Orderly disorder: post-human creativity

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Abstract

The paper examines the unresolved conceptual hybrids (or monsters) in the rhetoric and practices of the willed, purposive design strategies and mythologies of "the creative individual" or collaborating team (i.e. the conventions of authorship), contrasting these to the conventions of auto-poiesis (self-making) such as are adopted in algorithmic, generative or "evolutionary" design, artificial life art, emergence, and metacreation (the design of generative and creative processes). Applying Katherine Hayles' paradoxical notion of "orderly disorder" to experiments in emergence by "bioartists", "transgenic" artists or others employing processes outside the traditions of mimetic model making, the paper argues that an important consequence of locating creative and critical practice "at the edge of chaos" (i.e. at the tension between order and surprise) is the creation of new metaphors, possibilities for innovation, demands for interdisciplinary border crossings, hybrid networks, and capacities for *seeing connections*, which the paper claims will be a defining feature of our contemporary relationship – as professional practitioners, researchers, and critics – to "post human" creativity.

Keywords: authorship, design, auto-poiesis, intention, emergence, complexity, interdisciplinarity, art, metaphor, biotechnology, innovation.

Orderly disorder: post-human creativity[1]

> This precisely is the long story of how responsibility originated. The task of breeding an animal with the right to make promises evidently embraces and presupposes as a preparatory task that one first makes men to a certain degree necessary, uniform, like among like, regular, and consequently calculable.
>
> Friedrich Nietzsche, The Genealogy of Morals, Second Essay

As part of my research I contrast the conventions of authorship with those of auto-poiesis (self-making) to explore what we can we learn of society's changing priorities when privileging the willed, purposive design strategies (or mythologies) of "the creative individual" – or collaborating team – over the traditions of *ars combinatoria*, anonymous or "open source" development, algorithmic (generative or "evolutionary") design, artificial life, emergence, and metacreation (the design of generative and creative processes). To study such questions is to

1 This draft paper derives from two research projects in which I am currently involved; "Architecture and its Mythologies: Authorship, Judgement, Representation" (2003–2005) and "Auto-poiesis and Design" (2005–2007) both undertaken at the School of Architecture, Royal Institute of Technology (KTH) in Stockholm, Sweden. I would like to gratefully acknowledge the financial support of Vetenskapsrådet (the Swedish National Research Council) for these projects.

investigate how a society conceptualises creative production, its legitimising institutions and discourses, its attitudes towards human identity and consciousness. This demands interdisciplinary perspectives on the cultural, technological, and economic aspects of the changing figures of authorship, including the particular socio-cultural factors, technological developments, and institutions of *ownership* and *reward* that historically favour specific practices of authorship and design. As I have discussed elsewhere[2], the issues identified in Roland Barthes' "The Death of the Author" (1967)[3] or Michel Foucault's "What is an Author?" (1969)[4] affect a wide range of disciplines, raising questions such as How does the epistemological status of *author* shape that of work (*oeuvre*) – and vice versa? How does Foucault's "author-function" operate differently across different disciplines? And what does this reveal about the discursive allegiances of such disciplines? For example, when considering the allocation of authorship and ownership rights within contemporary scientific culture, a factor that often determines how scientific research is conducted and distributed, the issue of authorial attribution becomes deeply problematic since scientific authorship today is typically characterised by multi-authorship – i.e. a fragmented collection of collaborations. Furthermore, standards of openness, secrecy, publication, and credit vary significantly between different laboratories, between academia and industry, and even between different departments, disciplines and industries all of which might separately contribute to a specific, shared research goal such as decoding the genetic language of early life.

Whichever paradigm of authorship is ascendant during any given historical period will reveal how a society chooses to define itself in relation to its knowledge, its traditions and discourses. Thus the figure of the author (including the author's various reported deaths, disappearances, and resurrections) has always attracted a constellation of related concepts, including (but obviously not limited to) origin, ownership, agency, self, consciousness, causality, authority, accountability, theology, creativity and consciousness. We might also incorporate into our discussion the various 'anti-authorship' traditions that seem to have shadowed our changing author paradigms from the beginning – elements of *auto-poiesis* (self-making), for example, or the enduring ambition to automate authorship and cultural production more generally via strategies of *ars combinatoria*, OULIPO generative systems, Dada experiments and surrealist games (or, more recently, post-humanist paradigms of *emergence*, including "generative" or "evolutionary" art, design and science).[5] Techniques of sampling, intertextual citation, collage and montage are today so mainstream as to be incorporated into many mass market software programmes such as Apple's iMovie or Garageband, and this also affects our perception of authorship, creativity, and culture more generally. Perhaps we need to imagine – as Ronald Jones, artist and Professor of Interdisciplinary Studies at Konstfack, recently invited his audience to do – "a culture without copies because there are no originals"[6].

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2 See Rolf Hughes (forthcoming 2006) "Authorship and its Mythologies" and "Architecture and Authorship". Several of my remarks on authorship in the present paper are explored in greater detail there.

3 Published in English translation in *Image-Music-Text*, trans. And ed. Stephen Heath (London: Fontana, 1977), pp.42–8.

4 Translated into English by Josué V. Harari, in Josué V. Harari ed., *Textual Strategies: Perspectives in Post-Structuralist Criticism* (Ithaca: Cornell University Press, 1979), pp.141–60.

5 Space prohibits such a survey here, but this is a central focus of "Auto-poiesis and Design", a practice-based research project involving architect Pablo Mirando and myself as research leader. The project is funded by Vetenskapsrådet (the Swedish National Research Council) 2005–2007 and uses algorithmically-mutating programmes to explore the computer's potential as an active proponent of design, while examining auto-poiesis, emergence and related concepts such as the virus as metaphors of (and reactions to) authorship and competing claims of ownership. See www.automatic.se for further details.

6 Ronald Jones, lecture titled "clones, counterfeits, ersatzes, decoys, facsimile, duplicates, forgeries, reduplications, doppelganger, bootleg, instant replays, simulacra, replicas; now imagine a culture

The modern representation of the author (as originator and proprietor of a special commodity, the *oeuvre*) is held to derive from a paradox arising from mixing Lockean discourses of property and selfhood with the eighteenth century discourse of original genius; within such a formulation, the author exerts a highly disciplined command of materials, and therefore self – seizing and shaping the materials of authorship in their passage from idea, inspiration or commission to audience – while at the same time surrendering all control of the self to influences 'beyond one's control' such as divine afflatus or Romantic inspiration.[7] By the early nineteenth century, with the author now increasingly 'liberated' from church or state patronage and instead obliged to sell his or her works on the open market, the Romantic author posited the author as creative genius who, by virtue of stamping the imprint of a unique personality on original works, takes them into ownership and thereby provides the paradigm and reference point for intellectual property law (as well as for the personality cult of the author – a useful selling point in a crowded marketplace). At the same time, copyright discourse struggled to resolve the paradoxical notion of *intellectual property* with its hybridisation of corporeal and incorporeal, material and immaterial, body, identity and soul (or *Person*, *Man* and *Substance*, to use Locke's terms[8]). These unresolved conceptual hybrids (or monsters) continue today in the respective claims of (and mutual suspicion between) apologists for author-centred design practices (e.g. the designer as author figure whose *expert* knowledge is non-algorithmic, non-propositional, "non-cognitive") and the advocates of machine creativity, generative (or "evolutionary") design, "transgenic" art or "bioart", whose processes lie outside the traditions of mimetic model making and the representational logic of notational technologies. One consequence of this is the proliferation of new metaphors. Artificial life, for example, treats code as electronic and binary (drawing on the work of the cyberneticists) rather than genetic, and information thus becomes (as Fred Botting writes) "the new terrain of living, of creation and of technological innovation and, of course, the locus of a new species of monsters."[9]

Today the status of a solitary, "heroic" conception of authorship – based on the epistemological, technological and legislative logic of print and deriving its legitimacy from the Romantic espousal of the cult of individual "genius" – has been challenged not only theoretically, by deconstruction and post-structuralism, but also in practice by the anonymous, collective, collaborative (and/or corporate) paradigms which continue to define a great deal of contemporary cultural, scientific, technological and engineering work. Collaborative forms of cultural production have a long history, of course, and may, in fact, represent the norm rather than the exception.[10] But many commentators believe it is today's unique combination of the Internet, an unparalleled communications tool which makes massive decentralized projects

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without copies because there are no originals . . ." given during a seminar on copyright, 27 May 2005, Konstfack College of Art and Design, Stockholm, Sweden.

7 See Marton Dornbach's review of Timothy Clark: *The Theory of Inspiration: Composition as a Crisis of Subjectivity in Romantic and Post-Romantic Writing* in *Studies in Romanticism*, Volume 42, Number 2 (Boston: Boston University, Summer 2003). Dornbach comments "Inspiration … places the author in a precarious constellation with two forms of otherness: the dictating authority and the audience. The resultant "crisis of subjectivity" explains the often ambivalent role played by inspiration in many writers' self-understanding."

8 See John Locke, *An Essay concerning Human Understanding*. Ed. Peter H. Nidditch. (Oxford: The Clarendon Press, 1975).

9 Fred Botting (2003) "Metaphors and Monsters" in *Journal for Cultural Research*, Vol.7, No.4, 2003 (London: Routledge), 342.

10 Lev Manovich even claims "new media transforms all culture and cultural theory into an "open source". This opening up of cultural techniques, conventions, forms, and concepts is ultimately the most promising cultural effect of computerization–an opportunity to see the world and the human being anew, in ways that we not available to "a man with a movie camera."" *The Language of New Media* (Cambridge, Mass.: The MIT Press, 2001), p.333.

possible, with increasingly restrictive legislation protecting intellectual property rights that have led thousands of scientists, designers, programmers, engineers and scholars to explore different ways to work. Rishab Aiyer Ghosh notes that the various legal instruments of state protection covered by the term Intellectual Property Rights – copyright, patent, trademark and others – were developed "with the primary justification of increasing human creativity, increasing the public's access to this creativity, and increasing collaborative creativity" yet the drive of recent policy decisions worldwide to strengthen intellectual property rights threatens instead "to decrease creativity, decrease the public's access to creativity, and worst of all, to decrease collaborative creativity. […] This," he adds "is the context in which collaboratively creating knowledge, something inherently human, comes to be seen as a novelty. […] Businesses are looking at collaboration, not just in open source software, where the likes of IBM, Oracle, and Sun—otherwise holders of vast intellectual property domains—have investment plans of billions of dollars. The pharmaceutical and biotechnology industry has organized consortiums for genetic information, where individual discoveries are shared in a common pool rather than—as used to be the norm—secretly squirreled away in in-house labs for further commercial exploitation. Commerce matters, for free software has shown that collaboration can be profitable simply by virtue of leading to greater human creativity."[11]

"Open source" paradigms of cultural and industrial production, flourishing again partly due to the distributive powers of the Internet, operate far more widely than in software design alone – as a recent issue of Wired noted, biologists use open source methods in genomics and infomatics, NASA uses volunteers as part of its Mars mission to identify millions of craters and create a map of the planet, online initiatives such as Project Gutenberg, which has already digitized over 6 000 literary texts, and Distributed Proofreading, whereby the accuracy of the transcribed source texts are checked, each rely on hundreds of volunteers, and there are religious and legal open source projects and even an open source cookbook.[12]

In the context of our concern with authorship, the collaborative mode raises questions such as: what is at stake when we assign a collaboratively authored cultural artefact, such as a film, to a single creative source such as an author (or *auteur* – a figure conventionally held to be as distinct from *metteur-en-scene* as the architect from the structural engineer)? How do the pragmatics of intention operate within a collaboratively authored cultural artifact? Such issues can be further problematised via forms of cultural production that resist, replace, or seek to escape the conventions and 'design logic' of authorship, which brings us to what we might call "post-human" authorship – namely auto-poiesis, complex systems, emergence, and assorted disciplinary hybrids such as bio-technology, transgenic art, or bioart.

Post-humanism, according to Peter Eisenman, no longer views humankind as the originating agency, but rather as "a discursive function among complex and already-formed systems of language, which he [*sic*] witnesses but does not constitute. … It is this condition of displacement which gives rise to design in which authorship can no longer either account for a linear development which has a 'beginning' and an 'end' … or account for invention and form."[13] As one commentator remarks, the shift from linear, deterministic communications to interactive, non-linear, complex, networked and "emergent" communications, accompanies the shift of techno-scientific paradigms from the "hard" mechanical sciences of the early twentieth century to the "soft" biological sciences (and informatic technologies) of the early

11 Rishab Aiyer Ghosh, "Why Collaboration is Important (Again)" in *Code: Collaborative Ownership and the Digital Economy* ed. Rishab Aiyer Ghosh (Cambridge, Massachusetts and London, England: The MIT Press, 2005), p.3.

12 Thomas Goetz, "Open Source Everywhere", Wired, November 2003, p.162.

13 Peter Eisenman, "Post-Functionalism", in *Oppositions 6*, Fall 1976, reprinted in K. Nesbitt (ed.), *Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory*, (New York: Princeton Architectural Press, 1996), pp. 80–81.

twenty-first century, alongside a corresponding "decentralisation of human perception and individual creativity as the core evaluating criteria for an authentic work"[14]. This process of decentralisation has inevitably changed the way we articulate knowledge and our choice of metaphors for describing it. Julie Klein comments:

> The complexity of knowledge is suggested by the current rhetoric of description. Once described as a *foundation* or *linear structure*, knowledge today is depicted as a *network* or a *web* with multiple nodes of connection, and a *dynamic system*. The metaphor of *unity*, with its accompanying values of universality and certainty, has been replaced by metaphors of *plurality relationality* in a *complex* world. Images of *boundary crossing* and *cross-fertilization* are superseding images of disciplinary *depth* and *compartmentalization*. Isolated modes of work are being supplanted by *affiliations*, *coalitions*, and *alliances*. And, older values of *control*, *mastery*, and *expertise* are being reformulated as *dialogue*, *interaction*, and *negotiation*. Changes in the spatial and temporal structures of knowledge also call into question traditional images of knowledge as a cognitive *map* with distinct *territories and borders* or a *tree with different branches.* They are too linear. In their place, images of *fractals*, a *kaleidoscope*, or a wildly growing *rhizome* without a central root have been proposed.[15]

As Klein argues, with links in a wide range of practices – including literary studies, physics, biology, education, public policy and environmental studies – and with many concepts in common (such as broad knowledge, integration, and synthesis, as well as the capacity to exercise judgment in complex and rapidly changing situations), the ideas of interdisciplinarity and complexity have become over recent decades "increasingly entwined"[16]. Complex systems present profound challenges to the culturally privileged notion of authorship. A complex system is open to influence and change from external *and* internal factors, and is therefore fundamentally unpredictable, despite its apparently deterministic character. Katherine Hayles' phrase *orderly disorder* may be one appropriately paradoxical way of describing the complex structure of order and disorder within such complex systems. As Hayles observes, tiny deviations can produce radically divergent behaviour. "Emergence," she writes, "implies that properties or programs appear on their own, often developing in ways not anticipated by the person who created the simulation. Structures that lead to emergence typically involve complex feedback loops in which the outputs of a system are repeatedly fed back in as input. As the recursive looping continues, small deviations can quickly become magnified, leading to the complex interactions and unpredictable evolutions associated with emergence."[17] Self-organising, emergent or generative systems do not merely reproduce themselves unchanged – this would be merely the neurotic monotony of repetition – but within them forces of disorder lead to order, and order similarly mutates into disorder at a fundamental level. As Hayles indicates, this implies a *politics of the representation of order* but it also suggests a form of *cyberpoetics* in which noise (defined as the *unexpected*, or in Gregory Bateson's formulation "any difference that makes a difference"[18]) is seen to enhance informational value by resisting information's entropic, homogenizing tendency, whereas routine information degenerates into sameness and predictability and thus devalues informational currency. In other words, innovation is valued and continuity (repetition) devalued, which means that cybernetics and information theory effectively pursue modernist values of originality, individuality, and *making it new*. Maturana and Varela's concept of "autopoiesis" (the term is a neologism, combining refer-

14 See S. Iradj Moeini, "Architecture's Inspirations from the Information Age" in *Four Faces: Conference Proceedings* ed. Lena Wilner (Stockholm: KTH, forthcoming 2005).
15 Klein (2004), p.3.
16 Ibid, p.2.
17 Katherine Hayles, How We Became Posthuman (London: University of Chicago, 1999), p. 225.
18 Gregory Bateson (1973), *Steps to an Ecology of Mind* (London: Paladin), 428.

ences from literature, information theory and biology) treats noise as being crucial to the development of complexity in self-organizing systems, once again because it is used to counter informational entropy and enhance complexity. Literature is information rich, according to this view, whereas clichés are informationally impoverished[19].

Mitchell Whitelaw, in his outline of the history of emergence as a concept, traces the first technical use of the term to the English philosopher and literary critic George Henry Lewes in his *Problems of Life and Mind* (1875). Lewes uses the term *emergent* to describe an effect involving several causes that cannot be reduced or traced back to those component causes. His definition is part of a discussion on causality which was earlier addressed by the philosopher John Stuart Mill in *A System of Logic* (1843) in which Mill also discusses cases where multiple causes produce a single effect, but distinguishes between cases where the effect is a simple accumulation of multiple causes (for example, the vectoral composition of force will always move the same object the same distance under successive applications) and cases where the effect is irreducible to those causes (certain chemical compounds – water, for example, cannot be reduced to simply hydrogen plus oxygen; it is a new substance with properties very different from those of its components. It is these properties that Lewes labels "emergent.") Mill argues that regardless of how well we know the individual elements of the living body, "it is certain that no mere summing up of the separate actions of those elements will ever amount to the living body itself." Furthermore, he predicts that such "irreducible effects" will be discovered in many more areas, suggesting that this complex causality "will be found equally true in the phenomena of mind; and even in social and political phenomena." In other words, Mill anticipates the field now known as complex systems science.[20]

As both Katherine Hayles[21] and Mitchell Whitelaw[22]have indicated, the most successful manifestations of emergence appear to involve systems that operate outside the formal, technological grammar of designed robotics and computation. The introduction of biological materials or influences unhooks artificial life from design, human intentionality and conceptual modelling and effects a transition from the known to unknown, from the formal and familiar to the strange, unpredictable, mysterious, autonomous and open. Hence a kind of reverse reductionism operates – artificial life, as a scientific epistemological project, uses known components to create mysterious, ineffable results (or, as Mitchell pithily expresses it, "Instead of dissecting the frog, it tries to build one, although the goal, an enhanced knowledge of a living thing, is the same."[23]). The aims of a-life artists, in comparison, tend to be more synthetic, focussing on the absolute emergent result – the excess – rather than the relationship between the formal infrastructure and the emergent phenomenon. With such motivations, Whitelaw observes, a-life art becomes a "*metacreative*" endeavour; "it wants to create creation, variation, otherness. If a-life science is about knowing and understanding, a-life art is very basically about making and becoming, becoming-other, and becoming-unknown." Such an orientation, Whitelaw continues, puts a-life art in a paradoxical position:

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19 Norbert Wiener, discussing the necessity of difference in information theory, writes, "the more probable a message, the less information it gives. Clichés, for example, are less illuminating than great poems." Norbert Wiener (1954), *The Human Use of Human Beings: Cybernetics and Society* (London: Eyre and Spottiswoode), 21.

20 Mitchell Whitelaw (2004), *Metacreation: Art and Artificial Life*. (Cambridge, Massachusetts and London: MIT Press), p.209.

21 See N. Katherine Hayles (1996), "Narratives of Artificial Life," in *Future Natural*, ed. George Robertson, Melinda Mash, Lisa Tickner, Jon Bird, Barry Curtis, and Tim Putnam (London: Routledge).

22 See Mitchell Whitelaw (2004), "Emergence" (Chapter 7) in *Metacreation: Art and Artificial Life*. (Cambridge, Massachusetts and London: MIT Press), The following comments derive from Whitelaw's discussion in this chapter.

23 Ibid, p.226.

> currently making increasingly sophisticated a-life systems demands an increase in technical knowledge and in willed design, control, and intentionality, toward an end that hopes to exceed that very intentionality and knowledge. This approach leads to an a-life art that follows the explorations of scientific a-life, applying its techniques for cultural and aesthetic ends. If a-life art is to get what it wants, a becoming-other, an endless excess, it has to surrender its intentionality at some point in this process. The question is whether this point of surrender, the point of emergence, will arrive when technological and formal innovation reaches a certain crucial point, or appear in another domain, on another axis altogether.[24]

With complex systems and emergence discourse comes a different way of conceptualising the theory and practice of authorship. A couple of examples will suffice for now.

In *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*. Stuart Kauffman, a theoretical biologist and one of the leading figures in complexity studies, asks what is common to "the teeming molecules that hustled themselves into self-reproducing metabolisms, the cells coordinating their behaviours to form multi-celled organisms, the ecosystems and even economic and political systems". He answers:

> The wonderful possibility … is that on many fronts, life evolves toward a regime that is poised between order and chaos. The evocative phrase that points to this working hypothesis is this: life exists at the edge of chaos. Borrowing a metaphor from physics, life may exist near a kind of phase transition. (…) *Networks in the regime near the edge of chaos—the compromise between order and surprise—appear best able to coordinate complex activities and best able to evolve as well.* (my emphasis)[25]

Although Kauffman's focus is on biological networks, his analysis can also be applied to social and cultural domains; the moment of complexity within such dimensions of experience is a medium "[p]oised between too much and too little order" and, as such, one that facilitates the emergence of network culture[26]. With too much order, systems become static and do not change, whereas too little order means that things fall apart – the systems (cultural, political, or economic systems as well as technical, informational, or biological) cease to function.

Evolutionary algorithms, used by an increasing number of contemporary designers as a new architectural, engineering or design tool, mimic biological evolution by generating many different designs, without any kind of blueprint, and rejecting the less fit in order to select the most functional. Such an approach is most effective at addressing problems that are located beyond what mathematician John von Neumann has termed the "complexity barrier" – i.e. the dividing line between problems that can be solved using existing methods and those that require a more intuitive, or improvisational approach (evolutionary algorithms tend to spin out of control when confronted with problems that require a single, best solution).[27] John Frazer has defined emergent architecture, for example, as "a property of the process of organizing matter rather than a property of the matter thus organised" – it is, in other words, a "process-driven architecture" which emerges "on the very edge of chaos, where all living things emerge, and it will inevitably share some characteristics of primitive life forms." He extends the biological metaphor in his definition of what he calls "evolutionary architecture" which will exhibit "metabolism" and enjoy "a thermodynamically open relationship with the environment in both a metabolic and a socio-economic sense" while "using the processes of auto-

24 Ibid, p.226.

25 Stuart Kauffman (1995), *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity* (New York: Oxford University Press), 26. Cited by Mark Taylor (see below).

26 See Mark C. Taylor (2005), *The Moment of Complexity: Emerging Network Culture* (Chicago and London: The University of Chicago Press), 25.

27 See Sam Williams "Unnatural Selection" in *Technology Review*, February 2005, p.56.

poiesis, autocatalysis and emergent behaviour to generate new forms and structures". Here the emphasis on a "symbiotic relationship" between model and environment, the suggestion that architecture may be capable of a form of artificial life, an "organism" capable of responding to its surroundings and inhabitants, and modifying its structures accordingly ("Not a static picture of being, but a dynamic picture of becoming and unfolding – a direct analogy with a description of the natural world." [28]), clearly suggests that we have come a log way from the paradigm of architect as author, whose design intentions are seamlessly realised and expressed in built form.

Whereas evolutionary algorithms use fixed sets of instructions to vary the information they manipulate, a related field, that of genetic programming, is capable of improving over time by applying Darwinian evolution methods to software development. The computer shuffles millions of possible solutions to a specific problem, and progressively evolves a population of programs over several generations until eventually, via a process of relentless elimination and selection, it identifies an optimum solution. In some respects, evolutionary simulations can be said to replace design, since artists can use this software to breed new forms rather than specifically design them. At the same time, as Manuel de Landa points out, deliberate design is still a crucial component in the deployment of genetic algorithms – for the evolutionary results to be truly useful as visualization tools, the range of possible designs that the algorithm considers need to be expansive (so that all the possibilities cannot be considered in advance by the designer), surprising and qualitatively rich.[29]

Such technology raises important questions for design theory: is an invention, invented without the presence of a human inventor, really an invention? If so, who is the inventor/author (who is accountable if it goes wrong or causes unforeseen damage)? If the invention works and serves the purpose for which it was created, does it matter if we don't understand *how* it works? There are evolved designs, such as the evolved electronic circuits of Adrian Thompson, a researcher at the University of Sussex, that defy explanation, could not be reproduced in a simulation, and are described by their creator (or, rather, the by-standers overseeing the creation i.e. Thompson and his colleagues) as "bizarre, mysterious and unconventional."[30]

The work of a number of contemporary artists cross-breeding disciplines such as art, science, genetics, and technology raise similar questions about authorship, origins, intention and accountability. Natalie Jeremijenko, for example, is a "technoartist" and mechanical engineer at Yale University whose work illustrates how science and engineering can raise critical, aesthetic, political, and cultural awareness and whose technological/cultural artifacts solicit the active participation of their users in the formulation and articulation of such awareness. One such project was called "Sperm Economy", an installation of sperm boxes at Blasthaus, an alternative art space in San Francisco, to which visitors could contribute sperm which are then categorized and sorted by the same categories used by the California cryobank, including race, hair color, eye color, and height. Additional economic categories – such as consumption behavior and market demographics – were also added and the stored sperm were publicly displayed in nitrogen-cooled vats. Visitors could then select and blend specific characteristics of various men and these sperm "democracies", as they were called, were then auctioned off as anonymous human sperm, resulting in "a kind of do-it-yourself, primitive genetic-engi-

28 John Frazer, *An Evolutionary Architecture* (London: Architecture Association, 1995), p.103.

29 Manuel de Landa, Deleuze and the Use of the Genetic Algorithm in Architecture (2001). Available at: http://boo.mi2.hr/~ognjen/tekst/delanda2001.html.

30 Adrian Thompson, Paul Layzell, and Ricardo Salem Zebulum, "Explorations in Design Space: Unconventional Electronics Design Through Artificial Evolution," *IEEE Transactions on Evolutionary Computation 3*, no. 3 (1999):167–196. <http://www.cogs.susx.ac.uk/users/adrianth/cacm99/paper.html>.

neering experiment, which demonstrates and yet questions the ability to "choose" your own offspring."[31]

Another artist, Eduardo Kac, created a work called "Genesis" which he describes as a "transgenic artwork that explores the intricate relationship between biology, belief systems, information technology, dialogical interaction, ethics, and the Internet." Kac translated a line from the Bible's *Genesis* – "Let man have dominion over the fish of the sea and over the fowl of the air and over every living thing that moves upon the Earth." – into Morse code, and then represented the code's dot, dash, letter space, and word space as C, T, G, and A, respectively. Scientists assembled the resulting DNA sequence into a gene that they added to bacteria in a petri dish. Although the gene encoded a protein not normally found in nature, the bacteria making that protein seemed to grow normally. The living microbes were projected onto the walls of the room in "Genesis" while ambient music played, generated from DNA sequences. Whenever anybody clicked a button on Kac's website (www.ekac.org) an ultraviolet light, capable of mutating bacterial DNA, shined on the microbes. At the end of each showing of "Genesis", Kac's scientists re-analysed the added gene's DNA sequence and Kac translated it back into Morse code and then English. The original Bible verse thereby mutated — "fowl" became "foul", for example — and the book of indeterminate authorship *par excellence* was thus virally infected by gibberish.

A final example: "MEART – The Semi Living Artist" is a geographically detached, bio-cybernetic research and development project (developed and hosted by SymbioticA – The Art & Science Collaborative Research Lab, University of Western Australia) that explores aspects of creativity and artistry in the age of new biological technologies. The MEART web site describes the project as follows:

> MEART is an installation distributed between two (or more) locations in the world. Its "brain" consists of cultured nerve cells that grow and live in a neuro-engineering lab, in Georgia Institute of Technology, Atlanta, USA (Dr. Steve Potter's lab). Its "body" is a robotic drawing arm that is capable of producing two-dimensional drawings. The "brain" and the "body" will communicate in real time with each other for the duration of the exhibition.

Comprising a mix of 'wetware' (neurons from embryonic rat cortex grown over a "Multi Electrode Array"), 'hardware' (a robotic drawing arm), 'software' linking the wetware and the hardware, and using the Internet to overcome the geographical remoteness of its components, MEART suggests a future scenario in which "humans will create/grow/manufacture intuitive and creative "thinking entities" that could be intelligent and unpredictable beings. They may be created by humans for anthropocentric use, but as they will be creative and unpredictable they might not necessarily stay the way they were originally intended." The project's wet-ware/software/hardware hybrid is described as "a Semi-Living Artist" because it is made of both living and artificial components – part grown, part constructed – raising questions such as "What will happen when such a system starts to express qualities that are considered uniquely human aptitudes such as art? (…) What is creativity? What creates value in art? (…) What is it that makes a person a genius?" The MEART web site states:

> From an historical context, artists have always been concerned with imitating life and with giving life/animating qualities to non-living entities. Technology has also joined forces with art forms to create more sophisticated types of artificial life systems and "intelligent" machines. The uniqueness of MEART is the attempt to create an intelligent artificial/biological artist that has in itself the capability or potential to be creative. We are

31 See José van Dijck, After the "Two Cultures": Toward a "(Multi)cultural" Practice of Science Communication, Science Communication, Vol. 25 No. 2, December 2003 177–190.

> focusing on creating the artist rather than the artwork. MEART proposes to embody the fusion of biology and the machine – creativity emerging from a semi-living entity.[32]

Other questions arising from transgenic art (or the move from aesthetics to "genesthetics") include: What is involved in the shift from a traditional economy of art in imitation of nature, to one that subsumes or incorporates nature self-reflexively? What happens to the question of the artistic medium when the medium is alive? One way of looking at these issues, the participants propose, is to consider creativity along a spectrum, from a reductionist mechanical device, to an artistic genius (thus, ironically, the genius figure returns as the pinnacle of creative endeavour — although brought down to earth perhaps by sharing the same stage with the cultured neurons' attempts to link together diverse inputs and thereby show signs of very basic "learning" or "creativity").

Such conceptual work explores assumptions at the core of (Western) selfhood, concerning for example chance and authorship, biological parenthood and genetic manipulation, origin and reproduction, copy and authenticity. In *The Work of Art in the Age of Mechanical Reproduction,* Walter Benjamin describes what is at stake when mechanical reproduction strips an artefact of its aura of "authenticity":

> The authenticity of a thing is the essence of all that is transmissible from its beginning, ranging from its substantive duration to its testimony to the history which it has experienced. Since the historical testimony rests on the authenticity, the former, too, is jeopardized by reproduction when substantive duration ceases to matter. And what is really jeopardized when the historical testimony is affected is the authority of the object.[33]

We might ask whether "realities that emerge from handwork", to use Rilke's phrase[34], emerge from their algorithmic, digital, or combinatorial origins—or Jeremijenko's installation of sperm boxes—with any authenticity, authority – or indeed any capacity for historical testimony. Or is it more likely, as Whitelaw argues, that the drive of a-life art towards emergent excess and autonomy will ultimately lead to a point of dissolution:

> Any system capable of autonomous ongoing emergence could move outside the bounds of its host system, across domains. A work of a-life art that succeeds might be conceptual or cultural as much as robotic or computational; it might be imperceptible, subsisting within and across existing structures but changing, adapting itself and them. There is no reason why it should stay in the gallery or in the computer. If the coevolutionary processes observed in biological life are any indication, emergent a-life would sustain itself in processes that span strata of media, culture, technology, and biology. […] Thus if a-life art were to fulfil its desire for excess, it would cease to be identifiable (and functional) as art. It would be unbounded and unintentional, an adaptive pattern indistinguishable from the wider dynamics of its environment.[35]

Artists and scientists each claim to seek truth, in its different manifestations or expressions, and thereby discover new mysteries to explore further. Reductive thinking, critical analysis, inspiration, poetry, innovation – each form of practice marshals its own set of diverse inputs

32 http://www.fishandchips.uwa.edu.au/project.html.

33 Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction" trans. Harry Zohn in *Illuminations* (London: Fontana, 1992), p.215.

34 Rainer Maria Rilke in a letter (1903) to Lou Andreas-Salomé wrote: "Somehow I too must come to make things; not plastic, but written things—realities that emerge from handwork. Somehow I too must discover the smallest basic element, the cell of my art, the tangible, immaterial means of representation for everything…" Quoted in "Introduction," *Rainer Maria Rilke, New Poems: The Other Part,* trans. Edward Snow (1908; reprint, New York: North Point Press, 1998), ix.

35 Whitelaw (2004), p. 228.

to see connections where none were perceived previously. The many convergences taking place today (in what may, without undue exaggeration, be termed the era of *post-authorship*) – between biotech and art, for example, or interdisciplinarity and complexity – belong to a wider crossing of cultural, national, and political boundaries, all of which contribute, as Klein argues, to reversing "the differentiating, classificatory dynamic of modernity and increasing hybridization of cultural categories, identities, and previous certainties. […] All cultural categories, identities, and certainties have undergone de-differentiation, de-insulation, and hybridization. All boundaries are at risk."[36] Since there are as a result a growing number of problems without a discipline, this skill in *seeing connections* – a skill that fuses creative and critical modes of inquiry (or curiosity) – will become increasingly important. Philosophers such as Wittgenstein — whose work stages or frames an artistic *performance* of philosophical problems – sought "just that understanding which consists in 'seeing connections'".[37] He described Freud's work admiringly as comprising "all excellent similes."[38]and said something similar of his own work in philosophy: "What I invent are new *similes*."[39] In the domain of the cognitive sciences, attempts to plot the basic cognitive processes and structures that give rise to creativity in all its forms have identified "conceptual combination" as a process highly conducive to creativity. This comprises juxtaposing two or more concepts together to create a new conceptual whole with unforeseen, emergent properties[40]. The philosophical dialogue can be said to operate in a similar manner.

One way to re-conceive the role of authorship across disciplines while steering clear of the dual cul-de-sacs of the Romantic conception of author-as-creator and the author as absence (or, worse, as deceased pseudo-deity), may be to pursue a practice-based model of cultural and scientific production in which a pragmatic account of authorship investigates a range of associated labour, creative and commercial considerations. Within such a collaborative mode of cultural/scientific production, the specific creative, expressive and artistic input of the various agencies working together on a project (and their individual contributions to the project's 'style') can thereby be analysed, alongside the socio-cultural practices of contemporary media culture that help shape the reception of the work. While it is clear that the modern author concept (as solitary creator of original representations) increasingly fails to accommodate contemporary authoring practices, Western educational, industrial and legislative institutions continue to promote a largely outmoded concept of authorship at the expense of other possibilities, thereby colluding with commercial interests to impose strict (and increasingly narrow) borders on our creative horizons. Fortunately, creativity – both the human and "post-human" varieties – will generally find a way around such narrow-mindedness.

36 Klein (2004), p.8.

37 Ludwig Wittgenstein (1953), *Philosophical Investigations*. (Oxford: Blackwell), #122, p.49e.

38 Ray Monk (1990), *Ludwig Wittgenstein: The Duty of Genius* (New York: Penguin), p. 357. Monk is quoting from "Wittgenstein's Lectures" by G. E. Moore.

39 Wittgenstein, *Culture and Value*, p. 19e. Italics in original.

40 See, for example, Thomas B. Ward, Steven M. Smith, and Jyotsna Vaid, "Conceptual Structures and Processes in Creative Thought," in *Creative Thought: An Investigation of Conceptual Processes and Structures*, ed. Thomas B. Ward, Steven M. Smith and Jyotsna Vaid (Washington D.C.: American Psychological Association, 1997).