

PYLON

“Andy Gracie: Symbiotic Circuits”

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monsters

During the 1990s technology and biology seemed to become ever more tightly entwined. The Human Genome Project promised to reveal our innermost code, while Big Science demonstrated its ability to manipulate those codes in other species, creating genetically modified plants and animals. Tissue culture technology advanced; in 1995 American researchers showed a living mouse with a human ear growing on its back. Though unrelated scientifically to genetic engineering, the monster mouse carried the same message, of the increasing power of technoscience to manipulate the very substance of life. Many artists repoded, and continue to respond, to this nexus of the born and the made. Patricia Piccinini's 1997 Protein Lattice series used the ear-mouse to reflect on humanity, materiality and ethics in the face of modern science [1]. The Tissue Culture and Art Project lead a more recent trend, for artists to use bio/tech materials themselves, creating provocative monsters like the Worry Dolls from living tissue [2]. The cyborg, another form of bio/tech hybrid, also has a long history in the media arts; Stelarc has been using technology to probe and extend the boundaries of his own body for many years [3].

This work forms a minor tradition in recent new media art - a tradition of bio/tech monsters, hybrids and chimera. Miscegenation - the archaic taboo on inter-racial breeding - is revived here in a kind of inverted form, as such work exploits our immediate, affective response - our intimate revulsion - as a trigger for reflection. The transgressive thrill of mixing bio and tech is a recurring theme, and while cyborg art is now relatively old, it maintains its visceral effect because it accesses a primal psychic mechanism of identity-formation. It challenges the boundaries that we construct to establish our separation from the "outside" world, and maintain our identity. This is me: that is not me. This is human: that is mouse. Artists use this effect as a tactical hook, but by focusing on the cyborg or monster, work like that of Stelarc, Piccinini or TC&A can have a kind of renormalising effect. The monster is an age-old device for concentrating and objectifying anxiety: confining it, naming it, and restoring the boundaries of identity. As long as the chimera is objectified, it remains safely over there. It's the monster: I'm the human.

living (in) systems

In the late 1960s, art practice began to come to grips with the emergence of post-industrial capitalism, a social order characterised by increasing connectivity and interdependence. Influenced in part by the emerging field of cybernetics, artists turned to the figure of the system - a dynamic, real-time, abstract network of causally intertwined entities and forces. Like related approaches of conceptual and process art, systems art marks a shift away from the object: in 1968 theorist Jack Burnham declared that "we are now in transition from an object-oriented to a systems-oriented culture"; in a "systems aesthetic," "the artist ... consider[s] goals, boundaries, structure, input, output and related activity inside and outside the system." [4]

Hans Haacke's Condensation Cube (1963-64) is a beautiful example, a system with no moving parts: a sealed perspex box, containing a small amount of water [5]. The cube creates a boundary, a surface, on which the immanent, everyday dynamics of air, heat, water and gravity play out - literally, condense. Droplets form slowly inside the cube, patterning its surface with their own emergent dynamics, coalescing into rivulets. (<http://socialfiction.org/img/haacke.jpg>) The resulting form is a strong sculptural object but more importantly, and inescapably, it refers us to immanent and otherwise imperceptible material dynamics. It intervenes lightly, focusing our attention, only to turn it outwards again, diffuse it. As Burnham says, it deals with "the larger problem of boundary concepts" [4, p.32]

Haacke's later works embraced living elements, directing our attention to ecological systems by intervening in them directly: his Rhine Water Purification Tank (1972) transformed filthy river water into a suitable habitat for a large pool of goldfish [6]. (http://greenmuseum.org/c/ecovention/sect2/haacke_rhine.jpg). A year earlier, Helen Mayer Harrison and Newton Harrison exhibited Survival Piece No. 2: Notations on the Ecosystem of the Western Salt Works (with the inclusion of Brine Shrimp). This work is a simple but very robust ecosystem, a series of large shallow pools filled with *Dunaliella* algae and brine shrimp. The interaction between these organisms changes the salinity of the water, which in turn changes the colour of the algae; a dynamic living system throws off a visual, sculptural byproduct [7]. (http://www.greenmuseum.org/c/ecovention/sect2/harrison_brine.jpg). As Craig Adcock writes, the work reveals "basic patterns of nature ... basic ecological interdependencies"; Harrison says "those kinds of understandings can cause a revolution in values. ... One of the problems we all confront today ... is that our values are not changing fast enough in the face of new information."

Gracie's work reflects the concerns of the chimera tradition, contemplating technologised life, or living technology. However its great strength is that it does so through the methodology of systems art. It breaks open the monstrous figure and reveals it to be not a thing but a process, a coupling, a coming-together, a co-negotiation. Others, such as Ken Rinaldo, have explored similar systems, bringing living and non-living elements into intimate contact [8]. Rinaldo's work seeks to exemplify a benign symbiosis between biology and technology. In his *Delicate Balance* (1995) a Siamese fighting fish (Betta Splendons) swims in a small, bubble-like tank, balanced on a suspended cable. Movement sensors trigger the tank and its counterweights to move to and fro along the cable; the fish's range of motion is radically extended - it becomes a benign (and apparently happy) cyborg [9]. In *Mediated Encounters* (1998) four fish control two rotating robot arms, arranged so that the tanks pass close enough for the fish to see and interact with each other, if they choose; here technology facilitates movement, but also enforces non-destructive interactions between the fish.

symbiosis and the lifeworld

Symbiosis, as conventionally used, refers to a harmonious or mutually beneficial relationship between living things. We have become used to using the term more broadly as well, to describe relationships in and between other types of systems. The ideal that Rinaldo's work pursues, of the "sustainable melding" of technology with biology, reflects this notion of symbiosis. However symbiosis is more strange and complex than this usage suggests, and that strangeness offers a way to understand the significance of Gracie's work, and what makes it different to other bio/tech hybrids.



Symbiosis comes from the Greek roots *syn* ("with") and *bio* ("life"); literally, "life with life". In its broadest biological usage it refers to any close ecological relationship between living things. Symbiosis can be broken down further according to relationship types: mutualism, where both organisms benefit; comensalism, where one benefits and the other is unaffected; and parasitism, where one benefits at the expense of the

other. The same continuum extends to amensalism, where one organism is harmed and the other unaffected, and competition- where both species are adversely affected. What's more, symbiotic interactions are variable and specific: the African oxpecker bird was thought until recently to live in a mutualistic

symbiosis, feeding on the insects infesting elephants and buffalo. However the birds also prevent wounds on their hosts from healing, in order to feed on their blood [10]. Mutualism shades into parasitism. Gracie explores this continuum: the dynamic networks of real ecological relations operate not in pursuit of some overarching "harmony," but locally, specifically, functionally. Gracie's work plays out the externalised character of ecological relations; his bio/robotics illustrate what is machinic, systematic, about all ecologies: networks of functional connection.

Anthropomorphism - the tendency to project human perspective and subjectivity onto other life forms - is impossible to shed, but it's worth a try. The animals in a symbiotic relationship share a physical environment, but not an understanding or perception of that environment. The oxpecker's world is not congruent with the elephant's world, not least because each is part of the other's environment. The elephant is, for the oxpecker, a source of insects, earwax and occasionally blood, and an elevated place to roost; the oxpecker is, for the elephant, perhaps a few less insects and the occasional sting on the shoulders. Jakob von Uexküll used the term Umwelt or "lifeworld" to describe this sense of the specificity of the world for a particular organism [11]. The lifeworld isn't a barrier - it doesn't prevent connections - rather in contact with other lifeworlds it shapes a range of possible connections, a set of latent circuits, points of overlap and contact.

hybrid circuits

Gracie's work often creates real circuits across multiple lifeworlds. In *Fish, Plant, Rack* (2004), a robot listens to the electrical discharges of an elephant fish, gradually "learning" to interpret them as instructions for actions, including the maintenance of plants in a hydroponic system. Images from the robot's on-board camera are relayed to the fish. None of the actors recognises the other, at least on our terms; each acts on its own limited input: fish - electrical impulses - robot - nutrients - plant - video - fish. For the robot, the fish is a signal, a stream of clicks



and pulses; for the fish, the plants are a video image. Yet like the oxpecker and the elephant, a real connection occurs, a circuit is formed. There's a dystopian pathos in the slowly flailing robot, the hapless, hydroponic plants, and the mediated network that links them. But also something more mysterious, a complex that finds a way to function. Each actor becomes a part in a new whole. As Gracie writes, "we believe" that each is unaware of its role - but

what do we mean by "aware", here?

In Fish, Plant, Rack and other works, Gracie wires together organic and inorganic systems through different channels, coupling unlike parts together. We think of communication in human, social terms: symmetrical, conscious, face to face, like with like. In Small Work for Robot and Insects (2002-3) a robot interprets cricket sounds and responds with light, movement and sound of its own; the crickets (who knows?) respond, perhaps inflecting their calls; the robot listens and dances again. Another circuit that transduces, or converts, signals from sound to light and movement, and back to sound. Not face to face, whole to whole, but more sideways, lateral, part to part; again some unknowable circuit emerges.

Gracie calls the parts "subroutines" - a term from computer programming used to describe a module of code within a larger program. The subroutines here are nested, like Russian dolls: the crickets' call routine connects to the robot's listen; the robot's dance connects to the crickets' vision and movement sensors. But then the crickets and robot are themselves subroutines of the whole system, a new circuit, with its own dynamics, where each element pushes the other into an altered state.

That new whole is loosely joined, here, just so we can appreciate its parts, but that isn't always the case. Symbiosis is now recognised in biology as a significant force of evolutionary change. The cells of all animals and plants show traces of a symbiotic merger between ancient bacteria whose circuits became so tightly coupled that they literally incorporated each other. Biologist Lyn Margulis argues that all evolved life is fundamentally shaped by symbiosis, that complex organisms like ourselves are in a sense the product of a negotiated relationship between billions of co-functioning individuals [12]. Symbiosis is transformative, a product (and producer) of coevolution; not just life with life, but life adapting to, responding to, exploiting, inhabiting and incorporating itself. Not couples, but networks and collectives traversed by feedback spirals, arms races and emergent byproducts.

Gracie's work pursues this flux actively; in Autoinducer_Ph-1 (Cross Cultural Chemistry) Gracie and collaborator Brian Lee Yung Rowe plug digital, simulated bacteria into the existing symbiotic network spanning the water fern Azolla, the cyanobacteria Anabaena, and their human use in agriculture as organic rice



fertilizer. Gracie "teases" the water plant and the algae into new equilibria, as the digital bacteria manipulate the culturing of their biological counterparts, and in turn their symbiosis. Yet if this is evolution, it has none of the sense of purpose or improvement often associated with the concept. Neither algae, fern, rice or digital bacterial are

getting "better": this change is more prospective, as the network explores a newly available space of possibility. Autoinducer resonates strongly with the Harrisons' Survival Piece #2, a work that helped found the genre of ecological art; but the contrasts are more informative. The Harrisons, searching for the bare essentials, a self-contained unit of survival, focused on a single symbiotic couple; Autoinducer creates a sprawling hybrid, a complex network that is far from "natural," and whose connections inevitably draw us all in. The ancient agricultural technique and the computer simulating bacteria are both manifestations of human exploitation and manipulation of our host ecology; this isn't a lament for nature lost, though, but an ambivalent exploration of our inescapably hybrid present.

media, matter, machines

Digital media often function as connectors in these post-ecologies, but instead of sending a message or a representation, they are concrete inputs and outputs; in Fish, Plant, Rack the actors are linked through video and sound. Media as data, stimulus, not form or content. These channels also offer crucial interface points for human observation (again, we are connected). Gracie's earlier Samplebot also demonstrates this, as its piezo-electric pickup transduces its physical environment into sound, and interprets that sound as instructions for its behaviour; the program here is only partly digital; it is largely embedded in, and comprised of, the robot's environment. This is a beautiful collapsing of inside and out, organism and environment.



Again it counters our habits of thought, whereby the organism is active, purposeful, motivated, and the environment is a passive space or resource: here the environment "programs" the organism, steering the robot to sample another patch of floor, another set of instructions. This notion of environment as shaping organisms, and providing information, relates to stigmergy, the process by which organisms

modify their environment in ways that in turn shape the behaviour of others; the best known examples are termite mounds and the pheremone trails created by ants. The boundaries between organism and environment break down in stigmergy; a termite colony is, as has frequently been observed, a superorganism; stigmergy shows how that whole incorporates its material surrounds into its operation.

Like earlier systems art, Gracie's works are often self-contained circuits, constructed networks that furl inwards. But like Haacke's Cube, Gracie's networks are zones where wider systems condense; they are implicit, but can also unfurl, leading us outwards. A fish tells a robot how to water a plant. Living and nonliving things connect, part to part, subroutine to subroutine, traversing boundaries of identity and species. I walk the dog with my iPod on; my behaviour changes, lost in music; the technology mediates my relation to the animal, and inflects our joined social interactions in the world. Philosophers Deleuze and Guattari call these dynamic networks "abstract machines": this is a walking human-iPod-dog machine. The dog herself is a crossbreed, the outcome of thousands of generations of domestication; the iPod itself a corporate commercial vehicle, a bundle of advertising messages held together with integrated circuits and most likely assembled by exploited labour. Follow the connections outwards as far as you like; Gracie's work alerts us to the knot, the nexus. It's a kind of systems poetry: poetry because that form too works by condensation, compressing the world into a few lines.

Finally Gracie's work shows us something that cannot be contained in the new media tradition of the cyborg monster: an unbounded, latent, emergent agency that crosses (all) systems, that passes through and between us and the material continuum we inhabit. That agency is both more monstrous, and more wonderful, than our habitual concepts of self and other, organism and environment. It is not local and internal, but distributed and external, embedded in the environment. Agents are not independent but interlinked, and not like the consenting adults of the social realm, but through partial, contingent, concrete channels of input and output. Agents don't recognise each other, but selectively and adaptively mis-recognise; nonetheless they become inextricably, functionally, coupled.

Hostprods, Gracie writes, "is an entity that wonders at the universe." Wonder seems an appropriate response, in the face of these networked agencies. Like those networks, wonder leads us from the known to the unknown, and from the concrete and specific, to the immanent and omnipresent. It doesn't signal a lack of understanding, or an incapacity to act. Rather it is as Gracie writes a stance, a receptive mode, and a way of approaching unthinkable complexity and connectivity without reducing or bounding it. As a mode of understanding it seems increasingly necessary.

1. Patricia Piccinini, artist's statement on Protein Lattice (1997). Available: <http://www.patriciapiccinini.net/pp/plt.htm>
2. See for example Oron Catts & Ionat Zurr, "Growing Semi-Living Sculptures," *Leonardo* 35(4) (August 2002) 365-370. Also available: <http://www.tca.uwa.edu.au/publication/tcleonardo.pdf>
3. See <http://stelarc.va.com.au/>
4. Jack Burnham, "Systems Esthetics" *Artforum* 7(1) (September 1968), 31-32.
5. See for example Slought Foundation, "Framing (Haacke's Condensation Cube)" (2004). Available: <http://www.slought.org/content/11208/>
6. See for example Sue Spaid, *Ecovention: Current Art to Transform Ecologies* (Cincinnati: Contemporary Arts Center, 2002). Available online: <http://greenmuseum.org/c/ecovemention/sect2.html>
7. See Craig Adcock, "Conversational Drift: Helen Mayer Harrison and Newton Harrison," *Art Journal* 51(2) (Summer 1992), 35-45; and Sue Spaid (op cit).
8. See <http://kenrinaldo.com>
9. P.D Quick, "The Emergence of A-life: Interview with Kenneth E. Rinaldo," *Switch #3* (1996). Available online: http://switch.sjsu.edu/nextswitch/switch_engine/front/front.php?artc=207
10. See for example Paul Weeks, "Red-billed oxpeckers: vampires or tickbirds" *Behavioral Ecology* 11(2) (2000), 154-160.
11. See for example John Deeley, "Umwelt" *SEMIOTICA* 134(1) (2001), 125-135. Also available online: <http://www.ut.ee/SOSE/deely.htm>
12. Lyn Margulis, *Symbiotic Planet: A New Look at Evolution* (London: Weidenfeld & Nicolson, 1998) 33-49.

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