

Collaborative Learning Ecologies: A novel pedagogy for fostering creativity across disciplines

A reflective dialogue with two resident craft-makers on their experience of working with science students at King's College London

Catherine Dunton



Kate is an art historian by training. She undertook doctoral and post-doctoral research and taught at the University of Essex before moving into an education development role, first at Brunel University then at the University of Essex. She joined King's in January 2015 as Research & Education Manager, brokering and supporting collaborations between King's and the arts and cultural sector. In this role, Kate has been able to pursue her commitment to creativity in Higher Education and develop her interests more specifically in arts-based learning across the disciplines, participatory research in a cultural collaborative context and the relationship between research and creative practice.

Quantum dots in glass, Struan Bourke (PhD student at King's College London) and Shelley James, Artist

Introduction

In autumn 2014, the Cultural Institute at King's College London in collaboration with the Crafts Council¹ launched *Parallel Practices*, an initiative which matched King's academics with resident craft-makers with the aim of fostering innovations in practice on both sides. Following the success of this pilot, a second phase of *Parallel Practices* was devised, this time with the focus primarily on student learning <http://www.craftscouncil.org.uk/what-we-do/parallel-practices>.

Dr Matthew Howard, a Lecturer in Informatics at King's who had taken part in the first phase of the Parallel Practices project, and his colleague, Dr Riccardo Sapienza, a Lecturer in Physics, were excited by the possibility of installing resident craft-makers in the Wheatstone Innovation Laboratory – a newly created maker space which they had filled with various tools and instruments including a 3D printer and a sewing machine. The idea was to create a vibrant, student-owned space outside the formal curriculum where students from the Faculty of Natural and Mathematical Sciences could experiment and play alongside peers in different departments and at different levels of study. The lab was named after Sir Charles Wheatstone, a Professor of Experimental Philosophy at King's in the Victorian Era. According to archival accounts, Wheatstone, a scientist and inventor known for his work in early telecommunications, was constantly making new devices and instruments. By embedding artistic makers with skills in traditional crafts, Matthew and Riccardo sought to recapture Wheatstone's creative and inventive spirit, giving their students the confidence to experiment and learn by making, as well as the opportunity to learn new skills that would otherwise be inaccessible to them in the formal teaching of traditional science and engineering disciplines.

Through a careful selection process overseen by the Crafts Council and the Cultural Institute at King's, two makers were appointed: John Grayson, who specialises in metalwork and automata, and Shelley James, who works in glass. Unusually, this residency blended two models; combining a workshop approach, where the makers would directly engage students in structured activities that might broadly support their subject-based learning, with a more traditional residency where the makers pursued their own work in the space thus allowing for more open-ended and curiosity-driven conversations and activities to emerge. As will be seen in the dialogue below, it was this reciprocal need for both the students and the makers to take something from the encounter, and the process of making and experimentation that lay at the heart of their shared inquiries, that provided the impetus for creativity and learning on both sides.

For John Grayson, the basis of his Parallel Practices residency was the Collaborative Automata Project. This explored the shared histories for the fields of Science and Art in 18th Century automata. During the project, some twenty students and staff collaborated on the making of a part-analogue part-digital automaton in celebration of Sir Charles Wheatstone in whose laboratory they were working. The automaton provided a vehicle for knowledge exchange. As John passed on his 'distinctly analogue' craft skills to students through a series of workshops, they, in return, 'enlightened' him, to the world of robotics. Three distinct phases occurred. The first two, led by John, focused on the micro engineering of metal mechanisms followed by the creation of enamelled decoration for the object. It was then decided that the finished automaton would be 'hidden' amongst a display of Wheatstone's scientific apparatus on display

in the main corridor of the King's Building at the university's Strand campus. Thus, in the third phase, John's co-collaborators took over, applying their robotics knowledge to find innovative technological solutions that would enable audiences to interact with the artefact once it was trapped behind the glass of the showcase. MSc students devised a motion sensor system that would detect people passing by in the corridor, bringing part of the automaton to life. A PhD student then devised a 'mime handle', an ingenious amalgam of hard and software that would allow the viewer to mimic the turning of a handle (the traditional method of powering an automaton), thus bringing the rest of the machine, in John's words, 'into a joyous blur of movement!' This would also serve to attract the attention of passers-by to the content of the case, generating awareness of this important display of Wheatstone's instruments.

Shelley began the residency with a series of basic technical workshops that allowed her to gauge the level and focus of student interest. As students began to suggest new approaches and ask difficult questions, a common approach to research emerged, as well as a shared fascination with light. As Shelley and the students looked for ways to share this common ground, Shelley began to experiment with the 3d printer, discovering that she could use 3d printed objects to cast perfectly accurate casts in optical glass. Together, Shelley and the students built hyperuniform patterns, 'whispering gallery' structures and models of light-emitting materials that can trap, direct and even amplify light. In Shelley's words, 'this digital innovation quite literally allowed us to shine a new light on the structures of the future'.

Both projects led to a number of unexpected outputs, including student-led public talks as part of the Utopia season running across King's, Somerset House and the Courtauld Institute, and an invitation to the makers, academics and students involved in the project to part-recreate the residency at the Digital Design Weekend held at the V&A in September 2016.

For the Co-Managers of this project, Tiffany Radmore from the Crafts Council and Kate Dunton from the Cultural Institute at King's, it was particularly exciting to observe the innovative approaches to student learning and engagement that were developing. Articulating the value of these approaches was less easy, however, not least because the initiative operated in an unusual learning space that sat somewhere between the formal and informal curriculum, between the arts and the sciences, between the academic and the public spheres, and that brought together students at all stages of study from first-year undergraduate to doctoral researchers.

In the conversation below, Kate Dunton talks to makers Shelley James and John Grayson about their experiences with King's students in the Wheatstone Innovation Lab, using reflective dialogue as a means to tease out how they engaged with students in order to foster creative

experimentation, and what we might learn from this about approaches to designing and animating ecologies for learning for creativity in Higher Education more generally.



FIGURE 1 The Collaborative Automata project, showing the students and staff who made, created and decorated the different components as part of the Parallel Practices initiative. Image by John Grayson.

Reflective Dialogue

Interviewer:

Kate Dunton, Research and Education Manager, the Cultural Institute at King's.

Interviewees:

Shelley James, Glass Artist

John Grayson, Metal Smith and Automata Maker.

Kate's Preamble The official approach to learning design in higher education in the UK is predominantly outcomes based – ‘at the end of this programme the student will be able to...’ This project didn’t start off like that. We knew that we wanted the craft makers to be physically present in the Wheatstone Lab, and in some way to enrich or animate that space for students in a way that was in line with the ethos of the lab, that is to say, as a space outside the formal curriculum where students could come to play and experiment and tinker. Other than that, it was a blank slate. At the same time, the kind of interactions that might arise between the makers, the academics and the students wasn’t left to chance. There was a lot of discussion and reflection all the way through the collaborative process. In this conversation, I’d like to try and tease out how that balance between structured support and experimental play was negotiated in the planning process.

Q If we can begin by going back to the earliest phases of the project - what were the unknowns at that stage for you?

John: Obviously, the environment in the maker lab was quite different to anywhere that I had worked before. Matthew (Howard, Lecturer in Informatics) and I were trying to come up with project ideas that were clear in our own minds and share those with each other but we were coming at it from different sides of the fence; we couldn’t see into each other’s world. Essential to the collaboration was the realisation that I could see what Matthew and Riccardo (Sapienza, Lecturer in Physics) wanted but I needed to get something out of it for myself: it needed to be a knowledge exchange. So those first two or three weeks were a case of going along with ideas – working with enamel, or with card to make low-tech automata, for example – and evaluating them in terms of what the students would get out of it, what I would get out of it, and then redesigning the scheme; keeping the things that worked, dropping those that didn’t.

Shelley: Yes. That was the interesting thing for me, to try and find a way to develop short, single-session modules that the students would enjoy and find rewarding and could slot into their day and wouldn’t be pointless from an academic or intellectual point of view. From my initial conversations with Riccardo, I was very aware of the different levels of skills and dexterity that the students have. As kids, we’re told that glass is scary, dangerous and expensive so most people are a bit nervous – they have never actually worked with it, unlike clay or wood. I spent the first couple of weeks just watching and listening. I realised that, as Riccardo had already said, the students are quite sophisticated in their ideas. So the idea was to find things that would be difficult enough yet accessible, and also relevant to what they were doing.

What we do as makers is not only decorative; it can be seen as a powerful and radical activity. Many of the great scientists, including Charles Wheatstone himself, were instrument-makers. They believed that the tools that we have define what we can see and often built their own. That’s why I came up with the idea of making kaleidoscopes because it involves symmetry and maths and dexterity as well as a degree of personal design. I showed students some simple techniques for fusing and blowing glass. Because the glass changes colour and shape as it gets hot, we started talking about light and thermal expansion. The students seemed to find the activities stimulating and often stayed long after the time that they had booked. But, I wasn’t just there as a workshop teacher. I wanted something that was enriching for my own practice. Like John said, it was out of the need to find that balance between the students’ needs and mine that ideas emerged: students started to suggest other things that I could try.

Figure 2 Kaleidoscope made by a physics student

Shelley: Several of Riccardo's students had been playing with materials and when these got hot they began to expand and soften and change shape. So understanding materials has a direct relevance to how they design an experiment. I think it would have been interesting from the beginning to work out which skills I might offer them that would be directly constructive for their experiments, something that might be relaxing and intellectually diverting but also relating directly to their studies.

Kate: *I'd like to focus in a little more detail on the decision-making processes that you were going through as the project progressed. How were you deciding what to drop, what to continue, what to do next?*

Shelley: There are different things I do to relax my brain to the point where something interesting pops up. I might go swimming and as I'm doing the breaststroke, I'm thinking: "How the heck am I going to do that?" I also spend time just hanging around with an open mind. For example, I sat in the common room with my sketchbook. As I tried to work out what to offer these potential friends I imagined a couple of them and thought about how what I was going to offer might work for them. I also tried these activities several times myself, thinking about how much time they might take, levels of difficulty for different learners. I feel that if students are taking the risk to come, I want to make sure that that there is the optimum chance that they will find it rewarding.

Kate: *Does anything get written down at this stage – notes or drawings?*

Shelley: I have a book in which I write notes and draw little mind maps. I also have a bunch of sketches and models that I make; examples of experiments. So yes, there's a physical experimentation. Also, there was one student who was quite sophisticated and I would try things out on him. If he found it difficult, I knew it was going to be beyond most of the students I was working with. I invited some of the students to my studio so that they could see what I was trying to achieve and the tools that I had at my disposal; a kind of shared vulnerability, I suppose, "This is what I can do and I've never done this before." In the one-to-one projects with the post-graduate students, where there was a more sustained relationship, I could take more risks. But I still made sure that every interaction was properly structured and well thought through and projected. It was an incubated collaboration.

Kate: *That's an interesting phrase, 'an incubated collaboration'. So it's carefully thought through but it's not fixed in advance.*

Shelley: Absolutely. There's an envelope but it's an open envelope so the students can pop stuff into it as well. For example, I noticed that the bottles that they keep their amazing nanoparticle samples in are really ugly, so I showed them how to heat up and blow standard glass pipettes to make little vials. We put some of their nanoparticles in and then one of the research students said, "Why don't you make it longer, like fishing floats, and we'll put them in water..." And we all zoomed down to their labs in the basement where there were all sorts of big glass cylinders. I had no idea that space even existed. One of them ran off to get blue light torches and they were all so excited by the way the colour looked different when looking from underneath through the water, or from the top. As the 'tails' full of liquid crossed in front of each other, we could see new colour combinations. If I'd suggested it, it wouldn't have had the same spontaneity.

One of the students then wondered what would happen if we looked at the colour through thicker pieces of glass. We mixed their dyes and nano-particles with a special glue and used that to assemble pieces of glass. Again, the colour looked different depending on the angle of view and we've started to build some more complicated models together using these effects.

So it was important to leave space for the students to bring their own ideas. I suppose I incubated a situation that was still open.

Figure 4 Left: Quantum dots in vials blown from test tubes by students floating in water
Right: PhD student Struan Bourke experimenting with glue and glass in his lab.

John: The nice thing with this project is that it's not part of assessed learning against a module descriptor with a predetermined set of learning outcomes. And of course, that introduces an element of risk because it could turn out to be completely rubbish.

Shelley: And a waste of the students' time.

John: You could argue that not identifying outcomes at the beginning is a problem because you can't measure if you've met them. But equally, risk generates innovation. There will always be 'known unknowns', that is to say, the things that we know are going to happen because that's the nature of the project, but we don't know what they are exactly and we let them unfold. We can do that because it's not tied into a set of learning outcomes. We can extend those vials into long pipettes and chuck them in a bucket of water just to see what happens. In a formal module, where that might not serve the learning outcomes, those moments of spontaneity would be lost.

Shelley: I suppose it's how you define an outcome. For example, I noticed that the students kept the things they made on their desks. I think that's an outcome.

John: Yes, it is. I suppose what I'm saying is that the outcomes are much more fluid. For example, if you started with an outcome that was about developing new technology – lasers, for example – and then through the act of play it starts going in a different direction, somewhere amazing, you might feel you have to reign it in. That to me seems to defeat the whole point of doing something experimental.

Shelley: I think we can work with fluid outcomes because we're both quite experienced as makers and have done quite a lot of teaching in different settings. Also, there was the skill of the Crafts Council and the Cultural Institute in selecting and matching makers and academics who were going to get value and give value through the project.

Kate: *If there is an alternative kind of learning that is not outcomes-based, how might we define that?*

Shelley: You might need to call it a 'development'. People are changed in some way. It's something to do with the way they understand their own fields, their sense of their own potential, of themselves as human beings, of learning how to interpret the behaviour of the material they work with. It's about recognising that it's a journey, it's a process, rather than an outcome. I don't know if you feel the same way, John?

John: I think with a project like this, the students start to develop an understanding about the relevance of whatever they do within a much broader context. For undergraduates, in particular, it makes them realise that there is more to their learning than just soaking up knowledge and then being able to repeat that knowledge in a formal exam, or apply a bit of lateral thinking in a personal scientific project. They are starting to see that when they go out into the world, developing robotics for the medical industry, for example, they will be interfacing with designers, industrial engineers; a whole host of other people. Also their work will have an effect on medical staff, patients, and so on. They start to see that their work is one element in a bigger picture.

My dad used to race bikes when he was in his late teens and early twenties. He used to tell me about the man who made his bike, one of the best frame builders in the country. Later, this chap went into the medical industry and made cutting-edge prosthetic limbs. I suppose what I'm saying is that there are a lot of things that go on in other fields that you wouldn't think had any relevance. This kind of project opens that door a little bit. A student might realise the relevance in glass or automata making. It might make them more inclined to go out and look at what's going on outside their field and pick up on a technological innovation or a bit of lateral thinking they might otherwise have missed.

Kate: *In the context of this project, to what extent did that process of engaging with a related activity outside of their normal sphere impact on the students? Did you observe any shifts in their thinking, any light-bulb moments?*

Shelley: Yes. On a number of occasions. One student wanted to make waves by fusing glass spheres together. That idea came because he had come to a fusing workshop. Having access to a new technique unlocked something for him about a problem that he hadn't even articulated as a problem; something to do with the expansion coefficient. If he hadn't actually had the personal experience of getting glass hot in a kiln and seeing it run around like cheese on toast, he wouldn't have realised what he was trying to do. Another student wanted to make some pipettes. He thought he needed a bend in the pipette because that's how it is in all the literature, but in fact if you put the pipette in at a right angle you don't need the bend and it's much easier. For that student it was a realisation that it's possible to make your own equipment that will work for that specific experiment. In another instance, the students had been looking at how they could use the way that nanoparticles change colour under UV light for medical applications – they needed to get these molecules to zoom around in the body so they

can be tracked. As I mentioned earlier, when we looked at these molecules through glass, we could see a kind of glow which could be created by electron clouds. The PhD student that I was working with hadn't seen it happen before in that way. So he was able to see – and explain – how the shape of these molecules affect the way they respond to light and why what he is doing is so revolutionary. So those were some of the light bulb moments where students worked in a slightly different way.

Kate: *These examples, I'm guessing, come from the one-to-one collaborations with the PhD students. What about the undergraduate students?*

Shelley: The post-graduates are wrestling with an issue and trying to find an original way through a topic whereas the undergraduates aren't yet at that stage in their way of thinking. They seemed to engage in a more personal way – lots of them talked about their experience of doing art at school.

John: We did engage in a more sustained way with the undergraduates who were doing their project work, but because of the timing of our residency they were already some way through. I would like to have worked with them at the beginning. You could see that some of the student groups had spent hours making something but it wasn't well-made and so it didn't work in the way they wanted it to. I think it could work well to offer students at the start of their projects one-to-ones with makers. That way, the students would come to you with ideas about what they're trying to achieve. And particularly if it was endorsed by Riccardo and Matthew - the endorsement of the academics is really important. When it comes to the undergraduates, the people who would benefit most from this sort of project are probably those who are least likely to self-select. Those that are prepared to come along and engage with the makers already have an open mind. Building it into their project work might be the best way to allow them to stumble across the benefits of making whilst avoiding that sense that they're only doing it because they've been told to.

Kate: *Throughout this conversation, we've been talking about the approach to learning design that evolved in this project, but I wonder, is 'design' a term that you would use? Do you think of yourself as 'designing' learning?*

John: Yes, I would say so. Processes can be designed as much as objects and products. In the case of this project, we were using prior knowledge plus the information we were given when we first arrived. In that first week or so we were just seeing what was going on and then re-evaluating. And there are parameters that you have to work around; the timescale of the project, the budget, and, in my case, what amount of kit I can carry on the train. Then I was road-testing things. So, you're very much designing the optimum way forward and getting the best experience for the students and for yourself.

Shelley: It's a sort of devising. There's an improvisational dimension as well based on who the students are. That's why it's been so good not to have to work towards a learning outcome. It's more to do with offering an attitude and a set of activities, rather than saying, "You will know about quantum dots in glass by the end of this." Which, in fact, I had no idea they would.

Kate: *And is there a relationship between 'design' in the context of designing learning and 'design' in the context of your practice as makers?*

John: I see it as the same thing.

Shelley: So do I. Totally.

John: In both contexts, you're basically working with stuff. In terms of my own work as a craft maker, the stuff is metal and enamel. I start with drawings and maquettes, thinking it through in my mind, then periods of trial and error and experimentation, then reflection on that, and then I apply that knowledge to evolving the design, and then make the thing. You do exactly the same thing in the education context; it's just that the stuff is the student experience. But it's still a physical thing.

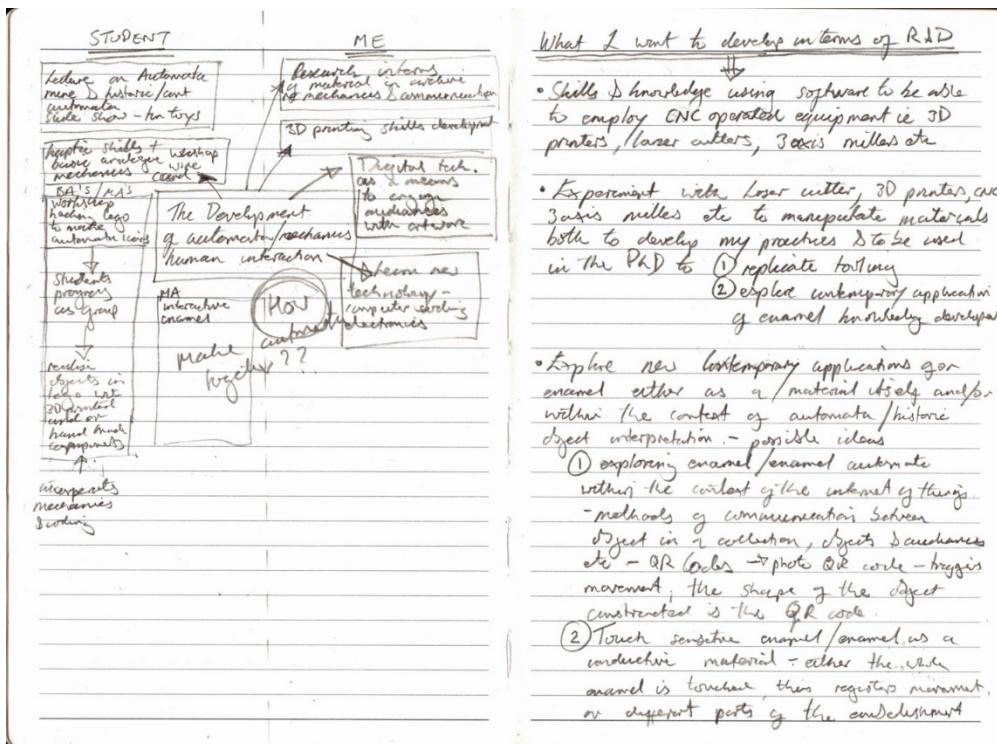


Figure 5 From John Grayson's notebook

Shelley: It is, and conversely, when working with materials, it's still a conversation because I might have an idea of what I'd like the glass to do, but it's like a human being in that you need to listen and respond and be respectful. So that's why there's a kind of improvisation and devising dimension to it, which is to do

with thinking on your feet and being responsive and sensitive at the same time. So yes, I agree with John, they are exactly the same thing except that the materials we're working with in the education context are relationships and insights as opposed to pieces of glass. I also think both my work and John's is site-specific. The work we've been doing with students at King's is also site-specific in that we're responding to a given space, a given situation.

Kate: Is there anything we can learn from this project about the formal curriculum and how we teach it – institutional strictures aside?

John: I think it would be really interesting if there was a module in every year that had nothing in it; no content, no learning outcomes, just a slot of time, a space, and some money for the staff to do something truly ground breaking. And if it all goes pear-shaped, no-one is going to get canned.

As a course manager, you go through a validation process with reams of paperwork. You're hoping the course will stay relevant for three years or so because you really don't want to have to go through the approval process again. Of course, these processes are about making sure that programmes are robust, but there are times when you want the opportunity to

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go with whatever is current and that might not have been there two years ago when you designed the course.

Shelley: Also, I noticed that with a few of your students, John, this project really gave them a sense of shaping their learning for themselves. I saw them really grow into defining the agenda. So this blank module might also be an opportunity for students to shape what is being taught and who is teaching it. That would be incredibly rewarding and empowering for them. And we all learn better when there is something new to get to grips with. In this project, I've been impressed by the dedication and insight of the academic staff. They know their students well, and I see them frustrated by the inability to respond to what the students are really interested in and excited by.

The blank page approach would support these kinds of intuitive, interactive modes of learning or of development. If you wanted to bring in collaborative artists, that's where the role of the broker – people like you, Kate, and Tiff Radmore from the Crafts Council – comes in. You introduce academics to artists who are vetted through the application process, and through networks of known practitioners, so the academics know they are dealing with a reliable, committed and safe pairs of hands. A department might build up a pool of practitioners who could be brought in for projects like this.

John: I think this could also work in reverse in terms of art education. Many art schools are now engaging with a whole range of really interesting ideas and approaches from the realms of science and technology but I've not heard of anyone inviting a nono-partical physicist to come and set up their lab in an art school. It's usually artists dabbling with technology for themselves. That would also give you a comparative project to evaluate against; you could see if there are common responses in the way that the students learned in both environments.

Shelley: I've realised, talking to the students as part of this project, that for many of them it turned on the head of a pin whether they chose to study arts or science or music.

John: A lot of them are multi-talented

Shelley: Giving students a chance to be themselves in a variety of ways is really at the core of what this kind of project offers.



Figure 6 From John Grayson's sketchbook

My ecological perspective

This issue of Creative Academic Magazine explores how the pedagogies of teachers, and others involved in students' learning and development, might create ecologies within which teachers and students both learn and achieve. The idea of creative ecologies was introduced in CAM5³ and reading Norman Jackson's framing article two ideas struck me as particularly relevant to the way in which students were supported to use and develop their creativity within the Parallel Practices project discussed above:

"People who are driven to be creative seek and find favourable environments to be creative in. They also modify existing environments in ways that enable them to realise their creativity and they also create entirely new environments (eg an ecology for learning) in which they and others can be creative. They are able to see the affordance in an environment they inhabit and use it to realise their creative potential."^{4:5}

"A creative milieu or environment represents a certain potentiality that must be activated through human communication and interaction. What makes a location attractive is its possible or imagined advantages, not the realized ones."^{5:2}

These perspectives describe very well the underlying ethos of our initiative. The space itself was crucial and was specifically designed to be somewhere that students might express their creativity. It embodied the ethos of the maker space; that is, a space to imagine, take risks, play, tinker, experiment and develop ideas that have personal meaning to the individual, making use of the abundant resources available and without fear of failure. This space, and the resources within it, provided what Jackson terms the 'affordances' for personal creativity but crucially participants had to recognize these affordances and be willing to act on them. Equally, the space needed to be animated by human communication and interaction, and that's where our makers and their academic partners were key. In the interview, Shelley talks of an 'incubated collaboration'. I think that chimes very much with the learning ecology idea, but importantly a learning ecology that is both created for students and within which the students are active in shaping and activating that ecology continually as key components of its survival. I am grateful to Norman Jackson for pointing out Erica McWilliam's idea of teachers as meddlers-in- the-middle⁶ helping, enabling and challenging learners and themselves to create in ways that have personal meaning. Certainly, the way in which the craft makers modelled their own creative processes and behaviours, constructively disrupting the students usual expectations and approaches, offering a glimpse, as John pointed out, into a parallel world, was an important element in fostering this collaborative ecology for learning and creative achievement.

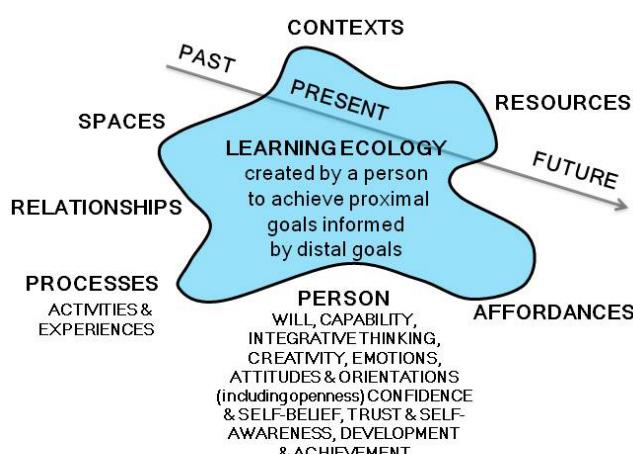


Figure 7 Model of a learning ecology³

The way that the space brought together and connected students across departments and at different levels of study, removing some of the usual hierarchies, is also interesting from an 'ecological' perspective. It allowed and demanded the sharing of resources, including participants prior ideas and knowledge as well as those which were developed collaboratively through making and practical experimentation. Creativity was driven by the need for everyone to give something and to get something

from their engagement with the milieu. This came out very strongly in Shelley and John's wonderful reflections – 'it was the drive to find a shared ground and reciprocal benefit that drove the creative encounter'. The idea of emergence was very strong in both narratives and the undeniable truth that our most creative ideas and achievements cannot be predetermined as a set of learning outcomes contains the fundamental wisdom of this story.

In a broader sense, the work we do at the Cultural Institute, drawing on the incredible richness of arts and culture in London to drive innovation in our research and education (and reciprocally inform innovation in the arts and cultural sector), is very much based on a relational, ecological model of partnership and interaction. Before I wrote this piece, however, I hadn't thought about creative pedagogies in terms of an ecological model, so it was interesting to draw on these emerging ideas when reflecting on the pedagogic value of the maker residencies. These are just some preliminary thoughts. It is a really interesting concept and one that I'm sure I'll continue to mull on in the context of our work at King's around arts based learning.

Acknowledgements

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End Notes & References

1The national development agency for the contemporary crafts in the UK <http://www.craftscouncil.org.uk/>

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