

Lea

LEONARDO ELECTRONIC ALMANAC

VOL 17 NO 1 A collection of articles, reviews and opinion pieces that discuss and analyze the complexity of mixing things together as a process that is not necessarily undertaken in an orderly and organized manner. Wide open opportunity to discuss issues in interdisciplinary education; art, science and technology interactions; personal artistic practices; history of re-combinatory practices; hybridizations between old and new media; cultural creolization; curatorial studies and more.

Contributions from

Frieder Nake, Stelarc, Paul Catanese

and other important cultural operators.

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W V 2 H

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NEXUS OF ART AND SCIENCE

The Centre for Computational Neuroscience and Robotics at University of Sussex

by

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MULTIPLE HETEROGENEITIES

The phrase ‘Artificial Life art’² is deceiving. It sounds as though it labels such a specialist niche that one would expect to find a high level of homogeneity behind it. There is homogeneity, but to a very limited extent only, in the sense that Artificial Life art, as part of Artificial Life, relies on a broad range of biology-inspired synthetic processes. Artificial Life artworks otherwise come in a widely heterogeneous multiplicity of forms. They may come as musical, visual or multi-media productions, as artefacts, installations or interactive man-machine performances, and belong non-exclusively to the soft (virtual), hard (robotic), or wet (chemically-produced) categories. The diversity is such that art historian Ingeborg Reichle and critical art theorist Mitchell Whitelaw have both felt the necessity to categorize Artificial Life art (and neither included

A B S T R A C T

The author explores the relationships between science and art that have developed at the Centre for Computational Neuroscience and Robotics (CCNR) of the University of Sussex, which harbours an internationally renowned, leading research group in Artificial Life, Cognitive Science and Evolutionary Robotics. The aim is to establish whether and how interdisciplinary art-science practices at CCNR may lead to novel forms of knowledge production. Using fieldwork material as well as bibliographic and web resources, it showcases a number of initiatives and realizations. It also examines how individual researchers may understand, conceptualize, and justify, their experience and practice at the art-science junction in Artificial Life. This paper derives from the author’s PhD research project, of which a main focus has been to investigate interdisciplinary practices in the field of Artificial Life, which cross over the ‘two cultures’ divide. Artificial Life art [1] is a predominant case of such interdisciplinarity crossover in the field of Artificial Life in general, and in the Sussex research group in particular.

Artificial Life music in the scope of their inquiry) prior to discussing it. Reichle identifies “three tendencies in media art which utilizes technologies of artificial life sciences in very different ways”, while Whitelaw presents the practice of Artificial Life art “through a simple typology based on four of its prominent techniques and tendencies”. With such similar sorting criteria, we could have expected them to come up with parallel typologies. Yet although they overlap, they do not converge.³

I will follow neither. I do not come to Artificial Life art from an art studies perspective but from a science and technology studies perspective, and my overall aim is to question how interdisciplinary practices at CCNR, crossing over science and art (and technology,

and philosophy), are attempting to establish novel forms of knowledge production. I have thus chosen to organize my inquiry into the art-science nexus of CCNR around another, more productive for my purpose, set of categories, transversal to those of both Reichle and Whitelaw: artists’ motives. Since Artificial Life art is foremost Artificial Life, it is worth asking what distinguishes it from non-artistic Artificial Life realizations. It is, in many cases, the lack of constraint from scientifically accepted empirical data. But my fieldwork perception has been that, more fundamentally, the distinction tends to be located in the authors’ motives – a view supported by Artificial Life artist Ken Rinaldo:

“Artificial life artworks could be considered as a subgroup of artificial life research in that most

artists are more concerned with the creation of an aesthetic as opposed to testing theoretical biology. Which is not to say that the techniques utilised by artists do not result in real artificial life, or that artificial life researchers cannot find a visual or behavioral aesthetic in their research. Still, motivations often differ between the two groups.”⁴

And the range of artists' motives reveals a deeper heterogeneity, hidden behind the more perceptible heterogeneity of forms. My plan is certainly not to investigate the full spectrum of possible motives for doing Artificial Life art that can exist at CCNR. Motives hardly ever come in isolation but are rather intertwined, and can be implicit as much as explicit. I will concentrate on motives that I find most relevant to the goal of my inquiry, and they fall into two broad categories. One motive is critical questioning; art motivated by critical thinking in the conceptual art vein is more likely to re-think existing forms of knowledge production than, for instance, art primarily motivated by such first-degree fascination as some Artificial Life scientists experience through their creations. Another motive is art as research method; a driving motive for interdisciplinary projects that involve artistic research methods is to investigate possibilities of novel knowledge production practices. But before I start exploring empirically these two broad categories of motives, I will survey yet another order of heterogeneity in the art and science nexus of CCNR, that of the sites where Artificial Life art is produced and performed by CCNR collaborators. It will add yet another dimension to the multiple diversity of Artificial Life art and highlight some of its crossbreeding potential. It will also broaden the location of my enquiry to encompass a myriad of connected nodes in the environment of CCNR. I will call this configuration the 'Sussex neighbourhood.'⁵

A THICKLY NETWORKED CONFIGURATION

The Sussex Artificial Life group organised the fourth ECAL conference in 1997, and although it was customary to have arts exhibits of sorts at Artificial Life conferences, mostly with participants displaying their realisations on the side of the sessions, ECAL 1997 went further: it was the first Artificial Life conference to involve the actual curation of an exhibition of art-science collaborations, Like Life, sponsored by the Arts Council England. Australian performance artist Stelarc, known for his provocative explorations of human body-machine interfaces, was invited as a keynote speaker. This led to his doing a residency with COGS/CCNR in early 1998, initiating a series of artist-in-residence internships. There is no special provision for providing artists-in-residence at CCNR with financial support, in the form of a stipend or otherwise. But as members of CCNR, they have some office space, access to computers, to the Robotic Lab, to the Creative Systems Lab, and more generally to all the facilities of the university. They are welcome to sit on courses, participate in reading groups, organise seminars, etc.

For resident artists, a major benefit seems to be the stimulating confrontation with perspectives different from their own. Paul Brown, artist-in-residence since 2000 and visiting professor since 2005, says that he used to be very much into the abstract computationalist paradigm but CCNR has converted him to embodiment. Australian computer artist Jon McCormack, who was in residence at CCNR for a couple of months in 2001, remembers that the variety of the population was both amazing and exciting⁶; he himself shared an office with a biologist doing research on bees' trails and enjoyed the interaction. Norwegian visual artist Sol Sneltdt, whose fascination with brain dynamics and the flux of mind states led her to meet professor of neuroscience and co-director of CCNR Michael O'Shea, writes:

“O'Shea bravely invited me to become an intern at the Centre for Computational Neuroscience and Robotics (CCNR) at the University of Sussex. During this time O'Shea would answer my zillion questions and arrange for Tom Smith⁷ and me to carry out computational experiments that resulted in a pilot and a plan for visualization of brain activity.”⁸

Overall, what is on offer is an enabling interdisciplinary environment, for the artists to appropriate and eventually to develop into collaborative projects. British conceptual artist Anna Dumitriu, artist-in-residence since January 2007, has given an exemplary illustration of such an appropriation, leading to project development, when taking stock in her blog of the two years she had already spent at CCNR:

“It's a long time since that first Life and Mind seminar I attended and a steep learning curve. I've audited many courses including: Artificial Life, Non Symbolic Artificial Intelligence, Object Oriented Programming and Generative Creativity. I've organised many events on and off campus including 'Forms of Life' at Lighthouse in Brighton. As well as attending a huge number of seminar groups and lectures including The History of Cognitive Science, Allergic, e-Intentionality, COGS and of course Life and Mind, who I created an art event for [..]. I've also made some great friends and am working on some fascinating projects [..].”⁹

The result is undeniable in terms of collaborative projects that have secured substantial grant awards from public funding bodies. Sneltdt and O'Shea's collaboration led to their successful application in 2003 under the first round of Art and Science Research Fellowships programme run jointly by the Arts Council England and the Arts and Humanities Research Council. Anthropologist James Leach, who had the role of 'attached observer' to the programme,

has insisted on its experimental nature, and observed that all of the nine projects selected for reporting in the art-science journal Leonardo at the end of the first round of fellowships¹⁰, among them Sneltdt and O'Shea's Mindscape project, “were long-term intense collaborations in which directions and possibilities emerged as a vital part of the process. They were genuine 'research' projects.”¹¹ The Mindscape project pre-dated the introduction of the fellowships programme, but the award allowed Sneltdt and O'Shea to develop and refine their plan, and to assemble an interdisciplinary team of neuroscientists, computer scientists and artists. For Sneltdt in particular, the award meant that she “could devote [her]self to full-time work in the up-to-date space [they] had established in the CCNR laboratory.”¹²

Another major funded collaboration was the international, highly interdisciplinary DrawBots project on computational creativity, that ran between 2005 and 2008 on an AHRC grant in excess of £300,000.00. DrawBots was brought about by Brown's close and long-lasting upstream collaboration with scientists and philosophers at CCNR and COGS.¹³ On a smaller scale so far, Dumitriu's collaboration with philosopher Blay Whitby and neuroscientist Luc Berthouze has led in 2009 to the “Emergence of Consciousness” project, funded by Arts Council England.

Artist-in-residence internships are one component only of the institutional backbone nurturing Artificial Life art at Sussex. The traditional route of research degrees is open to art-science projects. This was for instance the case with generative musician Alice Eldridge, who graduated from the EASY (Evolutionary and Adaptive

Systems) masters' programme run by CCNR in 2002. Adaptive music systems were the topic of her masters dissertation (comprising both text and sound tracks)¹⁴ and she went on to do a DPhil at CCNR, entitled "Collaborating with the Behaving Machine: Simple Adaptive Dynamical Systems for Generative and Interactive Music". Another example is Sam Woolf, whose EASY dissertation in 1999 was "An interactive installation artwork: The Sound Gallery", a work of Artificial Life art that made use of reconfigurable hardware technology to achieve interactive and adaptive behaviour. Woolf went on to do a DPhil in Interactive Art, which involved Artificial Life ideas and techniques, in the Sussex school of Informatics; one of his supervisors was a member of the Artificial Life group. Woolf and Eldridge both followed the EASY masters' programme before pursuing their doctoral studies. Their individual cases are corroborating some findings of the project "Interdisciplinarity and Society: A Critical Comparative Study", led by Andrew Barry, Georgina Born and Marilyn Strathern between 2004 and 2006. Their case study of art-science at University of California Irvine (UCI) and its masters in Arts, Computation and Engineering (ACE) showed that interdisciplinary degrees at masters' level, which accommodate students with artistic and creative profiles alongside scientific and engineering profiles, are a key component for an inventive and productive university-based art-science.¹⁵ Like the ACE masters' degree, the EASY MSc is interdisciplinary; and although scientific and engineering profiles are largely predominant on the programme, it attracts a healthy minority of artistic and creative profiles. In Woolf's year only, two other dissertations, out of a total of twenty or so, were on artistic topics. A quick survey of EASY dissertations between 1999 and 2005 shows that the proportion of topics falling within the arts and entertainment (gaming, edutainment, etc) categories is about 10%.¹⁶

Another important component of the institutional backbone sustaining Artificial Life art at Sussex is the Creative Systems Lab, a structure set up in 2003 within the school of Informatics to encourage projects at the intersection of art, science and technology. It serves as a forum for researchers and students, many of whom were members of CCNR and COGS, interested in using computers for creative processes and practices. In 2007 it started offering a MSc in Creative Systems. The curriculum and targeted audience are comparable to that of Irvine's ACE graduate programme. The Creative Systems Lab was an initiative of musician and computer scientist Andrew Gartland-Jones¹⁷, who "rapidly decided Sussex was his home" when he embarked in 2001 on a DPhil "on the application of adaptive computing techniques to algorithmic composition and generative music."¹⁸ When he looked for a supervisor, it was not out of chance that Gartland-Jones contacted one of the founders and leaders of the Sussex Artificial Life group: the latter has a background in music and strong connections with the world of generative music.

Music is indeed an important dimension of Artificial Life art in the Sussex neighbourhood. Gartland-Jones was instrumental in convincing the University management that they needed a new interdisciplinary degree crossing over art and science, and in setting up a pioneering undergraduate degree in Music Informatics as a collaboration between the Music department and the school of Informatics. The degree was successfully launched in 2003 and has been running since. Its present convener is a member of the Creative Systems Lab, and teaches on the MSc in Creative Systems. Such interactions should be fertile grounds for the development of interdisciplinary projects at the intersection of Artificial Life and music, as well as for the development of collaborations between artistic forms and currents that do not easily mix. An indicator that new research possibilities may emerge through these

interactions is the recently set up interdisciplinary music/sound research seminar series, InterMus, aimed at "all those with an interest in research on music and sound", be they from Informatics, Psychology, Music, Media and Film, Neuroscience, Creative Systems, Engineering, Mathematics, Physics, Acoustics, or other disciplines. Launched in May 2009 by two members of the Music Informatics group, it is advertised through the InterMus mailing list, but invitations are also circulated through various regular CCNR's mailing lists, showing the interest of the Artificial Life research group for InterMus. Indeed, the second term of InterMus seminars, which has only just started as I am writing, opened with a talk by a member of the Artificial Life group; while the second of the two seminars in the first term, held in June 2009, featured two presentations, one by a member of the Creative Systems Lab, the other one involving CCNR current artist-in-residence Anna Dumitriu.¹⁹

Gartland-Jones did not just actively participate in the development of an institutional framework for art-science projects. Outside academia, he collaborated with three other postgraduate students at Sussex University (all three were members of the Creative Systems Lab; one was researching the application and possibilities of Artificial Life in sound synthesis and real time performance and one was doing research on the scientific side of Artificial Life; the last of these students was Sam Woolf who I mentioned earlier; two of them are still at Sussex as of November 2009) to set up Blip:

"[...] a forum that would bring together artists and scientists whose practice involved artificial creativity, interactivity, generative and procedural processes, and artificial life. Basically, our idea was to invite people whose work we were interested in to come and speak in Brighton. We also decided to hold the events in city centre bars and show work

*by local artists and so they became a unique hybrid of a talk, a show and a night out."*²⁰

Blip was a successful idea. Between 2002 and 2006, it organised more than thirty-five presentations, exhibitions and gigs, as well as four annual Big Blip festivals. The first one was one day long, the second was two days long, and the 2005 and 2006 festivals lasted for a week. The last one had over two thousand visitors.

Although Blip proved quite resilient, the disadvantage of voluntary sites is often their volatility. In 2007 and 2008 Blip's activities were limited to participating in the first two editions of Loop, Brighton newly launched digital arts festival. By then, the initial group of volunteers had dwindled to two, who were increasingly absorbed into other projects. Blip has now gone dormant, "unplugged but not junked, and we'd be happy to talk to anybody who has the time and energy to power it up once more."²¹ But multiplicity can make up for volatility. Other non-academic voluntary sites propitious to Artificial Life art-science practices have appeared in, or come to intersect with, the Sussex neighbourhood. A software developer who is an ex-COGS student has set up Brighton Robotics, advertised through CCNR's mailing lists as "Brighton's only non-academic robotics and A-life enthusiasts group". Some Sussex ALifers have now joined her group, and have actively collaborated to a recent music/arts performance evening, entitled "Robot Takeover."²²

"Robot Takeover" was a fundraising event for the benefit of another organisation, BuildBrighton, which presents itself as "Brighton's hackerspace – a collective of like minded people who love to build stuff with electronics."²³ BuildBrighton is a not-for-profit community providing a space "for hacking, equipment, machinery and tools" to its members, as well as tutorials and workshops for the public.²⁴ The young woman who founded Brighton Robotics is among the seven

core members, as well as a recent EASY graduate, freelance web-developer, who “is very interested in the potential of artificial life and bio-inspired computing.”

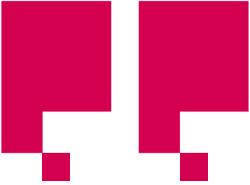
²⁵ The latter gave a talk at the first ever social event organised by hackUS, University of Sussex Informatics society. The evening program also featured a repeat of a talk given at “Robot Takeover”, “Do you want a robot lover?” by COGS philosopher and ethicist Blay Whitby, and a live interactive music generation performance. ²⁶

Another non-institutional site intervening both in academic and non-academic settings is Dumitriu’s Institute of Unnecessary Research, which she founded in 2005. The Institute of Unnecessary Research starts from the premise that artists are innovators, and as soon as a new piece of technology or a new medium

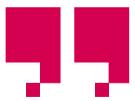
becomes available, they want to experiment with it and push boundaries. This is how they define themselves:

“The IUR is a hub for researchers and artists working experimentally and deeply engaged with their specific research areas. We present our research through performative and experiential methods, engaging the public and new audiences.”

Their research translates into performance events that can take place in a variety of settings: art galleries in the fine arts tradition, but also universities, festivals, businesses, participatory workshops, etc. ²⁷ Connections between the Institute of Unnecessary Research and the Sussex neighbourhood are multiple. One



As well as different styles of artistic expressions, these sites may also lend themselves better than academic sites to open-ended inquiry into the interdisciplinary collaborative process itself.



connection is through its Director Dumitriu. Another connection is through its Head of Ethics Blay Whitby, long-time member of COGS staff. The last connection is through its Head of Robotics Paul Granjon, low-tech ironic robotic artist whom many in the Sussex Artificial Life group became acquainted with through “Art, Body, Embodiment”, an interdisciplinary symposium held over two days at University of Sussex in March 2005. ²⁸

A material example of the role that non-academic, voluntary sites of art-science practice can play for university-based art-science is the recruitment of Anna Dumitriu by the Sussex Artificial Life research group: she first came across members of CCNR through Blip (in her own words: “[...] a great forum for artists, scientists and members of the public interested in new forms of art that explore[d] generative and procedural processes, interaction, emergence and artificial life, and I’ve spent many a wonderful evening at events they’ve put on [...] as far as I’m concerned Blip [were] doing some of the most interesting art stuff that happens in Brighton”). Her residency at CCNR was set up in the first place by one of Blip organisers. ²⁹

A doctoral student of the school of Informatics, who is an interactive new media artist member of the Creative Systems Lab, pointed me towards a less obvious way into which such sites may play a valuable role for university-based art-science. She felt that the institutional environment of academia had an impact on her as an artist. In her opinion, she was much more relaxed and informal in her relationships to other artists out of the PhD context. This led to different forms of collaborative productions. Different sites are socially governed by different rules of conduct, tacit ones no less binding than explicit ones. And as certain sites encourage types of social behaviours that would feel inappropriate in other settings, my interlocutor’s experience was that this had an impact on the art she produced; she was not the same artist in and out of the institutional context. Non-academic voluntary sites may thus offer a useful complementarity to academic institutional sites as they may motivate different styles of artistic expression.

As well as different styles of artistic expressions, these sites may also lend themselves better than academic

sites to open-ended inquiry into the interdisciplinary collaborative process itself, thanks to an environment that, being overall much less constrained by accountability than academia, is under less pressure to produce well-defined prior research goals and accompanying assessment criteria. Open-ended inquiry into the interdisciplinary collaborative process itself was for instance an important outcome of a project organised by Blip. The initial idea was “to encourage local artists and scientists to collaboratively develop an installation” for Big Blip 04. ³⁰ I would like to present this case in some detail, because it anticipates my examination of critical questioning and knowledge production as motives for engaging in Artificial Life artistic projects.

The Blip organizers solicited local communities for “enthusiastic, open-minded artists, scientists and technologists who could make a commitment to working collaboratively for up to twelve weeks. [...] Participants had to have some free time during the day to attend workshops at the University of Sussex and the University of Brighton. We offered training, equipment and support.” ³¹ The project was supported by Blip, by CCNR and by the Centre for Research and Development in the Faculty of Arts and Architecture at University of Brighton (about which more is below), as well as by the Arts Council England. It involved two CCNR Artificial Life researchers and three artists, who together acted as co-ordinators and mentors, two Brighton-based artists, and three graduate students (scientists and engineers), from the EASY MSc programme. It resulted in two installations. The first, corresponding to the initial brief, was an interactive installation involving eight low-tech custom-made robots in a display cabinet, entitled *There Does Not, in Fact, Appear to Be a Plan*. Clutch, the second, was an unforeseen last minute product of the collaborative process. *There Does Not, in Fact, Appear to Be a Plan* did not fulfil the artistic goals that the team had

set out to achieve since most of the project allocated time was spent getting the robots up and running, and Clutch was formed as a desperate one-sided effort by the unhappy artists to make the whole enterprise work as art, to the dismay of the scientists and engineers in the group: “Clutch was a visually arresting piece: the display cabinet was taken apart, the robots switched off and the velcro covered foam cubes scattered on the floor. This installation was filmed for display on a monitor at the Big Blip 04 and then the participants reconstructed *There Does Not, in Fact, Appear to Be a Plan.*”³²

A joint paper recounting the whole enterprise was presented at the AISB (Artificial Intelligence and the Simulation of Behaviour) 2005 convention. The paper aimed “to explore the relationship between scientific enquiry and artistic practice and stimulate new critical debate about this emerging cultural hybrid.”³³ The structure adopted in its writing was itself part of the authors’ inquiry into the interdisciplinary creative process they had experienced, as it weaved third-person factual accounts of the project and design of the robot technology with first-person subjective comments by the participants on the collaborative process and its end result, a narrative structure which for the authors “echoes the tension between practical constraints and creative ideas that was very evident in the collaborative project and that is at the heart of much artistic and scientific practice.”³⁴ Clutch, the emergent (in the complex systems sense of unpredictable) outcome of the project, which initially affronted the scientists as they took it as a rejection of their hard work and personal involvement in the project, was meant by the artists “not to belittle what was achieved in that project; rather, Clutch was meant as a commentary about the working process between two different practices.”³⁵ It is interesting that although the project failed in its initial goal, it achieved other things. Despite technical difficulties, problems of com-

munication across cultures, frictions between individuals, the initial anger and incomprehension provoked by Clutch in some of the scientists, disagreements on the set-up of the installations, the participants all ended up with a positive outlook on the project. For instance, one of the scientists commented:

*“I initially found the artists’ satisfaction with Clutch utterly beyond my comprehension. Upon reflection though I think the video has significance in that it captures aspects of the scientific process that don’t make it to scientific journals. Firstly, the murky issue of results that don’t conform with a desired hypothesis. Secondly, the lonely romance of the road to implementation.”*³⁶

The positive outlook could have been for the show only, but it seems that the participants remained convinced by the value of their original concept, and they have kept the collaboration going, to try and bring their idea of an interactive installation to fruition. An important conclusion reached by one of the mentoring artists was that the project was “a good case study for further discussion surrounding the pros and cons of collaboration. The question today is no longer ‘why collaborate?’ but rather ‘how might one collaborate?’”; for him, despite a common goal that could have ordered and directed the development of the collaboration, the project had instead explored collaborative practice “as a dynamic learning system with multiple feedback loops.”³⁷

To conclude on the case of the Blip project, I have just shown that the main two motives for engaging in collaborative art-science projects, which the reflexive inquiry into the project draws special attention to, are (1) critical questioning and (2) investigating the interdisciplinary creative process as such. These are two major stepping stones towards attempting to establish novel forms of knowledge production practices.

The case of the Blip project illustrates that voluntary sites at the margins of academia (this particular project brought together academic and non-academic resources) may be nurturing grounds for interdisciplinary practices possessing a real autonomy from their parent disciplines, both in terms of their objects and of their modes of knowledge production.

My survey of the sites available for the production and performance of Artificial Life art in the Sussex neighbourhood reveals their heterogeneous profusion – some short-lived, some more permanent, some institutionally driven, some voluntary and grass-root, some purely academic, some in the professional artistic circuit, some part-amateur – and the more or less transient configurations that they associate into. Such a profusion may appear bewildering, especially in its extra-institutional richness, unless we remember that the University of Sussex is located in the city of Brighton. Artificial Life at University of Sussex is embedded in a very dynamic and experimental city in the artistic domain.³⁸ It benefits from the proximity of University of Brighton Faculty of Arts and Architecture, which became in 2005 the Centre for Excellence in Teaching and Learning through Design (CETLD), and its world-class Centre for Research and Development (CRD).³⁹ For instance, Sneltvedt, ex-CCNR artist-in-residence, has since become member of staff at CRD; Dumitriu is a research student and visiting tutor at CRD, where she has been pursuing a part-time Fine Art PhD since before she joined CCNR; and another CRD staff member, Sue Gollifer, course leader for the MA in Digital Media Arts among other things, who like Paul Brown is a veteran of digital art, was a Blip adviser. Gollifer has since become adviser to Dumitriu’s Institute of Unnecessary Research.⁴⁰ Despite the ubiquitous discourse on the delocalisation of cyberspace and the ‘global village’, Real Life localisation still clearly matters.

We cannot expect all the sites of Artificial Life art production in the Sussex neighbourhood to give rise uniformly to interdisciplinary practices that could lead to novel forms of knowledge production. But their profusion reveals a thickness of networking between art, science and technology that marks a dense, durable and continuous engagement, as well as the will to sustain it and keep it as diverse as possible. A conclusion of Barry et al.’s analysis of the art-science case in the “Interdisciplinarity and Society” project, reached by comparing university-based art-science (especially University of California Irvine) and project-based commissioning (British programmes), was that “it is the scale, duration and continuity of university-based art-science that affords ambition.”⁴¹ Artificial Life art in the Sussex neighbourhood, ramifying around a strong and durable academic base, presents such a configuration.

I have a last couple of comments in relation to Barry et al.’s art-science case study. First, they point that university-based art-science is fragile (largely due, in their view, to the inadequacy of academic research evaluation procedures).⁴² I think that the thickness of networking characterising Artificial Life art at Sussex introduces a measure of robustness in the face of precariousness. It ensures that when some links are severed (for funding shortages, job redundancy, etc), the overall network is more likely to resist. The second comment concerns the approach Barry et al. have adopted. By comparing non-British university-based art-science and British program-based commissioning, they leave in the shadow the question of the relationships between these two forms of institutional art-science.⁴³ My own findings in the Sussex case reveal that there are, as may be expected, connections between the two. University-based art-science seems well positioned when competing for awards by funding programmes, thanks to the budding of projects upstream of funding opportunities, as was the case for

the Mindscape and DrawBots projects. What is more, the kind of informal and plastic networking encouraged by an enabling environment such as the Sussex neighbourhood may be instrumental in bringing about institutionally funded longer-term research projects. I will now turn to exploring empirically two broad categories of motives (ideal types really since they hardly ever come in isolation) driving Artificial Life art in the Sussex neighbourhood: critical questioning and knowledge production.

ART AS CRITICAL ENGAGEMENT

Critical questioning is in my experience, frequently put forward by artists themselves as a driver for their work, as well as identified by scientists (those I have questioned at the very least) as the number one motive, beside personal development, for having artists around. That critical questioning and personal development should be the most popular motives among Sussex Artificial Life scientists for engaging with art is hardly surprising: critical questioning cultivates reflexivity, a cardinal virtue of the Sussex Artificial Life research group⁴⁴, which as such is bound to be an important element of personal development in the eyes of its community.

Sussex Artificial Life scientists did not feel that collaborating with artists was a career booster. For Phil Husbands, a founding and leading member of the Sussex Artificial Life group, a major factor in his choice of coming to Sussex in the first place was the tolerance that the University was showing towards this type of interdisciplinarity, while it tended to be frowned upon elsewhere. When interviewed by Dumitriu for her blog, O'Shea, another founding professor of CCNR, had a similar appreciation of the impact on a scientist's career of engaging in artistic interdisciplinary projects. He told her that although he really enjoyed collaborat-

ing with artists, "he felt that his collaborations haven't really benefited his career, which is more reliant on publishing papers etc, but since he has published so many now he is freer to follow his interests in both art and science [...]"⁴⁵

Returning to critical questioning as a motive for bringing in, and doing, art in the Sussex neighbourhood, I have found that although art as critical engagement could target many different issues, science in its many dimensions was a major topic. This particular strand of questioning addresses issues as diverse as the aims, objects and nature of science, scientific method, or public engagement in science. It is very much a science and technology studies kind of questioning, but pursued through vehicles (art and performance), attitudes (playfulness and irony predominantly), and a general methodology (practice of the very science under questioning), that we in science and technology studies are usually unfamiliar, and possibly uncomfortable, with. I will focus on Anna Dumitriu's case to illustrate my point. Not only is she exemplary of this brand of critical engagement with science, but her involvement with CCNR is enduring. At the time of my writing, she has been artist-in-residence there for three years already, and looks as if she intends to continue.

To start with, despite the versatility of her skills, she positions herself deliberately as an artist, not as a hybrid of artist and scientist, and taking this stance is for her a critical move. Although she admits to belonging through her working practices to the narrow band at the blurred intersection of art, science and philosophy, she believes that art, like science and philosophy, is not autonomous or value free but culturally situated. As a result, both artistic and scientific products are situated in culturally specific contexts of conception, and she feels that displacing artefacts from their contexts of conception (for instance, exhibiting into a scientific context an artefact primarily conceived as an art piece,

even if it involves interesting science; or presenting as art a product of scientific experimentation) raises problematic issues that should not be dismissed. Her critical engagement with science works at multiple levels, many of which embodied in the Institute of Unnecessary Research (IUR) that she founded in 2005. She is very clear that the term 'unnecessary' in the name 'Institute of Unnecessary Research' is a meaningful choice and that it should not be equated with 'useless'. 'Unnecessary' in the IUR's name aims at questioning the objects of science: "it's about the nature of epistemology, going beyond the boundaries of what is normally researched."⁴⁶ This is a strong theme running throughout Dumitriu's work. For years now, a major research interest of hers has been 'normal flora', the bacteria and moulds that humans co-exist with, but which are classified neither as pathogens nor as beneficial.⁴⁷ As such, and despite constituting around eight kilograms of an average adult human body weight, being more numerous on one's finger "than there are people in the world" and making up around 99% of total bacteria, they are highly under-researched because "considered to be of no medical or commercial interest", i.e. of no scientific interest. For Dumitriu, one of their interests is precisely that "epistemologically they are important, they're about where we draw the line in terms of research."⁴⁸

'Unnecessary' research at the IUR also questions the politics of science from a public engagement perspective, as well as from a feminist critique perspective. The feminist critique in Dumitriu's work is apparent in her deliberate juxtaposing of traditional feminine crafts like embroidery, crochet, baking, porcelain painting, with scientific skills seen as more typically masculine, such as cutting edge biology laboratory techniques and digital media mastery.⁴⁹ The domestic ordinary is apparent in her subject matter of predilection ("Normal flora are kind of domestic and everyday"⁵⁰), which she makes a point of collecting

from her private domestic environment (a lab coat in her closet, her chairs, her bed sheets, her cutlery) as it links her work "to the traditional women's domain."⁵¹ At an event organised by the IUR at University of Sussex in May 2007, Dumitriu was wearing a lab coat on which she had stitched in whitework embroidery⁵² the microscopic images resulting from a culture of normal flora that she had sampled from the same lab coat, and she was enrolling visitors to help her crochet a bedspread inspired by a screen-projected light microscopy image of normal flora from her own bed. As was the case on this occasion, Dumitriu's use of traditional crafts is not only feminist critique but also a way to engage the audience in her performances:

*"[...] especially in non-gallery spaces, like hospital foyers and schools: they are a way of allowing the audience to enter complex ideas in a manner that creates dialogue rather than closing it down. There is a kind of respect amongst the public for skills like embroidery and that allows a way into my work."*⁵³

In terms of public engagement, one of the main aims of the IUR is to disseminate "innovative research, [...] through participatory art and performance, to diverse audiences."⁵⁴ For members of the IUR, their alternative approach encapsulates an explicit critique of traditional approaches to the public understanding of science that encourage scientists to explain their work to the public in a one way mode of communication. This tradition underestimates in their view the public's awareness that hidden agendas can lurk behind information dissemination. By contrast,

"The IUR engages with the very nature of what constitutes scientific research through artistic practice, directly widening participation in those debates as well as bringing about a deeper appreciation of contemporary scientific research. [...] The IUR demonstrates that we all can and should debate about

*the direction of research, its ethical implications, and what exactly science should be.”*⁵⁵

Germane to the critique of traditional approaches to public understanding of science, is the critique of science communication in general. Unsurprisingly, Dumitriu denies the objectivity of science and questions its narratives:

“The whole way scientific experiments are written up, in the passive tense, reinforces this illusion of objectivity. I want to write up my research in the first person (or third person, in terms of collaboration).”

Collaborative exchange is a strong theme of her work. Her artworks and performances, the events in which organisation she involves herself into, are overwhelmingly the result of interdisciplinary collaborations. But her interest in networking through communication, through exchange of information, goes way beyond interdisciplinary human networks, to include the non-human. Part of her work on normal flora bacteria could be depicted as ‘conceptual art meets Actor Network Theory’. Starting from the premise that the billions of different bacteria that we have in and on our bodies spend their time communicating messages between themselves, exchanging bits of DNA, talking to our cells, talking to the bacteria of the people around us, etc, her “big hubris” as she describes it is about getting the bacteria to exchange information with humans and computers. This has led to the ‘Cybernetic Bacteria’ project, “an ongoing transdisciplinary investigation [that] brings together an artist, a philosopher, a microbiologist, an artificial life programmer and an interactive media specialist, to investigate the relationship of the emerging science of bacterial communication to our own digital communications networks”. The first artwork in the series, by Dumitriu, involved humans communicating with bacteria as if

they were themselves bacteria; the second, ‘Cybernetic Bacteria 2.0’, combines in real time “the chemical communication of bacteria and the live data streams of our own digital networks [...] to generate a brand new artificial life form.”⁵⁶

On yet another level, Dumitriu’s fundamentally collaborative and interdisciplinary approach to research (I deliberately use the term research without epithet, as I would be seriously hard put to neatly categorize it as scientific, artistic, or otherwise) represents a critical engagement with scientific methodology:

*“[...] Suzi Gablik writes about ‘connective aesthetics’, working in this dialogical way, as an inherently feminine methodology. I do think that scientific methodology is something that was for the most part decided without women’s participation [...] As self-organising, adaptive and evolving, I have a conceptual basis for something that is a completely natural way of working for me: to feed off people, and then to give back. I feel strongly that it’s not about the artist using the scientist or vice-versa to their own ends. The end is not pre-determined and it should benefit everyone.”*⁵⁷

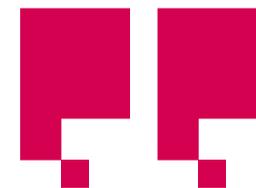
Her idea of what art-science collaborations ought to be is close to that defended by the Blip project participants in their post-project reflexive analysis, where they draw an analogy between the collaborative process and the biological phenomenon of symbiosis, to denounce parasitic collaborations, “[...] for example, scientists using artists as ‘decorators’ or ‘illustrators’ of their scientific project, or conversely artists using scientists as technicians to implement their ideas”, in favour of “mutualism, where both entities require each other for survival”.⁵⁸

My research project has shown that the critical questioning of research methods is something Artificial

Life scientists in the Sussex neighbourhood regularly engage in, for instance through philosophical debates around the epistemological status of simulations, or through the enactive research programme. Occasionally, some of them pursue this reflexive examination through artistic rather than philosophical engagement, even though they may have no formal artistic background. At a public art-science event co-organised by Dumitriu for the Life and Mind seminar group in October 2008, a ccnr PhD student was exhibiting a piece called Visualization, the computer visualization of a simulated Artificial Life agent with which the audience could interact by modifying three of its parameters – introducing a perturbation, altering the agent’s simulated environment, changing the visualizing method – with no knowledge of what the agent was

observers can try to pick apart what this model is. Meanwhile the Agent and environment is itself changing in ways outside of our control. Each way of viewing the system, each perspective, provides different insights into what it is that is happening. But what is truly part of the system and what is an artefact of our perspective? In this sense, this installation represents the scientific process.”

When I questioned the author on how he had come up with the idea for this piece, he explained that his PhD project was investigating theories about minimal environmental conditions necessary for the apparition of life processes. As part of his research, he had built a model and programmed it. Running the resulting simulation, he found that it was doing what he wanted



We can explore the assumptions that constitute a particular framework, or bounding container, but we cannot escape the fact that we always operate within some framework: it is an epistemic necessity.



meant to represent. The following notice accompanied the installation:

“Adapted from a scientific work-in-progress, this installation demonstrates the challenge of investigating and visualizing complex systems. By perturbing the Agent, by manipulating the environment of the Agent or by changing the method of visualization,

it to do, but as it did so, he was confronted with the realisation: Now what? What did it mean? How to interpret the results? And it had taken him a couple of weeks, tweaking the parameters of the simulation like he was allowing us to do with the installation, to start figuring it out. What I found striking about this interactive installation was that it was bringing to attention many layers of issues related to representa-

tion and interpretation in science, with an efficiency and an immediacy that a paper in the philosophy of science tradition could never rival. The strength of the message was reinforced by the fact that, like most of the participants, I fiddled with the simulation before I read the notice.

In Artificial Life art, the critical questioning of visual representation addresses art as well as science. Dumitriu's laboratory-based work on normal flora is part of her PhD in Fine Art research, "A Practice-Based Investigation into the Relationship of Normal Flora Microbiology to Philosophical Notions of the Sublime", whose aim is to "interrogate the possibilities of scientific imagery as art – its allegorical, expressive, and social character" and to bring her findings to bear on the conceptualization of the sublime in aesthetic theory.⁵⁹ The question of visual representation in both art and science, addressed through the issue of containment, is central to the work of Jon McCormack who was artist-in-residence at CCNR for a short period in 2001. This aspect of McCormack's work has been analysed by Jon Bird, Artificial Life researcher at CCNR and co-founder of Blip, in an essay entitled "Containing reality: Epistemological issues in generative art and science".⁶⁰ Bird explains that McCormack "is concerned with 'the conceptual and metaphorical meaning of the bounding container in visual culture, particularly in relation to concepts of the natural and the real' [...] McCormack focuses on the constraints that framing devices have on images, or representations, that they display", in art as well as in science.⁶¹ But Bird goes further, and builds from there to reach the conclusion that:

"We can explore the assumptions that constitute a particular framework, or bounding container, but we cannot escape the fact that we always operate within some framework: it is an epistemic necessity. McCormack's work vividly illustrates how

*exploratory modelling in AL and generative art can increase our awareness of the influence of our prejudicial nature and how these prejudices are embodied in the artificial systems we construct."*⁶²

Bird here defends the role of art in Artificial Life, as a critical instrument for reflecting on the black boxing of unwarranted assumptions and cultural biases in the models designed by Artificial Life researchers, be they scientists, artists, or both.

ART AS RESEARCH METHOD

I have already pointed out that critical questioning, and investigating the interdisciplinary creative process as such, were both stepping stones towards attempting to establish novel forms of knowledge producing practices. They were also the two motives for engaging in collaborative art-science projects, which the reflexive study of the Blip project that I presented earlier insisted on. The study report concluded that:

*"Arts-science collaborations [...] have the potential to be mutually beneficial to both artists and scientists, enabling them to generate and explore more creative opportunities than would be possible alone."*⁶³

Bringing art into Artificial Life as a research method that can be complementary to and mutually beneficial with science, is a motive widely shared in the Sussex neighbourhood, by scientists and artists alike. This is often the case, for instance, when collaborative projects spring from the encounter of individual researchers of different sensibilities who find they are interested in converging research issues. A CCNR researcher, co-founder and co-organizer of Blip, explained that what attracted him to collaborating with artists was that some strands in art, in generative art

especially, were asking the same questions that he was asking as an Artificial Life scientist, or very similar. Another CCNR researcher said that on some occasions he had experienced big connections with artists, on big questions, which had led to the generation of new ideas. This is also, and paradigmatically, the case with researchers, whose training and skills enable them to bring both an artistic and a scientific perspective to their research projects – like Alice Eldridge, or Jon McCormack.⁶⁴ Beside his own investigation of the frame problem in visual culture (a problem common to artistic and scientific visual representations), McCormack has suggested a number of themes that are open to an artistic mode of research through generative processes, like "the role of subversion; mental models of understanding for the artist and audience; the computational sublime."⁶⁵ Let us illustrate the use of art as research method through a few projects into which members of the Sussex neighbourhood have got themselves involved.

DrawBots was one such project. This three-year interdisciplinary project, which brought together computer and cognitive scientists, philosophers, artists, and critical art theorists, had an array of objectives attached to it, combining those of individual researchers from different fields to those common to the group. The main overall goals were:

*"[...] the production of machine-created art and the exploration of whether it is possible to develop (minimally) creative artificial agents and the research has two, mutually dependent, contextual frameworks. One concerns methodologies for making an agent that has the potential for manifesting autonomous creative behaviour. The second concerns methodologies for recognising such behaviour. Another emphasis is attempting to place this work in an art historical context."*⁶⁶

This passage broadly delimits the part explicitly devoted to art as research in the DrawBots project. It was the production of machine-created art, of which an outcome would be a large-scale art installation of a group of DrawBots, inscribed in a methodological framework that drew on aesthetics and art theory for ideas about artistic autonomy, uniqueness of the experience of art, computational 'meta-media' as privileged artistic experimental vehicles, precedence of process over object, possibility of signature-free processes, assessment of artistic content, etc.

The passage also points at the interdependence of the scientific and artistic frameworks. Indeed, it is necessary to construct a continuous theoretical meta-frame (with for instance, on the one hand, the idea that an artwork can display creative autonomy, and on another hand, that creative autonomy is a hallmark of living systems) to underlay the two distinct contexts, one scientific and one artistic, that frame the research. Without this continuous meta-frame, the project would be inconsistent.⁶⁷ Dustin Stokes, a philosopher who specializes in philosophy of mind, cognitive science, and philosophy of art, collaborated on the construction of such a theoretical base for DrawBots, while a post-doc at CCNR over the period 2005–2007. In a paper entitled "Aesthetics and Cognitive Science" published in 2009, Stokes explores a general research strategy called 'expansionism', which rests on the two theses that:

*"First, the creation and consumption of art involves the exercise of the same cognitive capacities used to negotiate the environment and engage with conspecifics. [...] Second, expansionism suggests that these capacities are extended in novel, art-specific ways when engaging with artworks [...]."*⁶⁸

His exploration of expansionism highlights the mutual theoretical importance of aesthetics and cognitive

remains. There is considerable historical evidence that humans are inept at recognising new creative behaviours amongst themselves. [...] It is only recently that humans have been able to acknowledge creativity in other animals so how will they recognise creativity when it emerges from an alife agent?"⁷²

science, and leads him to defend the following conclusion:

*"Purely scientific accounts of cognition neglect cultural facts that figure importantly in the cognitive environment. Purely philosophical accounts of aesthetic experience neglect the contingencies of cognition and perception. This, finally, is the basic moral of expansionism: the explanatory goals and resources of both aesthetics and cognitive science should expand to include those of the other."*⁶⁹

Expansionism, as developed by Stokes into a general framework for interdisciplinary practices across aesthetics and cognitive science, is clearly an attempt at developing a theoretical framework for novel forms of knowledge producing practices.

To finish with DrawBots, the quoted passage outlining the project indicated that an art historical perspective was brought in alongside the theoretical and methodological contexts framing the research. In practice, the research was such organised that three inter-related interdisciplinary teams collaborated. The task of the 'Art and Science team' was to evolve a robot that could demonstrate creative drawing behaviour. That of the 'AI and Cognitive team' was to "provide a theoretical base to the project and examine its implications for the fields of AI, Alife, philosophy, creativity and cognition." That of the 'Art Theory team' was to "relate the project from the perspective of art history and critical theory".⁷⁰ When DrawBots was presented end 2007 at the MutaMorphosis: Challenging Arts and Sciences conference⁷¹, it was explained that:

"With 15 months of the project still remaining the team are cautiously optimistic that their goal of evolving minimally creative behaviour will be met. However the very significant problem of how to recognise and acknowledge such behaviour

This passage reveals how in the DrawBots project, where history was not itself the main focus of the research, historical research methods were integrated into an overall framework of interdisciplinary research. DrawBots is exemplary of interdisciplinary practices that bring together a large diversity of research intersections – between art, science, philosophy and history.

Another project, in which art participated as complementary research method to science in an attempt at developing "an interdisciplinary collaborative approach to problem solving"⁷³, was the EPSRC and AHRC-funded Interdisciplinary Research Cluster (IRC) "Designing physical artefacts from computational simulations and building computational simulations of physical systems-designing for the 21st century", set up by professor of computer science Mark d'Inverno and artist Jane Prophet.⁷⁴ It run for a year in 2005/2006 and is accounted for in a paper co-authored by d'Inverno, Prophet, and CCNR researcher Jon Bird who was an active member of the IRC.⁷⁵ The IRC followed from the experience of the Wellcome Trust-sponsored CELL project, a collaboration between Prophet and stem cell researcher Neil Theise aimed at discussing new theories of stem cell behaviour:

"Through Jane Prophet's background in ALife [...], the work of Mark d'Inverno in multi-agents systems [...] and, moreover, through collective and sustained inquiry, Neil Theise became familiar with the notion of self-organising agent systems. [...] It became clear to the CELL team that the most productive way to model stem cells in the adult human body was as a dynamic system of self-organising computational agents. [...] What no one could have predicted at the outset of the CELL project was the massive impact that the collaboration would have on all members. For example, it led Neil Theise to radically change the conceptual framework he

*uses for thinking about stem-cell behaviour, moving from his practice of looking at stained 2D slides to having a clear conceptual model of dynamic interaction and self-organisation."*⁷⁶

The aim of the IRC was "to further investigate the potential of interdisciplinary research especially in the context of agent-based and interactive systems in design"⁷⁷, in what cluster members characterize as a 'performative' approach, where they define 'performative' in the following manner:

*"The term 'performative' is applied to diverse activities, ranging from science to curation, and it is used to signify 'the constitution of meaning through an act or a certain practice' [...]"*⁷⁸

Their approach, very much a heuristic process, is labelled as 'performative' because "both the goals and solutions develop over time through an open-ended process of trial-and-error."⁷⁹ They argue in its defence that it may be "the only viable option when trying to design systems with even minimal agency which respond to the environment in which they are situated. This is because it is not often possible to define in advance all the significant parameters of interactive systems and their environments and consequently it is hard to predict the behaviour that will result from system-environment interactions."⁸⁰ In their view, all sorts of ill-defined complex systems fall into this category, like in the areas of "global warming, urbanisation, immigration and terrorism"⁸¹, hence the relevance of the 'performative' approach.

An outcome of the IRC was to produce a simulation prototype of Net Work, a proposed large scale interactive art installation in Herne Bay, UK, aimed at giving the public an understanding of self-organised processes.⁸² The production of the Net Work simulation was almost an accessory outcome of the IRC, as although the cluster had started with a general idea of the kind of issues they wanted to explore, there was no real focus or schedule, and after a while it was felt that "it would be best to actually build a physical artefact that had computational and generative elements."⁸³ An interesting point regarding the Net Work prototype, in relation to the thesis about non-modernity that I have developed in my doctoral thesis,

is that following Bird's suggestion, the IRC adopted the cybernetic model of Ashby's homeostat (Ashby, one of the historical figures of British cybernetics whose inheritance is reclaimed by the Sussex neighbourhood) to drive the prototype. There were good methodological reasons for doing so, but the authors have pointed that they had a conceptual reason as well. They quote science and technology studies scholar Alan Pickering, theorist of non-modernity, who has written about Ashby's homeostat as a device illustrative of the performative ontology whose idiom sees the world as "a lively place full of agency – not something static and dead, sitting around waiting to be represented, as the representational idiom suggests."⁸⁴ They thought that "[u]sing a homeostat control system is also appropriate because it is illustrative of the performative approach to problem solving."⁸⁵

How does the IRC's report generalise the importance of art for the 'performative' approach to design of agent-based interactive systems? The authors use the empirical evidence of artistic contributions to research in the cases of CELL and Net Work, to vindicate the position of digital artist and art theorist Simon Penny,⁸⁶ on the value of artistic methodologies for agent design:

"An artwork, in my analysis, does not didactically supply information, it invites the public to consider a range of possibilities, it encourages independent thinking. So building an interactive artwork requires more subtle interaction design than does a system whose output is entirely pragmatic, such as a bank automat. [...] I have emphasized the relevance of artistic methodologies to the design of social agent systems. Typically, artistic practice embraces an open ended experimental process which allows for expansive inventive thinking. Artistic practice emphasises the cultural specificity of any representational act, acknowledging that

meaning is established in the cultural environment of the interaction, not in the lab. It emphasises the embodied experience of the user. And it emphasises the critical importance of the 'interface', because the interface of the agent, like an artwork, is where communication finally succeeds or fails."⁸⁷

Akin to the IRC's 'performative' approach, the value of artistic 'performance as research' is defended by artist and computer scientist Alice Eldridge.⁸⁸ Her experiences of designing, and interacting with, generative systems for man-machine musical improvisation have led her to defend the view that embodied artistic performance deserves to be investigated as a valid alternative knowledge producing practice:

*"It seems possible that by playing with these systems in musical and other artistic ways, we may gain insights into their behavioural dynamics which evade us when we sit staring at the computer screen. If these insights led to the generation of testable hypotheses, we could begin to take seriously increasingly common propositions of 'performance as research'. There are things you can only learn about someone by dancing with them."*⁸⁹

The IRC's 'performative' approach, as well as the idea of performance-as-research presented by Eldridge, strongly resonates with the phenomenological strand of research, especially the enactive research program, which is a distinctive feature of the research conducted at CCNR.⁹⁰ "Emergence of consciousness", a recent all-Sussex collaboration between Dumitriu, philosopher Blay Whitby and neuroscientist Luc Berthouze, is an example of collaborative project based on performance-as-research that borrows explicitly from the theoretical framework of enactivism:

"The project draws together rigorous practice-based artistic methodologies and scientific

*research to attempt to investigate the notion of conscious experience from a philosophical point of view, inspired by perspectives of embodiment (Varela, Thomson and Rosch, 1992) and situatedness (Brooks, 1991) in evolutionary robotics and neural network learning systems. An outcome will be a new performance artwork using sensory and movement deprivation (e.g. blindfolds, physical restraints etc) and augmentation to reflect physical developments in the human body (from infancy to old age). It will create an embodied representation of how experience might be constructed, through physical interaction with the environment and other performers, and the emergence of shared beliefs."*⁹¹

This passage makes it clear that artistic performance-as-research intersects with the idea of first-person methodology, of phenomenological pragmatics, that some enactivists at CCNR call for.⁹²

Enactive Dialectics, an enactive video installation, is another performance-as-research project in the enactive framework. This resulted from the collaboration of Dumitriu with artists John Holder and Pia Tikka. I was first introduced to the latter's work when she gave a presentation of her doctoral research "Enactive Cinema: Simulatorium Eisensteinensis" at the "Between life + mind + art" event co-organised by Dumitriu for the Life and Mind seminar series in October 2008. Enactive Dialectics was presented in October/November 2009 in Katowice (Poland), as part of the second exhibition of the e-MobiLArt (European Mobile Lab for interactive media Artists) initiative:

"The project 'Enactive Dialectics' investigates human enactment within an environment through an embodied and situated approach. The work is inspired by the current interest in enactive cognitive sciences, which emerged from the autopoiesis

*theory of Francisco Varela and Humberto Maturana. The philosophical background also reflects Theodor Adorno's notion of 'Negative Dialectics'. The installation embodies the enactive approach, showing that human beings are inseparably connected to their environment."*⁹³

Dumitriu is basing new work involving locative technologies and bio-sensing on the same enactive theoretical framework⁹⁴ as part of a 3-year EPSRC-funded project, a collaboration between University of Sussex departments of Sociology and Informatics entitled "Supporting Shy Users in Pervasive Computing", started in October 2008.⁹⁵

Such projects underline the connection existing, in the Sussex neighbourhood, between performative artistic research and other interdisciplinary practices that cross over analytic philosophy of the mind, continental phenomenology, neuroscience, technology and sociology, widening further the interdisciplinary scope of the Sussex enactive research programme, which possesses the kind of disciplinary autonomy that can foster novel forms of knowledge producing practices.

MULTIPLE GENEALOGIES

To conclude on the art and science nexus in the Sussex neighbourhood, I would like to don the historian cap. The multiple heterogeneities (of forms, sites, motives) of Artificial Life art that I have experienced in the Sussex neighbourhood are congruent with Barry et al.'s conclusion regarding art-science in the "Interdisciplinarity and Society" project, that "[w]hile art-science is a practical, intentional category for artists, institutions and funding bodies, it forms part of a larger, heterogeneous space of overlapping disciplines thrown up at the intersection of the arts, sciences and technologies [...]"⁹⁶ In search for an analytical

handle on the art-science phenomenon, they propose to understand it as having its genesis "in the mutual interferences set up between three broad and related genealogies: 1) conceptual art and post-conceptual art, including performance, installation, public and activist art; 2) art and technology movements; and 3) certain developments and debates around the computational and bio sciences and technologies."⁹⁷ My analysis of Artificial Life art in the Sussex neighbourhood certainly supports the idea of interwoven genealogies, and the three isolated by Barry et al. are all present in my material. Likewise, it brings support to the claim that Artificial Life has older and more hybrid roots than its generally accepted history would have it, and gives weight to artist Paul Brown's suggestion that in the 1970s, himself and other pioneers of electronic arts were doing Artificial Life before it was 'invented.'⁹⁸ Only a hybrid history of Artificial Life, reaching further in time than the 1980s, further in space than North America, and weaving together a rich set of concurrent historical strands, can account for the diversity of Artificial Life in general, and for the multiple heterogeneities of Artificial Life art in particular.

Only such a hybrid history can explain why so many artistic movements, some antagonistic to others, are thus represented in Artificial Life. For instance, the genealogy linking Artificial Life art to Modernism can be traced back through early computer arts to the systems art movement and early 20th-century Constructivists like Kasimir Malevich.⁹⁹ The genealogy linking Artificial Life to post-modern conceptual art is multiple, as it follows the many negations that, according to Barry et al., Conceptualism has defined itself through – "negation of material objectivity and the primacy of the visual [...]; negation of art's commodity form [...]; and negation of the philosophy of art's autonomy [...]" which resulted from the generalised critical questioning of art "as object, as site and as social relation": these are all present in my case study

of Artificial Life art in the Sussex neighbourhood.¹⁰⁰ A hybrid history might also give a better grasp on the strand of Artificial Life art that intersects with the agenda of cognitive science on high level cognitive functions like creativity, by investigating such issues as the role played by the pioneering research program in creativity and cognition first set up in the 1970s in Great Britain by Ernest Edmonds, early computer artist in the constructivist tradition who, incidentally, collaborated to the DrawBots project.¹⁰¹ According to Brown:

“At the time PhD research opportunities were not available within mainstream art education, so several of the [Slade] EXP students [...] went on to pursue PhDs under Edmonds’s mentorship and were among the first visual arts students to achieve this award in the United Kingdom.”¹⁰²

Here is a historical strand that may provide a major connection between early generative computer art (part of which later developed into a facet of Artificial Life art) and the cognitive science inquiry into creativity. ■

REFERENCES AND NOTES

1. ‘Art in an Artificial Life research group’ would be more appropriate, as not all artworks and performances make actual use of Artificial Life methods, but I will go on using the phrase ‘Artificial Life art’ for the sake of convenience.
2. In this particular instance I use it in its proper sense, restricted to art that actually involves Artificial Life methods.
3. Ingeborg Reichle, *Art in the Age of Technoscience: Genetic Engineering, Robotics, and Artificial Life in Contemporary Art* (Wien: Springer-Verlag, 2009), 168. See also: Mitchell Whitelaw, *Metacreation: Art and artificial life* (Cambridge, London: The MIT Press, 2004), 20–21.
4. Ken Rinaldo, “Technology Recapitulates Phylogeny: Artificial Life Art,” Sixth Annual New York Digital Salon, *Leonardo* 31, no. 5 (1998): 374.
5. For a thorough discussion of the idea of ‘neighbourhood’ in defining the perimeter of a research community, see Christine Aicardi, *Harnessing non-modernity: a case study in Artificial Life*, PhD thesis, (London: UCL, 2010), 163–210.
6. It was especially so since at the time COGS had not yet been dismantled by University of Sussex management, and housed many biologists and psychologists; the population diversity shrunk significantly after COGS was split and its computer science component became Informatics. The dismantling of COGS has been unanimously lamented by all my informants who had been acquainted with the former COGS.
7. Tom Smith was then a DPhil student at CCNR, working on the evolvability of artificial neural networks for robot control.
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9. Anna Dumitriu’s blog, January 14, 2009, http://web.mac.com/annadumitriu/SOA/Blog/Entries/2009/1/14_Review_of_Past_two_years.html (accessed November 19, 2009).
10. They were part of a special section dedicated to the Art and Science Research Fellowships program in *Leonardo* 39, no. 5 (2006).
11. James Leach, “Extending Contexts, Making Possibilities: An Introduction to Evaluating the Projects,” Special Section: Arts and Science Research Fellowships – Arts Council England and Arts and Humanities Research Board, *Leonardo* 39, no. 5 (2006): 447.
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13. Another collaborative project Brown has collaborated to at CCNR is the historical project that gave rise to Phil Husbands, Owen Holland and Michael Wheeler, eds., *The Mechanical Mind in History*, (Cambridge, London: The MIT Press, 2008).
14. Music tracks and the full text of Alice Eldridge’s MSc dissertation are downloadable from the EASy publications pages, <http://www.informatics.sussex.ac.uk/research/groups/easy/publications/msctheses2002.html> (accessed November 24, 2009).
15. Andrew Barry, “Interdisciplinarity and Society: A Critical Comparative Study: Full Research Report,” in *ESRC End of Award Report*, RES-151-25-0042, (Swindon: ESRC, 2007), 30. See also: Andrew Barry, Georgina Born and Gisa Weszkalnys, “Logics of Interdisciplinarity,” *Economy and Society* 37, no. 1 (2008): 38–42.
16. EASy web site, University of Sussex, list of MSc theses, <http://www.informatics.sussex.ac.uk/research/groups/easy/publications/msctheses.html> (accessed November 27, 2009).
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18. Phil Husbands, Tribute, Memorial website, “In Memory of Andrew Gartland-Jones”, 2004: <http://www.atgj.org/drew/tributes.htm> (accessed November 19, 2009).
19. InterMus private archives, University of Sussex, announcement and programme, <https://lists.sussex.ac.uk/mailman/private/intermus/2009-May/000002.html>, and <https://lists.sussex.ac.uk/mailman/private/intermus/2009q4/000009.html> (accessed November 20, 2009).
20. Jon Bird, Guest Book, Memorial website, “In Memory of Andrew Gartland-Jones”, 2004: <http://www.atgj.org/drew/guestbook.php?start=30> (accessed November 25, 2009).
21. Blip website, “Blip Unplugged”, <http://www.blip.me.uk/> (accessed November 25, 2009).
22. Held on 30th October 2009, “Robot Takeover” was “featuring live performance coding music by TOPLAP, the 55th Flotilla (rum and bass and nautical dubstep with an (un)theremin!), interactive art, real robots, electronics demos, robot dancing and talks by Blay Whitby ‘Do you want a robot lover?’ and Seb Lee-Delisle” (extract from its advertisement on Facebook).
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24. BuildBrighton, subscription page, http://www.buildbrighton.com/wiki/Subscription_Information, (accessed November 25, 2009).
25. BuildBrighton, “The Community”, http://www.buildbrighton.com/wiki/The_Community, (accessed November 25, 2009).
26. *Informatics_alergic_list Digest* 57, no. 17, email message to author, November 24, 2009. The event took place on 27th November 2009.
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28. Centre for Research in Cognitive Science, University of Sussex, “ART, BODY, EMBODIMENT, A COGS Interdisciplinary Symposium, University of Sussex, March 14–15, 2005”, <http://www.sussex.ac.uk/cogs/1-4-3.html>, (accessed November 25, 2009).
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30. Jon Bird, Bill Bigge, Mike Blow, Richard Brown, Ed Clive, Rowena Easton, Tom Grimsey, Garvin Haslett, and Andy Webster, “There does not, in fact, appear to be a plan: A collaborative experiment in creative robotics,” in *Proceed-*

- ings of the Symposium on Robotics, Mechatronics and Animatronics in the Creative and Entertainment Industries and Arts, AISB'05: Social Intelligence and Interaction in Animals, Robots and Agents, ed. Tony Hirst and Ashley Green, 58 (Brighton: SSAISB, 2005).
31. Ibid., 59.
32. Ibid., 61.
33. Ibid., 58.
34. Ibid., 59.
35. Ibid., 63.
36. Ibid., 63.
37. Ibid., 62.
38. For instance, the Brighton Festival, running since 1966, is the 2nd largest arts festival in the UK after Edinburgh, while the Brighton Festival Fringe, running alongside the main Festival since 1967, is the 2nd largest fringe festival in the world, also behind Edinburgh; Brighton has by all means a long history of attracting artists;
39. The CETLD is a five-year partnership project between the Faculty of Arts and Architecture of the University of Brighton, the Royal College of Art, the Royal Institute of British Architects and the Victoria and Albert Museum, funded by the HEFCE (Higher Education Funding Council for England).
40. Research staff and research students webpages of CRD, University of Brighton, <http://artsresearch.brighton.ac.uk/> (accessed December 10, 2009). Anna Dumitriu's blog, "Replacing Humans with Robots", April 19, 2007, http://web.mac.com/annadumitriu/SOA/2007-2008/Entries/2007/4/19_Replacing_humans_with_robots.html (accessed December 10, 2009). Blip web site, <http://www.blip.me.uk/> (accessed December 10, 2009).
41. Andrew Barry, "Interdisciplinarity and Society: A Critical Comparative Study: Full Research Report," in *ESRC End of Award Report*, RES-151-25-0042, (Swindon: ESRC, 2007), 30. For further discussion of the inadequacy of academic research evaluation procedures, see Christine Aicardi, *Harnessing Non-modernity: A Case Study in Artificial Life*, PhD thesis, (London: UCL, 2010), 211–319.
42. Andrew Barry, "Interdisciplinarity and Society: A Critical Comparative Study: Full Research Report," *ESRC End of Award Report*, RES-151-25-0042, (Swindon: ESRC, 2007), 30.
43. Gisa Weszkalnys, "Mapping Interdisciplinarity: Report of the Survey Element of the project 'Interdisciplinarity and Society: A Critical Comparative Study' (ESRC Science in Society, 2004-06)" (2006), <http://www.geog.ox.ac.uk/research/technologies/projects/mapping-interdisciplinarity.pdf> (accessed May 20, 2010), 22: for university-based art-science, the selected case studies were the ACE program at UC Irvine and SymbioticA, a science-art lab at the University of Western Australia; for funding programmes, the selected case studies were the Arts Council England/AHRC Art and Science Fellowships programme and the Wellcome Trust Sciart programme.
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46. Alexandra M. Kokoli, "Normal Flora and the Bacterial Sublime: An Interview with Anna Dumitriu", in *n.paradoxa* 20 (2007): 10.
47. Ibid., 5.
48. Ibid., 5–6.
49. Ibid., 7–8.
50. Ibid., 5.
51. Ibid., 11.
52. Anna Dumitriu in *n.paradoxa* 20, (2007): 7–8: "In historical terms, around the time of the Enlightenment when the 'gentlemen scientists' were out and about calculating the age of the Earth and suchlike, the highest form of achievement for a woman was considered to be an aptitude for whitework embroidery. This is white on white embroidery and you can hardly see what you are stitching but these women would work with candlelight, straining their eyes, hunched over their embroidery hoops, corseted."
53. Alexandra M. Kokoli, "Normal Flora and the Bacterial Sublime: An Interview with Anna Dumitriu", in *n.paradoxa* 20 (2007): 7.
54. Blay Whitby and Anna Dumitriu, abstract, "The Institute of Unnecessary Research: public engagement in science through art and performance", in programme of 4th Annual Science and the Public Conference, *Science and the public: uncertain pasts, presents and futures*, University of Brighton, 13–14 June 2009, (2009): 52, http://www.bton.ac.uk/sass/research/conferences/Science_and_Public_abstracts.pdf (accessed December 14, 2009).
55. Ibid.
56. *Informatics_alergic_list Digest* 58, no. 5, email message to author, December 8, 2009. Anna Dumitriu, The Normal Flora project's web site, "Cybernetic Bacteria 2.0", http://web.mac.com/annadumitriu/NF/Cybernetic_Bacteria_2.0.html (accessed December 11, 2009).
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58. Jon Bird, Bill Bigge, Mike Blow, Richard Brown, Ed Clive, Rowena Easton, Tom Grimsey, Garvin Haslett, and Andy Webster, "There does not, in fact, appear to be a plan: A collaborative experiment in creative robotics," in *Proceedings of the Symposium on Robotics, Mechatronics and Animatronics in the Creative and Entertainment Industries and Arts, AISB'05: Social Intelligence and Interaction in Animals, Robots and Agents*, ed. Tony Hirst and Ashley Green, 65 (Brighton: SSAISB, 2005).
59. Alexandra M. Kokoli, "Normal Flora and the Bacterial Sublime: An Interview with Anna Dumitriu", in *n.paradoxa* 20 (2007): 6. *Informatics_alergic_list Digest* 58, no. 5, email message to author, December 8, 2009. Anna Dumitriu's research student profile at CRD, University of Brighton, <http://artsresearch.brighton.ac.uk/research/student/dumitriu> (accessed December 15, 2009)
60. Jon McCormack, Jon Bird, Alan Dorin, and Annemarie Jonson, *Impossible Nature: The art of Jon McCormack* (Victoria: Australian Centre for the Moving Image, 2004), 40–53.
61. Ibid., 41.
62. Ibid., 52.
63. Jon Bird, Bill Bigge, Mike Blow, Richard Brown, Ed Clive, Rowena Easton, Tom Grimsey, Garvin Haslett and Andy Webster, "There does not, in fact, appear to be a plan: A collaborative experiment in creative robotics," in *Proceedings of the Symposium on Robotics, Mechatronics and Animatronics in the Creative and Entertainment Industries and Arts, AISB'05: Social Intelligence and Interaction in Animals, Robots and Agents*, ed. Tony Hirst and Ashley Green, 65 (Brighton: SSAISB, 2005).
64. I have developed the idea of 'voluntary hybrid' to qualify such researchers who exhibit a form of 'inner' interdisciplinarity, in Christine Aicardi, *Harnessing non-modernity: a case study in Artificial Life*, PhD thesis, (London: UCL, 2010), 163–319.
65. Jon McCormack, Jon Bird, Alan Dorin and Annemarie Jonson, *Impossible Nature: The art of Jon McCormack* (Victoria: Australian Centre for the Moving Image, 2004), 74.
66. Paul Brown, Bill Bigge, Jon Bird, Phil Husbands, Martin Perris and Dustin Stokes, "The Drawbots," in *MutaMorphosis: Challenging Arts and Sciences Conference Proceedings* (2007), <http://mutamorphosis.wordpress.com/?s=drawbots> (accessed November 1, 2009).
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69. Ibid., 715, 727.
70. CCNR, University of Sussex, webpage of the DrawBots project, <http://www.informatics.sussex.ac.uk/research/groups/ccnr/research/creativity.html> (accessed January 20, 2010).
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87. Simon Penny, "Agents as Artworks and Agent Design as Artistic Practice," in *Human Cognition and Social Agent Technology*, ed. Kerstin Dautenhahn (Amsterdam: John Benjamins Publishing Company, 2000), 412.
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photograph Murat Germen,
Muta-morphosis #79, Istanbul,
150 x 85 cm, 2011, 7 editions + 2 AP,
courtesy of C.A.M. gallery.