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Citizens of the future

Science fiction and the games of citizen science

Colin Milburn and Melissa Wills

Over the last decade, a variety of 'citizen science' projects have turned to video games and other tools of gamification to enrol participants and to encourage public engagement with scientific research questions. This article examines the significance of sf in the field of citizen science, focusing on projects such as *Eyewire*, *Be a Martian!*, *Sea Hero Quest, Play to Cure: Genes in Space*, *Forgotten Island* and the 'Project Discovery' experiments in *EVE Online*. The sf stories that frame these projects often allegorise the neoliberal assumptions and immaterial labour practices of citizen science, even while seeming to hide or disguise them. At the same time, the fictional frames enable players to imagine social and technical innovations that, while not necessarily achievable in the present, nevertheless point to a future of democratic science, social progress and responsible innovation – blips of utopian thought from the zones of crowdsourced labour.

Keywords: citizen science, video games, science fiction, science and technology studies

Perhaps we've heard the story before: a young science geek goes for a tour at an esteemed research laboratory and, after being bitten by a radioactive organism, becomes a crimefighting superhero. Yes, this is the secret origin of Spider-Man. But it is also the backstory for the newest member of the Heroes of Neuroscience, a team of superhuman do-gooders who represent the players of the science game *Eyewire*.[1] In the game's fictional frame, the Heroes of Neuroscience are tasked to protect the city of Eyewire, defending the land of Science from its enemies: 'The city of Eyewire never sleeps and is full of dastardly villains to boot! Use your powers as Eyewire's newest hero to save the city and keep the Citizens of Science safe!' (David n.p.).

Eyewire was created in 2012 by the neuroscientist Sebastian Seung and his lab group, originally based at the Massachusetts Institute of Technology and now at Princeton University. It is an online tool that brings together gamers from

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1. Written by Thomas Macrina, Amy Sterling, Rob Hamill, Celia David, and Devon Jones, and illustrated by Hyunah Choi, Daniela Gamba, Zoe Gillette, Rabbit Giraud, MJ Kim and Alex Norton, the 'Heroes of Eyewire' narrative sprawls across a set of paratextual materials – blog posts, cartoons, videos and listserv emails – that are not part of the core game software but instead form a transmedia assemblage of vignettes and images; see, for example, 'Heroes'. On the ways that such paratextual materials shape the meanings of games, see Jones.
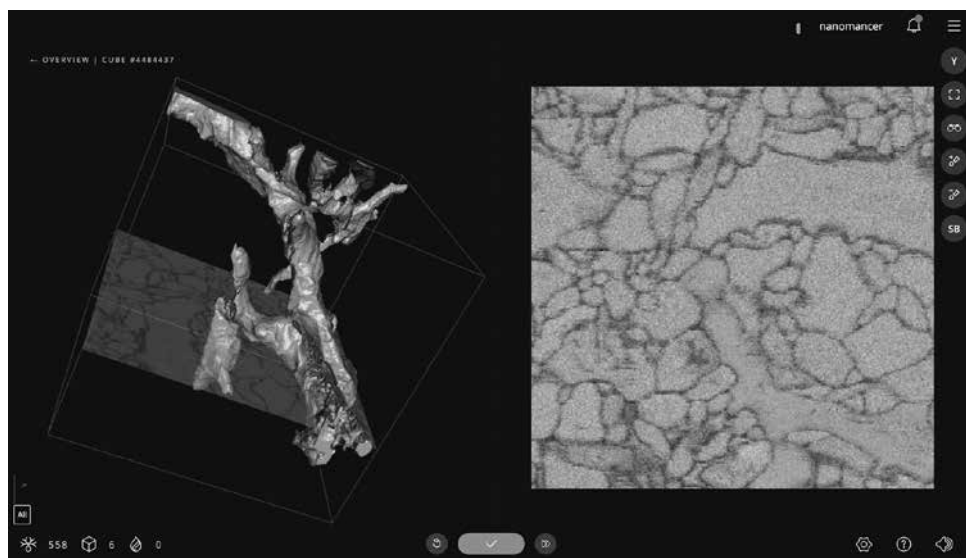
Tracing a neuron. *Eyewire* (Seung Lab, 2012–). 2020.

around the world to contribute to the research of Seung's lab, offering a playable interface to a large data set of electron microscope images, each representing a thin slice of a mouse retina. The slice images are stacked into a cube, and the challenge of the game is to disentangle and map the neurons in the sample by tracing their projections, their dendrites, their protoplasmic wires.

Although the *Eyewire* algorithm can reconstruct some neural details from the stack of tissue slices on its own, humans are actually much better at deciphering the complex twists and crossings of the cellular threads in the data set. *Eyewire* taps into the human capacity to recognise and reconstruct volumetric shapes, enabling players to grapple with neurological structure puzzles that even the best supercomputers have struggled to resolve. According to the *Eyewire* promotional materials: 'Solving the mysteries of the brain requires something more powerful than a supercomputer – YOU. Together, we're mapping neural circuits to decipher the mysteries of vision' ('Why Eyewire' n.p.). Yet, in the process of interacting with the game and highlighting the pathways of neurons, the players are also training the AI system of *Eyewire* to better recognise these pathways itself, contributing to machine learning. It is a dynamic system where the players and the computer help each other to develop new capacities and skills, enhancing neuroscience through the interactive experience of gameplay.

Eyewire has been a highly successful example of citizen science, a mode of scientific practice that involves nonscientists in the gathering of data and the

production of knowledge. Since the *Eyewire* project began, more than 250,000 gamers have contributed to the research by clocking in millions of hours of playtime, and the results have been impressive. For example, in 2014, the efforts of *Eyewire* players helped to reveal the mechanism by which neurons in the retina detect motion, solving an old mystery (Kim et al.). Since then, the *Eyewire* community has contributed to several other significant discoveries and insights in neuroscience, and the players often appear as co-authors on the resulting publications. To entice the players to continue participating in the project, the game also offers a variety of additional incentives, including a scoring system, leaderboards to recognise high-achieving players and regular competitions with prizes and swag.

Over the last decade, a number of citizen science projects have experimented with similar methods, the tools and techniques of gamification, to enrol participants and to encourage gamers to engage deeply with scientific research questions.[2] Following the breakout success of citizen science games such as *Foldit* (2008–) and *EteRNA* (2010–), dozens of other research projects have now added playful interfaces or competitive reward schemes, intended to generate scientific knowledge by luring more and more nonscientists into the domain of technical research. Citizen science games such as *MalariaSpot* (2012–), *Cell Slider* (2012–15), *Fraxinus* (2013–15), *NanoDoc* (2013–14), *Quantum Moves* (2012–18) and *Quantum Moves 2* (2018–) have been providing fun and competition in hopes of incentivising people to volunteer their time and energy for the cause of science.

While gamification often makes the routine tasks of data collection and information processing more fun, it has not always proved sufficient for transforming extrinsic motivations into intrinsic ones. To address this problem, several citizen science games have added narrative framing devices, wrapping fictive plots or scenarios around their collaborative software platforms. According to Amy Sterling, the executive director of the *Eyewire* project, narrative frames help to make citizen science more meaningful for participants:

Adding narrative to citizen science is a growing trend. … The human brain processes narrative differently than facts, and some researchers hypothesize that we evolved neural mechanisms specifically for story. Unfortunately, both within citizen science and beyond, scientists don't often present their results in the form of an enrapturing journey for knowledge. Perhaps we could all learn from the quests of games to reach more people. (Sterling 'Science Heroes' n.p.)

2. On the use of computer games for scientific research and the gamification of citizen science, see Milburn *Mondo Nano*; Schrier; Wynn; Squire; and Glas et al.

While any narrative framing may help participants to contextualise matters of facts and make sense of data, for the purpose of reconfiguring citizen science as action and adventure, transforming high-tech research into a game, some kinds of stories have appeared more suited to the task than others.[3]

As developed in recent years, the trend of wrapping stories around citizen science and its tools of gamification has relied predominantly on science fiction (sf). For games of citizen science, the discourse of sf seems fundamental, almost inevitable: it is a key resource for structuring how player-participants experience the procedures of knowledge production, the goals of experimental research and the institutions of technoscience. Even citizen science games with no overt narrative elements – the various puzzles, pattern-matching exercises and data-tagging competitions that constitute the majority of citizen science games today – align to some degree with the cognitive and aesthetic dispositions of the genre. After all, the process of turning scientific research into a playable format necessarily mixes elements of technical realism with ludic contrivances and figurative conceits, fictionalising science – at least to some degree – to facilitate the speculative, experimental mechanisms of gameplay.[4] But this generic affiliation has become especially pronounced in the recent boom of story-driven citizen science games. The *Eyewire* narrative, for example, with its cast of cyborg superheroes standing for all players of the game, reflects what Sterling describes as the 'hard sci-fi nature of Eyewire' (Sterling 'Behind the Art' n.p.). Indeed, the comic-book storyline amplifies the 'sci-fi' aura that already clings to *Eyewire* as an experimental platform, its ribofunk image of cutting-edge neurobiology projected slightly in the future. In adding such narrative wrappers to their scientific contents, citizen science games tend to replicate well-worn tropes and plot devices from the repertoire of sf – often with a dash of humour thrown in for good measure – and they reaffirm the use-value of the genre as a vehicle for scientific and technological extrapolation.[5]

3. In regard to the neurobiology of narrative, Sterling cites the neuroeconomist Paul J. Zak; see Zak. On the efficacy of narratives in citizen science games for deepening player engagement, see Prestopnik and Tang. On the significance of narratives and practices of storytelling in citizen science communities for making data meaningful, see Ottinger; Hecker et al. 'Stories'; Richter et al.; and Constant and Roberts.

4. For that matter, it is possible to argue that all video games belong to the domain of sf; see Milburn *Respawn* 21–7. On the speculative mechanisms of video games that intersect with sf, see Kunzelman. Moreover, video games often engage explicitly with the discourses of technoscience and speculate upon alternative futures; see Abraham and Jayemanne; Chang; Crogan; Fordyce; Frelik; Jagoda; Lenoir and Caldwell; Mitchell; Servitje; Tringham; Wills.

5. For many scientists, the appeal of sf lies in the ability to venture imaginary solutions to real scientific problems; see Csicsery-Ronay 111–45; Milburn 'Modifiable Futures'. But sf is also a way for
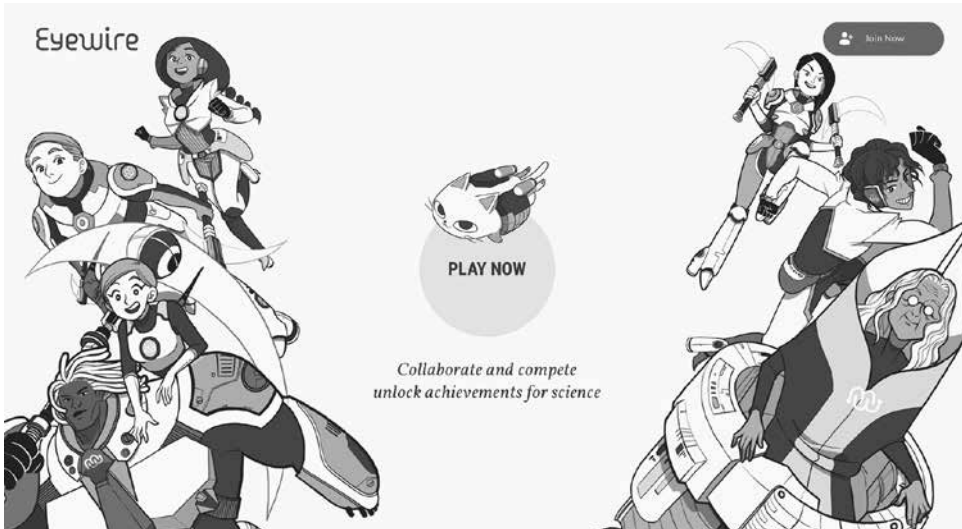
Heroes of Eyewire. *Eyewire* (Seung Lab, 2012–). 2017.

But their reiteration of familiar tropes and clichés is not purely nostalgic or uninventive; on the contrary, these games instrumentalise and modify earlier fictions in order to enable new technoscientific discoveries.

The sf narratives employed by the games of citizen science, whether they are presented through paratextual media or embedded directly into playable scenes, are not neutral, anodyne delivery capsules for technical knowledge or gameplay mechanics. As works of speculative fiction that situate science and innovation in the context of imagined futures, they often attend to the sociopolitical dimensions of scientific research and the economisation of knowledge, even when seeming to disguise these issues. That is to say, despite their ostensible function as promotional tools and enabling devices for citizen science, these games awkwardly expose the internal contradictions in the discourse of citizen science itself, drawing attention to inequities in systems of knowledge production at the same time as they champion the democratisation of science. Yet by the same token, these games also encourage players to imagine social and technoscientific changes that are not necessarily achievable in the present, and in doing so, they conjure traces of a different future altogether – blips of utopian thought from the zones of crowdsourced labour.

scientists to engage in discussions of the sociopolitical dimensions of scientific work; see Vertesi. In citizen science, sf can also help to teach ethics and responsibility; see Winter *Citizen Science Fiction*.

Citizen of the galaxy

The term 'citizen science' now encompasses a variety of interrelated concepts: participatory science, street science, crowd science, community science and so forth.[6] But in becoming the privileged term, it has also explicitly raised questions of civic belonging and political alignment. Instead of presuming participants to belong to one terrestrial nation or another (or perhaps none at all), most citizen science projects embrace a rhetoric that hails them preemptively as members of a community of science enthusiasts transcending mere political boundaries – in other words, citizens of science itself.

Like *Eyewire*'s framing narrative, the story elements of many citizen science games dramatise the immigration or naturalisation of players into the domain of scientific knowledge – the land of Science and its moral economy. Players join the profession of science, but not simply science as it exists today. Rather, it is science in a decidedly speculative mode: a forward-looking vision that anticipates the impacts of current research, an endlessly promising future in which science will have at last become fully democratized, meritocratic, egalitarian and operating for the benefit of all humankind. Almost invariably, citizen science games present the tasks at hand (puzzles to solve, data to analyse) in the guise of sf, relying on tropes and signifiers of astrofuturism, space opera, cyberpunk and transhumanist discourse to situate the player as less a resident of our own world than an explorer of a new world – a citizen of the future.

Be a Martian!, a citizen science project and educational platform developed by NASA, exemplifies these rhetorical configurations. Running from 2009 to 2018, the project involved users in tagging images captured by Mars rovers, marking craters and other landscape features. In the online environment of the game, various activities would occur within imaginary Martian spaces.[7] For example, the core task of processing rover images took place in the map room, represented as a grand chamber with a window overlooking the Martian

6. On the various modes and conceptions of citizen science, as well as their implications for social justice and the politics of expertise, see Irwin; Epstein; Corburn; Collins and Evans; Nielsen; Franzoni and Sauermann; Watson and Floridi; Chilvers and Kearnes; Hecker et al. *Citizen Science*; and Lintott. The current discourse of citizen science inherits from a much longer history of amateur science; see McCray; Wynn.

7. In addition to the main *Be a Martian!* online environment launched in 2009 (https://beamartian.jpl.nasa.gov/welcome), NASA also released a companion *Be a Martian!* mobile app in 2013, which features some of the same citizenship rhetoric but without any of the participatory citizen science features. Although the *Be a Martian!* citizen science project has concluded, the online environment remains accessible through the Internet Archive's Wayback Machine.

Martian Map Room. *Be a Martian!* (NASA, 2009–18). 2017.

terrain. Users could also participate in community Q&A at the Crater City Town Hall; watch educational videos at the Two Moons Rove-In Theater in the Crater City Art District; and settle into their 'new virtual home' by exploring a Martian atlas at the Visitors Center.

This science-fictional diegetic frame, situating the collective project of analysing rover data inside a Martian colony, aimed to capture the imagination and increase engagement. But it also concretised the values of citizen science, precisely by asking users to perform the ideals of a future-present scientific meritocracy. Involvement in *Be a Martian!*, as the title suggests, was framed explicitly and elaborately in terms of citizenship. The project's launch page placed the user inside the cockpit of a spacecraft approaching Mars and offered two options: 'I want to be a Martian citizen' (set up an official user account) or 'I just want to look around' (proceed with temporary guest access, an 'anonymous tourist visa'). The process of registering an account was represented as a citizenship application inside Citizenship Hall, which later served as the hub for all in-game activities.

To enter the game, the player was instructed to 'Identify yourself in the Martian community', acknowledging that 'I am signing up to be apart [*sic*] of a collaborative culture of discovery. In our community culture, fellow Martians can count on me to be a(n): …'. The player then selected from a series

of roles in a dropdown menu, each representing an aspirational persona in the meritocracy of citizen science: 'Good-Natured All-Around Citizen', 'Intrepid Explorer', 'Knowledge Creator', 'Willing Volunteer', 'Pioneering Innovator', 'Seeker of Awe and Wonder', or 'Life-Long Learner'. To proceed, a 'Citizen Oath' was also required, which acknowledged that 'I understand Mars exploration is a civilization endeavor, open to all' and 'I pledge to respect my fellow community members, conduct myself with honor and integrity, and make contributions that build my own capabilities in a way that serves knowledge creation and the well-being of all humanity (and robotity!)'. To participate in the game, then, meant finding one's place in a scientific project that was very much of the present – the account registration steps were really about guiding appropriate online behaviour – through the projection of an idealised future and a commitment to the ideals of citizen science itself.

Be a Martian! further cultivated membership in an imaginary meritocracy through the game's rewards system. Players earned 'reputation points' for tagging images as well as for participating in the community and exhibiting 'curiosity' (for example, posing questions to be answered by the NASA scientists). Reputation points were not redeemable for any objects or abilities, nor were there leaderboards. Rather, points were simply amassed, serving as an indicator of skill acquisition and scientist-brokered learning. Despite its perfunctory appearance, the reputation system was considered potentially useful to the project scientists. NASA's Michelle Viotti, speaking at the O'Reilly Gov 2.0 Online Conference in 2010, suggested a future version of Martian exploration in which skilled players would take an active role in shaping the direction of research activities. Looking ahead, she envisioned a time when games would cultivate true expertise, qualifying invested players for further participation in scientific futures:

There are a lot of people who are motivated by points … and badges that you can earn as you progressively do more and more science. Ultimately what we'd love to be able to do is, as people are really gaining knowledge about Mars, opening up the possibilities for participating even more so that if you actually have done a lot of work and know something about Mars, then maybe in future days, no promises, but in future days maybe we could open up some of the experiments at the rovers, for instance, or the orbiters are doing and get the public to weigh in, the now not just interested public, but knowledgeable public to say, yeah, hey, as a citizen group, as the people from planet Earth, let's go explore this rock, maybe, instead of that, and input that into the science teams and really have that open opportunity to discovery. (Viotti n.p.)

As Viotti's phrasing suggests, *Be a Martian!* and other citizen science games construe player participation as both work and knowledge production, enabling players to take their place in a democratic scientific community. No promises,

of course! Yet the promise is made even while pulling it back: a *fort/da* game of the future to come, thrown out, reeled back in, and tossed forward once more. It is a playful fiction, like the other narrative elements wrapped around *Be a Martian!*, that replaces the symbols of remuneration allegedly driving player participation – points, badges and so forth – with a vision of players now made experts by the game and cast as 'the people from planet Earth' who will belong to the experimental ventures, the expeditions on other planets to come.

A similar promissory rhetoric structures *Sea Hero Quest*, a citizen science game designed for studying the cognitive processes of spatial navigation in order to identify the neurological signatures of dementia. *Sea Hero Quest* was developed in 2016 by researchers at the University of East Anglia and University College London together with the game company Glitchers, Alzheimer's Research UK and Deutsche Telekom. The narrative that frames *Sea Hero Quest* concerns the seafaring adventures of a father and his son, who used to travel the oceans searching for sea monsters, gargantuan squids and other imaginary beasts of the deep, invoking a genealogy of nautical sf going back to Jules Verne's *Twenty Thousand Leagues under the Sea*. In the game's backstory, the father writes and illustrates a logbook about these extraordinary voyages: 'In faraway seas, they found incredible creatures. And captured them. Not with a hook, but with a pen.'[8] But years later, due to the onset of dementia, the father has lost the memories of his cryptozoological explorations. His life has now become completely mundane, unremarkable. Following the stories from his father's journal, the son must seek out sea monsters once more in order to help his father to recover his sense of wonder. The player takes on the task of navigating a ship through fantastical seas, recreating the father's former adventures. The player's decisions and manoeuvres though the game become benchmark data for charting the cognitive mechanisms of spatial memory and navigation.[9] The narrative encourages the player to understand the donation of time and effort to this project – becoming a volunteer test subject – as figuratively reenacting the son's mourning for his father, recollecting the amazing stories of the past: the lost world, out of time's abyss. But the son's aspiration is also the promise of the game itself, namely, to produce a speculative future, a reenchanted life to come. In the game, a passage written in the son's travel journal hails the player directly: 'My father and I travelled to undiscovered lands and found

8. The introductory video in the game's 'Story' menu, 'Memories of a Sea Hero', is hosted externally on *YouTube*; see lifeisforsharingDT.
9. See Coughlan et al. The *Sea Hero Quest* research project concluded at the end of 2019, and although copies of the mobile and VR versions of the game remain generally playable, gameplay data is no longer being collected.

incredible sea creatures. … By retracing our journey and rediscovering the creatures he once knew, you are helping to save the memories of the future.' The forward-looking goal of preserving 'the memories of the future' suggests that the cognitive functions of people in the future will be secured, protected from dementia, thanks to the anticipated results of this citizen science project. At the same time, the narrative of *Sea Hero Quest* also transparently allegorises the utility of sf stories – memories of the future – for addressing the cognitive limits and prosaic constraints of the present, indicating how retracing such stories can open a scientific future in which we might remember otherwise.[10]

By encouraging players to imagine themselves as forward-looking citizens of science – not merely belonging to the world of today but also the world of tomorrow, helping to create the world of tomorrow through their voluntary participation – many of the game narratives respond to the internal contradictions, the antinomies of citizen science as a field of practice. For even as they represent crowdsourced research as a democratisation of science, they also suggest the extent to which citizen science is haunted by a relation to neoliberal rhetoric and affective modes of production, relying on transnational pools of free labour made available by networked technologies: the immaterial labour practices of the so-called knowledge economy, where leisure and work, usage and production, fun and functionality become increasingly indistinguishable – playbour, in other words.[11] While players are enticed to contribute to scientific research in the form of gameplay, which recodes the repetitive tasks of classification, quantification and signal detection not as grunt work but instead as fun, and may even be recognised for their research contributions through acknowledgements or sometimes co-authorship credits on scientific publications, the potential value of their collective work remains vulnerable to capture, commodification and predation. Players donate time

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10. In this way, *Sea Hero Quest* would seem to align with Fredric Jameson's claim that the function of sf is not to proliferate images of the future but rather to show the limits of our ability to imagine the future – even as the form of sf affords consideration of a radical break from current conditions; see Jameson 211–33, 281–95. Notably, *Sea Hero Quest* is a game about cognition and the scientific study of cognition whose narrative trades on a representation of sf's own cognition effects; see Suvin; Freedman; and Chu. On the sense of wonder as a motif of sf discourse, see James; Landon.

11. See Milburn *Mondo Nano*; Schrier. On playbour and other forms of affective labour in the networked knowledge economy, see Postigo; Terranova; Kücklich; Castronova; Dyer-Witheford and De Peuter; and Scholz. For a critique of playbour as an ideological concept, see Lund. Notably, the thematising of playbour in several citizen science game narratives indicates not only its ideological quality for the discourse of gamification, which actively collapses distinctions between playing, gaming, working, and labouring, but also its instability, suggesting how citizen science also affords ways to decouple play and work from neoliberal exploitation – a least, as a utopian urge. On the neoliberal logics of gamification, see Jagoda.
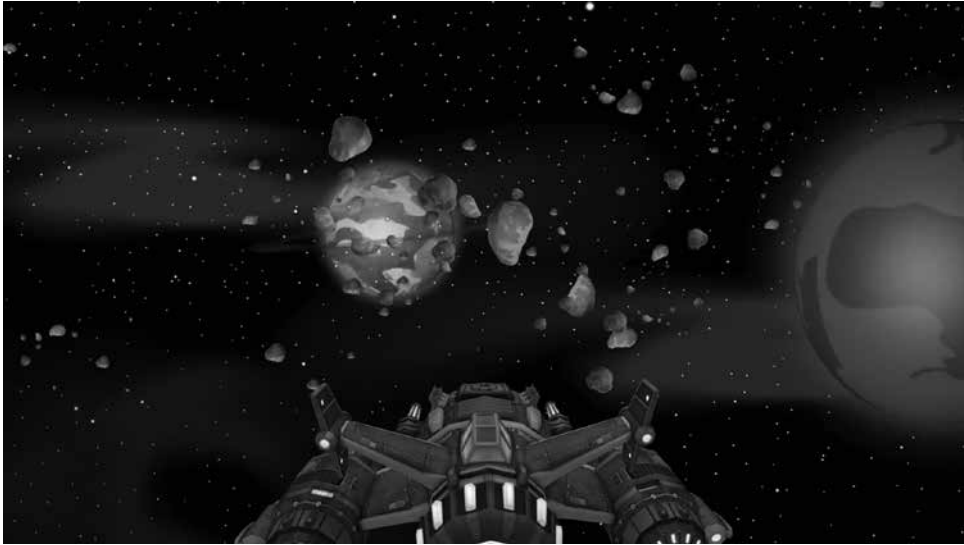
Searching for Element Alpha. *Play to Cure: Genes in Space* (Cancer Research UK, 2014). 2017.

and effort, informed that what they do is a moral virtue. (The slogan for *Sea Hero Quest* makes it perfectly clear: 'Game for good'.) But the results of all this research may nevertheless accrue value less for the players themselves or the common good than for specific individuals and organisations – in fact, its success may even be measured by its capacity to generate patents, contracts, start-up companies or marketable products. The knowledge produced by citizen science is always already caught up in the speculative economies of the scientific futures market. Although it may not pay off until some later date, it is nevertheless already banked, gathering interest.

This much is suggested by the citizen science game *Play to Cure: Genes in Space*, developed by Cancer Research UK in 2014. In this game, the player is a spaceship pilot, hired by a high-tech corporation called Bifrost Industries to fly through a field of asteroids and space dust, searching for a substance known as Element Alpha. The field of space debris is actually a data set: gigabytes of genetic information, a plot representing DNA microarrays from tissue samples of thousands of women with breast cancer. The game is an interface to the data, a way to research potential genetic factors of breast cancer by searching for significant differences in the microarray data: these anomalies are figured as Element Alpha. The diegetic contents of the game do not disclose any particular relation to oncology research; Element Alpha is a mysterious substance described only as 'a valuable space dust'. However, the game makes

clear that, as a natural resource and a research material, its value is entirely dependent on the financial market. Indeed, the 'market rate' for Element Alpha in the game fluctuates after each mission, apparently reflecting the mercurial appraisals of a galactic community of traders and speculators. The pilot must periodically decide whether to sell the cargo now or wait, betting that the value may continue to rise as time goes by. Yet no matter how much the pilot may earn by scavenging these nuggets of celestial debris, the game indicates that the future value of Element Alpha will ultimately be exploited by someone else – in particular, the pilot's employer, Bifrost Industries.

For the spaceship pilot, on the other hand, the credits earned for finding bits of Element Alpha allow for spaceship upgrades – apparently, in this career, any new tools required for the job must be bought by the employees themselves – and an experience boost, helping the pilot to move up the ranks in the corporate hierarchy.[12] The accumulation of credits over time sketches a pathway, a trajectory of technological improvements as well as a career track, which simultaneously measures the present relative to the speculative future: an anticipated state in which Element Alpha will have reached maximum value, that is to say, a world in which genetic research will have cured cancer.

As Cancer Research UK puts it, 'What takes scientists hours can now be done in minutes with your help and the collective force of thousands of players. And the more players we have, the quicker we get results, and bring forward the day when all cancers are cured. You don't have to wear a lab coat to help beat cancer sooner' (Cancer Research UK n.p.). Thus, although the player may not yet wear a lab coat, the credits earned in the game measure the approach to full scientific citizenship, the acceleration of a future beyond the end of cancer – as if bringing this day forward, proleptically, into the present. Players can therefore take comfort in knowing that their 'collective force' is already speeding its arrival, even if they may not be the immediate beneficiaries of whatever value Element Alpha may accrue in the gap between now and then. As one player has said, 'You help scientists cure cancer while having fun playing a game. It cannot get any more noble than that' (Zappka n.p.).

The performance of forward-looking scientific citizenship serves to neutralise any apparent contradictions between the ideals of scientific democratisation and the actually existing conditions of scientific research in the world today. If players of these games were merely to be citizens of science in the present,

12. Drawing from the narrative traditions of classical space opera but foregrounding the financial-isation of technoscience and the exploitation of technical labour, *Play to Cure: Genes in Space* resonates with many of the critical concerns of New Space Opera; see Winter *Science Fiction*.

they would face the dilemma of gifting free labour for the sake of research that, while perhaps intended for the common good, would likely serve the financial interests of some more than others. But if players are instead citizens of science in the future – or at least earning the right to apply for citizenship in the science-fictional world to come – then their contributions can be perceived as genuinely unalienated labour, collectively working through the disappointments and inequities of the present toward a utopian dream of tomorrow.

Surely this is the implication of Bifrost Industries in *Play to Cure*. Obviously, it is a symbol of Big Pharma – representing the likely scenario that, should any biomedical results from the game indicate a viable route to new oncology drugs or gene therapies, they would be quickly commodified and marketed for profit. At the same time, the corporate name of Bifrost refers to the flaming rainbow bridge of Norse mythology, which links the world of mortals to the realm of the gods. Thanks to Marvel Comics and several films in the Marvel Cinematic Universe, including *Thor* (Branagh US 2011) and *The Avengers* (Whedon US 2012), the popular image of Bifrost now also signifies a high-tech transportation system: an Einstein–Rosen bridge, a speculative pathway to other dimensions of spacetime. In this regard, Bifrost Industries in *Play to Cure* might suggest a way to span the distance from the here and now to the there and then – perhaps leading to a future in which market value may no longer be the most salient driver of pharmaceutical development, where knowledge in common may actually provide the common good. In other words, Bifrost Industries as a symbol of commodified citizen science may imply an inevitable but temporary step on the way to something better: a world in which scientific divinities and mere civilians find themselves on the same plane of being, Asgard and Midgard as one.

A similarly ironic thematising of digital labour preoccupies the citizen science game *Forgotten Island*. Developed by the Citizen Sort research group at Syracuse University's School of Information Studies in 2012, *Forgotten Island* asks players to characterise and identify different moth species in exchange for progressing through the game narrative. On the one hand, the game is a tool for crowdsourced taxonomic data, one of several Citizen Sort projects that enable amateur naturalists to classify and tag photographic images of organisms from different field sites. On the other hand, the game was also created to study how narratives can enhance the quality of citizen science, not only making the routines of taxonomic sorting more entertaining, but also helping players to think more critically about the purposes and promises of citizen science as such (Prestopnik and Souid). The story begins with a young woman, the player-character, awakening in a state of amnesia. She wanders

around a mysterious island and she sees photographs of various organisms falling from the sky. Apparently, a bomb has recently exploded in the island's laboratory, scattering the lab's archive of specimen images ('real photos of plants, animals, and insects, taken by actual scientists from around the world!'). She quickly sets to work collecting and re-classifying the specimen images under the direction of DOC73R-CY3NS3, a bossy and self-aggrandizing robot. DOC73R-CY3NS3 tells the protagonist that she is the one who blew up the island, even though she cannot remember doing so, and she must now repair the facilities. Manipulatively, mendaciously, the robot extorts scientific labour from the player-character. In this manner, the game allegorises the potential for exploitation that dwells in the heart of citizen science.

In *Forgotten Island,* citizen science has been ensnared by a pretentious technocratic regime: as the player-character travels around with the robot's 'atomic teleporter', sorting moths with the robot's 'atomic classifier', she is constantly berated by this same robot who can barely contain his opinion of himself as an engineering genius. DOC73R-CY3NS3 financially rewards her labour through his own system of currency – a form of company scrip – which can only be spent on a series of objects (pliers, wrenches, steam valves) that are required to repair the island. The narrative thus figures the sorting of biological data not as knowledge-making or personal edification, but instead as wage labour performed in the service of a high-tech institution – the robot and its island laboratory – which reaps all the benefits. Eventually, the protagonist discovers that she, not the robot, is actually the creator of this island laboratory. She is already a scientist, although her amnesia has prevented her from recognising the value of her own work. DOC73R-CY3NS3 turns out to be her former lab-assistant robot, as well as the culprit behind the lab explosion – a revelation that frames the robot's regime as illegitimate, a corruption of the lab's collaborative intent. He is a domineering usurper: 'Now I am the scientist, and I can boss you around!' He sees science as power, control and coercion. 'I am the one wearing the lab coat!' he yells. 'I am the one in charge! … Listen closely, and do not question my orders!'

The game encourages the player to maintain a critical distance from DOC73R-CY3NS3. Upon first encountering the robot, the player is warned that 'he doesn't seem very friendly, does he? In fact, he looks mean and bossy. You might have to play along for a while to get what you want'. The protagonist's running commentary indicates her growing frustration at having to 'play along', sorting all the data while the robot keeps the scientific knowledge for himself. At first, she accepts the promise of pay for play ('Classifying those photos isn't so bad. At least I'll get paid for it'). But she gradually becomes

discontent, pestering the robot more assertively for answers to the island's mysteries, to which she feels entitled by virtue of her sorting activities: 'Hey! I've done a lot already! Don't you think you owe me some kind of explanation? Can't you at least tell me something about the island? Please?'

Her persistent questioning models an incisive, innovative disposition. As she explores the island, she draws attention to small details that later become important, while also expressing ideals of humanistic literacy (the value of a well-stocked library, for instance) that challenge the robot's technocratic views. At multiple points, the player must cleverly combine items to solve a problem, whether building a makeshift light to illuminate the forest or stitching together lab coats to guard against the cold on the island's icy peak. While these combinations are sometimes suggested by in-game hints, this is not always the case. For instance, the 'super smasher' ('a powerful tool for smashing anything!') that brings down DOC73R-CY3NS3 is assembled from a scalpel, a bolt cutter and a hammer – tools acquired along the way but without obvious purpose. At other times, basic items must perform unconventional tasks: a lump of cheese is used to lure ants, which then reveal a secret passage. These creative solutions counter the robot's expectation of routinised, obedient rule-following.

Eventually, the protagonist recovers her memory and expels DOC73R-CY3NS3 from the island. The downfall of the robotic regime of exploitative playbour leads to the restoration of a more meaningful, naturalistic practice of creative experimentation and equitable robot–human partnerships – a reparative, affirmative mode of science. The game suggests that being a good scientist is not so much about skill or expertise as about cultivating a moral compass that resists the economisation of knowledge and the corruptions of hierarchic power – whether within the laboratory or without.

At the conclusion of the game, ED-D, a friendly robot who runs the laboratory store – and heretofore, while under the control of DOC73R-CY3NS3, a representative of citizen science as transactional marketplace – invites the player to continue working on the island's gardens. In other words, ED-D suggests that the player can go on sorting moth photos and exchange the island currency for floral specimens, but this time simply for their aesthetic potential to beautify the landscape. The imperative is now to 'garden to your heart's content!' and 'have fun!' This is citizen science apparently freed of any extractive premise, operating on a purely volunteer basis and rewarded only by the enjoyment of flowers and fungi. The protagonist announces her new sense of self-determination: 'I can still work with the gardens if I want to!' Likewise, ED-D is released from his role in the hierarchal robot regime,

Robot–human partnership. *Forgotten Island* (Citizen Sort, Syracuse University School of Information Studies, 2012–). 2017.

and he shifts his relationship with the player-character. 'What do you say?' he asks in the narrative's final frame. 'Let's be friends!' This proposed robot–human partnership heralds a future beyond the end of the game, a conjoined flourishing of high-tech research and civic values, a genuine collaboration that promises to be – finally, at last – mutual and nonexploitative on both sides.

Of course, this situation might seem to illustrate what the critical theorist Lauren Berlant has called 'cruel optimism':

A relation of cruel optimism exists when something you desire is actually an obstacle to your flourishing. It might involve food, or a kind of love; it might be a fantasy of the good life, or a political project. It might rest on something simpler, too, like a new habit that promises to induce in you an improved way of being … . Whatever the experience of optimism is in particular, then, the affective structure of an optimistic attachment involves a sustaining inclination to return to the scene of fantasy that enables you to expect that this time, nearness to this thing will help you or a world to become different in just the right way. But, again, optimism is cruel when the object/scene that ignites a sense of possibility actually makes it impossible to attain the expansive transformation for which a person or a people risks striving; and, doubly, it is cruel insofar as the very pleasures of being inside a relation have become sustaining regardless of the content of the relation, such that a person or a world finds itself bound to a situation of profound threat that is, at the same time, profoundly confirming. (Berlant 1–2)

Nevertheless, even if citizen science games may promote optimistic, future-oriented citizenship in the community of science as a way to obscure or reconfigure their relation to free labour, their fictional framing narratives often afford critical perspectives on the social dimensions of contemporary technoscience, including the practices of citizen science itself.[13] In this regard, whether accidentally or by design, these narratives provide players with cognitive resources for addressing their own position in the networks of knowledge production and for articulating their volunteer labour as a speculative investment, not merely in the future as an intensification of the present – a future that is the present, only more so – but instead in a future that might be entirely different.

Known space and beyond

Consider the massively multiplayer role-playing game *EVE Online*. Created in 2003 by the Icelandic game studio CCP Games, *EVE Online* boasts around 500,000 players and has become notorious for the complexity of its internal economy. In this game, the player takes the role of a capsuleer, a synthetic human clone linked into the control systems of a spaceship. The capsuleer and the ship are one unit, a hybrid human-machine system. Each capsuleer in *EVE Online* belongs to one of four different civilisations in the far reaches of New Eden, a faraway galaxy that humans ventured into eons ago through the EVE gate, a wormhole in space. The intrigue of the game largely revolves around the development of competing economic empires and ruthless financial wars – orchestrated through active military engagements between the different corporations, research organisations, pirate groups and trade alliances that have developed among the players. The game, as more than one commentator has suggested, is a hotbed of neoliberal ideology, a simulator of unrestrained transnational capitalism (Carter et al.).

In 2016, CCP Games joined up with Massively Multiplayer Online Science, a start-up company that specialises in linking university researchers and game developers, to turn *EVE Online* into a platform for citizen science.[14] The result was Project Discovery, an ongoing series of minigames that puts

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13. On the ways that sf makes legible the operations of cruel optimism in technoculture, see Bahng.
14. Massively Multiplayer Online Science (MMOS) was founded by the physicist Bernard Revaz and the high-tech entrepreneur Attila Szantner. In addition to their development work for Project Discovery in *EVE Online*, MMOS has also contributed to the Borderlands Science crowdsourced research tool in the 2019 sf game *Borderlands 3*.

legions of capsuleers to work sorting through scientific data. The first phase of Project Discovery began as a partnership with the Human Protein Atlas (HPA), a Swedish research program whose aim is to map all of the proteins in the human body. The minigame presented players with a data set of hundreds of thousands of human cell images and asked them to identify the areas in each cell image where certain types of proteins were expressed. The minigame came wrapped in the extensive narrative lore of the *EVE Online* universe. When launching the Project Discovery module from the NeoCom (the capsuleer heads-up display menu), a message appeared from Emma Lundberg, a professor of cell biology proteomics at KTH Royal Institute of Technology and the director of HPA's Cell Atlas project, now remade as a fictional character inside *EVE Online*.

The Sisters of Eve is a scientific and religious organisation in *EVE Online*. This fictional wrapper suggested that the capsuleers would be assisting the Sisters of Eve to study the genetic attributes of the Drifters, a mysterious species of cyborgs. The capsuleers were paid for their efforts: a combination of Interstellar Kredits (the in-game currency of *EVE Online*) and a tidy sum of Analysis Kredits, a special currency that could be spent on unique apparel and equipment developed by the Sisters of Eve. These rewards for services rendered were attuned to a game universe grounded in the machinations of economic competition and corporate espionage. As the development team at CCP Games indicated, 'We all know that capsuleers love doing science, however we also know that they are also dirty capitalists' (Team Psycho Sisters n.p.).

But when the first phase of Project Discovery came to a close, the developers noted a surprising turn of events: 'There was a special currency introduced in the game for Project Discovery, and we saw that many people didn't spend it. They were just doing it because they wanted to contribute. By far, the strongest motivation is to help science' (Attila Szantner qtd. McMullan n.p.). As one player has explained:

The Human Protein Atlas is an extremely worthwhile project that can make a huge difference to scientific research around the world, and gamifying it as Project Discovery was a fantastic idea … . I highly recommend that every EVE player has a go at Project Discovery, but don't do it for the tiny ISK rewards or the new Sisters of EVE swag. Do it to learn more about the different parts of the cell, to help with an incredibly important piece of scientific research, and for that slim chance of finding an abnormal sample that could lead to an interesting new discovery. Do it for science! (Drain n.p.)

Nevertheless, the success of Project Discovery has seemed more to do with its being embedded in the game's fiction. Shortly after the project launched, Lundberg suggested that Project Discovery was not only attracting but

Welcome to Project Discovery. *Eve Online* (CCP Games, 2003–). 2016.

also retaining huge numbers of participants precisely because its narrative integration and thematic rewards rendered it more meaningful:

Right now, after six weeks, we've had almost eight million classifications, and the players spent 16.2 million minutes playing the minigame. When we did the math, that translated – in Swedish measures – to 163 working years. It's crazy. We had a little guess, internally. We said if we get 40,000+ classifications a day, we're happy. If we get 100,000 per day, then we're amazed. But when it peaked in the beginning, we had 900,000 classifications in one day. Now it's stabilised, but we're still getting around 200,000 a day, so everyone is mind-blown. We never expected it … . Part of the problem with the gamification of science is that participation rapidly drops and that's what we hoped we could prevent by doing it in an existing game, with rewards. I think that's the biggest difference, that it's integrated into the game. (Lundberg qtd. Kamen n.p.)

To be sure, the fictive wrapper encouraged players not only to participate in the data analysis but also to decipher the somewhat cryptic implications of Project Discovery itself in the vast narrative of *EVE Online*. For example, the web portal for Project Discovery hails players with the slogan 'Citizen science begins with you!' But it also features a scrolling billboard advertisement for the Upwell Consortium, a space-station development conglomerate expanding the capsuleer infrastructure deeper into unknown territory, which features

Project Discovery portal (https://www.eveonline.com/discovery). *EVE Online* (CCP Games, 2003–). 2016.

the announcement 'Building the World of Tomorrow'. The Sisters of EVE designer lab coats, offered as rewards to capsuleers for contributing to Project Discovery, likewise featured the Upwell Consortium brand logo – suggesting that Upwell was acting as a corporate sponsor. Moreover, after the first phase of Project Discovery ended, the Sisters of EVE together with Upwell built a citadel station in the game as a monument to the success of the experiment. For many players, all of this evidence suggested that Project Discovery may be aligned not only with humanitarian aims but also with commercial interests – thus highlighting the sociotechnical contexts of the research outside of the game.[15] After all, as Lundberg has often mentioned, while the Human Protein

15. The landmark information for the Project Discovery Phase One Monument also noted that the continuation of citizen science efforts in New Eden would no longer be administered by the Sisters of EVE but would instead be under the direction of CONCORD (Consolidated Cooperation and Relations Command): 'Project Discovery Phase One came to an end on YC119.07.11, after 16 months of highly successful work. Project Discovery Phase Two is a new Exoplanets Hunting Program and is being operated under the guidance of CONCORD's Chief of Deep Space Research, Professor Michel Mayor.' The fact that the second phase of Project Discovery – enabling players to search through actual CoRoT telescope data for signs of exoplanets – would be managed in the game by CONCORD (and, in real life, in collaboration with the Nobel Prize-winning Swiss astrophysicist Michael Mayor and research teams at Reykjavík University and the University of Geneva) increased the concerns of some players that humanitarian goals were not the primary drivers of citizen science in *EVE Online*. In the fiction of *EVE Online*, the exoplanet research phase

Atlas is open access and gifted to the public domain, all of this free knowledge will be especially valuable for pharmaceutical companies: 'This research will definitely lead to the development of better drugs because 90% of the drugs on the market depend on targeting specific proteins' (Lundberg n.p.).

Attending to such connections, many players of *EVE Online* have approached Project Discovery with some scepticism, even while exuberantly playing along. Like the project itself, critiques of its motives and its implications have often been facilitated by the narrative resources of the *EVE Online* universe. For example, in March 2016, the player-character Muck Raker, who role-plays as a reporter for the New Eden news service the Gutter Press, wrote up a mock account of alleged in-game events pertaining to Project Discovery, expanding the community's non-canonical fiction about the citizen science organisation:

News reaches Gutter Press from Caille State University [a university in the industrial city of Caille on the planet Gallente Prime] … that biology students are protesting at having been drafted into participating in the Sisters of Eve's 'Project Discovery', a biological research project that involves study of cell samples.

The students claim that they are being exploited by their professors into participating, with the proceeds from each sample going to a university slush fund, for the academic staff to spend on luxuries … . 'We look at these cell samples, and classify the features. Someone gets paid by the SoE to do this, but it sure isn't us', said one student.

'We don't even know what this 'Project Discovery' is for! For all we know it's a biological weapon research program!', said another student.

'I heard the university professors spend the money on swimming pools and fancy clothes and exotic dancers', said a third biology student.

'What balderdash. There is no slush fund', said a suspiciously well-dressed professor. 'Totes', added her exotic dancer companion … .

Project Discovery is also at the centre of several conspiracy claims amongst capsuleers, who are some of the major participants in the research project.

Some claim that the project is intended to create a genetically engineered human that would be able to interface and operate the strange technologies used by the so-called 'Drifter' organisation of cyborgs.

of Project Discovery (2017–20) was configured from the outset as contributing to the expansion of corporate empires beyond known space. The third phase of Project Discovery, focusing on the analysis of flow cytometry data for understanding how infections such as COVID-19 impact the human immune system, launched on 15 June 2020. Supervised in-game by Dr. Cossarizza of the University of Caille (the avatar of Andrea Cossarizza, a professor of immunology at the University of Modena and Reggio Emilia School of Medicine, in collaboration with colleagues at McGill University, BC Cancer, and several research hospitals) and managed by CONCORD, this phase of Project Discovery was presented as an emergency biosecurity response to a novel coronavirus in New Eden that affects humans and capsuleers alike, 'a viral threat unlike any we've seen before', demanding a vigilant alignment of civic virtues and entrepreneurial interests.

Others claim that Project Discovery is a weapon for use by the SoE against the capsuleer class itself! … 'I bet they're reverse-engineering Drifter tech, and need a brain in a jar to work it', said one Caldari captain.

'It's a brain bomb, designed to kill capsuleers, I'm sure of it. Won't stop me from profiting from it in the meantime though', said a Gallente captain.

'It's a masterpiece of social engineering, is what it is. See, the SoE don't like capsuleers, since, well, you know, all that shooting stuff and exploding stuff that we do. By releasing this Project Discovery thing, then, a lot of capsuleers are staying docked to classify the samples, and not undocking and killing people. It's a masterpiece!', said a wild-haired Amarr captain.

'I bet they need a special brain thing, that has some kind of ability to open the EVE Gate. They believe God lives on the other side, and if they open the Gate then a new age of peace and goodwill for all humanity will occur', said a Minmatar captain. … It seems that Project Discovery is likely to remain controversial for some time! (Raker n.p.)

This faux news story, taking seriously the in-game lore in order to satirise the exercise of citizen science, captures a multiplicity of player responses to Project Discovery. It addresses the evident situation of citizen science, where the greater social rewards of any technical breakthrough or discovery will more likely gather around the scientists, the professors and their corporate partners, despite how much the gamers, the capsuleers, might find ways 'of profiting from it in the meantime', at least, within the recreational zone of the game.

It also attends to questions of social impacts, ethical implications, future scenarios and eventualities that might emerge from contemporary research – exhibiting a healthy awareness that the evolution of scientific knowledge constantly opens up new sociotechnical configurations, new fields of application, new dilemmas and problems that ought to be addressed in advance, before innovation pathways get locked in place, before consequences become unavoidable. Indeed, in recording the playfully paranoid theories about biological weapons, reverse-engineered cyborg technologies, brain bombs and speculative neuromantic devices, the satirical news report effectively practices an engaged form of science and technology studies, performing a critical examination of emerging technologies and the sociopolitical networks of citizen science in the language of speculative fiction. One *EVE Online* player, in reading this news article, summed up the position astutely: 'Question More' (Lanate n.p.).

While repeating the various conspiracy theories and advocating a critical perspective on the celebratory rhetoric of Project Discovery, the fictive news report also insightfully diagnoses the entire field of citizen science games: a 'masterpiece of social engineering' that diverts the collective playbour power of gamers from the routine tasks of the gameworld ('all that shooting stuff

and exploding stuff that we do'), turning the endless pursuit of competitive advantage, toward something that may, after all, prove more collectively uplifting. By recalling the Sisters of Eve's techno-religious orientation – the belief that continued scientific research might open the EVE gate, leading to 'a new age of peace and goodwill for all humanity' – the final quoted source in the news article, the Minmatar captain, refocuses the scepticism, the paranoia and the sense of exploitation that adheres to Project Discovery, pointing instead to something else beyond the present, a line of flight from the status quo and its contaminated features. Even as mere speculation, the possibility that the work of Project Discovery might reveal a new age, an undiscovered world on the other side of known space, recodes the present realities of technoscientific research – the limits of knowledge and the social forms that organise them – as preludes to a utopian future to come, provided that sufficient foresight is exercised. While making clear the ultimately theological character of such an aspirational vision, the news report gathers together a collection of sceptical perspectives precisely to affirm the present as contingent, open to question, allowing that things could be made otherwise. It suggests that scepticism toward citizen science is not a rejection but rather a necessary condition of what it promises, namely, a future in which all knowledge is held in common, a citizenry unbound from nation states or empires and united in the hope of prosperity and mutual flourishing.

The discourse of *EVE Online* players regularly converges on this perspective, a sense that citizen science may be an imperfect mode of knowledge making, that it may be bound up in structures of exploitation and neoliberal economic models, while nevertheless containing in itself the potential for remaking the world. These sentiments come across most strongly in the poetry that *EVE Online* players have composed in response to Project Discovery, a spontaneous overflow of powerful feelings about the promises of citizen science.[16] For example, Yadaryon Vondawn, one of the most dedicated capsuleers contributing to Project Discovery, wrote the following poem:

Amidst interstellar warfare
and my demi-god brethren of destruction,
I discovered tranquillity.

16. *EVE Online* poetry is a vigorous and diverse genre. Player-created poems often thematise various aspects of the gameworld of New Eden. In 2016, following the traditions of *EVE Online* poetry, members of the in-game Neophon Discovery Corporation (NeoDC) – a small mining and militia corporation that was also a major organiser for Project Discovery efforts, launched a poetry contest to encourage other players to wax lyrical about citizen science; see Shikra. On the functions of player-generated poetry in massively multiplayer gaming communities, see Pearce and Artemesia.

During the preparation of slaughter
and the meaningless waste of lives,
I contributed to the evolution of science.

While we capsuleers wage wars
to satisfy our violent needs,
I took the time to aid the mortal souls.

The Empires clash in endless bloodshed
abandoning their subjects lives for the glory of the noble,
but I analysed friend and foe alike.

For at the junctions of our choices
this path leads to progression.
So one day we may solve the ailments of our time
and we may know peace. (Vondawn n.p.)

The poem imagines the affordances of citizen science to carve out a zone of tranquillity and contemplation in the midst of endless strife, a space apart from the exigencies of imperialism, economic profiteering and military manoeuvring. Inside this temporary space, a historical bifurcation point appears, the possibility of breaking with the status quo. Indeed, the poem speculates a future state of affairs ('one day') in which the efforts of the cyborg capsuleers to study human proteins ('to aid the mortal souls') will 'solve the ailments of our time', suggesting not only medical solutions for disease but also social alternatives to the pathologies of the present. The thematising of citizen science as a utopian practice echoes repeatedly in the poetry of *EVE Online*.

Consider the poem 'PD' (2016), an ode to Project Discovery attributed to the capsuleer Retina Voluptuous:

I thought I knew you through and through,
Every every nook and cranny of your mind.
But what shrouded beauty is kept inside you?
The true achievement of mankind.

A project now we have to do,
There's a discovery for us to find.
And if to HPA you're true,
Suits to you won't be declined.

Optimism in the project grew,
When Yadaryon's mind with mine combined.
His message stuck to me like glue,
It's: 'To share knowledge, is to be kind.'

So, that message quickly of course I signed; My time to this I'd like to bind; I will continue to be kind,
To advance, mankind. (Molgvits n.p.)

The opening stanza indicates a reevaluation of the known and the familiar, a new appreciation for previously unrecognised capacities. It addresses both Project Discovery ('PD'), which the capsuleer-poet has initially approached with suspicion, as well as the capsuleer-poet herself, the neoliberal cyborg subject who seems destined to reproduce nothing but economic conflict and high-tech militarism ('I thought I knew you through and through'). But in the process of contributing to citizen science, the possibility of something better has emerged. Retina notes that there was widespread scepticism about Project Discovery, wryly pointing out the transactional aspects of the mini-game: 'if to HPA you're true, / Suits to you won't be declined.' In other words, the project at first looked like just another job in the gig economy, enticing capsuleers with new character suits and branded swag. And yet, the experience of working collaboratively with Yadaryon and other capsuleers has now changed everything: 'Optimism in the project grew'. The formal structure of the final stanza emphasises the growing hope, for unlike the alternating end-rhyming quatrains of the first three stanzas, the final stanza begins with an expanded line of three internally rhyming phrases – suggesting a sudden explosive overflow beyond the tight constraints of the earlier stanzas, a blooming of experimental visions and ethical aspirations.

It is a common sentiment, the idea that Project Discovery opens up new vistas of hope beyond the greed and contamination of the prevailing technopolitical regime:

I have seen so little of this world.
Experienced a minuscule fractional piece.
I have gleaned more questions than answers.
Developed inconsequential ideas of thought.
Decayed the fabric of time an feeling.
And I seem to be cursed with a wyrd.
My small space in this world is fading.
While the touch of the corrupted expands.
All that is gold has never glittered.
That which is silver never gleams.
Platinum expanses dissipate and fade.
All that is lovely is a shimmering mirage.

And so I shall seek the answer.
That in the myriad colors hide.

We shall find the sought out questions.
We shall stop the end of time. (Ivanovich n.p.)

As the poet asserts, the pursuit of knowledge – questing for answers in the swirling colours of digitised cells – only raises more questions, a desire to learn more, to see more. Thus, rather than conceding that the current ideological

order represents the end of history, the capsuleers look ahead to something completely different, an otherwise and an elsewhere.

These poems, addressing Project Discovery from within the space of role playing, show how the storyworld of the game provides meaning, a structure of feeling and an interpretative lens for making sense of citizen science and its values. Rather than cultivating a naive scientism or a cynical fatalism, the fictive framework allows players to inhabit both the imperfect present and the aspirational future simultaneously, critically reflecting on the conditions of knowledge production that might be turned to other purposes. As citizen scientists, that is, they come to see double: science and science fiction, all at once – the world of tomorrow already in their hands.

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