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Risk, Creative Spaces and Creative Identity in Creative Technologies Research (or *Why it's OK for academic creative technology outputs to look scrappy and be buggy*)

"Brakes, don't talk to me about brakes! Anyone can make a car go slow! It takes a genius to make a car go fast!!" From "The Race", by Peter Ustinov.

Summary

In this report I will draw on over ten years of practice-based research that applies emerging technologies, algorithms and code as a creative medium in the areas of music performance, music composition and media art installation. I will consider the competing demands of making things work technically and artistically, and the nature of collaborative work. I will consider my own recent research and that of a current PhD student as case studies in how this works in an academic context. Two concepts will structure the discussion. The first considers the question of time commitment and risk when undertaking specific activities, in relation to expected outcomes. I will look at how a practitioner handles the risk of an idea not working out at all, and the more pragmatic risk of unexpected barriers to success. The second considers how much effort goes into setting up a creative space, through prior technical work and design thinking. I will look at examples of building creative freedom into a tool.

Research and practice background

I have worked for over fifteen years as what I often describe as a creative technologist. I make both new creative works using technology and new technologies for creating creative works. In creative technologies practice these are interrelated activities[1]. Primarily my work contributes to knowledge through algorithms, interface ideas, other design ideas, and creative

practice methods and concepts that are ultimately aimed at benefitting other people in their work. Two obvious and different ways this can be manifest are:

i. new ways of doing things that are sufficiently well documented and explained as to be useful to others
ii. new tangible tools, such as a new piece of software, that can *actually* be put to use by other people.

For the former, it is possible to work as an experimental artist who reflexively examines and reports on their process using practice-based research methods. Engaging in inquiry-driven artistic practice can be enough to constitute significant technological experimentation leading to new insights, and sharing one's process through such experimentation can reveal new ways of doing things that benefit others in the field. Striving to explore the creative possibilities of technology, manifest through one's own personal creative outcomes, makes for a valuable contribution to the field when successful. Note however that not everyone who experimentally applies technology to creative outcomes does so in order to then abstract and share principles of creative technologies practice; many do so for example to critique or philosophically query the technology's implications[2]. But that has generally been *my* focus.

Creating new tools involves at least one significant extra step beyond the work involved in creating artworks themselves: the building of a *functional* system, not just a working prototype, is a distinct extra tranche of work. From a design perspective making tools also involves additional work in terms of ensuring the tool is usable for its users (possibly starting with oneself), for example through well-designed UIs. Working and usable tools depend on good design methods focusing on developing appropriate systems for their intended users. And yet these two activities (creative function, and usable tools) frequently overlap, and are sometimes indistinguishable, with artists producing tools for their own use primarily, with the sharing of these resources being a natural extension of their work[3]. In other cases, the researcher is not really pitching themselves as an artist, but a producer of tools, and yet nevertheless takes on the work of exploring and demonstrating a system's creative possibilities themselves (as a temporary or placeholder artist).

Practice-based and design approaches can also be structured in a natural progression from experimentation to product. Such a progression roughly plays out as follows:

- create an artwork that explores some technological idea

- assuming success, reflect and report on how it was made (the creative practice, as well as the technology, its affordances and interaction possibilities)
- consider what software might support the application of this process
- prototype the software
- iterate the software through further development and user research.

With so much to do, such research requires highly pragmatic time management. Several of the above steps may be beyond the scope of an academic research agenda. In particular:

i. Producing creative works may be more or less "prototypey" (versus "high production values" work). In the context of the creative possibilities of technology one may wish to focus more effort on the creative exploration than on the production of a finished artwork. To achieve the goal of discovering or communicating new ways to work effectively, the researcher is arguably wasting time by putting effort into polishing a work.
ii. Likewise, producing software may be more or less "complete" from an end-user perspective. Again, the time it takes to make software work, being bug-free and with great UX, is arguably work that shouldn't take up research time.

The ambiguity of the term "creative technologies" itself suits this situation. It can mean both "being creative with technology" or "making technology for creative people"[4].

Figure 1 summarises how one might step through a creative technologies project with different outcomes in mind[5]. At the end of each path lies something that would be considered a knowledge outcome, i.e., something that could be published as an academic paper. This is an incomplete representation; there are likely to be many other pathways, but as a categorisation of ways to achieve knowledge outcomes it covers the key methodological ideas. What this diagram does not represent, and what is critical to the discussion here, is the relative effort that one may need (or wish) to invest in each of these areas. Developing and reflecting on a single proof of concept may consume an entire project.

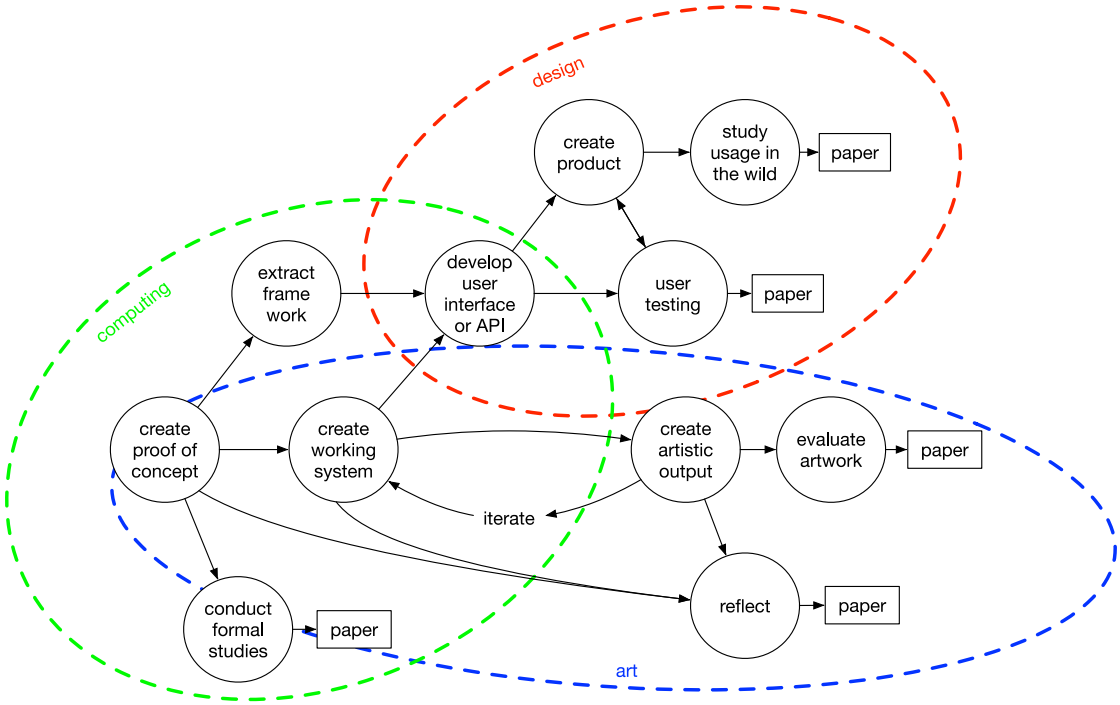

Figure 1: different pathways leading from an initial creative technologies idea (demonstrated in a proof of concept) towards different knowledge outcomes that can be published as academic papers.

Cases

From personal experience, I consider two concepts that go further in framing the challenges of the pragmatic creative technology researcher. The first considers the question of time commitment and risk when undertaking specific activities, in relation to expected outcomes. I will look at how a practitioner handles the risk of an idea not working out at all, and the more pragmatic risk of unexpected barriers to success. The second considers how much effort goes into setting up a creative space, through prior technical work and design thinking. I will look at examples of building in creative freedom into a tool. I discuss each in turn with specific reference to my own work and that of my PhD student Steffan Ianigro. In relation to these two points, I will also consider the issue of expertise and the development of an artistic identity and look at the very long timescale over which this happens, and how this influences one's strategies.

1. the question of time commitment and risk

My work *Zamyatin* for live improvised performance used evolutionary computing to discover novel realtime performance behaviours that could be incorporated into a hand-coded responsive, generative performance system[6]. The system was developed over multiple years beginning around 2010, following a previous concept iteration (previously I had used evolved neural networks, a specific non-linear system design[7], and for *Zamyatin* I developed my own non-linear system architecture based on decision trees and feedback[8].

As *Zamyatin's* developer and only user, I coded the system in an Integrated Development Environment (Eclipse) but also needed to interact with the system in multiple ways: running evolutionary algorithms to search for evolved behaviours, auditioning behaviours, interacting with the system in real time, and tweaking configuration parameters (both in realtime and offline). Coding time could be spent in a vast number of ways: implementing better evolutionary algorithms (which might improve the search process), implementing better evolutionary fitness functions, implementing a better realtime performance system, building better graphical user interface tools, building other analytical tools to help understand how the algorithms were behaving. In addition, coding time competed with time devoted to other activities such as auditioning, preparing test recordings, preparing sample banks and other raw musical material, and rehearsing[9].

Accordingly, making polished user interfaces, and even polished works and recordings, took away time from exploring the system from an academic standpoint, even though these things might have other benefits such as improved promotion of the work. Conversely, conducting formal user studies could have been effective but only if the system was well-developed enough and also conceptually clear enough to other potential users, which required significant development from the system I used in my own work.

A significant risk of creative technology research, which can also be found throughout experimental creative practice work and technology innovation, is the unpredictability of outcomes. This is fundamental to creative work, which by broad consensus of definition is work for which there is no prior known path to an outcome. Creative search has been defined as blind[10] and inherently undirected and heuristic[11]. As with many creative technology ideas, the existential risk with *Zamyatin* was not coming up with any worthwhile behaviour at all. The development of a new evolvable structure based on decision trees and feedback was highly speculative. Thus, it was essential to develop the work in an agile way, first attempting to develop any evidence that there was something there worthwhile, in as short a time as possible.

An agile methodology has emerged as one of the leading solutions to risk management in

technology development. Development occurs in short bursts with frequent review, with a readiness to revise design goals and plans. In an agile approach to the initial ideation and experimentation in creative technologies research, there is some potential to adapt goals on the go. I found that my evolved decision tree approach produced interesting-enough behaviour to justify its use, but as expected, that its complexity was hard to control or steer to specific goals via evolution. I therefore focused more on the creative practice of hand-coding behaviours that responded to the decision tree output, which gave me a form of meta control, and constituted a kind of slow collaboration with this complex system. That shaped the final form of the system and the kind of research that was involved.

In his PhD research, Steffan Ianigro has continued to work with similar systems, picking up my original evolved neural network research[12]. Ianigro's focus has been much more on the user interface possibilities, for which he has made an interactive web page where users can search through large populations of evolved behaviours, and an Ableton Live device, which allows users to immediately incorporate these dynamic non-linear behaviours into their creative work. To use this, users must deal with some very complex concepts and behaviours, but via a simple interface that 'black boxes' much of this complexity. Ianigro has produced his own suite of practice-based compositional works using these tools, but is also in the process of gathering user feedback from the fully functional tools he has shared online. For both of us, there are many more systematic experiments we could attempt in order to find better underlying system behaviours, and much more we could have done to make improved, working user interfaces, but through practical compositional and design decisions we have navigated the trade-off between time commitments.

2. effort and setting up a creative space

The second of my principles concerns the creative space, and the ways in which it is possible to set yourself up more or less easily to creatively explore. Consider how the knobs, sliders and buttons of a good synthesizer stimulate exploration, or how good modular frameworks, as in modular synthesizer design, can enable more high-level exploration. Such work can be grounded in a powerful body of research into creative systems design, creative technologies practice and the design of productive tools[13].

Working in code, one is faced with an infinite space of possibilities, but only some of those possibilities are ready to hand. Some time spent coding a useful framework for oneself to use might alter what is to hand, thereby enabling the potential for greater exploration. In *Zamyatin*, I went to great lengths to ensure that my system had good modular design, in

particular because in this system I combined evolved behaviours (clearly defined as a modular component) with hand-coded musical structures for each performance. I needed to ensure that I could easily prototype those hand-coded structures and connect them into the larger system interchangeably.

In Ianigro's case, part of the research was explicitly about providing an interface for rapid search: a website that one could explore for different behaviours (generated using a technique called novelty search, which promotes a diversity of generated outcomes), with the ability to embed those behaviours into a DAW for immediate use. Such search-enabling interfaces will normally promote search across some dimensions at the expense of others: it is not about enabling an exhaustive search space but a productive one. In Ianigro's current implementation of the interface, the beginner user can start with a set of six pre-sets that represent a diverse set of curated behaviours. This very small, curated set did not encourage more detailed search of the space of system behaviours, but did help focus search on how one applied the systems into a composition, much as I found with my coded behaviours.

Reflection

In Figure 1, I presented a diagram of different paths through a creative technology research process from an initial proof-of-concept system. This shows how one may arrive at different knowledge outcomes, which I highlight in Figure 2 for each of the projects discussed.

Navigating any creative technologies project with this high-level map helps identify the possible exit points where knowledge outcomes can be achieved. Just like a real map, which may not show the terrain or traffic jams, what the map does not show is the time and effort that might be required (or desired) to invest into each of these stages, which will vary radically depending on the immediate challenges presented for the current task. Adopting an agile approach to navigating this map means re-evaluating where one is at regularly and seeing what steps are needed to arrive at any knowledge outcome. Importantly, whilst complete working software, tested in the hands of users, or polished creative works presented in high profile public areas, are highly desirable outcomes, there are many other effective knowledge outcomes along the way that may serve the wider community to produce these things. Any of these stages might be vast multi-year projects or even unsolvable problems that need to be aborted. Conversely, 3rd party tools, prior research, or examples might already exist that act as platforms for researchers to start their paths at different stages (e.g., design researchers conducting in-the-wild research into existing products). Some journeys through

this space may be rapid, while others are stuck on one node for a long period. Creative technology researchers with limited time must plan accordingly how they get to the best knowledge outcomes given the circumstances in which they find themselves.

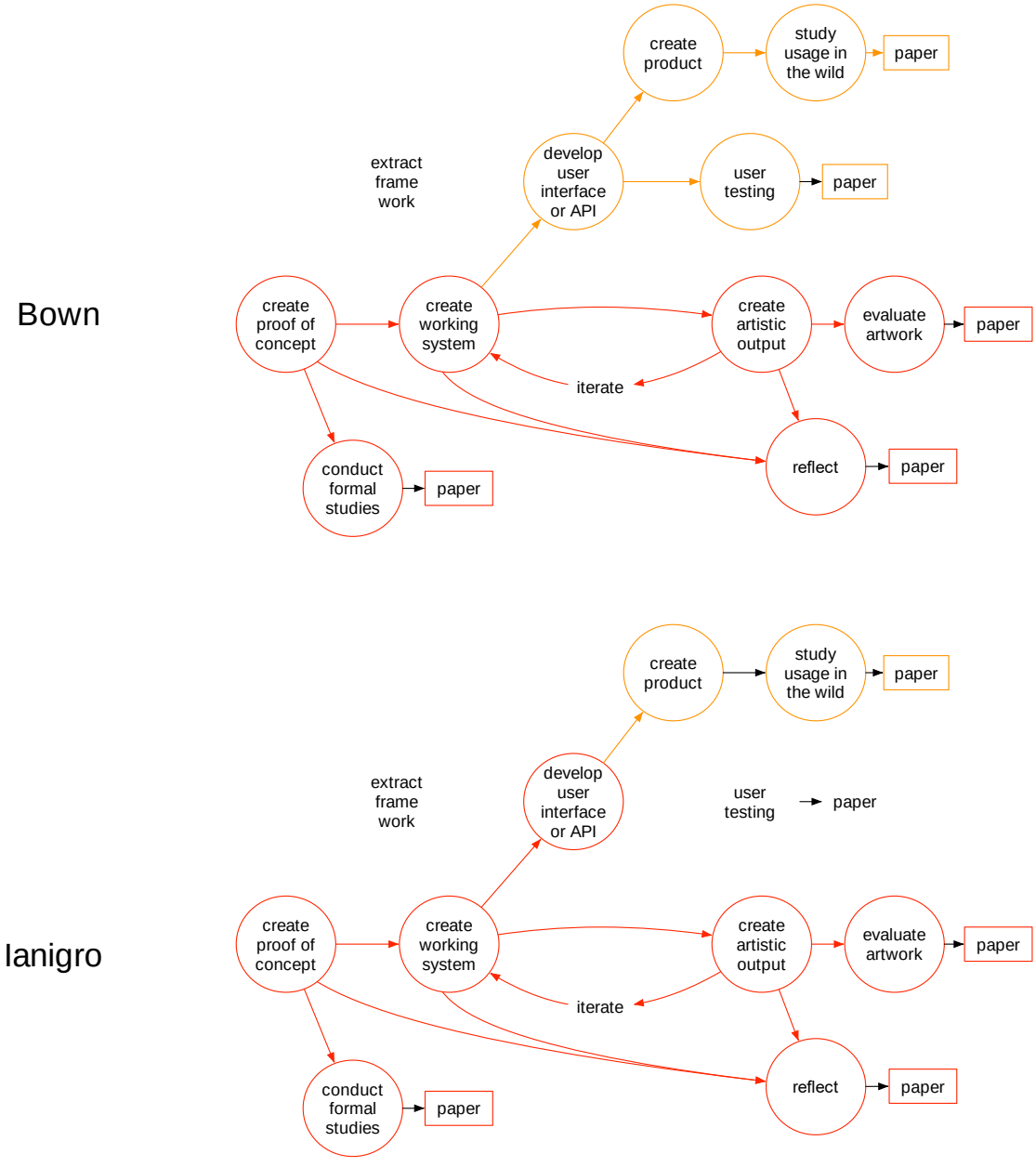

Figure 2: Two different research projects shown as paths through possible outcomes (highlighted in red for core outputs and green for peripheral outputs).

Occasionally system designs arise that open up vast spaces of creative exploration,

usually by taking an existing working concept and introducing an interface to that which is fast and agile. For example, the Runway program for interacting with machine learning (ML) models has made it very easy for non-programmer artists to explore creative applications of machine learning. The opening of such creative spaces offers both important knowledge outcomes that emerge from the processes just described, and also new creative ecosystems that enable entirely new genres of creative technologies practice. Students at my school of art and design, with no programming background, for example, are creatively exploring the generative power of ML tools via Runway, which lets them navigate new pathways to knowledge outcomes.

Likewise, creative technologists are constantly setting up their own spaces of exploration, through programming libraries and interfaces or configuring datasets and tools. This can be critical groundwork to support their own artistic creativity, or can be an end-in-itself, as a design outcome seeding a new wave of creative possibilities. It is important to identify these critical innovations in supporting creative work as a specific goal in creative technologies work, whether they are entirely there for the individual researcher to use themselves to improve their own creative outcomes, or as key landmarks in the development of effective creative tools for others. Practitioners should become familiar with thinking about the setup of these creative spaces, whether building tools for others or using tools themselves; they are critical foci of creative technologies research and they may turn out to be the critical outcome of a research project.

The above discussion relates to individual projects that one might think of as having a finite duration (such as a PhD project). A more holistic view of creative technologies practice recognises the long-term investment of individuals as they embark down these paths of exploration. A practitioner may spend many years gradually moving between nodes in one of these search spaces, developing expertise and honing a creative practice. They do so as part of a community of practice, bringing the baggage of their prior investments in time and technology (what skills, programming languages and tools they know and have ready to hand) and their embeddedness in a social network (what work they are exposed to, what status the aspire to, where they can get help, and what they are known for by others). Mostly, this longer-term embeddedness remains invisible from the standpoint of everyday practice, but as with the opening of creative spaces, this should be a constant source of reflection; often this is simply to know one's strengths and the scope of one's effective work, but occasionally it is because the true innovation lies in the (possibly blind) leap into a different way of working that will define one's research direction for a long time to come. Many

academics find themselves at this juncture at the beginning of a PhD where they are deciding on a path for their project, but also at the end, where their process of reflection may define their future career trajectory. In this sense, enabling such reflection should also be a crucial part of a PhD training.

In these comments I hope the above topics define useful ways to help others frame their project planning. This is perhaps particularly useful to PhD students and other research projects with limited resources and ambitious innovative goals. Sometimes you want to make something go fast and can add the brakes later.

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[1] Edmonds *et al.*, 2005.

[2] for one example among many, see Gemeinboeck & Saunders, 2013.

[3] a great example in creative technologies is the work of Rebecca Fiebrink which exists in an ecosystem of practice and technology research. See the discussion in Fiebrink *et al*., 2010, for example

[4] It could also refer to the technology itself being creative, but we should draw the line and reserve the common terms "creative AI", "generative systems" and "computational creativity" for this area.

[5] This figure was inspired by Smith and Dean's iterative cyclic web of practice-led research and research-led practice (Smith, 2009).

[6] Bown, 2011; Bown, 2015; Bown, 2018.

[7] Bown and Lexer, 2006.

[8] Bown, 2011.

[9] Further to all of this, one must decide to work on a project such as this rather than write a paper or a grant application.

[10] Simonton, 2011; Stanley & Lehman, 2015.

[11] Amabile, 1983.

[12] Ianigro & Bown, 2016; 2018; 2019.

[13] e.g., Blackwell & Green, 2003; Shneiderman *et al.*, 2006; Biskjaer & Halskov, 2014; Resnick & Robinson, 2017.