Report from the EU H2020 Research and Innovation Project Artsformation:
Mobilising the Arts for an Inclusive Digital Transformation

Case Studies of Impactful Artistic Productions

Ana Alacovska, Peter Booth, Christian Fieseler, Hanna Grønneberg,
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arts formation

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Introduction

The exponential, and often still unregulated, development of digital technologies in contemporary societies have raised concerns about 'the dark sides' of these technologies, that is their harmful impact on issues of privacy, freedom, democracy and even health. Digital technologies have been repeatedly found to enhance the racial, ethnic, age and gender inequalities via a built-in computational bias, which opens up new digital divides related to access and availability of digital technologies. This influence of digital technologies on all aspects of social, political, and economic life has led scholars and technology critics to question the kinds of digital societies emerging and reaffirm efforts at ensuring a more sustainable and equitable digital future.

This report zooms in on the role of the arts and a diverse array of artistic practices in remedying the harmful influences of digital technologies on social, cultural and communal life. Being inextricably related to advances in media and technology as a medium of expression, the artists have been always at the forefront of adopting current emerging technologies in their work and levelling vehement critique at toxic processes of digital transformations (Alacovska et al, 2020). By working within and against digital technologies, artists have the potential to interrogate harmful digital systems and practices.

Adopting a "pharmacological" perspective on arts and technology (Alacovska et al., forthcoming), we argue that the arts possess transformative—remedial, caring and healing—valence in the context of digital technologies. Stiegler's (2013) pharmacological perspective sees digital technology as both a poison and the cure to its own illness. Constituting an important care-giving role in society through its transformative potential, the arts have the ability to catalyze social change in the face of harmful digital transformations (Stiegler, 2013). This perspective offers a lens through which we can analyze the transformative and emancipative potential of artworks that appropriate, visualize and critique digital tools and systems, and which are enacting care-giving practices through a hopeful and critical engagement with digital technologies and their future-building potentials (Alacovska et al., forthcoming). Such a perspective implies an outright refusal to see the technology itself as an inherent evil. Moreover, such a perspective, enables us to appreciate the power of the arts as a mode of re-purposing harmful digital technologies as tools of protest, healing and imagining better and more flourishing future worlds in spite of, or even because of, the toxic uses the digital technologies have been put to over the last couple of decades.

The case studies included in this report, provide an overview of the genres of digital art that have come to define the field today. Touching upon the topics of anti-surveillance art, datasets art and critique of machine learning, net-art and platform art, AI generated art, NFT and crypto-art, arts-based public engagement and education, we aim to illustrate on concrete examples how the arts can function as remedial tools in the context of harmful digital transformations. Based on a multi-year engagement, formal as well as informal, with artists who make intentional efforts to intervene in the betterment of digital technologies, we have summarized the main points of such artistic practices in this report.

The case studies included, offer a broad selection of artistic fields and mediums, as well as a selection of artists who have a complex relationship with the digital technologies, acting at once as creators, coders, and designers. By appropriating already existing digital tools, these artists

provide robust, yet variegated, critical lenses of reflection that challenge the usual, corporation-led celebration of the benefits of digital technologies.

When engaging in this complex and contested terrain, there is always the risk for artists to perpetuate and reproduce the harms of digital technologies (Caplan, 2016). But when using and reflecting critically and caringly, artistic perspectives can still provide vital counter-narratives to those of financialized and corporatized computer science (Costa, 2020; Lee, 2020). What connects many of these cases is therefore a sense of both ambivalence and resourcefulness in the appropriation of digital tools, resulting in utilitarian art to meet collective needs. While still in some cases, for example in platform art or even blockchain art, art is feeding the media conglomerates owning the platforms or the financial systems the enable such creativity, we argue that artists nevertheless can offer critique and reclaim some agency within these contested structures, creating productive displacements within them. Through strategic occupation of technologies and platforms, artists reach new and wider audiences, making their practices culturally impactful. When involving the public, both by consciousness-raising about digital inequalities and control mechanisms, as well as through hands-on co-creation, artistic intervention be seen as empowering digital citizens to themselves to engage in critical practices of digital use.

While it might be impossible to completely safeguard against reproducing harm in the face of ever-accelerating technological evolution, the practitioners of digital art can nonetheless carve out spaces for thinking *otherwise* about how we, humans, can co-exist caringly and harmoniously with digital technologies. The artistic practices we include in this report show the pharmacological and caring potential the arts hold in transforming the world and imagining potential futures.

A note of caution. All the artistic practices included in this report, except one, have been gradually adopted and consecrated by the high-brow, even elitist, artworld. With artworks thematizing digital transformations garnering both artistic/aesthetic acclaim and economic value, we have also fallen prey to the gravitational power of 'enchanting' artworks to draw us into their orbit. Our last case study presented, however, challenges such enchantment, and presents an autobiographic, disenchanted, reflexive and speculative account of the low-brow, and popular culture genre of science fiction and its questionable relation to technology industries. Science fiction, a popular culture cinematic and literary genre, and science and technologies, have long been intimate bedfellows. We round off our presentation of the case studies of artistic practices that intervene in the digital transformation, with a provocative account of how and why science fiction—a demeaned and marginalized artistic genre, may indeed function as a pharmacological catalyst of the harmful, rather than remedial, properties of technologies.

Anti-surveillance art

What is anti-surveillance art?

As a sub-genre of socially engaged art practices, anti-surveillance art initiatives have recently proliferated exponentially in line with the largely imperceptible penetration of facial-recognition technologies into almost all contemporary public spaces, from international airports and metro stations to city squares and local parks. Common to various forms of anti-surveillance art is the intention to create opportunities to critically rethink the relationship of people to larger systems of technological control. Anti-surveillance art encompasses a broad range of artistic initiatives that directly engage with the 'algorithmic anxieties', or concerns about own subjectivity in the context of uncertainty about who participates in capturing information and processes of recognition, and how this information is used to form accounts of individuals.

Like other forms of socially engaged art practices, anti-surveillance art is typically characterized by a participatory dimension, meaning the artist's role is that of collaborator and producer of 'situations' rather than discrete objects, and that first-hand experience or *doing* functions as a mechanism for conscious raising or affecting social dynamics. As a highly participatory art form, anti-surveillance art provides practical 'creative' solutions to undermine, confuse, disrupt, and resist facial-recognition algorithms.

There are four broad directions within anti-surveillance art that seek to reassert human subjectivity or cast light on the threat to subjectivity by surveillance technologies: 1) works that enact plays of avoidance; 2) works that interrupt or confound data collection and processing; 3) works that expose surveillance practices to heighten transparency; and 4) works that emphasize viewer's complicity or participation in the regimes in question. In what follows, we briefly describe two most common types of technology-resistance strategies in anti-surveillance art: a) works that enact plays of avoidance or 'adversarial images' and b) works that interrupt or confound data collection and processing or 'poison attacks'. For each, we discuss how attitude and aims of how art and technology interact, and we consider the various actors involved and the nature of participation.

Strategies in anti-surveillance art

Corresponding to artworks that enact plays of avoidance, 'adversarial images' (Seabrook, 2020) are used as a strategy to disrupt neural networks to distort what the object-detection algorithm 'sees', typically through facial art and/or coverings worn by participants in political protests and acts of civil disobedience. The concealing of identities through adversarial imagery is a means of resisting techno-corporate pressure to reduce our subjectivities to mere aggregates of data exploited for the purpose of extracting information about sexual, racial, ethnic, and criminal identities. On the surface, one may be inclined to dismiss the facial art or coverings as an aestheticization of resistance or ineffectual game of cat-and-mouse between technologists and activists/hacktivists that only led to the improved effectiveness of surveillance technologies. However, the potential of adversarial images lies in their role as a material platform for consciousness-raising and community building in relation to digital surveillance and algorithmic control.

A common platform for experiencing and enacting 'adversarial images' as artwork is the workshop format. For example, Adam Harvey's project CV Dazzle (2010–present) is often disseminated via workshops, where participants learn techniques to thwart the 'Viola-Jones Haar Cascade' facial-recognition algorithm using a range of freely available camouflage techniques. Camouflage techniques used in CV Dazzle include flamboyant, hyper-visible, and Cubist-like make-up styles with sharply contrasting colours and asymmetric shapes designed to subvert computer vision. The objective, as Harvey discusses in a 2016 interview (Cerella, 2019), is not necessarily about beating the machine:

> *One of the biggest challenges in discussing topics related to surveillance technologies is to avoid becoming fatalistic. My work aims to imagine new and expressive ways of adapting to this environment. In my own work, there is an object attached to it that is a 'discussion-generator.*

As such, the workshop format functions to learn about how facial recognition algorithms 'read' humans, and in doing so it raises awareness of the harms of facial recognition and biometrics. In the workshops, participants, including artists, workshop facilitators, activists, and general public wanting to act on their algorithmic anxiety, typically practice applying the camouflage techniques to each other, all the while having a deeper discussion about speculative responses to the treat of surveillance technologies.

'Poison attacks' (Seabrook, 2020) are initiatives in which a collective draws attention to surveillance structures by 'polluting' and compromising surveillance databases with 'garbage information'. For example, Kate Bertash's *Adversarial Fashion* functions as a poison attack on databases of individual vehicular movements. Such databases have emerged through the proliferation of public and private optical-readers that track and store information on car registration-plates, with a single database often containing hundreds of millions of license-plate locations for use in predictive policing and for imposing restrictions on personal freedom of movement. Particularly problematic with such technology is the very few data privacy restrictions and inadequate data security. Bertash's *Adversarial Fashion* sets out to corrupt these databases and undermine their unethical data practices by fashioning clothing and accessories adorned with license-plate imagery that generate numerous false positives to disrupt the algorithm. From her website Bertash sells items of clothing and accessories with license-plate imagery, and those that buy and wear it resist surveillance technologies and explore imaginative and extraordinary ways to safeguard basic liberties (privacy, freedom of movement, and independent judgment). They also raise debate the allegedly 'convenient' and 'civic' surveillance technologies sold by governmental authorities or corporations as tools contributing to 'safer' neighbourhoods.

As strategies of anti-surveillance art, both adversarial images and poison attacks expose an otherwise invisible system of technological surveillance to highlight and render visible the discriminatory and toxic effects of biometric data-capture but also helps to offer remedial solutions. Such solutions usually take the form of a call for collectivised and politicised action, as reflected in the following declaration by US artist Sterling Crispin (2014: 43):

> *We have the agency and duty to guide these systems toward solutions which give back to the human, and address the human as human.*

Now in a situation whereby the majority of images are made by machines for other machines, a further direction of anti-surveillance art practice asks us to look beyond algorithmic data conceived from the perspective of human interaction, such as how algorithmic biases mediate representation of a subject. Instead, these anti-surveillance artists are concerned with unravelling 'machine vision' or the means by which machines automate visual perception to draw our attention to how data is used and how image categorization occurs (Celis, 2020). Contrary then to anti-surveillance artwork that seek to counter or restore subjectivity and humanity from surveillance processes, artworks that unveil the impact of algorithmic vision often communicate that the machinic eye does not think in terms of identity, subjectivity, or representation, but rather thinks in terms of statistical analysis and acceptable margins of error. Framed this way, these artworks recognize that algorithms used in surveillance such as gender classification algorithms cannot be assessed in term of objectivity (degree of non-bias) since the algorithm is always trained upon previous data. Instead the artworks recognize and communicate that algorithmic performance can only be measured in terms of its efficiency (statistical likelihood of accuracy). Such anti-surveillance artistic initiatives then morph into a newly-emerging paradigm of artistic practice that of so-called data-set art, to which we turn next.

Data-set art

What is data-set art?

The elusiveness of the term data, which can be understood to encompass any representation of entities, knowledge, or information, existing and taking meaning through their own contexts (Borgman, 2015) make dataset art hard to define. Broadly speaking, the label dataset art can be used to categorize any artistic practice that makes use of collections of information (databases or archives) stored digitally and which are either made by the artists themselves or are readily available on the internet. The infrastructural use of datasets in machine learning (ML) technologies, and the pervasiveness of these technologies in our daily lives, have been found to have repercussions on the marginalization of vulnerable subjects, (Borgman, 2015; Caplan, 2016; Crawford, 2021). Dataset art represents thus a critical enquiry into ML and the unethical use of datasets with artists interrogating the political, social, and material impact of machine learning. A more constructive definition of dataset art might therefore target practices that explicitly and conceptually engage with datasets and their uses in a critical manner.

ML refers to the process of training artificial intelligence systems (AIs), and *synthesized, generalized, and often classified collections of data, or datasets, are foundational to these technologies* (Thylstrup, 2022). *Creating a successful AI require* extensive and computationally intensive training with large datasets, either collections of images, text, sound and/or video, depending on what information needs to be captured. These collections are training datasets, and establish a "ground truth", becoming the premise for the AIs predictions or creations (Crawford, 2021). Often standing on the shoulders of older classifications and collections, datasets can reproduce gaps and biases already inherent in these, as well as creating their own biases through their particular accumulation of information. There is an underlying assumption in the tech community that all training data is interchangeable, and what is necessary for algorithms to work is a large-enough database. Datasets used in ML are only machine readable, and being hidden from

human eyes, this makes them prone to reproducing gender, ethics, racial and age biases. Since data always is attached to bodies and therefore have biopolitical implications, it can be used as weapons of suppression and marginalization.

Dataset artists set out to remedy such toxicity of digital technologies, as perpetuated by machine learning by exposing publicly how bias is being reproduced in and through the ways technology designers use, deploy and create databases.

For example, Trevor Paglen's *Machine Readable Hito* (2016) is an illustrative case. In this work, Paglen presents 360 colour photographic portraits of artist and art theorist Hito Steyerl, each depicting a different facial gesture. Beneath each portrait, the artist has added a short metadata text indicating age, gender, and other signifiers interpreted by the facial recognition algorithm. For Paglen, art has an important role to play in critiquing the flaws in recognition technology and drawing our attention to limitations of the underlying data sets used for training AI, particularly the widely used ImageNet database. Paglen elaborates on problematics with the ImageNet database in a 2020 interview (Blanch, 2020):

> *Keep in mind that the intention of this data set is to teach AI systems how to see the world. So, when you look at this data set, which is the most widely, publicly used data set in AI, you really see that it's horrible. It's horribly racist, it's horribly misogynistic, and really explicitly so. And that really bothered me, especially because so much of the discussion around AI is always that it's objective, it's superhuman, and it can be things that we can't be, and, when you look at the stuff that it's actually made out of it, it's just shit. So I made this online application where you could upload a photo of yourself, and then, a model trained on this data set would tell you what kind of person you are, according to that data set. And that took off and became this weird viral internet thing, and then, Stanford actually went back to that data set and said that they were going to try to fix it and take out a lot of those categories and things like that. I don't think it's going to work, though. I don't think you should be classifying people at all. But in a nutshell, those are the basics of the story. The point of that was to show that the ways of seeing people that were built into this data set were deeply problematic*

Often less participatory than anti-surveillance art strategies, dataset art functions in an educative manner to assert that the face in the age of algorithmic recognition is a matter of pre- and supra-personal probabilistic calculations rather than one of individuality and subjectivity.

The (ab)use of databases: social inequalities and bias in machine learning

ImageNet is one of the largest existing image databases, having the explicit goal to "map out the entire world of objects" (Crawford, 2021: 11). It draws its classification of images from a similarly large word-database, WordNet. Although classifications schemes like this usually are embedded in working infrastructures and therefore rendered invisible, classification of images in databases is a powerful tool and have large repercussion when databases are used in ML. In the case of ImageNet, words from WordNet are *manually* paired with images by underpaid Amazon Mechanical Turk workers, and many of the words used are racist, ableist, sexist and offensive in

other ways, and these harmful categories are later reproduced when the dataset is used in ML (Crawford, 2021).

Trevor Paglen and Kate Crawford in the artistic-research project *ImageNet Roulette* (2019), expose how technological systems come to not only reproduce, but also exacerbate such harmful classifications of people. In this project they asked users to upload pictures of themselves to see which classification category ImageNet might put them in (Crawford and Paglen, 2019). Through this project and related research (Crawford and Paglen, 2019), the artists were able to excavate the harmful and absurd categorizations of humans perpetrated by ImageNet, which has led to the platform removing the offensive image categories from their page and discontinuing the public use of the database Thylstrup (2022).

Another type of dataset art tries to "bring people back" into the critical rethinking of ML and datasets and aim at exhibiting the human bodies and faces needed to create the software, and thereby counteracting the dehumanizing forces of tech companies, and the treatment of humans like bits of information to be traded and used.

An example of this is the artistic project This Person Does Exist (2020, https://this-person-does-exist.com), created by Russian-German artist and researcher Matthias Schäfer. On the project's website, images of people are shown one by one, a new photo appearing each time you refresh, along with the belonging metadata, such as the name of the owner, link to their profile, and date of upload. The images come from a dataset originally created by Nvidia Research Labs through scraping images from the popular image hosting platform Flickr without the user's consent, although still available through the creative common license. In turn, software developer Philip Wang used this dataset it to train an AI into generating seemingly realistic photos of people who do not exist, exhibited on the website https://thispersondoesnotexist.com (Schäfer, 2021). The original website alarmed the public about the possibility of AIs producing fake images on the basis of 'real' ones (Schäfer, 2021). In his project Schäfer reveals the pitfalls when the faces of real humans who are used to train the system.

Yet, the artistic use of already existing databases, is not fully unproblematic. It could itself potentially perpetuate the same type of inequalities and breaches of people's privacy while potentially harming the depicted through re-exhibition of non-consensually extracted images, as well as overextending the creative commons license, by using datasets for commercial gain, for example when selling or exhibiting the artwork. Schäfer is also self-critical of his own project when he writes: "My work shows the person that does exist behind the AI model, but it does violate personality rights as much as the original database." (Schäfer, 2021: 220). The goal to "educate the public about the practice of machine learning as data hungry behemoth that can only exist, because researchers and companies scrape data from the web" (Schäfer, n.d.), might be a double-edge sword.

Another example of a playful creation and testing of an image database to expose the inherent gender bias of machine learning is the work by Ada ada ada or artist Ada Hyldahl Fogh. Ada is a Danish artist working with AI, blockchain, and digital platforms, among other mediums, within an intersectional eco-feminist framework (Ada ada ada, n.d.). Her work is often informed by her identity as a trans-woman, especially the project in transitu (2022-ongoing), an Instagram-based performative work. Every week, the artist posts a picture of herself to the profile

@in_transitu_ig, documenting her process of gender transition, posing the question: "When will Instagram ban my nipples?". The question refers to the infamous Instagram moderation protocol, which bans images of women's nipples from the platform, which have received continuous and heavy criticism from users as sexist censoring of women's bodies (Jacobs, 2019). On her website, Ada ada ada writes:

> *However, as a trans woman currently undergoing a gender transition, Instagram does not yet see me as a woman. So each week I put up a picture of myself, where my nipples are visible. At some point, my selfies will no longer be allowed on the platform, because they are perceived to be belonging to a woman. This will be a joyous occasion, because it means that even the largest image-based social media in the world sees me as a woman. However, it will also be a stark reminder that I have now lost my male privilege.*

Parallel to the selfies, Ada ada ada also runs the images through a series of commercially available gender recognition softwares, provided by companies such as Amazon and Microsoft, and posts the results along each week's image. All softwares present gender on a sliding scale gender percentage, from 100% male to 100% female. Each week, the artist seems to be classified differently, pendulating seemingly arbitrarily along the gendered scale, sometime categorizing her as "almost completely" one gender or the other, and often as something in between. The failure of the software is commented humorously by Ada ada ada, noting for instance: "I took this picture yesterday on my birthday, which Amazon celebrated by rating me 62% female. Thanks, Jeff!" (*Ada ada ada*, 29.09.22) or "I did it! According to face.api.js, I have reached perfect equilibrium between the binary genders. 50% female, 50% male, 100% confusing." (*Ada ada ada*, 15.09.22). Ada ada ada exhibits the ridiculousness of the gender recognition software, its biometric reading having little ties to the reality of individuals' gender identity. She also makes visible how transgender people fall outside norms of categorization imposed by these systems, and by relentlessly posting pictures of herself, appropriates Instagram's platform for sake of her own visibility, exposing a body which the platform and the AIs deem invisible or deviant. She is proving how gender identity is a more fluctuating and complex form than what can be captured by facial classification software.

The idea that data mirror an exact version of reality remains undebatable within many scientific communities, which provides the basis for essentializing gender, age, racial or ethic categories in ML (Crawford, 2021). An artist working with a critique of classification and systems of knowledge, is the London-based artist Anna Ridler. She was a part of the Photographers Gallery in London's *Data / Set / Match* programme (2019-2020), which explored the technical, cultural and social significance of image datasets, and in which Ridlers work *Laws of Ordered Form* (2020) was commissioned and exhibited (The Photographers Gallery, n.d.). The work consists of a two-part video and a downloadable handmade dataset, constructed using thousands of found images and texts from Victorian and Edwardian-era encyclopedias, and then manually reclassifying them (Ridler, n.d. a). Ridler writes on her website:

By collapsing this moment of history with today's current concerns around dataset bias, the piece emphasizes the problems with classification without thought, and consider the histories that remain in our present, even within the latest technologies.

Working with historical image databases such as the encyclopedias, Ridler sheds light on how contemporary AI classifications systems have their roots in 17th to 19th century science and classification schemes, in which a growing interest in ordering the living world arose, and how these collections were impacted by imperialist ideologies within knowledge production (Ridler n.d. b). While encyclopedias and collections were a way of fixating knowledge and determine neutral and positivist facts, these historic taxonomies of the world have largely impacted cultural beliefs, resulting in many colonial, racist and exoticizing values persisting within western society (The Photographers Gallery, n.d.). These worldviews continue to dominate the way in which we organize the world, influencing machine learning technologies of the present moment (The Photographers Gallery, n.d.).

In her work, Ridler chooses to classify the images herself, showing the subjectiveness inherent in the otherwise deemed neutral sciences of natural history and biology. In turn, she shows how these subjective biases are injected into machine learning systems, reflecting the world of the engineers behind technology back at them (Ridler, n.d. b). Entities of classification are both invisible and potent technologies permeating our living world, as well as a physical, hidden and time-consuming work done (Ridler n.d. b). Ridler exposes the human labor and the intensive and repetitive process behind AI production, which usually is concealed by tech-companies' discourse of smoothness, acceleration and automatization. Ridler works herself as a "human algorithm", decontextualizing images from their initial categories and placing them within a new semantic order, perpetrating her own biases, making the subjectiveness and inherent politics of dataset building visible (The Photographers Gallery, n.d.).

Through these works, we see the artistic pharmacological potential for transforming and re-enchanting the world through care-ful practices (Alacovska et al., 2020). By interrogating and excavating the harmful and dubious practices of big data-companies and governments, and by reappropriating datasets and systems of ML, artistic digital practices can be a remedy for these harms. As these technologies have big ramifications for our lifeworlds, the display of the inner workings of these system makes us aware of their inherent failures, which in turn can be an inspiration for social action.

While data-set art is largely consciousness-raising about inherent biases and inequalities of digital technologies, arts-based hacking imparts hands-on skills to art participants on how to challenge (hack) existing technologies and counter their harmful influences.

Arts-based hacking

What is arts-based hacking?

Art-based hacking is a participatory art practice involving the retooling and reappropriating of technologies via artistic means, often associated with a specific civic purpose or social good in

mind. It typically draws on citizens/audiences as co-producers in the artistic process of technological manipulation and subversion while collaboratively imparting hands-on capabilities and know-how. In this way, one of the aims of art-based hacking is the democratization of digital tools, technologies and making skills to people that might otherwise be excluded from such knowledge and equipment. Common practices in this genre include open-source programming, do-it-yourself technology design within maker communities, and 'creative coding'.

In contrast to the popular association of 'hacking' with illegal activities, hacking has its roots in knowledge acquisition, programmer subculture, transgression, free and open-source software, and transparency (Coleman, 2012; Richterich & Wenz, 2017). Hackers and artists share a range of common values; they uphold the values of freedom, open access, privacy, and inclusivity. As an activity that is at once playful and aesthetically oriented, but which also offers critical insights into our techno-social milieu, art-based hacking is aligned with a pedagogical model for developing technical know-how. Reinforcing the idea that learning and knowledge is typically more important than outcome in art-based hacking practices, the term 'digi-grasping' (Dufva and Dufva, 2019) has been used to capture the idea that there is pedagogic value in practice-based thinking about our embodied experiences of digitality, and that more playful, artistic approaches to working with technology removes the imperative on finished products and technical proficiency. In this way, arts-based hacking builds on many of the foundations of hacking, but does so in a more playful, pedagogical and arguably reflective manner.

Sharing a similar pedagogical leaning is the concept of maker communities. The recent surge in usage of the terms 'maker' and 'making', as well as the rise of 'maker spaces', 'fab labs', and do-it-yourself (DIY) collectives, testifies to a new era of arts-based technology customisation, citizen-led creative engagements with technologies, and the practice-based accumulation of tech knowledge. Makerspaces are organised as a means of providing communal DIY environments for shared learning, access to otherwise prohibitively expensive equipment, a platform for 'prosumerism', and—critically—a site for enhancing our digital literacy.

As a point of difference, arts-based hacking is typically more explicit in resisting intensifying tendencies to turn makerspaces into commercial venues and start-up enterprises. By infusing maker culture with a multiplicity of artistic perspectives, arts-based hacking reinstates a critical agenda into making. Arts-based hacking in makerspaces goes even further than extending conceptual understandings of critical sociotechnical issues. It fosters a form of hands-on care through the development of more equitable, fair and inclusive anti-corporate digital technologies. An underlying principle of arts-based hacking can therefore be what artist historian Abigail Susik (2019) describes as a "rerouting of both the means of production and consumption in a post-industrial capitalist sphere".

Beyond its pedagogic, critical, and 'caring' orientation, Susik (2019) identifies several other properties associated with arts-based hacking. First and perhaps most obvious, technology is both content and practice/medium in art-based hacking. Second, arts-based hacking involves the appropriation and/or use of industrially-produced commodities in image, material and/or process. Whether it be rerouting of social media technologies or crowd-sourced databases, arts-based hacking typically appropriates tools of everyday life to provide a critical reflection of their function and meaning. Third, art-based hacking typically operates as some kind of functional or

dysfunctional tool. This quality offers some degree of differentiation from the broader visual arts which may exist as a functional/disfunctional tool, but needn't have this quality to exist as art. Fourth, since art hacking typically involves a reconfiguration of technology into something technologically operative (however disfunctionally), some of its process are often embedded in systems of production or consumption. For this to work (i.e. for the arts-based hack to be embedded in a system of consumption or production), arts-based hacking often requires a collective mobilization (tools, knowledge, or space) that places the activity in close contact with 'non-arts' resources, processes and contexts.

Hack actors, hack events and hack strategies

Reflective of its democratised and decentralized quality, it is problematic to label and characterize key actors and structures involved with arts-based hacking practices. Nevertheless, it's a useful exercise for providing an overview of important individuals, groups and structures in this genre, and how they insert themselves within the genre of arts-based hacking.

Labs and Fab Labs (fabrication labs) consists of a range of urban and university labs and organizations that bridge technology research, maker cultures, arts spaces, industry and other elements. Common to these physical spaces and their communities is the quality of more free experimentation forms alongside more tradition technology-based research. Labs and Fab labs are typically oriented towards sharing technical skills and supporting experimentation, but are arguably less accessible to diverse groups of people partly due to a perception that they are specifically places for those interested or skilled in technology. Labs and Fab Labs provide a critical infrastructure for experimentation and realization of arts-based hacking projects to be 'activated' within the Lab / Feb Lab community (narrow audience) or outside that community (broader audience). In collaboration with visiting/resident artists, Labs and Fab Labs can function as infrastructures for sharing critical knowledge in relation to technology to more diverse audiences and provide a space to transform participants in to activate citizens who hack and repurpose technologies for alternative ends.

Art Hack Events, residences and workshops consist of temporary infrastructures of the maker movement and more traditional arts infrastructures. Art Hack Event, also known as 'hackathons', 'hackdays' or 'hacks' are intensive events that occur over a short time frame (from a single day to 48 hours) where there is an emphasis on co-making and problem solving. As a concept borrowed from the commercial tech sector, the short-time frame encourages participants to work in an experimental, low-risk manner, and the format is considered conducive to generating discourse, collaboration, the starting point for new artworks and ideas. Participant communities may include artists, hackers, makers, creative coders, engineers, scientists, data architects, technologists, arts and cultural professionals, and business. With a potentially diverse participants group, organizers of art hack events need to be sensitive to different motivations and needs. As expressed by a developer interviewed for a 2014 British Council study (Brearley, 2014) of arts hacks events, for the already technically proficient there may be a need to come away from the event with a new learning (p. 63)

> *For the participant I would say that the learning is the most important part. They are very much learning occasions. Personally if I come away from a hacking environment and I have learnt something then I*

am happy, if I come away and I haven't learnt anything and I have just created something that I would have created anyway, then my opinion is why didn't I just make that at home?

For others, as articulated by another participant in the same British Council study of art hack events, participation hinges on the perception it will attract interesting people and be arranged in a format where collaboration with these people be possible (Brearley, 2014, p. 43).

I attended the CultureCode hack not because I wanted to win a prize, not because I wanted to turn a prototype into a start up business, not because I thought it would lead to future lucrative work, but because I wanted to play and experiment with other interesting people.

Artists can be particularly sensitive to arts hack events that impose a commercial logic (emphasis on competition, prizes, outcomes, etc.) or where the contemplative aspect of the artistic gesture is limited by the speediness of the event. Artist Constant Dullaart (quoted in Ordnung, 2014) publicly declined his invitation to join the 2014 Transmediale Art Hack Day in Berlin, citing the following reasons:

A fast, cost effective, even competitive, corporate way in which a large quantity of approaches can be included, competing with each other, stimulating ridiculous work hours, without any fee or compensation. Stimulating easy and quick solutions to personalise mass produced technology with an artistic flair. After which the work is presented without any chance of contemplation, or for that matter curatorial intervention.

Hack residencies and workshops offer a slower frame for a rerouting of technology. Hack residencies often consist of an artist or technologist being provided with a working space and access to a range of partner organizations and visiting professionals. In addition, the resident (invited or by open call) may be given a stipend, access to equipment or data, or a public platform to share their work. In return, the hack resident is often expected to make their work generated during their residency—whether art, research, code, or machines—open source and accessible to the public through means like teaching tools, open events, public repositories, and documentation.

Art hack workshops occur both within and outside the art hack residency format. Workshops function as a means of testing research, honing an artist's skills, disseminating ideas to a broader audience group than would normally access Labs, Fab Labs, or Art hack events, working with a specific community group on a technology related topic that is particularly relevant to them, or as a mechanism for non-hierarchical exchange of knowledge. A common strategy in the workshop format is for the artist hacker to provide technological instructions for non-expert audiences to engage in various forms of technology rerouting. One such example is Caroline Sinders' *Feminist Data Set project* (2017-) which sets out show how citizens can re-appropriate the fight against algorithmic bias intrinsic to many technologies, such as algorithmic hiring that privileges male applicants. As algorithmic bias is contingent on the quality of the datasets on which the algorithm has been trained, Sinders collaborates with workshop participants to make 'better

data', that is to build a diverse and inclusive dataset co-produced by participants. In a very concrete, visual manner, Sinders new data set starts out as an ever-expanding wall of post-it-notes consisting of participant generated data.

Another example of the art hack workshop is Mirabelle Jones's *Diverse Sci-Fi Wikipedia Hackathon* (2021). This hack workshop was a response to the exclusionary and discriminatory tendencies intrinsic in the knowledge crowdsourcing technologies such as Wikipedia, and was structured around question of who gets heard and who gets to shape the development of technology and its history. In addition to sparking critical thinking on the place of women in the development and history of technology, the workshop developed the participants' practical skills in the programming and management of digital editing knowledge, enabling them to play an active part in expanding the currently scant and gender-biased Wikipedia entries on female designers, innovators and technologists.

Art hacking also offers effective modes for recuperating technical knowledge and competence hidden from view by commercially generated technologies whose convenient interfaces diminish user understanding of underlying processes. Illustrating this process, the Italian artistic duo Iaconesi and Persico set in motion a radical process of de-mystifying AI technology. The artists have designed (coded, built and run) and implemented an open source, free access, artificial intelligence for the purpose of arts-driven learning and exploration of the adverse implications of AI in communal life. The artists invited the inhabitants of one of the most ethnically diverse neighbourhoods in Rome to provide input data through workshop participation and daily encounters in bars, laundries, schools, or groceries stores. These interactions functioned to demystify AI by revealing machine learning inputs and processes.

Figure 1: *AIQOS Box soliciting knowledge-gifts: "Leave a welcome message to the new AI child" (left) and an inexpensive prototype of the AQOS placed in bars (right)*

Illustrated in the three example above, three main types of hack can be identified in Art Hack Events, residences and workshops. Common methods ideation methods across these formats include 'paper prototyping' involves brainstorming and idea development usually involving lots of flipcharts, post-it-notes and marker pens; 'data hack' where datasets form the basis of prototype development; and 'maker hacks' which utilize technologies such as 3D printers, arduinos, Raspberry Pis, synthesisers, soldering kits, recycled parts from old PCs and other bits of hardware, software and recycled materials.

Net art

What is net art?

The term 'net.art' appeared on online discussion forums in the mid-1990s to describe the emerging use of the internet's infrastructure and browsers as both a subject and medium of art making. Since then, 'Network art', 'net art', and 'Internet art' are terms that have been used somewhat interchangeably to describe art practices that respond to a specific range of themes and practices as pertaining to digital technology developments. These themes include: protocols of the Internet; informational processing; data; the ubiquity of web-based and digital technologies and their social, cultural and economic impact; a site specific arts-practice; a utopian Avant Garde project that uses technology to achieve a participatory and democratic mode of cultural production; a relational arrangement (network) that makes visible the connections and power structures between seemingly unconnected disciplines, actors, and objects; a type of critical software that refuses the ideological bias of the internet's professionally developed tools and architecture. Already by 2000, net art was declared dead, with the term absorbed into the more mundane label of 'new media art' or replaced by terms such as 'post-Internet' and 'post-digital' art which have a greater emphasis on the broader networked conditions of art production and reception. More recently, there have been calls to reclaim earlier terminology to assert the specificity of arts practices that are created on and about the Internet. In line with this call, this brief text draws on the reflections of several net artists to provide an analysis of the contemporary characteristics and strategies of what will be heron referred to as 'net art'.

Particularly with the emergence of terms like 'post-Internet' and 'post-digital', which refer to making (and consuming) art 'after' the internet and less art 'on' the Internet, it is easy to obfuscate the rich and ongoing history and knowledge of artists working with the site-specificity of the internet. Net art thoughtfully responds to the emergence of and widespread impact of networked informational technologies, and does so via a site-specificity which distinguishes it from the ever more networked conditions of contemporary digital society. Net art predominately functions online and through web-based architectures, which is to say it is predominately art made on and for the internet.

Net art's site-specificity coupled with the ephemeral nature of online architectures and communities gives it a transient nature. Net art can then be described as a web-based performance that exists for those present at the right place and the right time. A significant challenge of net art (as with other forms of technology-oriented artworks) is that of conservation. While net art is often documented, the record removes the work from its original active state and its time-

based medium and is therefore is only ever a 'shadow' of the original. This problem is exacerbated by a common delay between net arts creation and any subsequent institutional recognition and attempts to introduce broader audiences to these works that may no longer be in their original active state or complete form. The transient nature of web-based art such an ingrained feature of net art that artist Guido Segni created a website (https://topexpiringinternetartists.com/) that provides a daily updated list of the most influential net artists based on the expiring date of their website. Talking about his project, Segni (Lorenzin, 2015) offers further reflections on net art's transience:

> *Working with digital based technologies, I've always had to face the problem of ephemerality: every year I need to renew the subscription to the hosting service of the many websites I own, I periodically have to upgrade the technical environment of my works and often I also need to recode them from scratch in order to keep them all working. That's why I decided to transform this everyday battle with technology into an ironical and nonsense race for artists, aiming to survive.*

In addition to site specificity and ephemerality, a third key characteristic of contemporary net art is its engagement in critique of digital material conditions of using networks. To understand net art's critical engagement, it is useful to recognize the genre's utopian origins. In Alexei Shulgin and Natalie Bookchin's online publication from the 1990s, 'Introduction to Net.Art (1994-1998)', it is argued that net artists sought to break down autonomous disciplines and outmoded classifications imposed upon various activist practices. As the net art scene was emerging in the 1990's, there was a hope that artists could use the internet as a space to circumvent hierarchy, physical limitation, or government control to build autonomous and egalitarian worlds. Net art has subsequently taken on a distinctly more critical position towards technology and networks framed by technology, and this is attributed to the collapse of this earlier utopian promise following the rise of the tech companies in the Silicon Valley and their progressive control over discoverability and accessibility of content.

Key strategies in contemporary net art

In contrast to early net artists, many of whom were concerned with the formal properties of browsers and their open-source HTML code, the newer generation of net artists are more likely to work with Web 2.0's easy platforms, thus rendering coding skills non-necessary. As has been done throughout the history of art, these artists turn to existing content – the observable footprint of users who engage with, manipulate, post and repost content on commercial platforms. Reflective of the common loss of authorship and credit when images or content are shared online, the net artists' role then becomes something akin to A DJ, post-producer, and remixer.

For example, the Austrian artist Oliver Laric uses 3-D scanning technologies to make historical artworks and other objects available to be copied on his website, threedscans.com. In a 2009 interview Laric offered the following rationale for re-working existing online material:

> *And it's really obvious, video material that exists, there is everything you can imagine, from on sites like Youtube, or just on TV, or stock image sites, so there's not really any sense in producing anything, for me, right now. And I don't understand why few artists still use this*

material, and why so many still produce their own material, because I have a feeling there's just too much material produced—well, I don't know if it's too much, but there's such a load, and I would rather just find the ones that I can use. I also don't think that it's an issue of copyright anymore, this is a topic of using Youtube-like material, or using material that I'm taking from music videos or whatever. I think you have to ignore this topic, it's become kind of boring even to discuss it, to question of authorship, and who owns what, because some of the more revolutionary changes that are unique to technology are linked with ignoring authorship. If Youtube would be done in a very professional way, where everybody would get paid for the material that they are putting on, or if the rights would be cleared, it wouldn't work. I think it's necessary to ignore authorship, to create a space for something that's interesting again.

For many working with net art, cultural output is always 'work-in-progress', whether the output be a website, a database, an image, a platform, or something else. The JPEG image or video spawns a whole new set of online offspring, which for many net artists is a successful outcome. This quality also reveals the utopian ideals of net art have not been completely erased as net art took a more critical turn in the early 2000s. That output and activities should be shared also marks a notably distinction between net art and a derivative of net art, NFTs. NFTs have emerged partly to resolve economic and authorship problems associated with digital art, but they also thwart a more radical potential of digital art – shared ownership and authorship. While predating the rise of NFTs, Oliver Laric reflects on the importance of what he refers to as the 'involuntary collaborations' made possible by net art:

There are only few things as satisfying as involuntary collaborations. I stumbled upon the possibility as it happened naturally; in 2006 numerous viewers modified one of my videos ["787 Cliparts"] without my knowledge. As a response to these responses, I began creating scenarios that necessitate continuation. If it doesn't happen, it feels like the work is not working.

Site specificity is certainly contested for the expanded field termed 'post-internet art'. For net art, however, site specificity is a modus operandi that frees it from the curatorial, social and economic constrains of the museum or gallery environment. Net art often seeks to circumvent the art world's traditional structures and logics by actions and outputs that question authorship and exclusivity, or by ignoring 'expert appraisal' in favor of peer-to-peer review for determining artistic value. Although written nearly 25 years ago, Alexei Shulgin and Natalie Bookchin's 'Introduction to Net.Art (1994-1998)' affirmed the genre's aims for structural independence by asserting it sought "0% compromise…by maintaining independence from institutional bureaucracies". Of course, there are strong economic incentives for maintaining the status quo regarding the production of exclusivity and scarcity and processes of taste making within the art world, and efforts are continuously made to present and intermediate net art within the walls and structures of art institutions. As artwork made on and about the Internet, the presentation of net art within these physical spaces very often fails, particularly where net art is encountered as a screen-based object, even an interactive one, unable to capture the time-specific, networked

dynamics of the online version. Alternatively, as experienced by US artist Martine Syms when her net-based *Reading Trayvon Martin* (2012-ongoing) was presented in several gallery exhibitions, it creates an unresolved situation whereby the artist feels the need to clarify "it's a website".

Net art practices, past and present, remain fundamentally linked to the relational linking processes embodied by the network concept. Net art excels in linking heterogenous elements to formulate new structures and meanings. To achieve this, a common strategy of net art is to assemble speculative structures online that make visible connections between people, objects and disciplines that we might otherwise consider non-connected. Moreover, net art does not merely use the network as an artistic tool. Instead, it becomes the basis for radically moving art away from object and individual practice towards processes, connections, and collective artistic outputs. A highly successful if perhaps unlikely example of net art was the 2017 (repeated again in 2021) r/place collaborative art project developed by digital artist Josh Wardle for his then employer, Reddit.

On April fools' day 2017, Reddit released a white canvas square of 1000×1000 pixels on the subreddit /r/Place. Registered Reddit users were allowed to paint one pixel at a time from a palette of 16 colours. Because users were required to wait 5 minutes to add another colour, and because each pixel remained open for others to change over the 72 hours that the project ran, collaboration with other likeminded users was necessary to develop and hold a motive. In the end, more than a million users participated. Members of other online communities, rallied by various streamers, engaged in some tense battles for real estate. Rather than descending into disintegrated pixel chaos or offensive text or imagery, some surprisingly beautiful coordinated pieces emerged. More sophisticated users build extensions to coordinate image building among their online communities, while different groups were forced to negotiate to retain real estate. After 72 hours, users were only given the option of adding white pixels, and so the piece gradually faded back to white. In a 2017 interview (CBC Radio, 2017), Wardle discussed some of the relational dynamics essential to the r/place project and why it worked:

> *... the canvas is kind of a screenshot of the Internet at this moment in time. So there are a lot of Internet culture references and memes, but also it reflects the kind of collaborative nature of the Internet.*
> *... So you could place your pixels on top of someone else's. And there was a very popular movement early on called "the blue corner" and these were individuals that decided just to start painting blue in the bottom right hand corner. It was like the Canadian flag or any of the similar projects there was a simple directive paint blue. So it was very easy for people to follow. It's not like drawing the Mona Lisa where you really have to think about it. You're just placing blue pixels, but what happened is they ended up overriding a lot of other art that had already been drawn and they kind of felt bad about this and kind of came to terms and then invited all the other communities back to draw on top of this now blue area.*

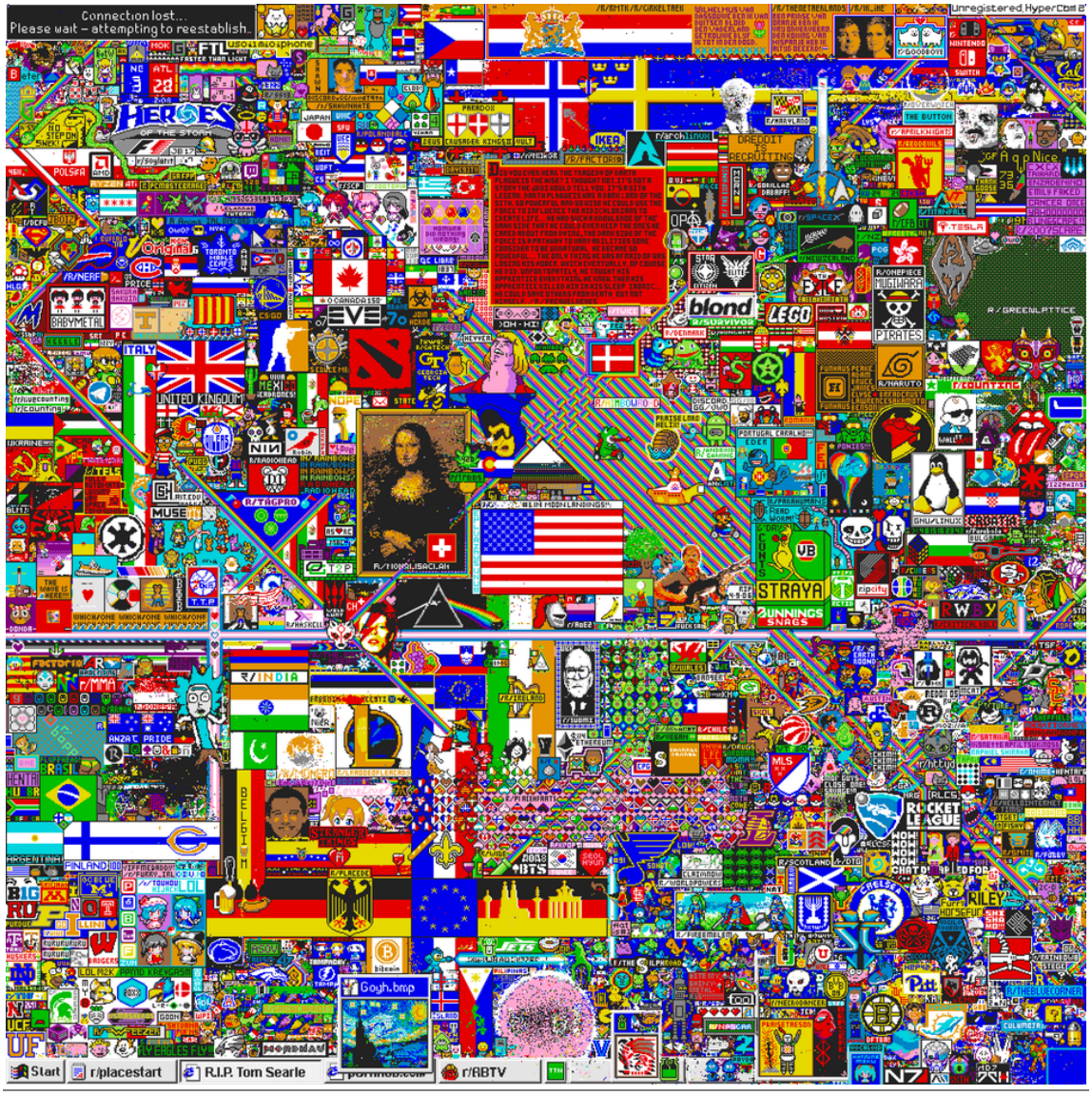

Figure 2: *R/place 2017 Canvas. Source: https://www.reddit.com/r/place*

Platform art

What is platform art?

Platform art is an extension of net art in the social media age. Social media platforms have increasingly become the infrastructural framework of the internet during the last couple of decades, giving rise to a so-called “platform society”. Platform society refers to the centrality of platforms within contemporary society, and is described by Dijck et al. (2018: 4) as “a society in which social and economic traffic is increasingly channeled by a (corporate) global online platform ecosystem that is driven by algorithms and fueled by data.” Platforms are complex sociotechnical systems in which numerous components are entangled; components such as data, algorithms, interfaces, formalized ownership systems and business models, as well as user agreements and law. Platforms such as Google, Amazon or Facebook are inextricable from the content produced by their users the monetization of their attention, privacy and data.

Social media platforms have accordingly received heavy criticism for their trading of users' personal information, as well as their attention-stealing cycle of accelerated content exposure. Crary (2014) describes perpetual online availability as an imposter in all parts of social and personal life, creating feelings of powerlessness and alienation. Capturing both our time and experience, this new capitalistic acceleration of production through content creation leads to an erosion of social connection. Similarly, Zuboff (2019) describes how platformization strengthens control technologies when users' data are used as capital on a market trying to capture consumer habits and annihilate user agency.

It is within this highly contested platform society that the platform art operates. Platform-based art utilizes software afforded by platforms, and such art is accessible through the same interfaces of social media apps and websites. Simultaneously adhering to and contesting the hegemony of social media, platform art offers a sense of urgency and hope within these toxic structures.

Platform art strategies: selfies, mediated performance and digital identity

For example, platform art challenges the manufactured connection between our social media profile and our 'real' self. Instagram, owned by Meta, has been deemed problematic in this regard, since highly aestheticized and normative images of faces and bodies flourish on the platform pretending to be a 'truthful representation' of reality. An artist working with the representation of the self on Instagram, is the Swedish artist and model Arvida Byström.

Developing a cult-like following on the platform, Byström has, through her mono-colored pastel and hyper-feminine universe, been influential in constituting the aesthetic for a certain fourth-wave, digital feminism (Weinstock, 2016). Although Byström's art today is exhibited in conventional galleries as well, the images themselves and their way of communicating with an audience seem to originate from the platform, bringing the "Instagram-aesthetic" to mainstream art venues (Pistachio, 2022). Selfies have been integral to Byström's practice on her profile, aligning with mainstream use of the platform. Through adopting what is commonly seen as a low-brow and narcissistic form of self-exposure (Lehner, 2019), Byström highlights the transformative potential of self-photography as a woman. Her work relates to earlier artistic practices within woman self-portraiture as way of re-distributing the power of self-representation, and as a salvaging of the female body from the art-historically situated male gaze. The practice of selfies has facilitated a diversity within image-making, enabling otherwise representationally marginalized people to contribute their own visions of themselves to visual culture. In an interview, Byström states that:

> *To be honest I think loads of us still represent ourselves through some kind of male gaze, but I do think there is a huge difference to somewhat be able to hold the camera yourself and take a selfie without having a man present. (Weinstock, 2014)*

Although herself being a young, white woman, presenting images of a type of body deemed profitable and usually highly circulated on the platform, Byström has experienced multiple instances of censorship, even with images not explicitly violating the terms of service, such as images with visible body hair (Pistachio, 2022). This might be revealing of how the platform lends itself to a specific sort of male gaze, profiting from sexually implicit images of women, but not

tolerating slight variants to this rigid image of femininity (Donovan, 2017). Through continually sharing images of herself despite norms imposed by the platform's seemingly arbitrary regulations, Byström is appropriating the feed for her own means of 'unvarnished' self-representation, in conversation with a more conventional performance of femininity on Instagram:

> *Most of my followers think that this is an aesthetic that is fun to play with. A lot of the time, I feel like I do it in a very hyper-sexy way that is barely sexy to a lot of straight men, because I'm too much (Rosenzweig, 2018)*

By using Instagram as a platform for her art, Byström reaches a larger and perhaps not usually art-consuming audience, implicitly encouraging empowered self-representation, as well as offering an adoptable artistic universe for her audience to play with, creating an awareness of the role of social media on the way femininity is perceived and judged.

Another example is Molly Soda, real name Amalia Soto. Soda is a New York-based artist working with themes of internet celebrity culture and identity, reflecting on her status as an early Tumblr sensation, rising to fame on the platform in the 00s and 10s (Dansdill, 2020). While exhibiting in physical galleries as well, Soda has stated she feels her work lives best on the internet, where it becomes part of a larger sociotechnical ecosystem (Duffy, 2018). Drawing upon the confessional practices of vlog-culture, much of Soda's work consists of YouTube videos of her speaking to her web camera in what seems to be her bedroom.

In an early piece, *Inbox full* (2012), Soda recorded herself for ten hours straight, reading aloud all messages in her Tumblr-inbox. The video seems to be a comment on the strangeness of a certain kind of micro-celebrity status produced by social media. The messages—many confessing deep love or disgust with Soda's internet persona—are read back to her followers, thereby exhibiting the projection that takes place between viewer and online creator. Soda is reflecting on the artificial sense of connection produced on social media, stating in an interview: "I think the internet accelerates feelings of intimacy." (Geffen, 2018). Her work is made by and lives within these feedback-loops of para-social relationships on the internet, and comments on the loss of control over how one is perceived online.

Another aspect of Soda's piece is its length, which, bordering on absurdity, seem to be reflecting on online time-use and attention-theft. The long-form YouTube video format has only grown in popularity in the ten years since the upload of *Inbox full*, the platform's algorithm continuously pushing creators to create longer videos (Sung, 2022). The popularity of long form vlogs, as well as the algorithmic push for frequent and seemingly less curated posting on all platforms, might stem from the simulation of closeness with the creator when viewers feel they get to peek uninterrupted into someone else's life (Nunes, 2015). The oxymoronic relationship between social media's-obsession with "being real", at the same time as content creation largely is becoming more professionalized, is something Soda continue to explore in her work (Duffy, 2018). Uploading them to YouTube, Soda make her videos intentionally indistinguishable from other vloggers. She has said:

> *My favorite thing about the work that I make is the misconception that people have because we're looking at each other online all day and we're just projecting whatever onto one another. I think it's really*

amazing that people interact with my work and they don't know that I'm an artist. (Dansdill, 2020)

Another example of how social media-based art exists intertwined within interactive platform structures, making interaction between users and content a continual performative and relational aspect of the work is the Instagram-feed and its "digital resting point"-format, as originated by the Brazilian-American LA-based artist Gabi Abrão, otherwise known as the Instagram-profile @sighswoon.

Abrão launched the format in 2021, by placing the text "Congratulations! You've reached a digital resting point. Stay as long as you'd like." on video-clips of natural landscapes such as sunset beaches and lush waterfalls. The format aligned with the content otherwise posted on @sighswoon, usually being images and videos expressing a caring and contemplative mentality, such as existential memes and manuals for dealing with everyday issues. "Digital resting points" were quickly picked up by the profile's followers, creating their own versions by filming other kinds of peaceful scenes, such as wind blowing through a field of grass or a dog resting on a bed, and posting them with the predescribed text. The text seems essential to the format, creating a sense of achievement within the possible endless scrolling on Instagram, as well as configuring the posts as a physical space within which the viewer can stay (Lorenz, 2022). The format's popularity can be connected to the disintegration of rest due to social media's constant attention-grabbing stream of stimuli. Commenting on the format's effect, Abrão says:

I don't believe they work in the sense that they fill someone with automatic peace. […] I think digital rest points more so remind you that rest is possible, rest is a choice you often have to make, and beauty is all around us. You can turn your phone off right then and go take a walk instead. (Yalcinkaya, 2022)

The "digital rest"-format can be seen as an offering of self-care practice to a community of followers, creating a way to share peaceful and beautiful imagery, not as a way of boasting about being able to travel or take time off, but as collective reminder that rest is possible. While much mainstream content on Instagram is enhancing consumerist values, and even a serene beach-side view can be used to sell products, these digital rest-spaces seems to subvert the Instagram logic and reimagine the attainability of rest. In this way they inspire slowness within scrolling and therefore resisting algorithmic pressure and configuring new worlds and modifying our own within the generative potential of the digital.

What connects these platform art cases is a sense of ambivalence and resourcefulness in the appropriation of social media platforms. Working within and against platform structures, social media-based art practices such as these interrogate issues relating to perpetual availability, accelerated connectedness and self-presentation on the internet, among other concerns.

AI-generated art

Generative art and AI-art, are vivid examples on how artists are expanding the known limits of the arts since the arrival of computers. The last months have seen a staggering evolution of AI capabilities, allowing human artists to co-create astonishing artworks capable to convey a message and evoke a sentimental response from the public. Artists, either as coders or using machine learning models as well as users of AI art generators operating on natural-language instructions, are creating innovative pieces of digital art shocking the art world on a daily basis for their rapid evolution. The leaps AI image generator have made in recently are the subject of debate in the arts. On one hand, there are those who criticize the ability of algorithmic image generators to produce original works and some who go further even considering that we are reaching a point where technology could replace us in an area that has been considered the last bastion of our humanity, that is, the arts. On the other hand, we find new spaces where artists, who are also coders or collaborate with technologists, are trying to push the computer capacities beyond their limits to expand their creativity horizons and produce original pieces in fields like visual arts, music and literature.

Thinking about generative art and AI generated art lead us to go back to eras when artworks were a product of some kind of controlled randomness game introduced in the process of creating artworks. The *Musikalisches Würfelspiel,* a system arguably used to compose classical music from throwing the dices and picking pre-composed pieces to complete the whole opera, is an example of how artists would be intrigued about adding arbitrariness to their works. Jackson Pollock knew well how to take advantage of this controlled randomness over his creative process in painting and in our era generative art and AI-generated art is bringing a brand new dimension of unpredictable works in fields where this has been practiced before the computers.

The beginnings of computer generative art in visual arts can be tracked back to the 60's. In 1965, Georg Nees presented his exhibition of computer generated art Generative Computergraphik and followed by artists like Charlotte Johannesson, Vera Molnár, Frieder Nake, Michael Noll, Manfred Mohr and others, who started exploring the use of computer programs in semi-autonomous (controlled) processes to produce artistic works. By giving rules to the computer, the artist/coder allows the machine to decide how to work under those circumstances rather than following instructions step by step in an algorithm (Boden and Edmonds, 2009). In other words, generative art is art produced by computers working under certain rules but permitting them to behave randomly following controlled scenarios. In generative art, thus, the computer can surprise its coder with sparks of "shocking" creativity when producing novel artworks unpredictable to the control of the artist behind the code (Boden, 2009; Du Sautoy, 2019).

This kind of art sets on the table philosophical questions such as who really does the art, the human or the machine? And whether if it can be really considered art in case it is the machine the only author? If the artwork is produced in a controlled randomness, that is, it starts with the artist/coder setting up a set of rules, a certain kind of sketch so later the machine can deliver an original piece of art, could it be seen as a co-creation where the artist is teaming up with technology to produce new pieces that are still meeting the aesthetic requirements? And does this collaboration affect the capacity of the artwork to convey a message and elicit responses in their spectators? To some artists, working with machine learning and generative art is like setting the

outlines to train and help the computer to deliver finalised artworks, but there is a lot of work in preparing the way for the machine to take control over the process, an intellectual and creative work that is essential for such cooperation to be successful. The truth is that beyond whether or not generative art can be considered true art or questions about the authorship, matters unrelated to this report, generative art arrived decades ago not only to stay but has also paved the way for new art subgenres and movements such as AI generated art, inspiring the exploration of computer-mediated art. The artist-robot interaction through AI systems is revolutionizing the art world and opening new debates about who can be consided a "real artist" and the acceptability of this kind of art in the most classical and conservative spheres of art. The arrival of AI art and flourishment of text-to-image tools on online platforms is just a sneak peek of a new world of possibilities where artists are already beginning to find their own space and where many believe that the same technology will discern between those who have real talent and will take leverage of it and those who are in the game just for speculation.

AI generated art: Now everyone can be an artist?

AI generated art is attracting all the attention in recent months after an astronomical sale of an AI generated piece took place in 2018 at a famous auction house in New York. During the late summer of 2022 an AI generated picture took the first place of the digital art category at the Colorado State Fair's fine arts and since then, the AI generated arts are making the daily covers of magazines and specialized media as well as being hot trends on platforms, social media and chats of digital art fans and crypto art communities. A whole diversity of platforms has swarmed during the last months where prospective artists only need to introduce few words to obtain images, literature, music and even storytelling pieces of an originality and intellectual quality that resembles that of a human being. In the visual arts field specifically, the AI-generated artworks have stunningly developed over the last few months, having the capacity to produce pieces of an amazing quality that makes them almost indistinguishable from what artists educated in fine arts would be able to do.

Some consider AI generated art as a subgenre of generative art where artists are working closely with AI through machine learning, Generative Adversarial Networks (GANs), and most recently, diffusion models to train systems with data sets and create new works that are later curated by the artist in a twofold collaborative process. AI art is therefore greatly influenced by human intervention, where making art becomes an interactive process that could have the potential to help humans to understand how an AI works through creativity. Through this artistic interaction, i.e., the artist training an AI machine through programming which is a language that few people understand, they can originate another type of more comprehensible language, the arts, a language that is not only able to communicate a message but also induces an emotional response in the spectator who engages with the artwork. Perhaps, by allowing people to interact creatively through AI systems, we will overcome the fear to a future where AI can help us to expand our creativity and open the doors to a new era of AI-generated art. It is almost certain that not every piece will make the cut to reach a space in the best museums and galleries which are already showing interest in this technological advance. However, it is interesting to see how AI is having an impact on different fields of the arts, already defining a route that has no going back and is transforming fields like the visual arts, literature, and music.

Generative art and AI-generated art in different fields: Visual arts, literature, music

In visual arts, AI systems can create or emulate realistic images and paintings from descriptions introduced in natural language, text-to-image. The machine is trained to process large amounts of data to produce original pieces or make forgery pieces based on famous artists. This technology is now also capable of delivering photorealistic images and is even able to produce portraits of human-alike but fictional subjects. The interaction between the artist or user and the AI allows a new type of artistic system where human-machine are able to produce pieces of digital art in a self-curated manner. Below (Fig.3) you will find an example of a futuristic cyborg city generated by an AI-system after introducing a text-based description including the style required.

Figure 3: *A futuristic city of cyborgs interconnected by neural circuits in Hyperrealism style*

Literature

Literary works are now also co-created through AI. Technology like Generative Pre-trained Transformer 3, GPT-3, a neural network that is able to learn natural language and produce well-structured literary pieces, has been in the arena for the last few years. Even if sometimes the

writings do not completely read like human production or lack of a context, the technology is improving on a daily bases and is now use to produce tweets, blogs, news articles and even novels that are for sale online. This is a piece of text that an AI-text generator produced when we asked it (her?) to do a short fictional piece about the first encounter of humans and aliens:

> *It all took place on the night of August 25, 1843, from the point where the German colonists first arrived at a European colony in the West Indies. In their first attempt to conquer a colony, the invaders were defeated with a battle of attrition. But the aliens took the lead, destroying all ships in a single strike. They then moved on to establish a more independent colony in the Bahamas. The story tells a story of human invasion and oppression…*

Every November Since 2013, National Novel Generation Month (NaNoGenMo), a movement originated by a twitter community, challenges participants to produce a code able to generate a 50 thousand words novel. In this generative art example, the coder is compiled to share the final product together with the source code at the end of the competition using a code hosting platform to advance in their community practice. Regardless of how understandable or good these literary works are, this is one of the domains where AI has shown rapid progress, having a variety of literature on the market promoted for the times when we grow tired of reading works made authors of just flesh and bone.

Music

AI-generated music is another innovation that has made headlines during the last years. Through the use of neural nets, the AI systems are able to create music on different styles and artists in a diversity of genres. The pieces produced through this technology contain music and lyrics that can go up to minutes, and even though the vocals are still rudimentary, the sound, style and coherence of the lyrics are accurate. Different online platforms are freely accessible, inviting people to play and explore with their AI systems to co-produce musical pieces and even to further develop their machine learning process. These generative models also preoccupy actors from fields like the audio-visual and marketing industries, considering that now it is possible to co-create pieces for movies, series or advertisements without the need of a whole group of musicians and composers, reducing drastically costs but at the same time eventually having a negative impact on the real life artists. As such, AI-generated music is also seen as a tool to enhance creativity and many artists working in mix-media and audio-visual fields are already taking advantage of this advances, proving than rather being replaced by technology, they can augment and diversify their creative practices while reducing hours of work with the help of artificial intelligence.

Computer Generative and AI Interactive Art - Performance

In this domain of the modern arts, building on the definitions provided by Boden and Edmonds (2009), computer generative art and AI art, that is, art produced by machines under minimal control of human factor, show also a development in the interactive and performative arts. Here, the interaction with the spectators' influence the way in which the artwork is developed and a good example of this is are the works done by Machine Movement Lab in the field of choreography and social engaged arts as well as Patrick Tresset and his AI-drawing robots.

In Machine Movement Lab, the artist and researcher Petra Gemeinboeck (Gemeinboeck and Saunders, 2021) collaborates with her colleagues to develop non-human alike machines that are able to develop choreographic interactions in a kinetics-performative act through machine learning. This is an attempt to overcome the human-humanoid paradigm where embodied robots are made human alike to facilitate a more familiar engagement with people, proving that there are chances for other mechanisms of communicating with robots through the practice of arts, helping each other to improve their social skills and learning from their continuous interactions.

Similarly, Patrick Tresset, an artist working with non-human alike robots, proposed an interactive installation where AI-trained robots capable to draw, each in their own style, performed a drawing of a portrait of the participants taking part of the exercise. The robots would take their time to complete their sketches, drawing at the same time, in live action, and each of them producing a different final result. It is definitely an interesting exercise where humans are "at the mercy" of robots as their models for producing art, raising questions on assigning agency, personality and creativity to machines while at the same time generating reflections on the participants and spectators on how the human-robot interaction can be shaped by the arts and AI.

Conclusion. AI art and generative art - technology as a toolset for escalating creativity and the logic behind artists-Robots interaction

After offering an overview of the definitions of generative art and AI generated art, we can recapitulate by saying that beyond the aesthetic or authorship issues of works of art made in collaboration with computers and AI, we evidence an active interaction system where the artist is interested for leveraging the technological advances to further their own practice and push the development of technology, having an impact in fields such as literature, visual arts, music and performance practices. To sum up, we propose three logics behind the artist-computer interaction in their artistic co-productions: First, artists are teaming up with technology by experimenting and tinkering to explore their own creativity, enhance their production by reducing the working time and delivering innovative and original pieces through their collaboration with computers and AI systems. Second, the artist seeks to improve and push the limits of technology by interacting with it and producing artworks, contributing to the development of these technologies so they become more accurate and helpful for their own practice. Third and final, the artist tries to understand the human-robot interaction, looking to facilitate this communication in the future by the practice of collaborative artistic production and contributing to explain technologies like AI to the general public through the arts.

NFT art: Art on the blockchain

What is blockchain art?

Recent years have seen a staggering interest in NFT art: rare digital artworks that are codified into a blockchain and sold via blockchain-based galleries. The recent speculative craze in this new asset class brings to light the promises and contradictions of the digital economy, while attracting the attention of a slew of artists. On the one hand, NFT-based art may have a liberating potential to free the artists from the confines of traditional art-market dynamic and to enable

them for example to derive secondary income for a notoriously hard to monetize digital art forms and offer potential access to underrepresented artists into the economy of digital arts. On the other hand, the process of coming from commodification to a novel type of asset-economy for the digital arts has opened the doors for at times frenzied speculation in line with volatile cryptocurrency markets.

An NFT artist develops an idea into a piece of digital art, then they choose a platform (virtual gallery) to offer it online and set an initial price and then put up their artwork for auction. Some curated platforms tend to review the artist in order to give accessibility to the market, but they usually do not scrutinize the artwork as such, and if the platforms standards for inclusion are met, the artist is granted permission to upload the piece. Once the piece is uploaded, the author enters information such as the title and description of the work, whether or whether not it is part of an edition, and the (reserve) price or if it is part of a bidding process. The auction runs for a set amount of time. Should a sale happen, the ownership of the token gets transferred to the collector through the blockchain technology and the peer-to-peer InterPlanetary File System (IPFS) network. The transaction transfers a token uniquely associated with the work of art into the collector's cryptographic portfolio. The transaction is digitally signed by the artist, using asymmetric encryption, in order to prove the authenticity of the work.

How are the artists reacting to the blockchain technology?

When discussing with digital artists about their endeavors in innovating in the economy of digital art through NFTs, we found them welcoming of a technology that is bestowing some form of recognition to their artistic practice. Digital artists felt that the new blockchain technology legitimized digital art, long considered marginal and unworthy of aesthetic appreciation, in the eyes of the art world, mostly galleries and museums. At the same time, the artists felt that the new technologies could bring in profits that were unimaginable years ago.

NFTs were thus welcomed as a new tool that creates opportunity for artists to commercialize digital art that previously had little to no commercial value. Even compared to the often-precarious opportunities for traditional artists to make an adequate living out of their profession, digital artists were especially struggling. Before the adoption of NFTs, digital art was something infinitely copyable without any loss in quality, hence nobody paid money for it. With no worth as such, there was no incentive by the traditional art market to institutionalize digital art. With the advent of the blockchain and the connected NFTs, creating artificial scarcity was suddenly possible which turned this type of art into valuable pieces, fetching staggering prices on the art market. NFTs also allowed for the payment of resale royalties to the artists. Artists therefore started to perceive of the benefits of NFTs as the production of future financial and not only an immediate income from the initial sale, i.e. through the NFTs their work turned into an asset.

With the global pandemic, most traditional art institutions were failing artists (through a lack of exhibition opportunities and thus commercial opportunity), which was driving many (already) commercially viable artists into the NFT space as part of the Web 3.0. This new model of ownership and exhibition seemingly also has fewer barriers to up-and-coming artists than the traditional art market. Unlike the traditional art world, (crypto) artists do not need to seek acquiescence and validation from gallerists, agents, auction houses, or other gatekeepers to share and sell their work. Potentially, it also opens the art market for artists coming from a diversity of

backgrounds, practices and geographical areas (they simply do their own show on the digital gallery and self-promotion via digital media). The opportunities to exhibit and commercialize digital art were also somewhat insignificant before the rise of digital galleries. Artists believing in the decentralized internet movement, are setting the bases for communities passionate about supporting each other's practice while developing a self-regulated economic model that aspires to be more equitable and bring opportunities to creatives looking to be part of this *new era* of the arts.

The arrival of the NFTs has transformed the art market dynamics as known before. Although it could seem that the market is slowing due to the volatility of the market produced by the oversupply of artworks and saturation at the moment of writing, the process of turning a cryptoart piece into an asset for the fine artists still reveals a series of underlying forces that deserve a deeper analysis. To begin with, let's consider the assetization process as a medium and long-term initiative of the artist looking to perceive an income on the work minted as NFT, knowing it also carries risks and may or may not work in the future. The artists decide to assume a cost to mint their artwork, hoping to obtain much more than the price assumed for the gas fee. However, the success is uncertain, considering the value-determining factors already explained above. Artists who have been in the game longer have an advantage over those who are just starting to enter the world of NFTs. With more recognition, they can afford to leave their works open for bid being aware they can play the 'long-game' and are not depending on their first sales; on the contrary, for those who are just beginning to enter the market, it could be a 'double-edged sword', having to agree to set prices that guarantee recovering the investment or leave it to the collectors' arbitrariness, hoping that it will give a much better result than setting a floor price for their artwork.

In this process, another dynamic has emerged between the market actors. From the beginning, the roles of artist and collector were the most relevant, since the artists were usually also collectors at the same time looking to boost the market and make a name in the ecosystem. Subsequently, collectors began to divide into those who were artists and bought for arts-sake and support to other colleagues, or collectors who were buying because they liked cryptoart and wanted to support artists even though they were not artists themselves. Later, collectors came to the market looking for short-term investments, buying cheap to sell later for a higher price and not necessarily interested in the artistic value of the piece. Nowadays, large capital investors, auction houses and museums are finding the mechanisms to benefit from the price fluctuations as a reminiscence of the same old capitalistic-dynamics, however the ideal to maintain independence and decentralization remains as one of the main motivations to artists innovating with new platforms and communities. The rise of new actors such as artist collectives and community driven galleries who still believe in the potential of NFTs and Blockchain technology for social benefit as a response to 'unfettered capitalism' is topic that deservers further exploring.

NFTs were perceived against the background of a shift in consumer culture, where art collectors in particular, became more comfortable with owning and spectating on art solely through their screens in a period where the digital realm was the only route to the outer world subjugated to reduced social interaction in real life. A new generation of art collectors has come of age, who grew up with attaching value to digital objects, many of them also made money from

the speculative rise of cryptocurrency which they are now spending. Under this lens, the demand by collectors might seem more sensical, whereas from the notoriously precarious artist side, any income prospect especially in times of pandemic, seemed promising. Many formerly disenfranchised artists suddenly saw the potential to make a paid living from their work. They saw the NFTs as a means through which they can support their art making adding value able to generate income in the future, as one of the interviewed artist comments:

> *With the NFTs I started to do what I wanted with my work, all the dreams and objectives that I have seems to become real… In the NFTs, people paid for my art and invested in me, they paid a fair price, knowing they are doing an investment while supporting an artist at the same time…*

Many artists found a semblance of financial optimism, and were delighted that positive stories circulated within the community, permeating the feeling that they can make a living of their work by perceiving royalties from future sales thanks to having a place for commercializing their artworks. The system works currently on royalties granted by the platforms as far as the new sale occurs on the same, leaving important profits in cases where the piece is resold due to its attractiveness and scarcity. Artists and collectors participating in a market that revolves around the originality of each piece see in their artworks a possible lucrative asset, bringing hope to many of them; however, this process of assetization is also criticized for copying old-economic schemes in a game that is ruled by valuation through supply and demand in a very competitive market. Still, the rapid turnover of the original piece of art and their quick returns are allowing many of the artists to make a 'socially responsible financial investment' by supporting new artists looking to find their own space on the NFTs universe, this time as collectors, giving a boost to the community in a collaborative process.

The questions on how to evaluate and value the digital artworks as well as the necessary skills to cope with the rapid evolvement of digital art are entangled with the tensions between the need to satisfy the market and create what artists consider valuable and meaningful to their own practice. To some, it is in the cryptoart communities where the artist found a place to create what he wants to create and leave it up to the collectors to decide if their style is welcomed or not. Artists are more aware that styles can change instantly, creating a self-curation dynamic within the community where the effort, the techniques and even the talent of the artist are combined with his fame and the story behind that piece or collection up to sale. Despite all, both artists and collectors seem to agree in encouraging a higher quality in the artworks submitted through engaging discussions which in the end benefits a new market looking for constant innovation and creativity to endure and attract new collectors

In the meanwhile, a new category of art and artistic practice has started to gain shape and distinction that of cryptoart.

Cryptoart

What is cryptoart?

Cryptoart is limited-edition or unique digital art cryptographically registered with a Non-Fungible Token (NFT) on the blockchain has become a new and widely used aesthetic and economic label. The originality, authenticity and uniqueness of the cryptoart is guaranteed by the NFTs codified into the blockchain. Cryptoart represents a one-of-a-kind piece, unlike traditional online objects which can be endlessly reproduced, and thus be held and securely traded from one collector to another without intermediaries (Franceschet et al., 2021). In what follows, we evidence a set of two interrelated mechanisms through which the cryptoart is intertwined with discussions of both cryptocurrency and the much-hyped metaverses revolution: *assetisation* and *community-building.*

Key processes of cryptoart assetization and community building

One example that reveals the dynamics that we investigate is Francien Krieg whose artistic work flourished as cryptoart, after initial struggles to enter into the 'analogue' art world. Francien is a professional artist with more than 20 years of experience doing classic visual arts. She went to the Royal Art Academy in The Hague and her works display the transformation of human bodies over time, the aesthetics of the flesh and feelings like desperation, vulnerability and fear. From the beginning, she believed that traditional artists should switch to cryptoart after she witness the astronomical sales of Beeple. She understood that she could also find a space on the NFTs platforms, especially in virtual spaces working on Tezos cryptocurrency, where traditional analog-art was welcomed, but now as digital pieces. Francien has not only taken her art to platforms as NFTs but has started to tinker with Artificial Intelligence, generative art and collaborating with other artists who are also minting their works on the Blockchain. To her, the biggest advantage brought about by the NFTs to the art market dynamics is precisely the royalties, as she mentions: "Through the NFTs, the piece is traceable, you can look back and see who is the current owner and you will always get a piece from the secondary market, that is lucky for us the artists" and continues reflecting when she did not receive any royalties from second-sales before her immersion into the NFTs: "I felt a bit used, now I feel treated with respect, it is a big improvement in the system". To Francien, the NFTs are transforming the misconception that art cannot be about making money, separating herself from the art for art's sake doctrine. To her, "there is nothing wrong about enjoying making your art and being committed to it while also making some money, that is, a business minded artist" and the new technologies are contributing to bring up this discussion on the table once more.

Francien has experienced an increase in her revenues derived from her digital artworks, she is still doing art in physical mediums and considers it as the most important part of her work, however, she is starting to see her digital pieces overcoming the prices of her analogical (physical) artworks, giving her more freedom to work patiently on her physical pieces. Even though, she feels a special connection to her physical paintings, she is aware that through the NFTs she will reach many more people, taking her art beyond the white cube gallery and being accessible to anyone on the web and not necessarily just the *connoisseurs* of classical visual arts. Nonetheless, Francien is also aware of the need for artists who come from the analogue world to familiarize themselves not only with the dynamics of the NFT communities, such as making their work

visible through social networks, being part of discussion groups in spaces such as twitter and having a "business minded" attitude, factors that in one way or another are not so different from the traditional art world but now in a digital world. Although, it is also necessary to learn the rules of supply and demand and other market dynamics in order to survive and find a space where speculation is the norm. To her understanding, “it is not only necessary to be creative, original and have social skills, but also to have a strategy that plays with the dynamics of scarcity” that heavily influences the NFTs market.

Another example is Nacho Frades. Nacho started his career at a very young age, coming from the arts academy but rapidly turning into an animator for movies to make a living. He dedicated his career to doing digital visual arts, selling them at that time as printed versions until one day he found out about the NFTs and he thought: “Art is not dead, it is now found in the NFTs”. Nacho has been doing digital art, including pixel art, since 1987 and he has found a place thanks to the blockchain that is also allowing him to do what he really enjoys. To him, the boom of the cryptoart brought him freedom, because during many years he had to manage so many tasks around delivering a printed version of his pieces. Now, he has the freedom not only to create whatever he wants to but also he has no need to paint too as much as he used too. While he is gaining recognition, his digital pieces are selling at prices that he would never have dreamed before

> *Although I used to sell a lot before the NFTs, now I have seen an increase in my income with this technology, it is allowing an artist that could not afford a living from his work to be able to live from it now, it is almost like hitting the lottery jackpot.*

To be successful in this new world “you need to play the long game”, and that implies being patience and keep doing high quality works to impress a market that is gradually turning more demanding to satisfy.

Figure 4: *Yellow Car by Nacho Frades - https://superrare.com/artwork-v2/yellow-car-34074*

To Nacho, the NFTs also brought a sense of liberating potential, empowering a diversity of digital artists that before were struggling to find a place to showcase their works and were definitely not making ends meet through their practice. According to him, "it was almost impossible to enter in the traditional art market, like galleries and museums, for artists that were doing certain type of art such as pixel art, so what future could these artists have outside the NFTs?" and remarks: "The NFTs are thus not only economic freedom but artistic freedom as well". He is not really concerned that much about the speculation on the market since it is "natural to it and can also be beneficial because in every sale the artist will always get a piece, whoever and wherever the artist might be". Even though, Nacho is a believer in the potential of the NFTs as a game changer in the art market now in the transition to the Web 3.0 he is also conscious about how it is becoming more difficult for many artists to have access to it; especially those who are new to this world. He does not believe it is turning into an exclusive arena since everyone is welcome to participate, however, he sees that many old-schemes of the art market are being copied, where the most famous artists are the ones selling and the beginners can find themselves struggling and taking risks in order to make a name and stagger their business. To Nacho, the artists innovating with NFTs "need to have hope, make a piece to the best of their capabilities and people will see their value and support them…" and the benefits will arrive at certain point.

Digital artists coming from a diverse spectrum of practices are concurring in online spaces where they finally feel the freedom and autonomy to redirect their careers in a way they have never been able to experience before. An emancipatory counter-culture movement was born and is not only disrupting the art dynamics as known before but is fighting to overcome the speculative origins brought by the NFTs and volatility of cryptocurrency markets. The arrival of a new era where people refuse to be identified only as users, claiming the control of their own destiny in a decentralized economy, a *creators' economy* that congregates a community of members including artists, coders, investors, collectors and fans, who occasionally converge in the same person, is giving rise to the question of how to govern a world that precisely denies the control of a central entity.

The members of these communities are trying to safeguard their interests while opening spaces to new adherents, since legitimation to a decentralised economy is only given by the inclusion and participation of more people willing to take part of it. Community building is paramount to many who are setting up requirements for artists' acceptance and joining guidelines to their platforms. Auto-curating systems are put in place to accept creatives that meet the quality levels of their communities. Some communities are exploring the creation of voting system through tokens on blockchain, a peer reviewed process and the creation of advisory boards, trying to preserve their identity while guaranteeing the democratic participation of its members. Innovative ideas such as implementing artificial intelligence (AI) to identify the originality of the artworks are also discussed inside the cryptoart communities, forecasting an interesting future where self-regulation can inform the development of a new legal field.

The discussions among artists, collectors and digital art fans often revolve around how to redistribute the benefits of cryptart in a more equitable manner. The participants in the cryptoart spaces are seeing their pieces as lucrative assets, bringing hope to many attracted to a game ruled by the typical dynamics of market economy such as valuation through supply and demand. Though, the benefits brought by the NFTs are tangible, it is also true that many pre-

existent conducts from Web 2.0 have been adopted and even "radicalised" as *Maria*, a digital artist who talked with us mentioned:

> *As an artist you also need to entre in the dynamics of social media and be very aggressive in order to succeed. You have the kind of artist that is good in their artwork but they are also influencers, you need to have many followers on twitter or Instagram and be all day long promoting your art*

A diversity of solutions are proposed to make more inclusive and reachable the cryptoart spaces to those who do not necessarily have the means. Renting pieces, loaning pieces and even artists thinking on "tokenising" themselves are some of the ideas visible in the discussions on cryptoart platforms. One artist, who is a collector at the same time, proposes the idea of sharing the pieces in a scenario where "multiple collectors own a single work, can exchange shares of that artwork, and eventually can buy up 100% of the shares and take it to their private collection". Yet, other members are more sceptical about these ideas and do not believe in having people interested on not owning a token, since that is "the whole idea behind crypto art". In any case, behind each piece there is a lot of work from artists balancing their own artistic interests with the economic aspects and community trends. Artists need to learn how to promote themselves and how to reach more 'investors' as collectors are sometimes called inside the cryptoartists' environment.

Art-based public engagement and education in technology

What is art-based public engagement and education in technology?

As we have shown thus far, there is an intimate connection between the arts and the digital technologies with critical, awareness-rising, and experimental artistic practices engaging with the perils, harms and toxicity of digital technologies. Given such art-technology intimacy the sphere of technology education has started to show an increasing interest in the arts. With the increasing influence of digital technologies across all aspects of social, political and economic life, there has been an emergence of public engagement and educational organisations who work to interrogate how new and emerging technologies impact society. But there are multiple challenges to and limitations of public engagement and education programmes that deal with the socio-technical concerns of digital technologies (Fraaije et al., 2022). These challenges to existing public engagement and education on technology include the concern that while public engagement is important at the early development stages of technology (and therefore before the technologies become mainstream), early engagement is typically limited to certain better educated and well to do socio-economic groups and not to the wider society. Another challenge of tradition public engagement and education on emerging technologies concerns the absence of a common language or vocabulary to discuss the implications, owing to the fact that they are often intangible and difficult to identify. In addition, there is evidence to suggest that traditional public engagement and education mechanisms around technology have little to no impact on the technology development itself.

In light of these challenges and limitations of traditional modes of public engagement and education that deal with technology, arts-based public engagement and education that specifically incorporates the work of artists and the creative practices is increasingly seen as a promising means to critique the existing state of technological development and to aid the discussion and imagination of alternatives with diverse publics. Fraaije et al define 'art-based public engagement' as "a wide range of initiatives of artists, scientists, policy-makers, educators and science communicators to engage publics on emerging and controversial technologies through and with art" (2022). For the purpose of this report, we also include related educational programmes and models that focus on technology literary and critical data studies through arts and design-based methods. Common to art-based public engagement and education is the aim to provide space for diverse audiences to critically explore and reflect on the implications of emerging technologies as well as the potential to envision alternative futures. Art-based public engagement and education typically include a broad range of artistic initiatives that directly engage with the public and encompass formats such as exhibitions, workshops, educational material and mediation. They are typically characterised by a strong participatory dimension that includes the facilitation of some form of formal or informal learning. While existing research highlights several benefits to art-based engagement with technology, including that it can open up understandings of technology to wider audiences (Salter et al., 2017), there are also concerns around how these types of public engagement might lead to the instrumentalising of art-based practices (Reinsborough, 2020).

Key strategies and developments

In what follows, we describe three diverse examples of art-based public engagement and education – Tactical Tech, the Science Gallery Network and the School for Poetic Computation – each which focus specifically on the intersection of technology and society in some form or other. For each, we discuss how art-based methods are used to engage or educate the public about emerging digital technologies. We consider the nature of participation and the impact and influence of the various programmes.

Tactical Tech

Tactical Tech is a non-governmental organisation (NGO) that engages with citizens and civil-society organisations to explore and mitigate the impacts of technology on society. While formally based in Berlin, they operate at an international level and commonly tour their exhibitions and disseminate their work transnationally. In order to engage publics about the impact of technology on daily life, Tactical Tech conceptualise and produce exhibitions and educational material that provide accessible knowledge to diverse audiences, and so invite discussion and raise awareness about contemporary technological transformation. In addition, they also provide trainings, conduct research and create cultural interventions that contribute to the wider socio-political debate around digital security, privacy and the ethics of data.

Their techniques are informed by a cross-disciplinary expertise in political engagement, advocacy, creative production and technology. Their methodologies stem from an iterative, design-based way of thinking, creating a continuous loop between ideas, testing and development. Essentially, the aim of their work is to make the issues accessible – at times fun and at times challenging – but most importantly, to create interventions that make these issues relevant and

accessible to new audiences. They work in collaboration with multiple partners from across all sectors – art and creative practices, cultural institutions, political organisations, local and national government – to enable the contextualisation of their work, considering nuances in movements, geographical regions and activist practices. Working with multiple international partners also allows for the continuous testing, iterating and further development of their work. And lastly, they enable us to increase our reach and impact among diverse audiences. This large network, built over a decade, continues to support our work by utilising, adapting and translating our resources, often in partnership with local communities.

An example of one of their exhibitions is the "Glass Room", an exhibition space intended to mimic an Apple store. The Glass Room looks like a sleek tech pop up, but as you look closer you see nothing is for sale; instead there is a collection of art, design, and technology objects that explore data, privacy and our relationship with the technologies and platforms we use in our everyday lives. The interactive exhibition is designed as an immersive, self-learning experience, to allow audiences to engage in a conversation and reflect on the impact and challenges of technology developments and to show possible alternative approaches to them. More specifically, the exhibition brings to life the hidden aspects of everyday technologies and provokes reflection on how we relate to the internet, data privacy, surveillance technologies and the inner workings of the contemporary tech industry.

To reach a wide variety of audiences in different geographical contexts, the exhibition is reproduced in various formats – from large-scale exhibitions in major cities to a portable version that can be set up in any location. The large-scale version of the Glass Room began in 2016 at the Haus der Kulturen der Welt in Berlin as part of a larger exhibition, examining the relationship between human and machines. After the success of this exhibition, Tactical Tech partnered with Mozilla to create The Glass Room in New York as a stand-alone, pop-up exhibition, with additional exhibits and a full programme of events. Later Tactical Tech brought the large scale version of the Glass Room to London and San Francisco, with each location receiving critical acclaim in terms of media coverage, attendance and overall engagement.

As a result of high demand from visitors of larger Glass Rooms, a smaller portable community version was developed for those who also wanted to set up similar exhibitions in their own locales. This smaller, portable DIY version comes in a lightweight and adaptable format is intended to be delivered independently by individuals and institutions and can be set up in a variety of different spaces from libraries and schools to conferences and metro stations. To date the large-scale Glass Room exhibition has been produced in Berlin, New York, London and San Francisco while the pop-up Glass Room Community version has been hosted in nearly 200 libraries, schools, festivals and organisations worldwide. More than 168,000 people have visited the Glass Room exhibitions and Glass Room Community Editions in over forty countries around the world. In 2020 Tactical Tech launched the Glass Room Misinformation Edition on media literacy for libraries, schools, organisations and events across Europe in English, French, German, Spanish and Italian, as well as launching Glass Room Community editions for organisations, events, schools and libraries in Latin America, Asia and Africa.

A further iteration of the Glass Room as developed by Tactical Tech is an educational initiative for younger audiences entitled 'What the Future Wants' (WTFW). The WTFW initiative is designed specifically to educate and empower young audiences, with the intended aim "to put young people in the driving seat of their digital futures through education, co-creation and capacity building".[1] Based on research with and feedback from approximately 200 young people, the WTFW project helps young audiences consider the impact of technology on society and young people through a number of creative art media including a pop-up educational art intervention that features interactive posters, 3D objects and design-based activities, in addition to the project website https://theglassroom.org/what-the-future-wants/. Owing to the increasing prevalence of digital technologies in the lives of young people, WTFW seeks to uncover and address the associated challenges in terms of technology addiction, discrimination and data surveillance. Ultimately, the project aims to engage with and empower this younger cohort to self-develop a critical awareness on the impact of digital technologies and to equip them with a form of digital literacy that allows them to make informed decisions about their personal use of technology.

Overall, the creative art-based approach as taken by Tactical Tech is intentionally employed as a device of engaging with a diverse range of people in a conversation about how technology is changing society at large. They see working with visual, interactive materials and creative practices as a powerful means to both disseminate ideas widely and to get lay audiences interested in critical debates around technology. Most importantly, Tactical Tech use art-based methods of public engagement and education to open up a space of pause, reflection and creativity in these times of technological acceleration.

The Science Gallery Network

The Science Gallery Network is an international network dedicated to public engagement with science, technology and art. Each member of the Science Gallery Network is affiliated with an associated university and at the time of writing, the Science Gallery Network has eight members across four continents: London, Melbourne, Bengaluru, Venice, Detroit, Rotterdam, Atlanta and Berlin. Collectively, over 4 million visitors have engaged with Science Gallery and hundreds of artists and collaborators from science and technology have presented work through their exhibitions and events. The model of the Science Gallery is to provide programmes that allow visitors to participate and facilitate social connections as well as to offer informal learning and a social space that actively engages young audiences in science and technology developments. An important aspect of this informal learning is the mediation of exhibitions and activities as provided by students.

The official aim of the Science Gallery Network is to bring science, art, technology and design together to deliver world-class educational and cultural experiences for young people.[2] Through

[1] https://tacticaltech.org/projects/youth/#:~:text=What%20the%20Future%20Wants%20is,and%20dependent%20upon%20digital%20technologies.

[2] https://sciencegallery.org/about-network

its programming of transdisciplinary exhibitions, events and educational workshops, it endeavours to connect technologists, scientists, researchers, students, artists, designers, inventors, creative thinkers and entrepreneurs around changes in science and technology, and to encourage audiences to critically explore the wider dimensions of these developments in contemporary society. At the core of the Science Gallery Network is a commitment to transdisciplinary learning and public engagement across the arts and STEM (science, technology, engineering and maths) subjects. On the impact of such cross-disciplinary learning, it states that "transdisciplinary approaches to education and innovation are fundamental to future-proof the university; sparking catalytic conversations, connections and collaborations across networks is instrumental to develop and implement these approaches."[3]

In particular, the Science Gallery aims to offer a diverse range of art-based educational programmes in providing young people with the opportunity to pursue creative ideas that interrogate and explore the boundaries of art, science and technology. With a target audience primarily made up of young adults aged 15–25, the Science Gallery education programmes are designed to highlight the rich network of interconnections between science, technology the arts, culture, design, business and innovation. Ultimately the objective is to actively engage with this audience (who are at a key stage of their lives in terms of decisions relating to future careers) and to encourage an interest in them towards the subjects of science and technology through participative and creative means.

Examples of such educational programmes include the Open Science Hub Network, an EU Horizon 2020 project which aims to engage schools and local stakeholders in research and innovation as a tool for sustainable community development. The Open Science Hub Network is intended to empower and engage the public in STEAM learning and research opportunities, grounded in collaborating with the local community and other stakeholders.

The School for Poetic Computation

The School for Poetic Computation (SFPC) is an independent, arts-based school based in New York City that was founded in 2013. The artist-ran school brings together a small group of students and faculty to work closely on exploring the creative and expressive nature of computational approaches to art and design — focusing specifically on artistic intervention and pedagogical practice. The primary programme of the SFPC is a ten-week immersive session for adults to learn coding, critical theory and poetry. The school approaches writing code like creative writing — focusing on the mechanics of programming, the demystification of tools, and hacking the conventions of art-making with computation. In addition to the main programme, the SFPC also initiate a series of public programmes, including approaches for teaching computation in creative fields and community events.

The SFPC is an arts-based institution that offers a new mode of learning about and engaging with technology outside of the conventional educational arrangements. Operating at the intersections of code, art, design, hardware and theory, it offers an opportunity to work intensively

[3] Ibid.

with a small group of artists, faculty, and students to explore questions about the poetics of computation. It defines 'poetic computation' as "an act of resistance against utilitarian notions of progress and efficiency" and considers the application of poetic computation as the use of coding for the purpose of critical thinking and aesthetic inquiry.[4]

Science fiction, sci-fi fandom and technology industries

Why science fiction?

Science fiction and technology have always been intimate bedfellows. For example, recently Jordan et al (2018) explored and reflected on the abundant use of science fiction references in Human Computer Interaction (HCI) literature. As an illustration, they explore the use of 18 popular science fiction robots in HRI literature. They performed a full-text search of the chosen robots in the Association for Computing Machinery Digital Library and identified 121 relevant mentions across 102 individual publications from 1973-2017 (Jordan et al., 2018). The abundance of science fiction references is possibly linked with the presence of science fiction in STEM learning environments as shown by Dou et. al (2019).

The question though remains as to how a popular culture genre of science fiction, often considered by the art world a debased, pulp and low-culture genre, is intertwined with the technology fields. We deem science fiction to be a neglected and long marginalized artistic form whose interference with the technology industries has been obscured and unexamined.

As a coda to our report on how the arts *matter* in the context of digital transformations we offer an auto-ethnographic account of how sc-fi (science fiction) fandom, sci-fi events and the technology industry are entangled in a complex and ambivalent, even *controversial*, embrace necessitating further scholarly and policy attention. In contrast to the preceding cases, which belong to, or have been recently consecrated by the elite artworld, science fiction remains a popular culture, debased and marginalized genre. As such, science fiction represents an open arena for the popularization of science and technologies, that often goes unnoticed or even outright neglected. Hence we offer a provocative account of the ways in which science fiction, gets in action in sometimes harmful and contested ways in the fields of science and technology.

What is sci-fi fandom?

I'm a science fiction fan, in the "narrow", fandom sense of the word. I go to conventions, rush to sign up for a k*affeeklatsch with my favourite authors, and I have strong opinions about the genre. I also fill my Hugo ballot (or portions of it) religiously, and enjoy the glamour of the Hugo award ceremony at Worldcon.*

Short glossary of terms unpacking the previous paragraph follows:

"*Fandom is (…) a collection of people with a common background in sf and a common interest in communication, whether through discussion, chatter, correspondence, fanzine publishing or*

[4] https://sfpc.study/

(increasingly) online mailing lists and social networks. The result is more nearly a group of friends, or even a subculture, than a simple fan club or a literary society." *5*

Conventions (Cons) are gatherings of fans; discussions, events, and general socialising are on the programme. Con attendees are usually called members, and cons are organised by the fans, for the fans; programme participants are authors and fans alike. The largest con is the World Science Fiction and Fantasy Convention, the Worldcon. Held in a different city every year (historically dominated by US cities as hosts, but moving to other continents lately), Worldcon also hosts the Hugos.

Hugo awards are one of the most prestigious awards in science fiction and fantasy (alongside Nebula awards). They are awarded at a Worldcon to works in the genre published in the preceding year. The selection process for the Hugos is ran exclusively by the fans: all members of Worldcon have voting rights.

Controversy: The 2021 Raytheon Hugos

It is rather obvious that prizes and prize awarding ceremonies are spectacles: their non-ordinary nature is both bottom-up and top-down: let me illustrate that in the case of Hugos. The award is there to celebrate the work of creators and fans alike, recognise the trends in the community, and to be the central point of a glamorous evening of extravagant, alternative fancy dress. The Hugos have an elevated sense of community and ownership due to the voting process: the awards are a result of polling the members of the Worldcon that year, and not selected by a smaller circle of professionals, critics, or other proxy figures. I'd sit in the audience at Worldcon and feel a part of it almost as much as the nominees.

Arguably, I am romanticising the mechanism of the spectacle in this description. In a fairly materialistic reading of the award economy, we would recognise a lot of the effects observed in modern art and content creation, subject to the same economic lens.[6] That economy encompasses controversy as a force multiplier of spectacle. Controversy keeps us talking about the awards—so it makes sense to expect any respectable award to stir some, even at a vulgar level of understanding the effect of controversy. Hugos have a fair share of controversies under their belt, some of which I remember fondly (for example, Jeannette Ng's acceptance speech at the 2019 ceremony, which was so influential that it won its own Hugo for best related work in 2020[7]), some of which I don't remember at all as they were before my time.

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[5] From the "Fandom" entry in The Encyclopedia of Science Fiction (https://sf-encyclopedia.com/entry/fandom)

[6] A relevant read here is English, J.F., 2005. The economy of prestige: Prizes, awards, and the circulation of cultural value. Harvard University Press.

[7] It was a speech Ng wrote on her phone during the ceremony, as she did not expect to win the 2019 John W. Campbell award. A blogpost version of the speech is available at https://medium.com/@nettlefish/john-w-campbell-for-whom-this-award-was-named-was-a-fascist-f693323d3293

In 2021, I witnessed the new big controversy unravelling at the very start of the ceremony. For the context, when the COVID-19 pandemic brought in-person gatherings to a halt in early 2020, CoNZealand, that year's Worldcon, was moved online. It was a new, strange experience, that brought many people who wouldn't be able to otherwise participate in a Worldcon, into the virtual room. The 2021 Worldcon, DisCon III kept an online component to its programme, but nevertheless attempted to return to the physical world. The host was Washington, D.C., and the organisation proved to be rather difficult, with the original venue not being available, and a substantial delay between the planned date of convention and the actual dates at which it ran. I chose to participate in an online capacity, not eager to travel far in the COVID era. As much as I enjoyed the online panels and the Worldcon atmosphere on social media, I wasn't sure what to expect from the Hugo award ceremony: the one in 2019 was perfect for a live experience, the one in 2020 was optimised for online viewing, so what would the hybrid experience bring? Worldcon's twitter account made sure to give us a peak at the glamorous red carpet and the photos backdrop.

The story so far: In the beginning the photo of the photo of backdrop was tweeted, announcing Raytheon as the sponsor. This has made a lot of people very angry and been widely regarded as a bad move.

This is the first time the con members online found out about Raytheon being the sponsor of DisCon III and/or the Hugos ceremony. They were not in the booklet, or on the social media; those walking the red carpet would only find it out when faced with the checkerboard pattern of Raytheon and Hugo logos on the backdrop.

Raytheon is one of world's biggest military device manufacturers, with its weapons deployed in warzones around the globe; press coverage of Raytheon Technologies was, at the time, mostly dominated by murdering civilians in Yemen. A pivot to fiction and fantasy is not unexpected, both in terms of what Raytheon wants to achieve with its general public image, and in terms of the demographic it wants to reach. Raytheon (and similar companies, e.g. Lockheed Martin) are

no strangers to sponsoring large events celebrating science, creativity, and art.[8] The public image there is created via the "aerospace" context: Raytheon makes rockets, and some rockets do in fact fly into space and support space research. It is reminiscent of the very origins of the space race, and as such it ties very closely to the history of the 20th century science fiction, especially in the US (the shape of the Hugo prize trophy is, in fact, a rocket!). I will return to this briefly later, for the time being it is important to note that the fans were very frustrated with the appearance of Raytheon, and with the fait accompli nature of it.

It took four days for the organisers of DisCon III to respond to the outrage, apologise, reflect, and suggest further steps to prevent similar situations from occurring again.

It was the Raytheon controversy that made me think more about the relationship between weapons and science fiction. There is the connection that is rather genre-intrinsic: a lot of science fiction thematically involves weapons (rockets, lasers, etc), depicts epic wars, and has an uneasy relationship with the space exploration as an act of colonisation. However, I was more interested in what the fandom and the authors community relationship with weapons is.

Who Brings a Gun to a Post Office

The relationship between the fandom, technology, and weapons extends to weaponisation of the fandom organisational tools. Technology doesn't have to be a sophisticated rocket to be technology[9], nor to be weaponised. Here I'm talking about the tools that keep the community together and aim at welcoming previously excluded fans and authors, networks of communication and care, the carrier bags of fandom. Once again, I return to Ursula K Le Guin and her essay "Carrier Bag Theory of Fiction" where, building on Elizabeth Fisher's "Women's Creation", Le Guin compares the novel to a carrier bag. Fisher argues that the first cultural device isn't a phallic spear, but a womb-like receptacle; Le Guin proceeds to observe a novel as a collection of stories and characters. I look at networks that connect communities as net bags; but what happens when the net is used to choke the most vulnerable?

Pseudonymous author Camestros Felapton wrote a detailed account of the Sad Puppy/Rabid Puppy saga, and this volume, published on Felapton's blog under the title "Debarkle"[10] is a read that contextualises the reactionary campaign against diversity in the Hugo awards in the wider context of the world/US politics of the mid-2010s.

As noted earlier, the nominations and the votes in the annual Hugo awards process are cast by members of that year's Worldcon. The members are invited to nominate works across a wide range of categories, and entries with most nominations make it to the ballot, five per category. The options on the ballot are to vote for one of the entries in each category, or alternatively state that the voter believes that in a particular category, no Hugo should be awarded that year.

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[8] For example, the National Air and Space Museum in the US had Raytheon as the sponsor of the Apollo 11 50th celebrations: https://airandspace.si.edu/newsroom/press-releases/national-air-and-space-museum-announces-sponsorship-apollo-50th-celebrations

[9] An apt read here is Ursula K Le Guin's blogpost "A Rant About Technology" http://www.ursulakleguinarchive.com/Note-Technology.html

[10] Debarkle is available at https://camestrosfelapton.wordpress.com/debarkle/

There are some other (rather important) technical details omitted here: this set of rules is enough to explain the controversy and the weaponisation of systems the Hugos, and consequently, the fandom, have been subjected to.

Sad Puppy and Rabid Puppy were voting bloc campaigns in the mid-2010s playing the system of Hugos: through blogs and social media, the creators of these campaigns promoted the idea that Hugos were becoming too diverse, at the expense of white male authors, and that traditional stories were shunned while promoting new progressive concepts. Fans were advised to fill their nomination forms with a prescribed list of works, and thereby overtake the Hugos ballot. The 2015 ballot was the peak: each bloc managed to get more than 50 entries onto the ballot, and five categories on the ballot were filled exclusively by entries from the Puppy lists. At the voting stage, almost all of the entries from the blocs were ranked below the "No Award" option, which also resulted in "No Award" being the winning outcome for the five Puppy-only categories. A change in the ballot-making procedures in 2017 helped with the wane of the Puppy blocs.

In a context not limited to fandom, we are here observing the production of cyberspace which reduced communication distances and enabled access to content. A lot of the fandom interactions are rather postal in nature: make a fanzine and distribute it, post the Hugo ballot, get the Hugo ballot entries for evaluation in a special Hugo pack—all of which is simplified with the 21st century technology. It opened access to many fans outside of the usual hotbeds of fandom (i.e. the US). In this sense, the information and communication technologies follow the footsteps of the postal networks as the "true public utility" in Illich's sense[11], "a left-wing institution" that has a democratic, rhizomatic structure without a "product" in mind (as opposed to hierarchical structures which process inputs and provide outputs, e.g. factories or schools). A technological network there grows into a symbiotic relationship with the social network of fandom: remember that the attendees of a convention are members, not guests. They are a part of the convention.

Weaponisation of this network is again not something limited to fandom. Without overstepping into causality (as Camestros Felapton avoids to do as well in the Debarkle), the elections in the US and beyond in the mid-2010s were a technosocial network phenomenon. In a somewhat controversial fashion, I'd argue that the Puppies tale is the clash of the two interpretations of "Fans are Slans", a famous (and dated) slogan from the early years of fandom.

Fans are Slans

At the beginning of World War 2, A. E. van Vogt published Slan, a science fiction novel about a fictional race of super-intelligent humans who are persecuted by the ordinary humans. Take it as a humoristic or a serious slogan, "Fans are Slans" was a fandom motto which suggested that science fiction fans are something else. When I say that the Puppies were a clash of two interpretations of the slogan, one is the reactionary reading, nostalgic for the Golden Era, and that science fiction fans shouldn't succumb to the modern progressive politics, because they're *something else*. The other is one that suggests that science fiction fans should react strongly and oppose the reactionary moves, championing the progressive politics, as they're *something else*.

[11] See Ivan Illich's essay "Spectrum of Institutions".

This is how you simplify a culture war. I'm intentionally reductionistic, as the Slans story is a segue into my next showcase: the relationship between the authors and the guns.

Cleve Cartmill's Deadline

"Two cast-iron hemispheres, clamped over the orange segments of cadmium alloy. And the fuse...a tiny can of cadmium alloy containing a speck of radium in a beryllium holder and a small explosive powerful enough to shatter the cadmium walls. Then...the powdered uranium oxide runs together in the central cavity. The radium shoots neutrons into this mass—and the U-235 takes over from there." This paragraph is in Cleve Cartmill's story Deadline, published in Astounding Science-Fiction magazine in early 1944. It could pass as a decent explanation how the nuclear bomb works—or how it would work in year and a half, when dropped on Hiroshima.

The science in the paragraph comes from the magazine's editor, John W. Campbell, and it was tailored by Cartmill to fit in his story about the war between Seilla and Sixa. Campbell claimed that all the information in the paragraph is distilled from the available scientific journals, and that any reader of those would have access to this information. What is also notable is that Campbell surrounded himself with authors who worked on relevant defence projects of the era, adjacent to the Manhattan Project of the nuclear bomb, at places like Bell Labs and Raytheon[12]. The Golden Age authors were a part of the ecosystem, or to use the less euphemistic word, the military-industrial complex. It didn't stop at the Golden Age, though.

Star Wars

It's easy to tell the story of Star Wars (the Reagan policy, not the space opera) wrong. It could be told as the two hard-SF (and hard-conservative) authors, Larry Niven and Jerry Pournelle pitching a sci-fi scenario to President Reagan for a science fiction-inspired defence system to be built for the United States. It could also be told as Reagan hiring science fiction authors to create this massive and unrealistic vision for him. The truth is, Niven and Pournelle were creating in the millieu of Reagan and Reaganites well before there was a Reagan. The group of scientists, astronauts and science fiction authors called "Citizens' Advisory Council on National Space Policy" and informal groups before it were venues to spill science fiction concepts (often heavily focused on weapons and extractivism) into policy proposals and imaginaries of technocratic state of the future. While they could use the pages of their novels to pitch ideas widely, the interested ear of the defence industry and the policy makers was already in the room.

Sometimes, however, it's the medium of the science fiction spectacle that is necessary to pitch an idea to the weapons manufacturers—and it works at drawing attention (Cartmill did draw unwanted attention of the government with his A-bomb story, but that's surely different). A known example is that of John Underkoffler, the creator of the famous user interface that

[12] For more details and for a relevant bibliography of sources, see Forte, J.A., 2010. " We Weren't Kidding": Prediction as Ideology in American Pulp Science Fiction, 1938-1949 (Doctoral dissertation, Virginia Tech).

features in the film “Minority Report”. He used the film to showcase his invention, and the deal that this showcase led to was with Raytheon.[13]

Instead of a conclusion

There is, of course, a lot to be said about the complex, ambiguous and controversial relationship of science fiction, sci-fi fandom, sci-fi authorship, and the tech industry, and harmful tech systems in general. We barely scratched the surface of intricacies from the perspective of a long-term fan of the gerne. Such an intricate relationship alas has largely escaped the scrutinising eye of social scientists. It is high time this omission is rectified. Popular culture as much as the arts *matter* in the context of technology development, use and promotion.

[13] This story is told, among other places, in Kirby, D.A., 2011. Lab coats in Hollywood: Science, scientists, and cinema. MIT Press.

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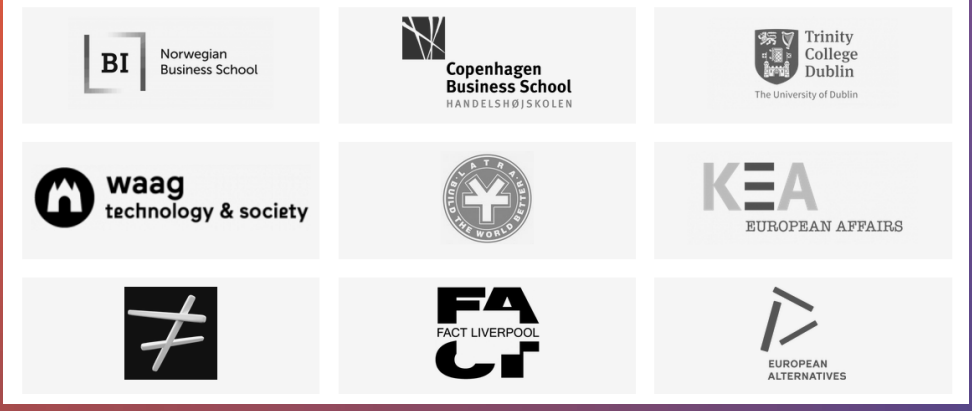
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