# Generative Craft
# A brief critical inquiry into design automation and design automata

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**Abstract**. Popular discourses and representations of automation in design practice have often committed to an ontology of design and creativity where both materials, media and tools are rendered passive actors in design processes. The ways in which these narratives are articulated have consequences for how the materiality of media and of construction elements is construed in both design discourses and environments. Providing a brief critical history of the mutual construction of design technologies and notions of creativity and design is a concern of this paper, which concludes with a critical re-writing of disembodied conceptions of automation in design.

**Keywords**. Design studies, Generative design, Design automation, Cultural studies of design

## Introduction

### Automation, design, and narratives of technological progress

Design automation, understood as the delegation of aspects of a design endeavor onto a machine, is a worthy subject of discussion and debate. Its study discloses conceptions of design and creativity held by its promoters and reveals aspects of the social orders from which it emerges. In 1966 MIT Professor Stephen Coons told an audience of designers and artists that with computers and fabrication technologies "At last [the artist] will have the perfect slaves that are to perform the dirty work of dealing with materials, while he [sic] concentrates fully [on] the creative act."

Coons' characterization of automation in design is a crystallization of a deeply entrenched western tradition of elevating mind over matter. The discipline of architecture is tied to this separation. In his Ten Books of Architecture Renaissance architect and scholar Gian Battista Alberti famously established the distinction in architectural practice between Lineamenta and Structura. In Alberti's theory – almost a myth of architecture's origin- Lineamenta refers to the building's representation, specifically the ground plan, a domain in which "all the ideas of the architect are incorporated" whereas structura refers to the material construction of the building, a domain belonging to a "skilled craftsman". Alberti's distinction between the mental sphere –the sphere of the architect's reasoning, closely tied to the visual- and a physical sphere is consistent with a western tradition of elevating the mental over the material –put in other words- of contrasting the plasticity of thought to the brittleness of matter. This tradition has fundamentally shaped the western conceptions of design and creativity Coons evokes in his address at MIT.

At an earlier stage of the industrial period, in 1823 –more than a hundred years before Coons' address- Timothy Walker, a Harvard lawyer and self-proclaimed "America's attorney" contended: "machines are to perform all the drudgery of man, while he is to look on in self-complacent ease". A precedent to Coons, Walker asserted that once the corporeal necessities of man are satisfied by machinery "there would be nothing to hinder all mankind from becoming philosophers, poets, and votaries of art. " Walker's talk stands for the hopes that the economic and technological changes brought by industrialization instilled in the imagination of people, the promises of life of contemplation and of a seamless, automated, transit from ideas to object.

Coons and Walker's words evoke faith in technology as a force that will free man from the "toil" of physical matter: Walker's was the world of textile mills, factories and steam engines; his Defense of Mechanical Philosophy was an ode to the promises of a nascent technological society. Coons' world, on the other hand, was Post-war US America, a world in which computers and other technologies developed mainly for military purposes were starting to be assimilated by consumer markets in the United States: Coons' talk was an ode to the promises of the information society, to digital computers and their potential for faster, better and cheaper manufacturing. Despite their different technological contexts their ideology is similar: both Walker and Coons believe that the manipulation of physical materials is not only peripheral to design, but actually that it constitutes an unnecessary and undesired part of human existence. The physical and the material are considered dirty and abject, while the purely mental is ennobled. In their discourses machines reify Alberti's idea of a division between a designer and a skilled craftsman; they wish to "automate-out" physical engagement with the world.

This "higher and noble nature" that Walker mentions in his Defense of Mechanical Philosophy maps into what -more than a century later- Coons' refers to when he uses the word "creativity".

## Coons, design, and the automated utopia

The key implication of Coons' characterization of automation in design is that creativity is construed as the process of or the ability to operate in a clean and unconstrained world of ideas and symbols. Coons' view of CAD/CAM as a "perfect slave" reinforce the separation in western thought between the physical and the mental, the mind and the body and –perhaps more important for us architects and designers- design from construction (or implementation). The ways the narratives of this distinction are articulated have consequences in how the materialities of media and of construction elements are represented in both design discourse and design environments. They also continue to shape the roles that technology – and specifically automation – plays in design today.

Under the light of these examples the creative dream of the Western man seems to be to reign over a fully "automated utopia", and rests on a dialectic tension that deprives creative design of its physicality.

In Coons' utopian proposition the concept of creativity stops at the visual and is implicitly linked to the "soft" and "human". The role of construction, as a consequence, falls outside the sphere of the creative, and is linked to the "hard" and automatable. Its role as a "scaffold" for creativity renders it passive rather than active participant in the generation of designs.

## Can Coons' machines design?

Coons' stance is that computers cannot design. Furthermore, he suggests that computers may do anything except design. Design and fabrication systems carry in Coons and Walker's discourses the unflattering ontological baggage of being subjugated to the tyranny of a disembodied authority. Are there other ontologies of computation that circumvent the dialectics of creativity and materiality adhered to by Coons, Walker, and prefigured by Alberti? It seems that if we are to come up with a critical history of "creative" design automation the slavery of matter is not a great place to start. The following paragraphs seek alternative conceptualizations of technology and computation through a brief and somehow arbitrary history of design automation.

# Pocket history of design automata
## Considering design automata

Automata can be seen not just as technical explorations, but also as subjects of socio-cultural and historical analysis. Psychologist John Cohen discusses automata as "manifestations of those modes of consciousness which reach out for a symbolic interpretation of the world around them in contrast to a factual, literal or scientific interpretation." Cohen locates the origins of automata in veneered idols of ancient cultures, imbued with voice by concealed priests and veneered by believers as symbols of power and religious mysticism. Ramon Lull's "Ars Magna", for instance, was a combinatorial device that yielded different statements when one in a set of concentric circumferences was rotated, constituting perhaps the first expert system. In the 18th century Pierre Jacquet-Droz's devised humanlike mechanisms that imitated human activities such as drawing, playing music and writing, to the delight of the public and his own personal fame.
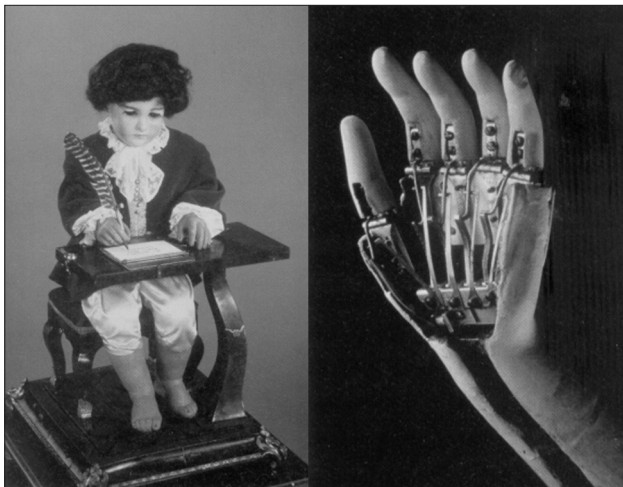


Figure 1. Jacquet Droz's automata, 1774

Human-like machines have epitomized human ingenuity and embodied their makers' mastery of the laws of nature, magic, or mechanism. The relatively late appearance of the "creative automata" may indicate that the faculty of creativity and invention tends to remain specifically human in the popular imagination.

With industrialization different narratives, new hopes and desires emerge around technology.

## Automation of chance

Twentieth century avant-garde movement's fascination with the random and the unpredictable was developed consistently throughout music, art and literature. Under the influence of ideas from information theory the 1968 exhibition "Cybernetic Serendipity" in London included simulated Mondrian paintings, stochastic musical scores and dancing/mating machines. This exhibition displayed artists and technologists efforts to explore machine's ability to perform in unpredictable and therefore creative ways. Under this narrative the automation of chance becomes a creative instrument by virtue of its ability to bring unexpected outcomes to the work of art, outlining a different ontology of creativity, related –as can be expected from the exhibitions name- to a notion of performance that is tightly coupled with information theory and cybernetics.


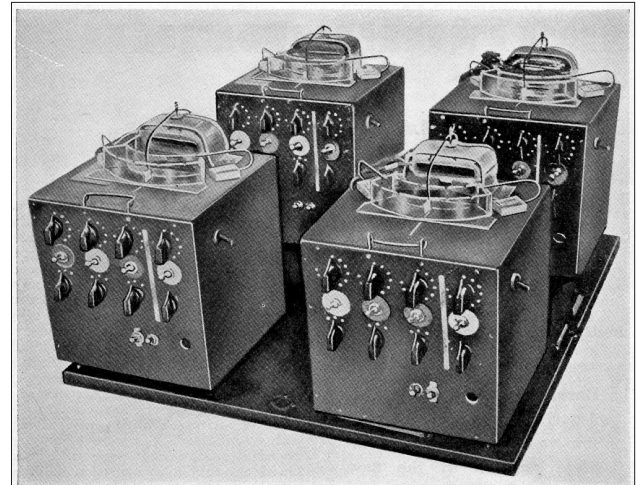
Fig. I—The homeostat, with its four units, each one of which reacts on all the others.

Figure 2. Stills from a computer animated film by Ronald Resch, 1968

## Representation and Performance, a cybernetic dilemma

In "Cybernetics and the Mangle" physicist and sociologist of science Andrew Pickering writes about the devices and experiments made by British cyberneticians Ashby, Pask and Beer as pioneering a transition between a scientific paradigm of representation, largely based on Newtonian linear physics, to a paradigm of performance based on the interaction of electromechanical systems with their environment. We can think of a corresponding transition between Jacquet-Droz's drawing automata and the playful machines of early computer art explorations of "Cybernetic Serendipity": a transition from a paradigm of imitating creativity via representation, to a paradigm of enacting creativity via performance.

It is worth noting that the role, expectations and experiences of the operator of the machines is radically different at both extremes of this transition: while the person operating the Mondrian simulator, or the dancing machines, expects to be –reasonably- surprised –and to derive aesthetic pleasure from this surprise- the operator of Coons' machine expects a perfect "translation" without surprises. The "design automata" of the "Cybernetic Serendipity" exhibition embody different hopes and desires from the ones made explicit in Coons' "perfect slave" narrative.

## Generative specifications of design descriptions

In "Algorithmic Aesthetics" Stiny and Gips propose that designs are susceptible of algorithmic description, interpretation and evaluation, and formalize a theoretical agenda for computation and design. In their proposition computation is not interpreted as a technology-specific concept but as a logical scaffold in which any aesthetic language, as well as technique and material can be phrased. Discussing the possibility of formulating an algorithmic description of a certain art masterpiece they write:
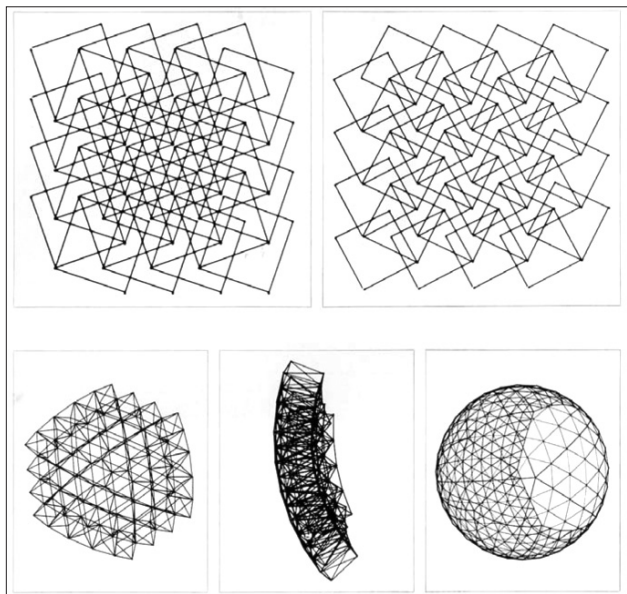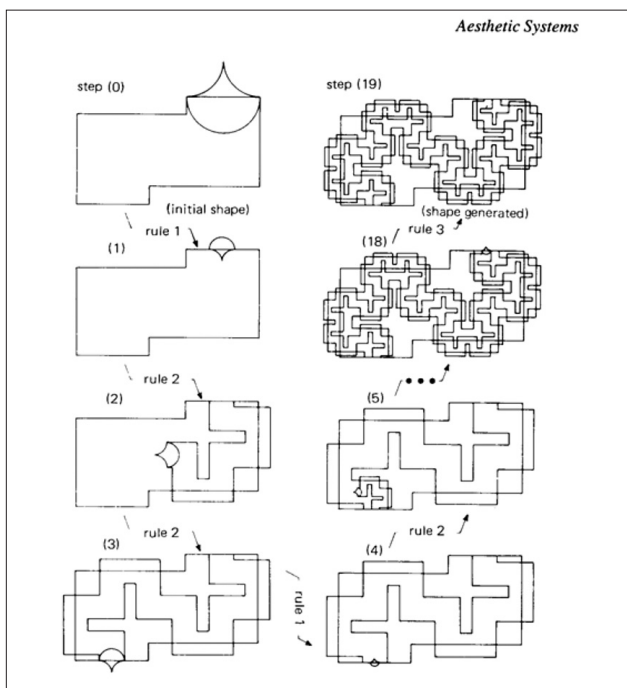
Figure 3. Ashby's "Homeostat", 1954



Figure 4. Stiny's generative grammars, 1975

We do not believe that such algorithms ought not be specified in any moral or ethical sense. It is simply that the specification of such algorithms is not a project for 7 man-years or for 7,000 man-years or for 7,000,000 man-years or for a civilization-+." (p. 5)

The approach of "Algorithmic Aesthetics" to design analysis, description and evaluation rejects the idea of design as an expression of the self as well as the cult of the creative genius that Coons so eagerly promotes. For Stiny and Gips the issue of authorship is irrelevant to the formal logic of the design. This rejection of the author in design is relevant. Stiny and Gips' computational alternative creativity and design are located in the sensorial dialogue of the designer-interpreter and the representational medium. In their performative conception of design Stiny and Gips "kill" the author of design like post-structural critical theorists killed the author of the text.

## Conclusion

In this paper I have argued in favor of adopting a critical perspective on discourses of design and automation based on narratives of technological progress and on the notion of the work as an expression of the self; I have shown how such narratives deprive design from its physicality and reify a separation between design and construction that redefines –and impoverishes- both. A critical perspective on such discourses is one that asks who is getting the benefits, and how it changes the power relations in design practices. Cybernetic discourses and generative formulations of design practices provide valuable tools for interrogating the disembodied 'perfect slave' narrative enforced by Coons and others. Other fields, like the social sciences (STS) may provide additional conceptual tools for building a critical, distanced, perspective on design automation.

Deprived of narratives of progress and of disembodied conceptions of creativity and design as well as of the notion of design as an expression of the self, and influenced by an understanding of design as a sensorial engagement with multiple contingencies, a re-writing of Coons' narrative of the 'perfect slave' could be:

Design languages evolve creatively through our contingent, contexted, messy, ambiguous, sensorial, social-material and technological practices as designers.

It is that which I refer to in the title as a "generative craft".

## Acknowledgments

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