawford’s 1990 game ‘balance of the planet’ to the more recent Fate of the World from 2011 by the game studio Red Redemption. These politically aware and intentional games can be described as interventions that help understand the existing political dynamics at play and political actors involved (Vervoort et al. 2022), which in the game can be experimented with, but which also remains not totally predictable (Arroyo 2017). Like in the sophisticated art installation *Asunder* (<https://asunder.earth/>) made by Tega Brain, Julian Oliver and Bengt Sjöln there is a benefit in taking actual data, models, currently used technologies, which can then help underscore how these intelligent systems and actual data might lead up to “absurd outcomes” and help to actually probe state-of-the-art climate and environmental simulation technology (V2 2024). For Half Earth Socialism, Tseng developed a web tool early in the development process, so other people could contribute content like these cards and events, and collectively research estimate effects of policies or technologies. Central for this are the so-called IAM’s (Integrated As-

essment Models) used, that make it possible to do predictions and tinkering with outcomes of specific choices within the game. Recently also a new editor mode was introduced in the game that allows you to modify different parameters of the game-model which might lead to a more open setup of game possibilities and outcomes. As such it can function as a conscious subversive practice tool (Flanagan 2009) especially when developed towards “critical metagaming practices” in the form of playful strategic appropriation for resistance (Beke et al. 2024). Focussing on game and simulations, these projects stress there is ‘everything to play for’ in relation to the current power relations and undermining of ingenuity (Did 2024).

The game now seems to promote a specific top down global (future) government strategy. It accompanies the book ‘Half Earth Socialism’ which sketches a theoretical framework that explicitly stresses the necessity for global planning tools and global authorities. The book urged the public and its representatives to work on blueprints, socialist planning, and climate modelling for an eco-socialist future, which in the game should be taken up as planetary measures made through GosplanT, a central planning authority in power. The accompanying book was criticized for “its narrowing of the alternatives it faces, and its wider refusal to engage with conviviality, decolonization, and the agrarian question” concluding that it leads “ecosocialists down a frustrating dead end” (James and Johnson 2022). Similar critiques on playable models and systemizations of earth through design science recently came up in relation to the exhibition “Terra. Designing our Planet” at Mudac (Kugler and Longfellow 2023). Longfellow attacks the idea of ‘total design’ or the ‘technophile ecological approach’ of Benjamin Bratton as instances of a planetary “earth systems” approach based on an inherent deceptive solutionism on a global scale, ultimately stems from colonial logics. The designer of the Half Earth Socialism game made clear alternative, more local ecosystems to stave of ecological collapse were considered as relevant future iterations to be developed in games, discussing options like a more regional approach with more radical democratic processes (Tseng 2022).

3.2. Situated and embodied local solutions

In comparison with Half Earth Socialism and similar game simulations, a different type of creative practice aims to bring people and other lifeforms that are too often marginalized by design towards actual situated and experimental, hands-on and inclusive design efforts. In extension to more simple notions of co-design or participation (Cizek and Uricchio 2022) these projects are characterized by the fostering

of different social relations (Escobar 2018) through a determination to support liveliness and resilience through what is called “commons in design” (Schranz 2023). It tries to bring decision-making back in the hands of under-represented or assailed communities and spaces (Diehm 2022). It sees opportunities to move away from “malls and computers” instead looking for what can be understood as a “revival in imagination, self-knowledge and connection with animals, rivers, mountains, and trees” (Dunlap 2024, 197).

As an example, the Algorithmic Food Justice workshops by Sara Heitlinger, Lara Houston and Alex Taylor consisted of a bottom up, embodied and situated approach for developing a more-than-human value system for sustaining food commons (Algorithmic Food Justice 2019). Three workshops were organized by City University of London, in partnership with Spitalfields City Farm, Furtherfield, and Gaia Foundation, to experiment with food production that is “sustainably managed for collective benefit” and which recognizing all types of organisms and relations involved. Several small-scale urban farmers and collectives were brought together to brainstorm different (future) stakeholders, mapping resources, and to prototype and experiment through Live Action Role Playing (LARP). It included the creative development of rituals and assemblies, the design of certain card sets, instructions, and risk matrices. The third workshop focused on blockchain technology and DAO’s, experimenting with related “algorithmic methods for valuing and exchanging labor between multiple species in the process of growing food” (Algorithmic Food Justice 2019). During the workshop future follow-ups were discussed like “bacterial festivals, cross-species work placements, holidays for micro-organisms, piloting multispecies communications working groups”. New technologies are reluctantly approached here as mainly “tools that crush divergence and nuance” especially when taken up by designers that continue to create “under the auspices of design thinking, user personas and so-called “ethical design practice”.

It experiments with collectively investigative forms of resistance that takes cues from new technologies but only to improvise completely new relations and economical systems. As Massumi argues the aim of it could then be to become a driver of resistance, beyond more simple commons-centered, collective, collaborative models, and feeding off the dominant capitalist economy, awaiting a tipping point to be reached where the alter-economic way would be capable of taking over” (Massumi 2018, 124). It is related to other initiatives that focus on rethinking the (local) economic dimensions, like Arango Orozco from Grupo Semillas explained, “in a way that departs from

voracious and destructive economic models” and looks for alternatives that prevent irreversible effects on the environment and create a more balanced relationship with the territory (Arsanios 2022). New technological developments here are counterintuitively used to spark undisciplined practices focusing on hands-on engagement and disobedient action research, that could lead to “locally produced experimentation, practice and refinement to create socioeconomically justified and liberated spaces” (Snelting 2022).

3.2. Low-tech affirmative refusal

This focus on local experimentation and hands-on engagement can also lead to different technological infrastructures that work as “a countermodel to the current platform(ed) perception, where everything is served effortless at the nearest screen, hiding infrastructures, carbon pollution and exploitation of data” reconsidering the everyday infrastructures we often take for granted (Pold and Andersen 2022, 110). A prime example proposed here is the ‘naturally intelligent network’ of the Solar Protocol project (<https://solarprotocol.net/>) developed from 2022 onwards, which consists of a website hosted across a network of solar powered servers and technology to make this website available to you from whichever server receives most sunshine at the moment you access it. The Solar Protocol website shows how this works, transparently communicating its own functioning and the power remaining for that specific server and stating the constituent principles. The website offers a manifesto that calls for a shift from artificial intelligence to natural intelligence and imagination that is not tied to fossil fuels and to work within natural limitations. It consists of documentation, including technical specifications and guides, to make your own server and become part of this network. The website offers inspiration for additional creative exploration of a more patient, contemplative, and localized relationship with technology, data-visualizations of the network, poetry generators, video works, low bandwidth gaming, all presented and discussed during a ‘sun thinking’ exhibition. Inspiration for Solar Protocol website comes from the website of Low Tech Magazine (<https://solar.lowtechmagazine.com>) which for example also applied this way of thinking to a downsized transport network (De Decker 2023).

Additional theoretical underpinning of this kind of projects allow for diverse visions on what computing or technology might be used for, as for example there are convivial computing, benign computing, salvage computing, small tech, appropriate technology or slow-tech (De Valk 2022), or approaches based on degrowth and ‘computing within limits’ (Roscam Abbing 2021) and permacomputing (<https://perma->

[computing.net/](https://www.computing.net/)). Such approaches refute the ‘current data spectacle’ (Thatcher and Dalton 2022, 84) and refuse to get trapped in structures that seem unchanging and self-replicating, instead opting for “making otherwise” (Voss 2024, 64). It can be understood as a type of refusal that works as affirmation and repair more than denial: a redirection to ideas otherwise unacknowledged or unquestioned, as recently has been theorized in relation to the anticolonial work done in the Civic Laboratory for Environmental Action Research, for which also other useful questions around possible methodologies and protocols were posed (Liboiron 2024, 142). Design makes use here of a type of refusal that usually takes shape in conditions of precarity, domination, and escape (Agid 2020), but the development of such countermodels has ambitions for global scale and planetary impacts when these decentralized alternatives are expanded on through “mutualist and decommodified” cooperation for reskilling, recomposing, and rethinking (Ray 2024).

3.3. Protest architecture

In order to challenge the dominant systems, any alternative has to find ways to actively disarm, power down, abolish, possibly create social antagonism, or actively engage in careful political conflict and clashing (Ray 2024). In the face of climate collapse, it might for example be necessary to overpower and stop corporations which are key players in the theft of the commons (Whyte 2020). The fourth and final type of intervention can be distinguished through such efforts to push back against all kinds of destructive dynamics (Brand and Wisen 2021, 189) and to disrupt the usual “extractive infrastructures and the administrations that enforce them” (Dunlap 2024, 198). It consists of creative efforts that are envisioned to directly challenge and disrupt existing power relations (Camfield 2022, 73) up to possibly sabotaging or dismantling existing systems (Voss 2024, 180). Although every such disruption and sabotaging can also promote repression and become a catalyst for the system’s incessant need for more devaluation and capitalist expansionism (Ploeger 2022) the creative work done in this direction is over the last years more often seen as necessary to creatively stop devastating projects from happening, carrying the opportunity to finally direct the world into a different course and save lives (Étienne 2024, 53) and an “injection of collective empowerment” (Malm 2021, 161).

The creative work done at the ZAD (Zone d’Aménagement Différé, that became Zone à Défendre) de Notre-Dame-des-Landes in France could serve as an encompassing example – where a range of protests, buildings, events, rituals, including the necessary new relationships

and learning sessions, were created in what actually amounted to a new kind of (temporary) society that came to exist after the occupation of an airport from the 2010s onward (Fremeaux and Jordan 2021). Where the 'airwold is a smooth and seamless transit between substitutable spaces' the occupants insisted on the "perpetuation of the possibilities of common life that place-based social relations can create, even amidst a striking diversity of beliefs" by an eclectic and diverse group of people "not foot-soldiers to a pre-existing theory or revolutionary prediction but the flesh, blood and thought of the movements they are making" (Mauvaise Troupe Collective 2018). Organization relied on information and exchange tools, like the Zad News newspaper and Radio Klaxon pirate radio (Mauvaise Troupe Collective 2018, 112) and imagination did not remain just 'dreams' but houses were built in the image of the way life outside the norms and the moulds, actually inhabiting these territories (Mauvaise Troupe Collective 2018, 122), furthermore sharing tools, exchanging food, envisioning new collective structures for living and defending. It culminated in huge protests and defensive actions in 2018. There is a rich global history of such protest movements and different types of struggles against what can be summarized as 'land grabbing', where global corporations and governments are countered in their grabbing, commodification and consumption of space and resources (Ross 2014). A recent example that explicitly engaged with the high-tech industry was the mobilization against Tesla's expansion of its Gigafactory in Grünheide's forest (near Berlin) by groups such as the Grünheide Citizens' Initiative, the "Turn Tesla off" alliance, and other organizations and action groups like Fridays for Future. From March 2024 onwards people occupied the adjacent forest, creating tree top houses, involving the residents of the area, culminating in large scale action days organized by Disrupt, an alliance including 'Ende Gelände' which is known for earlier occupations and large-scale protests. Together they protested "car capitalism in a green guise" including the neocolonial supply chains, felling of trees and destruction of forests, water usage of 1.8 million cubic meters a year, and more general the proliferation of individual transport in the face of the evolving climate catastrophe (Disrupt 2024).

It is taken up within the field of art and design by stipulating the creative work involved. This consists of festivals, treehouses, pavilions, but also barricades and tripods, which are taken to constitute a broad range of 'protest architecture' also encompassing more satirical materials and subversive tools. It is recently elaborated through a list of accompanying design principles (around for example originality, repeatability, comfort, 'spiciness') and example student work (Newman

2024). Protest Architecture's goal is to blockade, defend, seize space, produce resistance – which scales up to design of complete camps for global movements, of which a recent art exhibition recaptured an already impressive history (Elser et al. 2023). This history of blocking, stopping, destroying and occupying industries' devastating infrastructures or planned extensions and land grab also includes clothing, demonstration material, digital media, graffiti, places for assembly, projections, manuals, protest songs, protection shields, all of which currently received attention as somehow necessary and relevant forms of creative practice (Flood 2014).

4. Current design experiments and the developed criticism

In contrast to how technological innovations have already for decades negatively impacted ecology and natural environments, indeed also diverse forms of creative experimentation have been developed over the last years. Four specific cases served here as example projects that vehemently try to resist and search alternative creative approaches to and uses of the application and development of algorithmic technologies in the face of acute ecological and environmental concerns. Through such projects, as was proposed based on recent literature, designers can be able to steer away from and counter more passive discursive design projects, or any green capitalist solutions, adaptation, mitigation, and negotiation, or further involvement in extraction and solutionism.

The cases were selected to show how eco-literacy and activist sensibilities can be incorporated in design projects by strengthening engagement with more radical aspects of eco-literacy. Half Earth Socialism accommodates all kinds of concepts and actual activist cultures in the scenarios and cards, which can be applied and experimented with in the game, which are the result of a collective investigative research on what these concepts and scenarios actually mean or could set in motion. The Algorithmic Food Justice workshops deal with eco-literacy and activist sensibilities to experiment with nurturing different relations or collaborations, leading up to and underpinning LARP sessions and creative workshops. Eco-literacy is also essential for the accompanying manifesto's to the Solar Protocol project and the contributing theories on for example slow-tech, degrowth or computing within limits. Eco-literacy and activism furthermore inform the rituals, camps, and direct actions at the ZAD or Disrupt actions. These cases thus present diverse examples for nurturing more radical eco-literacy within and through design.

The cases also provide a set of options to creatively challenge and disrupt of existing power relations, for example by thinking through and simulating alternative governance strategies (through game simulations or LARPs), local economies and collaborative tools (through food workshops and low-tech solutions), and active sabotage and occupy land (protest architecture, blockades). It amounts to multiple creative ways to experiment with points of leverage, whether it are climate data models, policies, infrastructures, or the land use of devastating industries. Creating design interventions like this consists of making games, card sets, attributes, matrices, solar panel powered servers, protocols, rituals, festivals, manuals, houses, clothing, protection, and much more, and as such offers diverse opportunities for the design of all kinds of artefacts and 'things'.

By bringing these diverse projects together some preliminary directions can be distinguished for how design can indeed be able to take part in social investigation to push towards engagement with more radical eco-literacy and concrete interventions. It shows ways to invite others to join the experiments, and stimulate self-organization and creative development of alternative infrastructures for exchange. While these cases are part of certain art and design platforms (for example Trust) or exhibitions (for example about protest architectures) they are reaching outside and beyond these, and thereby show ways designers are already traversing and expanding the traditional design discipline and break out of the safe 'design' environments and the passive affirmations of design described in literature. They involve communities and groups outside the institutional settings and art and design disciplines, for example by realizing a game that can be played and updated by a much broader public, invite and empower decision-making of local food cooperatives, or investigate forms of architecture in relation to ongoing struggle by activists occupying land, and make their work available for others to take on. This is the way the here presented design related projects currently reorients towards political activation and the actual fostering of different social relations, in the form of embodied and situated experimentation building towards more liveliness and resilience, inviting in underrepresented and assailed communities, and through countering hidden pollution and destructive effects of technological infrastructures.

By analyzing and relating these projects, and contrasting them to complementary theory, design critique is developed that can focus creative efforts on possibilities for social investigation and contributing actual systemic interventions. For this, the focus of that criticism was on bringing projects in relation to each other, and presenting

them together as a rich field of creative resistance and experimentation. These cases are furthermore supplemented with for example anticolonial affirmative refusal and other critical theory not usually encountered in design criticism, and confronted with limitations like the ones encountered for earth systems thinking or the risk of reappropriation of design working on alternative economical experiments was offered. Together this offered some exploration of the type of design criticism that could serve further bold creative efforts.

5. Towards more substantial design efforts

Analysing examples of design projects and providing (this kind of) design criticism remains open to different perspectives or further interpretation. The choice for these projects and especially presenting sabotage or blockage as design can be disputed. The above tried to make clear why it seems necessary to consider such more defiant options for design and how design criticism might be developed in relation to the mentioned projects to understand some of their possibilities and risks. Designers and design teachers then might at least use them as a curated set of concrete reference projects and accompanying theories when developing new projects regarding more experimental engagement with technological innovations or when looking for alternatives for what now often is presented as a sustainable or green alternatives within design (education). How to encourage this in the design profession or within design education could be elaborated, for example in relation to current working conditions in the field of design and in relation to the now often used design models and ethical frameworks in design and design education.

Possibly the above will help develop future creative projects, through design or other means, to address inherent environmental problems and the devastating effects of (algorithmic) technologies currently being deployed. It might expand as a diverse field of contemporary (design) exploration, where diverse cases complement, reaffirm, but also contrast or mutually challenge each other, inviting multidisciplinary collaboration. Critical play, simulation games, cocreation workshops, occupations and alternative infrastructures might be developed to interrelate and overlap with social experiments and activism. Whether design is able to participate sincerely in extended social ecosystems of revolt and contribute to the ecological imagination found there remains to be seen. If so, design projects then might have to be developed into even more substantial or incisive creative efforts than are encountered in the projects above. Research into how exactly this can be done in more varied circumstances, also in other places around the world, would then be welcome. Involve-

ment and collaboration with more diverse communities and struggles seems necessary. For this, writing and discussing this paper in the setting of a design conference might be considered a (side)step. More substantial could be to organise more socially embedded collective forms of creative resistance to algorithmic technologies or actually instigate more challenging (design) research in light of the current environmental devastation.

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