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FEAT Special Section: Becoming.a(Thing): An Artists' Perspective on High Performance Computing

# BECOMING.A(THING): AN ARTISTS' PERSPECTIVE ON HIGH PERFORMANCE COMPUTING

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**Abstract**

The article summarizes the process and outcome of the Future Emerging Art and Technology residency during which new media artists Špela Petrič and Miha Turšič undertook the challenge of understanding and manifesting the artistic potential of high-performance computing (HPC). As a result of the collaboration with FET-HPC the artists developed a concept liberated from the complex computational technicity to underscore the (un)intentional construction of meaning by algorithmic agencies. The performance presents a *congress of actors* sensing, interrogating and interrupting each other, thereby producing an excess of relation, interpretation and translation. The heterogeneous congress performs an expulsion of imposed (anthropogenic) meaning, substituted by authentic, autogenic sense and non-sense.

*Keywords:* performance, algorithm, high-performance computing, sense, semiotics

Future Emerging Art and Technology (FEAT) is a program, which embeds artistic research into cutting edge technological development and scientific knowledge production. As a subdivision of the Future Emerging Technologies (FET), FEAT acknowledges the immense impact that sites of technological innovation have on various levels of society, from facilitating biopower's grip on each individual to influencing decisions in geopolitical processes. By enabling collaborations between artists and scientists, FEAT reflects ever-growing institutional and financial support of interdisciplinary practices, which expand goal-driven applications of technology and to an extent counteract the utilitarianism increasingly penetrating science.

During the six-month residency we collaborated with Dr. George Beckett and several scientists of the high-performance computing (FET HPC) consortium, which connects scientific and commercial partners within the European Union dealing with upscale parallel computation (high throughput complex simulation, deep learning, data mining and algorithmic prediction). The field of HPC itself is currently undergoing a transition, navigating between two mutually exclusive strategies: continuing along the path of incremental increase in speed or focusing on ease of use. Because a continued increase of computational power necessitates ever more specialized programming languages suited to the particular architecture of each supercomputer, it in turn limits accessibility. Moreover, the HPC community is searching for ways to better connect to industry and to implement big data into research.

As complete novices to the field, the residency presented us with a unique opportunity to visit various HPC centers and talk to the scientists and engineers on site. In July 2016 we started with the European Centre for Medium-Range Weather Forecasts in Reading (UK) where Dr. Peter Bauer (ESCAPE FET project) introduced us to weather forecast supercomputing and guided us through the infrastructure, computer room, data storage and support facilities. During the same month we also visited the IRISA center in Rennes (FR) where Dr. Francois Bodin (EXDCI FET project) talked to us about to the scientific method of simulation, different applications and in particular about the organization and structure of HPC institutions, including their wider political ecosystem. He also invited us to the EXDCI conference in September in Barcelona (ES) to experience the policy making process in action. There we had the opportunity to present the FEAT initiative to the representatives from all FET HPC projects and institutions. The visit was a fruitful exchange of perspectives on HPC, its infrastructure, computation and the sociocultural footprint of algorithmic production. On that occasion we also had a tour of the Barcelona Super Computer MareNostrum that is highly photogenic as it is located inside a decommissioned church. It was surprising that despite its centuries old appearance the church was built less than fifty years ago—and is as such a simulation of sacral architecture.

The conceptual development of the artwork took place in the EPCC center in Edinburgh (UK) where we concluded the final phase of our research, working on experiments, artistic interventions and first prototypes. We were provided with a space to work and the availability of experts from all required fields of science and engineering. We will outline a few of the many threads we pursued.

Coming from the fields of biology, bioart and art in outer space, we were initially interested in HPC's energy metabolism and the materiality of supercomputing. We wanted to understand the ecological niche that algorithmic processes occupy in our ecosystems, hoping to root the abstract flow of information in its ultimately material manifestation. What possible computation is so important that we as a society commit a whole power station to its operation? (This premise turned out to be somewhat of an exaggeration; e.g. the UK national HPC service ARCHER uses up to 2 MW [1], compared to the average coal power plant output of 2000 MW.) The answer was underwhelming—most of Europe's supercomputers are employed to run simulations of scientific experiments, the so-called third pillar of science (beside observation and experimentation), which obfuscates their connection to society at large. They do, however, fulfill a political role, as having the fastest computer helps to establish a position of power amongst nations [2].

At the EPCC we conducted a pataphysical experiment [3]: considering the huge impact (big) data has on our lives, we wanted to measure its weight. Using a highly accurate balance at the Department of Geosciences, University of Edinburg, we weighed an SD card, the first time filled with all zeros (the state we dubbed "empty"), then later with random zeros and ones written to it (Fig. 1). The difference was 0,0042 mg, but the interpretation of the results is highly contestable, as we couldn't figure out which state of the SD card was actually full. The experiments were cut short due to the scientific senselessness of our endeavor.


**Fig. 1. Weighing data. (© Špela Petrič and Miha Turšič. Photo: Špela Petrič and Miha Turšič.)**

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Another aspect that piqued our interest was the subjectivity in computer science. The programmers we spoke to readily admitted to a personal signature in the codes, reflecting the proficiency and skill of their author, but moreover they pointed to "subjectivity" as a result of the process of deliberation with the client. During their development, all algorithms are provisional, but only what is deemed undesirable within the scope of the aim is addressed and modified. This implies that it is difficult to ascribe responsibility for adverse effects algorithms might have [4]. Further, with the use of deep learning and neural networks a subjectivity that is a contingent property of the algorithm itself emerges. Often these algorithms present a black box that can only be monitored by observing input and output data, thus acquiring an intrinsic agency much like the organisms used in biotechnology.

Finally, we wanted to understand the openness of algorithmic governance to public initiatives. We were pleased to discover two recent big data projects (Perth Big Data Week and GovHack in Australia) that organized public access to governmental datasets based on which the skilled public could algorithmically extract information. However, as explained to us by San Francisco developer Ben Werdmuller, the Silicon Valley perspective sees individuals more likely to partake in algorithmic governance through personal assistants, which will be proprietary and will ensure the maximum customization of our consumer needs. In the case of UK's ARCHER, we identified a slump in computer usage during the holidays and see this as an opportunity to approach the otherwise scientifically dedicated supercomputer with proposals to run algorithms that might be interesting to the wider society.

Taken together, our research pointed to an objective limitation in the possible artistic use of supercomputing due to the specialized nature of programming required as well as the difficult access and substantial cost associated with running a program on the machines. We wanted the art piece to reflect these cross-disciplinary struggles and simultaneously speak about the semantics, which underlie algorithms as we found the meaning-making process—with misunderstandings, ill communication and decontextualisation—to be a pivotal aspect through which the social, cultural and computational spheres intertwine.

Bits and bytes are organized in the space and shape of contemporary concepts; they are the result of our cultural achievements, biases, future projections, ideologies and policies. Moreover, like a cybernetic loop, they feed back (and forward) into the very space they emerge from, sometimes disrupting but more often reinforcing notions that generated them in the first place. By their action algorithms produce intended and unintended meaning; more appropriately, a sense of the world, and a non-sense, which is different from that created by a human agency. The ability of living systems to engage in an adaptable interpretation of signs (the so-called semiotic freedom [5]) extends to objects and nonliving agencies as the sense producing technological mentality [6]. Algorithms can be looked upon as abstract machines in the production sense, which bathe us in their open non-operability [7].

The performance consists of various categories of objects—an ultrasound scanner, the SD card, articles, books, image analysis and speech-to-text algorithms, human cells, photographs, computer programmers, the ARCHER supercomputer and the artists—attempting to interpret each other's signs, enacting a multitude of semiotic relations which emerge at the other-than-human level (Fig. 2). The so-called congress presents an ontological slippage in agency in the vein of new materialisms, acknowledging the extensive production of sense amongst the algorithmic and non-algorithmic objects, which reside in the various forgotten layers of our experience. By its action it produces an excess of signifiers, which dwarf the discrete algorithmic categories and propose a form of resistance to algorithmic 'objectivity' and its totalizing effects. The artwork is a cross-entity machine within which the human is just another thing.

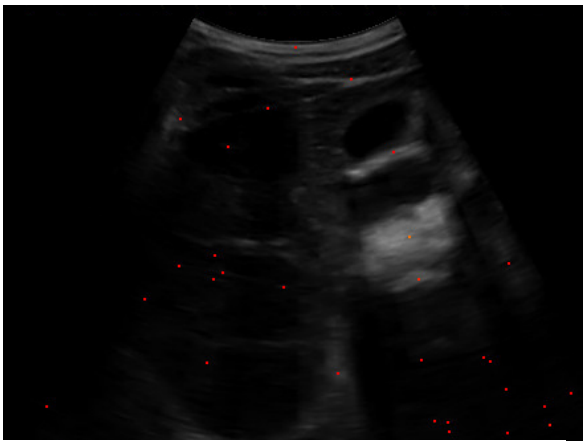

**Fig. 2. Stars and galaxies identified in an ultrasound image of the human body. (© Špela Petrič and Miha Turšič. Photo: Špela Petrič and Miha Turšič.)**

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**References and Notes**

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