arts

The Machine as Artist: An Introduction

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Abstract: With the understanding that art and technology are continuing to experience an historic and rapidly intensifying rapprochement—but with the understanding as well that accounts thereof have tended to be constrained by scientific/engineering rigor on the one hand, or have tended to swing to the opposite extreme—it is the goal of this special issue of *Arts* to provide an opportunity for artists, humanists, scientists, and engineers to consider this development from the broader perspective which it deserves, while at the same time retaining a focus on what must surely be the emerging core of our subject: the state of the art in mechatronics and computation is such that we can now begin to speak comfortably of the *machine as artist*—and we can begin to hope, as well, that an aesthetic sensitivity on the part of the machine might help lead to a friendlier and more sensitive machine intelligence in general.

The Machine as Artist: An Introduction

If we can accept the 1967 founding of the journal *Leonardo* [1] and the 1968 publication of Jack Burnham's *Beyond Modern Sculpture* [2] as milestones—and the latter of which had an extensive chapter on "Robot and Cyborg Art"—it must come as a shock to realize that the study of electronic techno-art has been established as a formal discipline for half a century, and which study since placed in brackets with the appearance of at least two comprehensive surveys [3,4]. It continues to be the case, however, that there has also been constant and now breath-taking progress, and to the extent that *we can at present begin to think of the machine, not as the artist's subject matter or medium, but as creator or co-creator*. Indeed, it is this subject to which the current special issue of *Arts* is dedicated; and we begin by noting that the literature bears ample witness to this emergence, and with the contributions documented therein falling into several major sub-fields:

1.   The kinetic or robotic art works whose movement and/or behavior has become so sophisticated that we are entitled to regard them as performance artists in their own right [5–8].
2.   The algorithmic studio assistants set loose to embellish computer-mediated graphic or sculptural works of art, and which work is then output via large-format ink-jet printer or additive manufacturing system, or as video [9–14].
3.   The autonomous and cleverly-designed painting robots which, drawing upon the emergent properties of minimally-intelligent systems, are nonetheless able to create striking abstract works [15,16].
4.   The far more computationally-intensive anthropomorphic robots (Figure 1) able to create sensitive and imaginative portraits of their human subjects, or engage in other forms of graphic virtuosity [17–23].

5. The purely computational/AI systems which qualify themselves as aesthetically competent entities, if not actual artists, by their ability to predict the style period and/or author of existing works of graphic art [24–28].
6. The purely computational/AI systems capable of isolating and capturing the style of a given work of graphic art and applying it in an aesthetically-pleasing manner to an arbitrary image [29–37].
7. The purely computational/AI systems capable of generating striking imagery based on otherwise mundane or even random visual input fields [38–42].
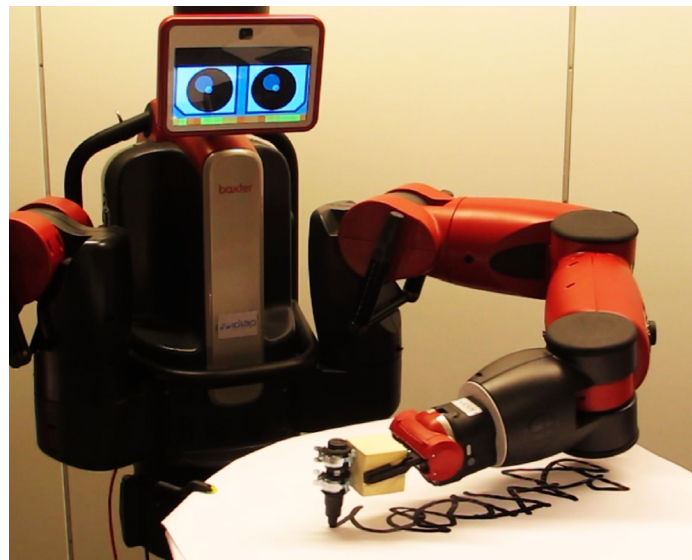

Figure 1. Baxter Signing His Name in Graffiti Style [22].

It is of particular interest and significance, moreover, that these sub-fields tend to overlap within the genre of the traditional *graphic arts*—the physical robotic systems producing sophisticated portraits, and the purely computational systems generating sophisticated analyses and transformations of historic and well-known paintings—for we have here a coming-together of a number of critical threads.

This overlap is due, in the first place, to the fact that graphic art can of course be represented by two-dimensional arrays of pixels, and is thus ideally suited for computational analysis. Indeed, virtually all of the important results reported under categories 5, 6, and 7 above have been achieved with that same family of computational techniques—the "deep neural network", or DNN—that has also been responsible for the recent and unprecedented victories of computer over human in master-level Go and Poker tournaments. In other words, *the graphic arts have emerged as a vital research arena for the artificial intelligence community, and to some extent as a replacement for the board game*—and along with this circumstance comes the opportunity for our own contributors to address the larger questions associated with AI.

And the ultimate question at this point is no longer whether or not artificial intelligence will be capable of achieving some real degree of autonomy [43]; the question, rather, is the degree to which such an autonomous or semi-autonomous intelligence can be designed to operate in a consistently humane and responsible manner [44], and with "responsible", in this day and age, understood to include an environmental dimension.

But of course it is not merely the status of the graphic arts as a computer-friendly medium that should encourage its various practitioners to take on the question of a humane AI: the far larger point is that the graphic arts represent a creative and non-competitive and distinctly human activity—an activity, in fact, intimately associated with the emergence of humankind from a preoccupation with mere survival [45,46]—and an activity as well in which the entire focus is on sensitivity of observation and execution.

In short—and if we can thereby conclude with Herbert Marcuse that "the aesthetic values are the non-aggressive values par excellence" [47]—then *the addition of aesthetic capabilities to the machine intelligence armamentarium would perhaps bring us an important step closer to the addition, as well, of a sense of empathy and responsibility*—and it is this possibility that we would like to propose as the focus of our special edition on "The Machine as Artist".

But let us emphasize here—and as strongly as possible—that it is not only those who have been involved with the computational graphic arts who are making, or who are in a position to make, an important contribution to the genesis of a "friendly AI". In particular, the artists and scientists and engineers who have worked to bring the robot out of the factory and into public gallery and exhibition spaces are playing a critical role in introducing machine intelligence as a physical as well as mental presence, and we are eager to hear more of their work; and to the extent that our basic thesis is correct, most such contributions will tend to have at least some bearing on the question, "Can there be a humane intelligence apart from the sense of balance and harmony and attention to detail that we normally associate with aesthetics?"

Given, however, the speculative and cross-disciplinary nature of this question, it is anticipated that many of the submissions to this special edition will take the form of scholarly *essays* or even *communications* (albeit still subject to peer review); i.e.,—and at the risk of repeating ourselves—we hope to provide here an opportunity for specialists in the fields of computer science, neuroscience, anthropology, and art history to share their thoughts on a more open-ended basis.

In this context—and we rush here to our conclusion, and by way of returning to our central theme—the status of the graphic arts is given a powerful boost by the fact that so distinct is the emergence, and so invariant over time the performance and reception of certain of its styles, that we are entitled to regard it as a *phenomenon*—a phenomenon as yet imperfectly understood, but no less worthy of study, and potentially no less rewarding, than the phenomenon of a certain mineral ore able to fog unexposed photographic plates. Or in other words, we have here a near-ideal venue for interaction between the humanities and the sciences in respect to the question of a humane machine intelligence; and in support of this claim we exhibit following a group of drawings from the Chauvet Cave created some 32,000 years ago (Figure 2)—and the freshness and clarity and sensitivity of which must instill in us a deep wonder:

Figure 2. Group of Chauvet Cave Drawings. By Nachosan - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=32316562.

And given, finally, that no modern intellectual enterprise can be complete without a reference to the very real environmental threat facing our planet, we note that here also the graphic arts have a critical role to play, and as likewise deeply embedded in our culture and history—and there is perhaps no better example than Audubon's depiction of the Swallow-tailed Kite (Figure 3).

A computational analysis of the exquisite lines thereof (refined, as we must note, by the master engraver Havell) would almost certainly reveal, from a human factors standpoint, some noteworthy, if not indeed uncanny, qualities; but what should strike us as most uncanny is the fact that the collected set of such images—the graphic art created by Audubon under humble circumstances as he trekked through the wilds of North America—has been responsible for an outpouring of public commitment to environmental preservation to which no modern public relations campaign can bear comparison; i.e., we have here an example of the fact that art has a very real and unique power, and a greater appreciation and understanding of which has now become a vital matter.

Figure 3. *Swallow-tailed Kite* by John James Audubon.

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