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CAN A COMPUTER BE AN ARTIST?

ALGORITHMS, EVOLUTION AND THE FUTURE OF ART

At first glance, art and evolutionism do not seem to have much in common, maybe even nothing at all. However, it turns out that the use of mechanisms associated with the theory of evolution can influence artistic activity in a very interesting and non-obvious way and open up interesting perspectives for the future of art. The role of a 'mediator' between evolution and art is assumed by algorithmics, specifically evolutionary algorithms.

Imitation of Vincent van Gogh's painting *The Starry Night* generated by an evolutionary algorithm created by Krzysztof Para, a student of computer science at the University of Silesia

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It is a class of computational methods developed in the 1960s – and continuously improved since then – inspired by mechanisms found in biological evolution, such as crossbreeding, natural selection, and mutation. Evolutionary algorithms are the subject of research conducted by Prof. Urszula Boryczka from the Institute of Computer Science at the Faculty of Science and Technology of the University of Silesia.

'Genetic algorithms, pioneered by the American scientist John Henry Holland, are the oldest and relatively the simplest to describe in terms of their functionality. The way of coding the optimisation problem – its most effective solution is always the task set for the algorithm – is based on the binary system, using which we can already write down human chromosomes. On the other hand, in genetic programming, popularised by John R. Koza, we operate with structures known in computer science as "trees", i.e. multi-level dependencies between the characteristics of a solution to a problem. We can modify them by removing certain parts, just like cutting branches off a tree', explains Prof. Boryczka.

Evolutionary algorithms also include: scatter search, evolutionary programming, neuroevolution, and evolutionary strategies, which were used by the Swedish artist Roger Alsing to create the Polygonal Mona Lisa – with the face of Gioconda consisting of tens of thousands of triangles generated after entering specific parameters and then filtered according to their similarity with the original.

'In 1968, two German scientists, Ingo Rechenberg and Hans-Paul Schwefel, worked on optimising the shape of aeroplane wings. When mathematical solutions did not bring satisfactory results, they got inspired by genetics, or more specifically, by subjecting genes to slight mutations based on standard deviations – and this is how evolutionary strategies using mathematical statistics were created', explains the scientist and emphasises how important and inspiring is the analogy between the self-improvement of algorithms encountering an optimisation problem and the ever-improving adaptation of living organisms encountering environmental challenges.

Art generated by artificial intelligence using evolutionary algorithms is met with mixed reception, and the validity of such an approach is often questioned. However, Prof. Boryczka is convinced that in the times of a general creative crisis, as diagnosed by today's humanities, it can provide an invaluable stimulus for the development of humanity in this area. Above all, the study of algorithm-generated art directs the efforts of scientists towards the modelling of the creative process. The mathematical framing of this process would be considered a milestone on the road to the creation of artificial emotional intelligence, which in turn could give rise to empathetic devices, simulating the behaviour of a doctor or carer for lonely senior citizens. There is, however, one serious problem.

'We are still unable to mathematically describe the variable that represents the viewer's impression of a given work. For one person, generative art will be better the more closely it imitates the original, and for someone else, the opposite will be true – the more it deviates from the original piece of art. As the developers of the programme, we would have to use multi-criteria optimisation, assigning a different weighting for each type of evaluation, but in all likelihood, there'd be so many of them that they would quickly become unmanageable', explains the IT specialist from the University of Silesia.

Evolutionary theory of art (evolutionary aesthetics) offers an interesting perspective on the nature of the creative process. According to this relatively young concept, art as a human activity developed as an adaptive mechanism, not by exaptation – a process that is, to some extent, peripheral to evolutionary development. Going even further, art is, therefore, a form of lifelong adaptation of the individual, and specific artistic trends and styles are in fact civilisational needs.

'If we stick to the exaptive option, we will not be able to avoid the need for a two-track method of evaluation when constructing a model of the creative process. Even if we introduce aesthetic and similarity metrics into the algorithm, we will still need an "expert" opinion to determine whether a given work of art won't be frustrating for the audience, for example. This leads us towards co-creative systems in which humans and machines work together as equals', warns the researcher.

Prof. Boryczka does not share the fear that sentient and self-aware robots could one day turn against humans. In her opinion, the development of artificial intelligence will rather set the desired direction of progress for our species, also with regard to artistic activity (although art is likely to change as the computer becomes its primary tool). The ability to simulate spontaneous (emergent) phenomena in the creative process – even at a very basic level – would open up tremendous opportunities for further development of science.