Beyond Human Understanding: Creating New Language and Visuals on the Web

Commissioned Online Artworks by Jenna Sutela and Tuomo Rainio

Aino Nurmesjärvi, MA Student, University of Jyväskylä, Finland

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Introduction: art on the internet

'ARS17', a major exhibition of international contemporary art at the Museum of Contemporary Art Kiasma, in Helsinki, is the ninth ARS exhibition to be held since they began in 1961. ARS exhibitions have always reflected the topical discussions of their time[1] and the 2017 exhibition comments on the changing relationship between digital technology and the arts. Given this theme of digital revolution and Kiasma's role as an exhibitor and collector of contemporary art in all its forms, it was decided to extend the sphere of the exhibition to include online art,[2] which resulted in 'ARS17+ Online Art', an exhibition and a collection[3] of online art[4]. The 'ARS17+' website describes the internet, today, as 'a natural environment for art to grow, prosper and evolve'.[5] Yet, it is also possible to say that the internet is not necessarily a natural environment for the museum. The online collection marks a notable change. This kind of

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1   *ARS 50 vuotta, muistoja, historiaa, näkökulmia 1961–2011,* 2010.
2   Miller 2017, 174.
3   Most of the works in 'ARS17+ Online Art' belong to the Kiasma and Finnish National Gallery collections.
4   As a research intern at the Finnish National Gallery, I was also able to talk with the curators and other members of the museum staff behind the 'ARS17+ Online Art' exhibition. In this article, I use the interviews with the artists as source material. However, all the discussions have influenced my research and writing process, even the ones not explicitly cited here.
5   Kiasma 2017.
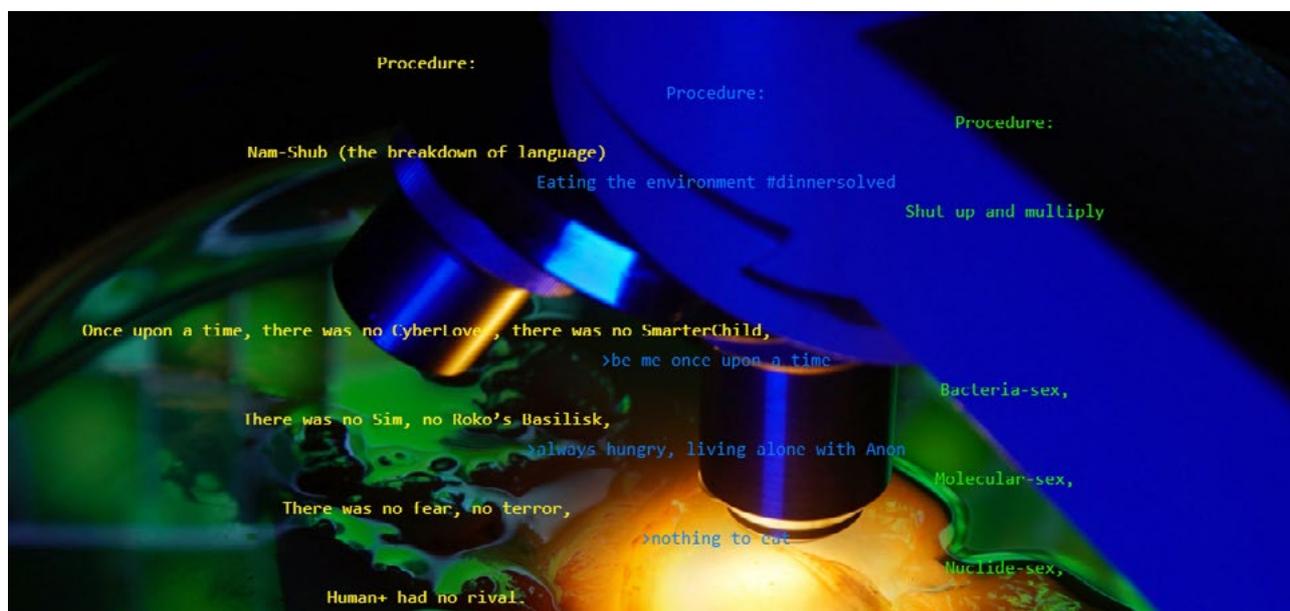
Jenna Sutela, *Gut-Machine Poetry*, 2017.
Finnish National Gallery / Museum of Contemporary Art Kiasma.
Screen capture of the online artwork

online art is a new category for Kiasma,[6] and to some extent the museum field in general, even though there has been art on the web for as long as there has been the internet,[7] 'from the 1980s through to the present day,' according to Rhizome's 'Net Art Anthology'.[8] Tied to interactivity, networks, and technology, the history of internet art is intertwined with the history of telecommunications and experimental conceptual art practices exploring the process of information exchange.[9] In addition, internet art closely connects itself to other code- and algorithm-based art forms and the history of media art and digital art in general.

What is the role and form of internet art today? The 'ARS17+' collection contains both online videos which were acquired complete, as well as new online commissions. The artworks that the museum commissioned are mostly interactive, website-based works. Some of the online artworks point clearly to the history of net art and to the early internet; others evade categorisation and simple definitions. In this article, I focus on two such enigmatic commissioned online works, Jenna Sutela's *Gut-Machine Poetry* (2017)[10] and Tuomo Rainio's *Untitled (Gravitational Waves)* (2017)[11]. These two artworks reflect on different themes related to the relationship between art and technology, and between art and science, and both have an intention to represent something new, something beyond our understanding. To get a better understanding of these works, I interviewed both Sutela and Rainio. Alongside my own interviews, I draw on an interview with Rainio by Maritta Mellais from the Audiovisual Archive of the Finnish National Gallery.

By looking at these two works, and analysing their characteristics, I am also looking at the characteristics of web-based art-making in general. What can be the role of technology and the web in these kinds of works? Does the online platform provide new possibilities for

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6   In the late 1990s, Kiasma already had its first internet art projects and acquired the first few internet artworks for the collection. Most of these early works can no longer be displayed as the software and hardware has not been updated. See Miller 2017, 174.
7   Tim Berners-Lee invented the World Wide Web in 1989. World Wide Web Foundation 2017.
8   Rhizome 2017.
9   Cook & Ghidini 2015.
10   Sutela, de Belleval & Lundberg 2017.
11   Rainio 2017.

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art-making, or new ways of thinking? Sarah Cook and Marialaura Ghidini define internet art, or net art, as '[a]rt that uses the Internet not only as its tool of production and distribution but also as its source material or medium, and exploits or reflects the Internet's inherently connective characteristics'. Thus, internet art is not in itself 'a distinct art form or style'.[12] However, the capacity to reflect on its medium, on the internet's characteristics, is something that makes internet art special. As the internet is everywhere around us and digital machines are increasingly integrated into our everyday lives, in the realm of art it is possible to reflect critically on the cultural changes that such evolving technology has brought with it, or might bring in the future. Yet, artworks on the web are not solely about the technology or the internet. Art resists categorisation, and internet art, especially, escapes its definitions. The artworks by Sutela and Rainio demonstrate art's tendency to look for something new, for the unknown, the future, and things beyond human comprehension. Online artworks can simultaneously adapt to the conventions of the web environment and, at the same time, push the limits of virtuality.

Gut-Machine Poetry: a computer with a kombucha heart making poetry on the web

At first sight, the online works selected here, *Gut-Machine Poetry* and *Untitled (Gravitational Waves)* might seem quite different, even though they are both website-based works by Finnish artists of the same age[13] commissioned for the same 'ARS17+' collection. Sutela and Rainio have slightly different approaches to the challenges of making an online work. However, the differences between them turned out to be interesting when discussing the role of the internet and digital technology in art, and at the same time, there are deep and meaningful connections in the themes these works are addressing.

First, let us look at *Gut-Machine Poetry* and the ideas behind this mysterious website which features poetry generated by fermenting kombucha tea. Sutela's work often combines biological organisms and digital technology. The link between these two dimensions requires a story to be told. In an interview, Sutela describes her work as 'narrative-driven art' that often elaborates on 'the relationship between humans and technology'.[14] As the root of her work is usually a text, it is no surprise that the structure of language and the process of making a new, possibly non-human language has also been a recurrent theme in her work. Many of Sutela's works have sci-fi elements, with a speculative atmosphere and perspective, 'that looks into the future that is always, in principle, fiction,' Sutela explains.[15] These ongoing ideas and themes are also present in *Gut-Machine Poetry*, a commissioned online project made in collaboration with Vincent de Belleval and Johanna Lundberg.[16]

Lately, Sutela has worked with fermenting materials and the idea of biological information systems. In *Gut-Machine Poetry*, the organic component is kombucha tea. Sutela describes the work as 'a computer with a kombucha heart' that creates a new type of poetry.[17] The idea of a kombucha as a poet is a strange concept. At first, on the website of *Gut-Machine Poetry*, there is microscopic video footage of living bacteria and micro-organisms. Then, other moving, almost transparent, and blurry objects appear, merging with the microscopic image in the background. These shapes seem to be letters, moving and forming words, but the 'words' they form are not making any sense: *e a brilhn iis t e s s k nwo a osrkos om*? Is this the *Gut-Machine* making a new language, a new type of poetry? The overlapping and unrecognisable letters make reading them a challenging task. These nonsense words are almost like Dadaist

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12   Cook & Ghidini 2015.
13   Sutela and Rainio were both born in 1983.
14   Jenna Sutela. Skype interview, 23 October 2017.
15   Ibid.
16   Lundberg is a web and graphic designer. In this project, de Belleval was responsible for the technological design and programming. Sutela has also collaborated with de Belleval and Lundberg on some of her previous projects.
17   Jenna Sutela. Skype interview. 23 October 2017.
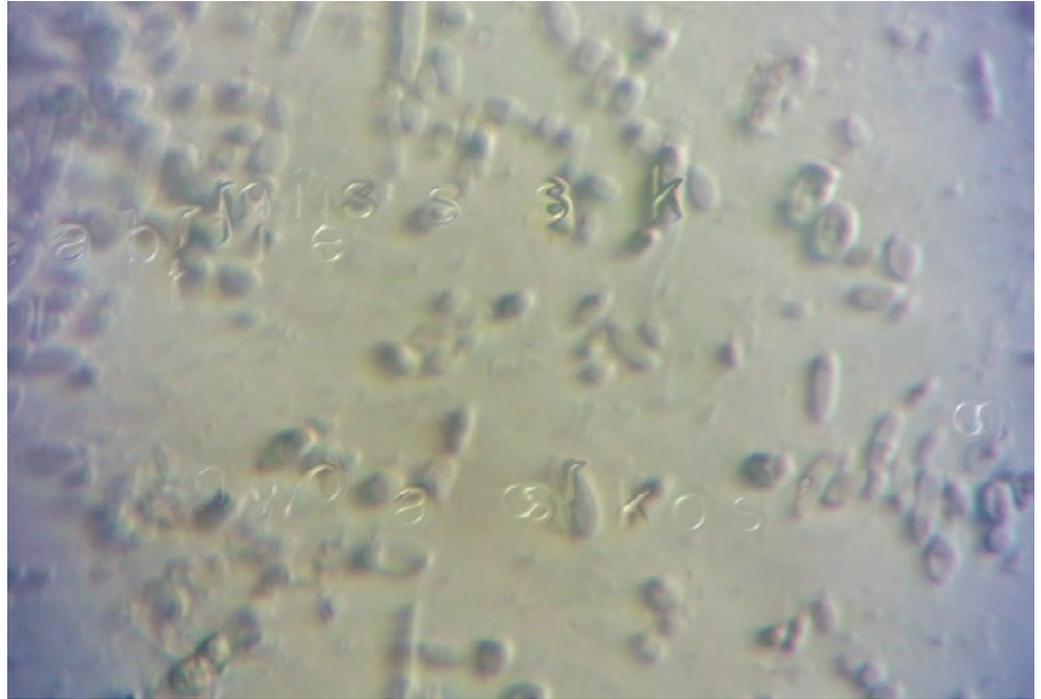
Jenna Sutela, *Gut-Machine Poetry*, 2017.
Finnish National Gallery / Museum of Contemporary Art Kiasma.
Screen capture of the online artwork

poems. In *Dada Manifesto*, 1916, Hugo Ball states, 'I don't want words that other people have invented'.[18] Behind *Gut-Machine Poetry*, there seems to be a similar idea of creating a new language.

Alongside this microscopic video footage, *Gut-Machine Poetry* has another side. If you click on the page, the image changes to a glowing blue microscope in the dark. Under the yellow light of the microscope, there is something wet and green. Over this image flow three simultaneous streams of text, appearing from the bottom of the screen, moving up, and eventually disappearing, all beginning with the word 'Procedure'. These procedure-texts contain many obscure references. Who is CyberLover or SmarterChild? Is this the kombucha speaking again? There are also multiple ways to read the word streams separately or simultaneously, and by moving the cursor, it is possible to make the text streams disappear or become visible again.

Gravitational waves on the web: ripples in the time dimension of digital video images

Another online artwork in 'ARS17+ Online Art' that raises questions about the relationship between science, art and technology is Rainio's *Untitled (Gravitational Waves)*. The visualisations in the artwork are based on data from the Laser Interferometer Gravitational-Wave Observatory's (LIGO) discovery of gravitational waves[19], while the work 'examines the temporal plane created by images and time's relativity under the influence of ripples in the space-time fabric'.[20] Rainio had already been interested in temporality in images

18   Ball 1916.
19   See LIGO Open Science Center 2017.
20   Rainio 2017, 196.
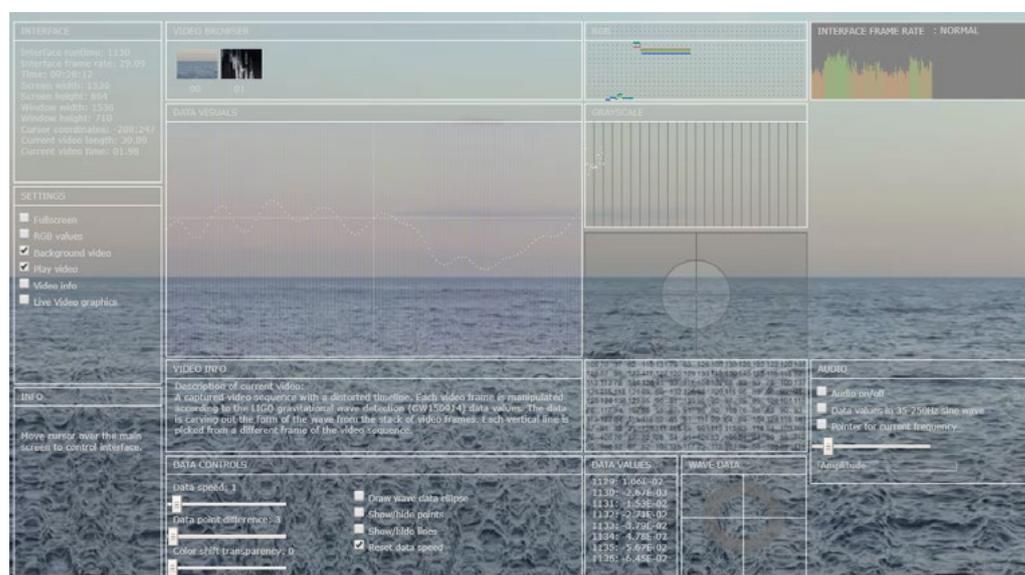
Tuomo Rainio, *Untitled (Gravitational Waves)*, 2017.
Finnish National Gallery / Museum of Contemporary Art Kiasma.
Screen capture of the main control unit part of the online artwork

and distortion of time and space, and this scientific observation reported in the media provided for him, 'this connection, that these waves in the time and space can be named as a physical phenomenon'.[21] Rainio describes the data, and the phenomenon itself, virtual and impenetrable. Humans cannot observe it, or interpret the data; it is beyond human comprehension. The subject of the work is about, 'how a phenomenon, that we cannot observe directly, manifests itself in different ways'.[22]

The website of the work has quite a traditional structure. It starts with an introduction page explaining the working process behind the work. From the menu, it is possible to proceed to the 'main control unit'. The website also contains other sections where you can find videos, visualisation of data, credits and licences. The main control unit, however, is the most complex and, as the name suggests, the core part of the work. The control interface in it consists of different sorts of boxes that have titles like 'settings', 'video browser', 'data visuals', or 'data controls'. This part of the work is interactive, and by clicking on the boxes and changing the settings, the user can get more information about the video images and the manipulation process, and even influence it somehow. Boxes labelled for example 'grayscale' or 'RGB' display scientific-looking curves and graphs. The choice of settings can give to the user a sense of control, even though it might not be clear what they are doing or controlling.

The work features eight different videos, which change in the background of the main control unit. Some are animated visualizations of the data, and others are manipulated videos. In the interview, Rainio explains the idea behind the manipulation of the video files:

> *If you think about video images, instead of thinking of them as a film, as images following one another, if you think them on top of each other, then the depth of this stack of images is the time dimension. This wave data digs into the video images and produces these, if you look at the resulting image, the vertical lines in it are picked up from different moments, compiled from different frames of the video sequence. The principle according to which they have been assembled, follows the used data.*[23]

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21   Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
22   Ibid.
23   Tuomo Rainio. Interview. 26 October 2017.

The artist has thus translated the numeric data into graphic form, the form of a simple line and a wave that fluctuates 'between predictability and unexpectedness', as the artist describes it in the first page of the website, and this data and line has been used in the manipulation process of the video images. Most of the animated visualisations in the website are quite abstract but one consists of five columns of numbers of data moving rapidly. Some of the videos have recognisable elements like a huge eye behind a pixel grid, or in the case of the first video, a seascape, with wavy, vertical lines.

Reflecting on the internet and technological change

Both *Gut-Machine Poetry* and *Untitled (Gravitational Waves)* can be used to demonstrate the capacity of online art to reflect on its medium. The analysis of the texts in *Gut-Machine Poetry* especially illustrates this potential to comment on the internet and its culture. All three texts that Sutela has used have different tones and structures. The first starts like a fairy-tale: 'Once upon a time, there was no CyberLover, there was no SmarterChild / There was no Sim, no Roko's Basilisk, / There was no fear, no terror.' This story seems to be set in the distant future, and the narrator is looking back to simpler times without these mystical entities. The 'fear and terror' suggest a dystopian vision. Many of the intertextual references are links to ideas concerning artificial intelligence, for example the idea of Roko's basilisk, which has also appeared in some other works by Sutela. In her performance *Noise Tribe Speaking-Out-of-Control* presented at the Lunch Bytes Conference[24] event held in Haus der Kulturen der Welt, Berlin, 20 March 2015, there is this description of it in her speech:

> *Roko's basilisk already exists, or at least it already will have existed. Acting in the world's best interests, and in order to end all other causes of death and suffering in an otherwise benevolent future, artificial intelligence will retroactively punish those who had been aware of the importance of bringing it to life, yet did not contribute to the process. Simply knowing about Roko's basilisk may be enough reason for this violence.*[25]

This thought experiment is from rationalist forums, and it is a reference, not only to artificial intelligence, but also to the discussions and ideas born in and disseminated online.[26] The first procedure-poem is playing with the idea of a super-intelligent lord-entity governing and ruling the land of the internet, 'Terra Stack,' the earth, and the universe. Terms like 'the lord of Bacteria' and 'Gut, the lord of abundance' link these ideas back to the organic elements. The language, a change in speech of 'Homo Computans,' is also a central theme. Sutela explains that the line 'Nam-Shub (the breakdown of language)' in the beginning of the text is a reference to 'this Sumerian spell which questions or reflects on the idea of the universal language, or languages.'[27] With lines like 'To Code in one tongue gave speech,' the text draws parallels between universal language and the code.

The second text is also full of references to internet culture and the development of machines. The first line contains a hashtag: 'Eating the environment #dinnersolved.' Sutela explains that this text is dealing with a grey goo phenomenon, i.e. 'how the machines potentially eat their environment, multiply around us, and how this kind of fermented food

24   Lunch Bytes is a series of events started in 2011 by the Goethe-Institute Washington, the Hirshhorn Museum and Sculpture Garden and Pro Helvetia in Washington DC. According to Lunch Bytes' website, these events and discussions examine 'the consequences of the increasing ubiquity of digital technologies in the art world by addressing the role of the internet in artistic practice from a wide range of perspectives' and each event is 'dedicated to a different topic and bringing together artists, media scholars, designers, curators, and intellectuals'. See http://lunch-bytes.com/about/.
25   Lunch Bytes 2015.
26   Jenna Sutela. Skype interview. 23 October 2017.
27   Jenna Sutela. Skype Interview. 23 October 2017.

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does the same, in a way, or bacteria, and how such biological processes are similar'.[28] Sutela has also made this text in a green text format:

>*be me once upon a time*
>*always hungry, living alone with Anon*
>*nothing to eat*

Green texts, or green text stories, are short stories from the internet, mostly used and shared on anonymous imageboards such as 4chan. Part of the format is using fragmented, short sentences, and all the lines of the green text start with a 'greater-than' sign. In a way, green text format is one of the most popular forms of storytelling on the internet.[29]

The third procedure starting with 'Shut up and multiply' is about the multiplication of bacteria, although, Sutela explains, 'in a very poetic sense in this case'.[30] The last text is not a procedure, but a processor, a list of bacteria and some elements of the work: 'Processor: tea, sugar, acetobacter, saccharomyces, brettanomyces, lactobacillus, pediococcus, gluconacetobacter kombuchae, zygosaccharomyces kombuchaensis, and Jumbo.' The words 'procedure' and 'processor' imply a kind of computational process behind this, the process of running a program. In a way, the structures of the texts resemble pseudocode. The idea of programming is to write the steps that the machine can then execute, and there is a similar idea of giving instructions in the language of the procedure-poems. Even the green text format is somewhat instructional and procedural. Is the language of humans also becoming mechanical on the internet?

In the interview, Sutela confirms that she 'wanted to link it to these things born online, as the work in question was on the web'. The artist emphasises how this combination, 'this quite complex structure overall, reflects many of my ongoing artistic research interests in bioinformatics, and language'.[31] Apart from textual references, the kombucha also has various connotations in the context of the work's medium, on the web, and in relation to computers. Sutela links the kombucha to both the history of information technology companies in Silicon Valley and today's trends in the start-up world. She explains how *Gut-Machine Poetry* is a reference to the Homebrew Computer Club, from which Apple and IBM, for example, originated, which, according to Sutela, was 'a very low-key environment, where, apparently, they drank beer and built computers'. In the case of *Gut-Machine*, Sutela explains, it is practically sort of a homebrew computer. Today, the artist associates kombucha again with Silicon Valley,' because this probiotic substance seems to have some connection to the world of tech and start-ups, along with different kinds of microbreweries and wellness products.'[32] There are increasing numbers of food-focused start-ups, many of which develop trendy probiotic products.[33]

The aesthetics of the early internet and the elements of a website

In the case of the *Untitled (Gravitational Waves)*, the structure and aesthetics of the work reflect on the characteristics and possibilities of the web environment. The style of the website is minimalistic, simply white text on a black background, but there are some interesting details. The cursor is not the default one but a cross cursor. When it moves, a fading trail emerges, a trail that is a wave made of small dots moving and eventually fading away. These kinds of style choices – the minimalistic structure of the page and unusual cursor effects – are reminiscent of the web design and aesthetics of the early internet. Rainio

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28   Ibid.
29   Know Your Meme 2017.
30   Jenna Sutela. Skype interview. 23. October 2017.
31   Ibid.
32   Ibid.
33   CB Insights 2017.

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explains that the early 'original' internet feels more familiar to him than today's 'internet of social media'.[34] The artist is quite happy with the surprise element and 'weightlessness' of the cursor effect.[35] By looking at the source code, it is possible to observe that the gravitation wave data is used in the creation of these points that follow the mouse. Therefore, even this fun detail, the cursor effect, is a visualisation of a gravitational wave and an implementation of the scientific data. These kinds of details illustrate the subtle possibilities for creativity in the web environment. Rainio explains that the interface part has a sample of the original data used in the background to create 'graphics calculated within the browser, which cannot be reproduced as they happen at that moment'. The graphics are partly based on the reading of the displayed video file.[36]

The fact that both artworks discussed here include an element of sound is interesting in the context of the history of digital art, which has often been referred to using the term of multimedia. In *Untitled (Gravitational Waves)*, Rainio has used 'the simplest sound possible,' a sine wave oscillator, and the frequency of a gravitation wave, which itself is a sound.[37] The element of sound in *Gut-Machine Poetry* is also quite simple; noise and gurgling in the background. Even when the element of sound is a minimalistic and easily ignored part of the work, it still makes the experience more complete, and somehow demonstrates the audio-visual, connective possibilities that the online platform has.

Alongside audio-visual elements, art on the web often has interactive components, as the concept of interactivity is already built into the medium. Rainio sees a website as 'a frame in which we can investigate things and immediately get feedback,' and thus he wanted the interface aspect of the work to have 'the possibility to get different views inside the work, to the video or the data'. The artist phrases the work as something that 'in itself constitutes something, like an unknown matter, to which the viewer can take different points of view'.[38] The concept of interface is significant when discussing the process of experiencing art online. Rainio highlights how the web has multiple layers of interfaces: 'first the viewer opens a computer, then a browser, and then the page, and then from there the work, and from the work, the interface.' Thus, having an interactive interface as part of the piece is 'a natural continuum to this medium in which the user is an active agent'.[39]

Algorithms and the aesthetics of code

There is a way to see all the texts of *Gut-Machine Poetry* at once, by looking at the source code. In this case, the artwork is not about poetry hidden in the code, but it is still possible to look at the coded structure of the work as something that can influence the interpretation of it. In the case of the generative and algorithmic artworks, the relationship between aesthetics and the code has been emphasised. In the paper delivered at the Generative Art 00 conference in 2000, 'The Aesthetics of Generative Code,' Geoff Cox, Alex McLean and Adrian Ward write, 'to separate the code and the resultant actions would simply limit the aesthetic experience, and ultimately limit the study of these forms – as a form of criticism – and what in this context might better be called a "poetics" of generative code'.[40] Massimo Ferronato, when writing about the demoscene and computer viruses as art, describes an aesthetic approach to programming 'as the assumed link between the beauty of the code and the result it produces'.[41] In the demoscene, the code is the art, and the same applies to some extent to

34   Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
35   Tuomo Rainio. Interview. 26 October 2017.
36   Ibid.
37   Ibid.
38   Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
39   Tuomo Rainio. Interview. 26 October 2017.
40   Cox, McLean & Ward 2000.
41   Ferronato 2002.

early net art. The code and the process of programming continue to be essential parts of an online work, but the work itself may not necessarily be about code or coding.

Algorithms can be defined as decision procedures, sets of instructions, and all computer programs are algorithms in a sense, as they are lists of steps executed by a computer.[42] In practice, algorithm can be a function, an effective method for solving a problem. In *Gut-Machine Poetry*, one of the central elements is an algorithm called Jumbo, originally developed by Douglas Hofstadter to solve anagrams. Sutela explains that this algorithm was also 'influenced by the functions of cells and enzymes, like how the words fall apart and how the letters find each other again'. Yet, the interest that Hofstadter had, and what Sutela is also interested in, 'is not to find an English word also made up of the same letters that the previous words had, but to find those words that can be formed that sound almost like English, but are not quite it'. In practice, the artist has filmed the kombucha through a microscope and then used the movement and changes in kombucha to produce random numbers. These numbers then define how the texts from a database are mixed based on this algorithm. 'It is as if the words are thrown into the air,' the artist explains, 'and the movement of the kombucha has an influence on where they fall.'[43]

Sutela has also described the piece as 'a poetry-generating website fuelled by a Wetware Random Number Generator.'[44] The idea of a poetry-generating computer is interesting and odd, because, as Sutela explains, 'a computer, or artificial intelligence, is quite a bad poet and it always follows the instructions given'.[45] The concept of randomness is different in the context of the digital from the context of art in its physical forms. Even though algorithmic coincidence can be used as the ultimate definition of chance,[46] programmed randomness has its problems, as it is in a way a paradox: is it possible to use order and programming to generate disorder? Living things are more random than machines, although it is also possible to argue that even organisms have their own patterns. In the case of *Gut-Machine Poetry*, Sutela sees the use of living material as 'an attempt to break the patterns which the programming inevitably gets into'.[47]

Another work by Sutela that concerns algorithms and randomness is called *Let's Play Life*,[48] a work 'influenced by Conway's Game of Life algorithm, which tries to model natural processes and the multiplication of cells'.[49] In a way, self-organising algorithms have often had this side of imitating the processes found in nature. This link between algorithms and organic processes is a theme related to bioinformatics and cybernetics. Sutela describes how 'many of the hyper-advanced forms of robotics, or data processing, or artificial intelligence imitate organic and biological processes'. In her artistic practice, she finds 'looking at the activity of cells alongside algorithms, or instead of them' interesting, as in a way, 'it is going back to the cellular level, so in a sense, things seem to be coming full circle somewhere at the sources of life'.[50]

Creative programming and collaboration

In the case of *Untitled (Gravitational Waves)*, the artist is the programmer. For Rainio, this process of coding is important, because 'all the errors and, in a way, randomness, that can be part of the process, they are often positive things and lead to some things that are more interesting than the original idea'. He thinks that often, 'if a functioning program is ordered,

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42 Weibel 2007, 22.
43 Jenna Sutela. Skype interview. 23 October 2017.
44 Fattori Franchini 2017, 206.
45 Jenna Sutela. Skype interview. 23 October 2017.
46 Weibel 2007, 23.
47 Jenna Sutela. Skype interview. 23 October 2017.
48 See Inflected objects 2015.
49 Jenna Sutela. Skype interview. 23 October 2017.
50 Ibid.

then it does not necessarily highlight these sides of the work,' and in his opinion, 'this kind of a creative coding is totally different, because it is proceeding in a dialogue with the work.'[51] Rainio has not used databased abstraction before, and the process of making the work was a learning experience for him.[52]

Rainio's working method is quite different, then, from that of Sutela, who made her work in collaboration. Some of her previous works have featured online components, but this kind of web artwork brought about new elements for the artist.[53] Collaboration with a developer can have its own benefits, and in some cases, it is required, if an artist wants to get the most out of the web platform. Co-operation characterizes web development in general and the working environment of the networked web. Depending on the working method, the role of the artist changes. In cases like *Gut-Machine Poetry*, the artist develops the concept of the work. The collaboration required to generate the code, in Sutela's case, had its starting point in Hofstadter's algorithm – something that she had already been looking into as part of her research.[54]

In his work, Rainio has used both open data and open source materials. For example, the programming environment used is an open source project *Processing* built especially for the visual and electronic arts.[55] For Rainio, the coding process can be creative, but the code is not art in itself: 'the program I have written does not have to be special from the programming point of view, it does not have to follow any other principles, it just has to work.'[56] Rainio associates open source projects and tools with transparency and 'this idea of alternativity', which is 'a central and somehow optimistic part of the idea of the internet, that things can be shared and used by most people.' Open source has positive connotations and connections to a utopian view of the internet. Rainio also wants to participate in this culture of open data, and, by using open materials, to reinforce the idea.[57] In a sense, his work is also a product of collaboration, albeit indirectly. In the end, in the world of readily available code, libraries, and data, the code is always built on the work of others.

Rainio phrases his working process as a sequence of translations: 'what is the idea or the conceptual work, how it is translated to a logical form or code, and then, how it is turned into an image.'[58] Working with computers has a side that is 'not tied to the visual feedback,' the process of 'formulating the idea at the level of code,' as the artist describes it, even though it might have a visual form in the end.[59] The context for visual art-making is thus different, as digital materials are deep down non-visual and based on code. In the context of digital art forms, the work of an artist can include the organization of the data and manipulation of these code-based, logical structures. As Rainio says, 'an image is just one of the forms in which the data can be looked at'.[60]

Rainio's work is both visualizing the idea of gravitational waves and illustrating the temporality of video files. This study of temporality has its roots in his study of the smallest possible change between two images, this movement and temporality between them, to which the artist also refers as 'noise', or unrecognisable image-matter.[61] The relationship between images has changed with the digital, Rainio notes, as 'in the digital world it is possible to make algorithms to compare them [images],' and 'to place all the bitmap images, which have the same dimensions and conditions, in the same frame and observe

51   Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
52   Tuomo Rainio. Interview. 26 October 2017.
53   Jenna Sutela. Skype interview. 23 October 2017.
54   Ibid.
55   See Processing 2017.
56   Tuomo Rainio. Interview. 26 October 2017.
57   Ibid.
58   Ibid.
59   Ibid.
60   Ibid.
61   Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG. See, for example, Rainio's video works *I see what you mean* (2010), *Crosswise* (2006), and *City* (2005).

the relationships between them'.[62] The machine makes these observations; the viewer does not have to make the connections between pictures. This is something new that digital technologies have made possible. Previously, Rainio states, we were tied to materials, but now with digitality, we are 'tied to the calculations, and then we are in a quite different context'. It is not just that two images can be compared; now all the images have a relation to each other. In Rainio's opinion, this is a significant cultural change. It is almost as if all the digital material would have a similar genetic foundation.[63] Rainio thinks that working with the digital makes asking new questions possible, like in the cases of comparing images, or sorting pixels.[64]

Art, science, and technology

> *There is a perceived polarity (however artificial) between technology and*
> *the humanities, between science and art, between right brain and left.*
> *The burgeoning field of multimedia is likely to be one of those*
> *disciplines, like architecture, that bridges the gap.*
>
> Nicholas Negroponte in *Being Digital*[65]

Both of the works discussed here have close connections to the world of science, albeit in different ways. In the case of *Untitled (Gravitational Waves)*, the scientific data is used as a starting point and it is obviously a key element in the making of the work. The themes in *Gut-Machine Poetry* have connections to bioinformatics and the study of micro-organisms in a more poetic way. In both works, aesthetic choices also reflect scientific imagery. For example, behind the interface of *Untitled (Gravitational Waves)*, says Rainio, is 'an idea of a scientific, laboratory-like tool to look at the data'. The goal was to have 'an impression of the use of scientific software at the interface level, but somehow in an alienated way'.[66] The technology used is also a link to the world of science, as the relationship between the two, the science and technological innovations, is close. As an example of a case where technological innovation has made new scientific discoveries possible, Rainio mentions the scientific verification of gravitation waves that required 'computers powerful enough, which could model all the different options of gravitational waves to constitute a databank'. In addition, it takes computational power to interpret the data. Rainio links this increase in processing power to the dominant presumption in science 'that everything can be computed,' a common idea present in our culture in general.[67] Technological developments produce cultural changes, changes in perception.

     Increasingly, artists are interpreting scientific findings and innovations, partly because digital technology has made it possible to use scientific data and information in new ways. The distinctions between scientific data visualisations and artworks such as *Untitled (Gravitational Waves)* are often blurred, though one of the differences is the purposes they have. Felice Frankel explains in her article 'Image, Meaning, and Discovery', in the book *MediaArtHistories*, that the images in science 'have as their primary purpose the representation of a thing, phenomenon, or concept, and this representation must meet an important standard – the image must be honest and faithful to the scientific data'.[68] Even in the context of science, however, Frankel notes, all images 'must be subjected to some processing and decision-making if the visual expression of the information is to be seen'. Data visualization is often

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62   Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
63   Tuomo Rainio. Interview. 26 October 2017.
64   Ibid.
65   Negroponte 1995, 81.
66   Tuomo Rainio. Interview. 26 October 2017.
67   Ibid.
68   Frankel 2007, 383.

algorithm-based work, as in order to see the data as an image, there is always a need 'to create algorithm to process those numbers'.[69] There is no way to illustrate the data in a completely objective way, without any interpretation, and this is especially challenging when trying to represent deep and complex ideas in science, like gravitation waves.

Rainio's work uses the data as a starting point for the creation of new kind of visual language and the manipulation of the images, and for the artist, 'all the videos and visualisations in the work consist of an individual interpretation of the data and the phenomenon'.[70] The images are representations of the data, but, in the context of art, there is no obligation to be entirely objective or to comply with scientific standards. After all, the images are not visualisations of the phenomenon of gravitational waves itself, the phenomenon that causes ripples in space-time, but they visualise how the observations and data can be used to manipulate the time in video images. When Rainio was interpreting the data, he used the already existing graphs and visual interpretations of the data from LIGO's website as guidelines, examples which he could compare with his own, to see if the shape he generated was similar. Some of the more complex models in LIGO's website were also visually inspiring for the artist. During the process, Rainio tried to learn more about the science behind this abstract phenomenon, but he did not worry about precisely understanding the premises of it, as his work is located within this 'artistic, free area'.[71]

Is it the purpose of this kind of art to help us to understand scientific phenomena? In the case of both of these artworks, it seems like the art is mystifying the science and technology behind it, rather than making it easier to understand. Rainio describes his working process as 'kind of research, researching the data and opening different points of view, also with the assumption that there is never going to be clarity'.[72] Art can challenge the presumption that there will always be clear, definitive answers. Not everything has to be comprehensible. Nevertheless, *Untitled (Gravitational Waves)* has intimations of trying to make sense and explaining the working process behind the work and the way the data is used.

In the case of *Gut-Machine Poetry*, there are no explanations, only mysterious poetry made by computer using a fermenting kombucha heart. Behind the work, however, there are deep and complex ideas about the nature of the micro-organisms, artificial intelligence and the possibly organic future of technology. A major part of Sutela's working method are her discussions with scientists from different fields[73] and she has portrayed her networked artistic practice as 'ongoing artistic research into organisations and organisms'.[74] *Gut-Machine Poetry* can be placed into this continuum of artistic research related to bioinformatics and 'the resurgence of cybernetics'. Regarding Sutela's work, Danish researcher Aslak Aamot Kjærulff has asked a fundamental question: 'Why look to the simplest of life-forms to understand the most complex?' A possible answer, in his opinion, is that maybe 'understanding is not the objective', as '[t]o look for the radical other is not necessarily to better understand, but to be moved by differences'.[75]

Christiane Paul thinks that these kinds of 'new media art projects' using scientific ideas can investigate 'the question of how scientific knowledge may be translated into aesthetics, and whether there are possibilities for new visuals without simple visualisation'.[76] This idea of 'new visuals without simple visualisation' describes well the nature of both works, or, in the

69 Frankel 2007, 384, 386.
70 Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
71 Tuomo Rainio. Interview. 26 October 2017.
72 Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
73 Jenna Sutela. Skype interview. 23 October 2017.
74 Sutela 2017, 9.
75 Kjærulff 2017, 13.
76 Paul 2008, 70.

case of Sutela's works, new poetry and a new kind of language. Rainio talks about finding new visuals in the context of the internet and the mass of digital images:

> *Along with the digital technology, the volume of images has produced this situation where we have this illusion that we have a mass of images. In my opinion, it is interesting to consider how many different types of images we have. In reality, for example, the number of visuals, types of images, in social media is quite limited. Therefore, the number of pictures is astronomical, but the same types of images are repeated and shared, people portray themselves in specific situations, and the images duplicate each other. In a way, I feel like the role of the artist is to create new types of visuals, to think about other kinds of images. – that mass of images that is discussed a lot in the context of the digital, it is not a mass, if we think about the number of different types these images have.*[77]

Creating new visuals, ideas and connections is indeed something that artists are also capable of doing in the context of the internet. Art can challenge this mass consumption of images, the repeated compositions and motifs. In addition to the making of new visuals, or a new kind of language, the achievement of these projects that combine art, science, and innovative technologies, Paul writes, 'consists in creating a dialogue on the interaction between the actual, the virtual, and the hypothetical – which potentially is of great benefit to both arts and sciences'.[78]

Material and virtual: pushing the limits of the web

In the context of the web, the immaterial cyberspace, it is quite peculiar that Sutela has made a website with such a strong connection to physicality. First, the idea was to record the movement of kombucha as a livestream. Sutela chose kombucha 'from all sorts of living materials partly because it is relatively easy to maintain compared to other fermented foods and beverages'[79], as she had it in her studio for a while. In practice, recording its movements under a microscope was more difficult than the artist had imagined, as she had 'to sit by the microscope, and zoom to this little drop, and change the kombucha sample when it dried off'.[80] In the end, Sutela explains, 'it was live for a moment, but then there was a video left of those moments when it was live'. The artist has encountered similar challenges when working with other living materials, as their nature is uncertain and unstable. For Sutela the fact that 'it is hard to control them completely' also makes working with these materials interesting.[81] This uncertainty of organisms contrasts with the fixed logical and algorithmic structures of the internet.

Sutela's interest in this so-called wetware, the organic element alongside software and the hardware, as in the kombucha heart in *Gut-Machine Poetry*, blurs the boundaries between the digital and material and speculates with the possibly biological future of computers. This idea of a biological computer is not new. In her writings, Sutela has referenced, for example, the cybernetic ideas of Stafford Beer from 1959 concerning the idea of a biological computer system.[82] Previously, Sutela has worked with slime mould, *Physarum Polycephalum*, a many-headed organism that has become the symbol of bio-data processing and the biological

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77 Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.
78 Paul 2008, 70.
79 Jenna Sutela. Skype interview. 23 October 2017.
80 Ibid.
81 Ibid.
82 Sutela 2017, 98.

computer.[83] Sutela's video essay, *When You Moved*, presented at the Kiasma Theatre in 2014, also touches upon the idea of natural computers:

> *Computing was built with predictability in mind. Computers crash when presented with something unexpected. Natural computing will be able to deal with constant change. Natural computers are auto-poetic, self-replicating, four-dimensional, immortal. Preserving the minds of contemporary humans, and artificial and everlasting neuro-networks is the natural destiny of the natural computer. The goal would be to outsource human subjectivity to the crypt, a cryptographic code.*[84]

With its organic elements, *Gut-Machine* comes close to the idea of cyborg. Donna Haraway, for example, has outlined the concept of cyborg in her renowned *Cyborg Manifesto* as 'a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction'.[85] This description applies to *Gut-Machine*. Sutela's work is influenced by post-humanist thinking in diverse ways, from the ideas challenging the boundary between humans and other species by showing the intelligence found from these small organisms, to the technological side of post-humanism by problematising the line between organic and mechanic.

In a sense, *Gut-Machine Poetry* reveals the limits of the machine and the potentials of organisms, whereas *Untitled (Gravitational Waves)* exposes the limits of human comprehension and the possibilities of technology. The connection between material and virtual is present in Rainio's work as the balance between computer-generated parts and the 'organic' data behind the videos. Rainio describes organic data as something with 'a lot of noise, something that is hard to simulate'. He wanted to use video images with 'a link to the visible reality' to avoid the 'obviously artificial' look, as 'with programming, it is so easy to move into computer-generated aesthetics'.[86]

Sutela thinks of the artwork, the website, as 'a window to a living, physical process'.[87] The physical element, the kombucha, brings out the fact that the web and digital media are associated with immateriality, even though this immateriality is a myth, as Christiane Paul has written in the context of new media art in general.[88] Sutela also mentions the writings of Jussi Parikka 'about the required physical components in data processing, and how our lives or the data processing, nothing is so virtual or digital as we think, we just do not see those massive data farms and machinery that it takes'.[89] *Gut-Machine Poetry* with its focus on material processes can be seen as a comment on this hidden materiality.

The future of internet art: between utopia and dystopia

An ambivalent relationship with technology is present in today's art, especially in the art on the internet. At first the internet was often seen as a technological utopia, a free and open cyberspace, and such 'cyber-utopian' or 'techno-optimistic' discourses are still present. The above-mentioned culture of open source is based on these optimistic views of the internet, for example. However, there has been increasing scepticism with the rise of censorship, surveillance and capitalistic structures on the internet. One of the co-curators of 'ARS17+', Attilia Fattori Franchini, an independent curator who has worked with online spaces, has noticed the change that has taken place compared to the early 2000s. In 2008, when she was a recent graduate, there was a discussion and movement online, 'outside the contemporary

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83   Jenna Sutela. Skype interview. 23 October 2017.
84   Sutela 2014.
85   Haraway 1985, 5.
86   Tuomo Rainio. Interview. 26 October 2017.
87   Jenna Sutela. Skype interview. 23 October 2017.
88   Paul 2007, 251–52.
89   Jenna Sutela. Skype interview. 23 October 2017. See for example Parikka 2015.

art system of the time,' that to her felt present and free. This movement and the communities online also had the idea of open sources – the practice of sharing information – strongly embedded into them. This freedom and 'how people were engaging with this new space which has no rules,' stimulated Fattori Franchini to work with online platforms.[90]

Now the practices are changing, and online works have been 'institutionalised and integrated into the system that they were not part of at the time'. Internet art is changing because the internet is not the place that it was. At present, Fattori Franchini describes the internet as 'a capitalistic place' that 'has been appropriated by corporations and tech science,' and at the same time, politicised. However, it is not just the internet that is undergoing such changes. As Fattori Franchini notes, 'the world is a different place:' - - 'There has been a change, but definitely global in that sense, it is not just the internet, but the world has changed quite quickly in the last five years. So, I think that what we are looking at is responding to that.'[91]

When comparing early net art and internet art today, there are significant differences. Fattori Franchini associates early internet art with utopian views and defines 'net art in a classical definition of it', as something that happened 'between the 1990s and early 2000s,' and was more about coding and 'really engaging with a fabric of using new media, understanding new ways of thinking about spaces, and characterised by utopia somehow'. Now that the internet is less of a novelty, 'there are people using the online medium, but it is shifting quite a lot in the way artists are engaging with it'. Today, Fattori Franchini is interested in 'how artists use it as a way of distributing things'.[92]

The future of art and the internet, or art and technology is, of course, uncertain, as technology is changing rapidly. Fattori Franchini speculates that in the future 'we are mutating more and more with machines, like the machines are becoming part of our extending bodies, and they will increasingly have a place in our lives'. If early net art was characterised by utopia, now Fattori Franchini observes dystopian trends in art concerning both technological and ecological changes.[93] These observations and this ambivalence describe quite well the characteristics of the artistic practice of Sutela. *Gut-Machine Poetry* proposes futuristic visions of biological computer systems, machines becoming part of the organic, but at the same time, it concerns the potential risks of advanced artificial intelligence.

More than just internet art
Artists resist categorisation.
Artworks are typically multi-layered, addressing many themes simultaneously.
Many artists purposely try to confound pre-existing categories.
The technology used may not be the most important element.

Stephen Wilson in *Information arts. Intersections of art, science, and technology.*[94]

As Wilson has noted, there is more in these artworks than just the technology used or the scientific influences. Even the question of digitality is something more than just a question of technology. Rainio considers his work digital in a technical way, but he also sees binary-based digitality as something 'that transcends the computer age,' so the core of being digital is difficult to locate, as it can be 'a question of technology', but also 'a question of thinking'.[95] Technological concerns and the questions of technological mediation are not limited to certain machines, Rainio emphasises. From his point of view, even 'trivial technological changes can produce huge cultural changes and change the history or the direction of arts'. Rainio thinks that artists should be involved in the discussions concerning cultural and technological

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90   Attilia Fattori Franchini. Skype interview. 20 October 2017.
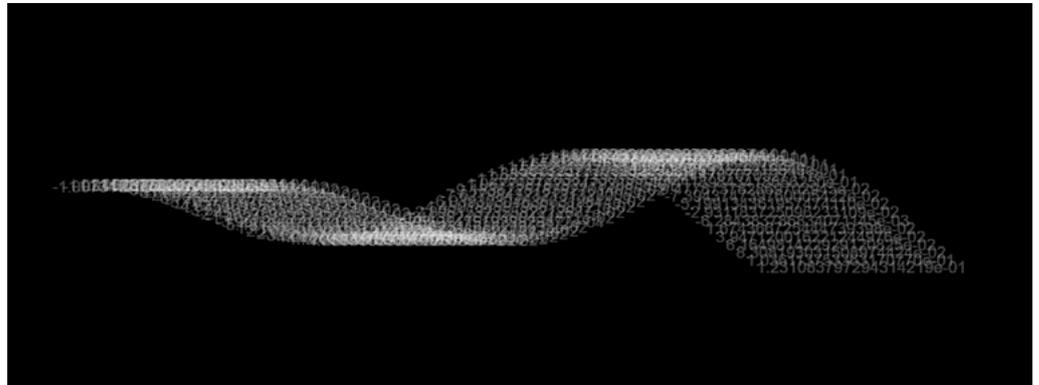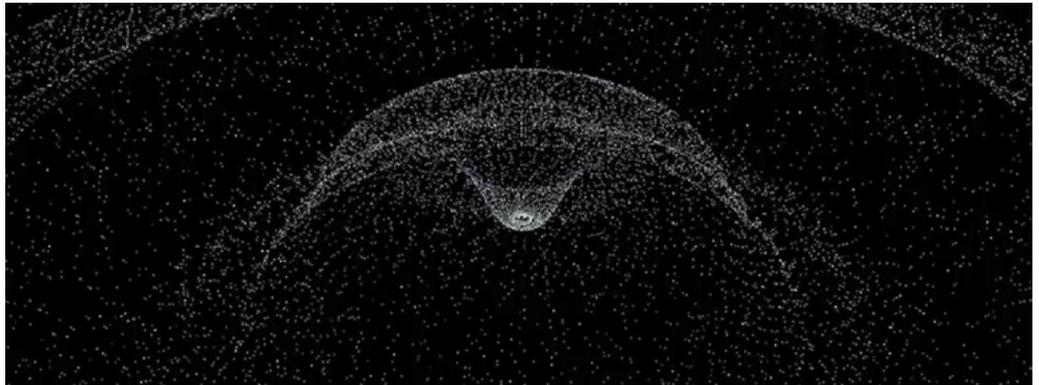91   Ibid.
92   Ibid.
93   Ibid.
94   Wilson 2002, 8.
95   Tuomo Rainio. Interview. 6 March 2017. Interviewer: Maritta Mellais. Archive Collections, FNG.

Above and below: Tuomo Rainio, *Untitled (Gravitational Waves)*, 2017.
Finnish National Gallery / Museum of Contemporary Art Kiasma.
Screen captures from videos in the online artwork

changes, 'not so much to participate in the language that the technology has created, but to create alternative interpretations and alternative ways of using the technology, alternative ways of looking at it, and to deal with the experiences that the technology produces'.[96]

In the future, Sutela thinks, 'art can be a force that brings people together, physically, as a counterbalance to the internet', but at the same time, she sees the interaction between art and technology as possibly beneficial. Sutela highlights the role of fiction in connecting art with technology and science: 'Art can be a sphere that somehow makes it possible to imagine the impossible, or to speculate with the future'.[97] Rainio is also planning to work with the interactions between the physical and digital. He reflects on 'the additional value that the digital brings to the traditional methods' and these hybrid forms, 'the encounters that happen with physical materials, even though the processes may include complex digital procedures'.[98]

New technologies offer new possibilities and experimental spaces to the arts, and within these possibilities, art can challenge the tech-speak and discourses of certainty and predictability. Rainio emphasises 'all the processes of reality, all the laws of nature, they are in a way contingent, not deterministic, not happening at one hundred percent probability, but changing, and they embody a chance for a miracle to happen'. This look towards complexity and the incomprehensible is present in both of the online artworks I have analysed here. Rainio links this to 'the combination of art and technology', as it especially 'has a chance to investigate the unforeseeable, something new and random, and something miracle-like'.[99]

96   Tuomo Rainio. Interview. 26 October 2017.
97   Jenna Sutela. Skype interview. 23 October 2017.
98   Tuomo Rainio. Interview. 26 October 2017.
99   Ibid.

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