Creating with the Digital: Tool, Medium, Mediator, Partner

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Abstract. This chapter is about the different kinds of relationships that creative practitioners have with digital technologies in the making of artworks. Four types of creative process are described in which the role of the digital is differentiated as tool, medium, mediator and partner. In many cases, the digital technology performs more than one role: practitioners are using ready-made tools for making interactive works and at the same time writing algorithms to create digital partners with whom they perform. In this kind of creative practice, the technology is often the material of the creative works as well as the means by which they are made. It can enable a wide range of aesthetic qualities as well as facilitate different kinds of experience for both creators and audiences. This is a journey that many artists are taking in the 21st century contemporary digital arts world. The discussion is illustrated by the works of creative practitioners for whom digital technology is integral to the way they work.

Keywords: Creative practitioners · Creative process · Digital technologies

1 Introduction

Digital technology is ubiquitous and all pervasive in everyday life from mobile phones and domestic appliances to communications satellites, transportation vehicles of every kind and home movie streaming. Those born since the year 2000 have known nothing else and learning to program computers is part of a normal education. Even so, for a majority of people, how the various manifestations of digital technology are designed and constructed remains a mystery. Being able to customize one's personal devices is possible but usually at a relatively surface level. Digging deep into the software and hardware is a skill that only a minority possess. This has implications for the type of relationship between human and machine and how we think about the role of the digital in practice.

This chapter is about the different kinds of relationships that creative practitioners have with the digital tools and media they create and use to make works of many different varieties. I will focus on four kinds of creative amplification in which the digital role is differentiated as tool, medium, mediator and partner. In many cases, the digital technology performs more than one role in the creative process. Practitioners journey from

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using tools to set up mediated environments and in the same project, deploy software as medium to create digital partners with whom they perform. The ideas and examples here draw upon and extend a theme developed in 'The Creative Reflective Practitioner' [1]. The discussion is informed and illustrated by the ideas and works of established creative practitioners in the field for whom digital technology is fundamental to the way they work. I believe that in order to understand the nature of creativity and how knowledge is generated through practice, we need to listen to those for whom making and research is integral to a life of practice. This chapter draws upon many interviews with creative practitioners working in a wide variety of creative and professional fields: visual and sound artists, curators, designers, film makers and scientists. They are well known in their respective fields and enjoy success in the public realm having exhibited or performed their works in galleries, museums, exhibition spaces and events across the globe.

My approach to the subject has been shaped by living through almost all the phases of digital development that reached into and transformed our personal and working lives. I started my research in the mid 1980s when as an HCI researcher I was dedicated to designing user-oriented systems that were effective, efficient and satisfying to use. That they might support creative purposes was not on the agenda: that came later when we began to study creative practice itself. A significant change in my perspective began with sustained contact with artists through art-technology residencies. I noticed that artists approached digital technology in a way that was different to system developers and researchers. It was apparent to me that these were the people to watch.

2 Superseding or Supersizing Creativity?

Because we live in a world permeated with digitally powered devices large and small, how we think and talk about the digital in our life and work has become second nature and it is sometimes difficult to understand the full extent of what has happened to us and how much we are influenced and indeed altered by its presence and the roles we give to it. There are many challenges that digital technology brings to our lives and it is sometimes tempting to be somewhat defeatist in the face of the rise of artificial intelligence (AI). A persistent theme is how AI will inevitably supersede humans in many activities including the creative ones. The value of replacing human expertise with AI, we are encouraged to believe is inevitable; the machine is 'neutral' when it comes to making judgements over error prone people and so on. But it doesn't have to be that way and there are other scenarios. If we are to counter the negative narrative, we need to go to places where people are taking control of the opportunities digital technologies afford for enhancing, amplifying and transforming their creative capability. In this space, new kinds of relationships are being formed and new ways of talking about them are evolving. In the creative world, actions and experiences are being changed as a result of making with digital technology and these changes are reflected in the language used by practitioners.

2.1 Turing's Meaningless Question

Alan Turing posed the question 'Can machines think?' triggering efforts to create thinking machines in the first round of AI research. However, if we look again at what Turing actually wrote, there is another implication. The question was, he said, meaningless because: *'at the end of the century, the use of the words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted*' [2].

Turing's point was not that machines would 'think' in the same way as a human being but rather we would speak as if they do as a result of our experience of them. Of course, what actually happened was that the 'can machines think?' question set off computational experiments that aimed to develop the means to prove that the answer was 'yes, machines *can* think'. The early days of AI were preoccupied with devising tests to see how much a computer could simulate a human response in such a way as to be believable. Joseph Weizenbaum was an early experimenter with natural language computer conversation. He created the program 'Eliza' in 1966 which simulated, you could say 'parodied', the way a psychotherapist using a non-directional style of questioning a new patient, would communicate [3]. Weizenbaum was dismayed by the way people engaged with the program and confessed personal feelings to it as if Eliza had real understanding. He was prompted to write his celebrated critique disputing the claims of the proponents of thinking machines in relation to human reasoning capabilities [4]. Eliza was the grandmother to vastly more sophisticated natural language programs represented by Siri, Apple's voice assistant[1].

What we have seen over the years since the 1950s and 1960s is that Turing's comments on his 'meaningless' question, interpreted more carefully, were right. What is meant by thinking *has* changed as a result of our experience of what computers can now do. In the beginning, it was relatively easy to understand them as very fast calculating machines that could outperform human beings on the basis of speed and accuracy. Today, computer systems have advanced to the extent that we see no surprise in the claim that not only can they execute routine tasks well but they are equally capable of producing creative outcomes. We have become accustomed not only to *thinking* digital technologies, but talking, listening, sensing, forecasting and even *creating* ones. The creativity extends from the mastery of chess to diagnosing medical conditions and assessing legal cases as well as making music and drawing pictures.

What does all this mean for human creativity? Does digital technology diminish it or even supersede it? What do creative practitioners think about the relationship of their practice to the technology, how do they use it and what are the outcomes?

Today's creative digital comes in many forms from the camera on our phones with facilities for image transformation to the programming systems for making and controlling interactive art installations. The range of possibilities is vast and the role the technologies play depends upon the intentions and aspirations of the people who use them. It is not just the uses, however, but rather the roles that creative practitioners

[1] Siri (2010) was developed by SRI International Artificial Intelligence Centre and is an offshoot of the US Defence Advanced Research Projects Agency's (DARPA)-funded CALO project. It is integrated into Apple Inc.'s iOS, iPadOS, watchOS, macOS, tvOS and audioOS operating systems.

ascribed to them and the nature of the relationship these have to the enormous variety of works that are created. As in the case of 'thinking' machines, these relationships are reflected in the words used to refer to them.

How digital technologies shape and influence the nature of creative reflective practice is the main focus of what follows. How do creative practitioners view the technologies they use: as tools for making objects, as mediators between thinking and action, as media for making or as partners to interact and perform with? Or perhaps, a combination of one or more of these categories? What do these terms tell us about how creative practitioners think about their relationship to the digital in their practice and the influence on reflection in action? How we talk about the different roles that digital technologies play in creative practice gives clues as to how the relationship is perceived.

3 Digital Technologies as Tool, Medium Mediator, Partner

There are many ways to create with digital technology and differentiating between the terms used can help us better understand the relationship of the digital technology to the creative practice and creative works. How we label the different roles that digital technologies play in creative practice gives clues as to how the relationship is perceived. Today, terms like 'tools' and 'medium' are commonplace in creative practice but increasingly, 'mediator' and 'partner' are being used by practitioners as they explore what it means to amplify their scope for making works. These words reflect the changing experiences with digital technology which, in turn, alter the implied meanings as happened with the word 'thinking'.

3.1 The Digital as Tool

A tool is a device designed precisely for a purpose, like a file to shape nails or a drill to make holes in wood or plaster. Many tools have been refined over time so as to be highly effective and efficient. However, they can be somewhat inflexible for turning their use to other purposes, although of course that is possible: a chisel can be used to cut food instead of shaping a piece of wood but it will not work half as well as a knife.

Tool effectiveness relies on the degree of skill the human user possesses. As an example, consider the difference between using a mechanical type-writer and its digital equivalent, the word processor, both machines for writing characters similar to those produced by a printer's movable type. Typing was once a valuable skill that was essential for employment as a secretary or office clerk. To be proficient required considerable skill, speed and accuracy and much effort went into training for that purpose. Without training, using a typewriter for your personal writing was a laborious process. It is a tool for writing neat typeface but the quality of the writing content and style depends on the user's skill. If, on the other hand, the word processor makes suggestions about content and how to structure the text, it is then contributing actively to the writing process.

Digital applications that are specifically designed to modify images or sounds could be said to fall into the tool category. We can draw, design spaces and make movies on our everyday devices using easy to use tools that take no time at all to learn. Tools such as Adobe Photoshop were originally designed to work with photographic images, and,

although you can apply it to drawings, its features are not ideal for that purpose. Many practitioners today use digital tools for visual art.

David Hockey is an artist known for his openness to new methods and techniques and was an early experimenter with the Quantel Paintbox in the 1980s [5]. The iPad was Hockney's first encounter with a digital technology that offered a more fluid and natural way of art making. It provided facilities that could not be replicated by conventional media and his practice was amplified as a consequence. Did using these digital tools transform Hockney's art in a deeper sense?

Hockney saw the technology as a powerful tool that enable him to expand his capabilities: '*Technology is allowing us to do all kinds of things today…It wouldn't have been possible to paint this picture without it'* [6]. Digital technology in the form of tools for production were vital to the pragmatics of preparing for an exhibition. He used digital photography for instant reproduction and then digital printing for creating very large paintings in ways he was unable to do before. By building up the work from individual prints this enabled him to see the full scale in overview. This process freed him from the limitations of painting 'en plein air'[2] and he was able to create very much larger scale pictures than previously possible using standard techniques. In this way he exploited the digital tools to create bigger works for high profile locations such as The Royal Academy London where the results were very successful with the public. The works on display had been made using new processes, but they were nevertheless, immediately recognisable as in Hockney's signature style. The changes in his practice did not transform the art in a fundamental sense.

A second example of a creative practitioner tool user is Anthony Marshall. When he began to work with the iPad, he discovered a multiplicity of applications. But there was no single tool that could do everything he wanted and so he set about identifying a set of image blending, enhancing and combining tools that together served his purpose. Anthony had started his creative life as a photographer but through his use of digital tools, he turned to visual art. The tools not only amplified his creative process, they transformed it: '*…it has completely changed the way I think about creating art*.' Anthony's adoption of the iPad enabled a sense of unity between hand, eye and brain that was open to more opportunities for improvisation. His creative process now involves exploring, selecting and combining towards his own unique interpretation of the visual image shaped by a love of fluidity, movement, and pattern seeking from the world around [1].

3.2 The Digital as Medium

Artists talk about 'truth to the material' by which they mean exploring a raw material such as wood, metal, canvas and exploiting its inherent properties in the form and structure of works they make. Digital technology can be seen as a raw material that is explored and exploited in a similar way as a medium for thinking and defining the artwork. Seen as a medium, an algorithm determines the visual appearance, sound, movement and

[2] En plein air - in open air painting leaves the studio and goes outdoors. The practice was made into an art form by the French Impressionists. Their desire to paint light and its changing, ephemeral qualities, coupled with the creation of transportable paint tubes and the box easel allowed artists the freedom to paint anywhere.

the mechanism for delivering it: the type of screen, canvass, aluminium base or the environment into which it is conveyed. For artists working with digital technologies, there is a distinction between the code as medium and the tools used for performing supplementary tasks. The computer code is not just an instrument for making something but it is also the very material of the work itself.

Paul Brown is an artist whose pioneering work in computational systems as a medium for the visual arts has endured for 50 years [7]. His early interest in generative forms stems from systems art and the arrival of the digital computer which, in turn, brought art and technology together in his art making. The 'art that makes itself' by which is meant artworks that are generated by computer code as a medium, has emergent properties that can bring surprise to the artist even years after they have been created: '*My knowledge of computers and coding…is an integral part of my work… because the works have an emergent property I can be surprised by their behaviour*.'

Paul's computer code reveals properties of the visual image that he finds novel and unexpected. His artworks change shape over time according to the instructions embedded in the algorithm. Many artists use random numbers to introduce unpredictability into the images created by their algorithms. In Paul's algorithms, he replaces random numbers with a more deterministic mechanisms called Cellular Automata (CA). CA are simple rule-based computational procedures that interact with each other and reproduce and propagate over time. This means it is difficult to predict what will come next, giving the works a sense of continual change and unexpectedness within the parameters of colour, shape and time he has written into the code [8].

Another artist using the digital as medium is Esther Rolinson whose 2D drawing processes are realized in 3D as in the case of the sculptural installation 'Splinter'. Here, both physical and digital media are fundamental to the concept of a shattering dynamic sculptural form. The acrylic shards were carefully researched and selected for their reflective, transparent and low weight qualities. Exploiting those properties accords with the artistic intention to create:

'*a burst of acrylic shards hovering in space. The acrylic fluctuates in fades and pulses with muted colour changes and variations in quality of movement*'. The movement patterns of light through the sculpture mirrored the drawing process of the artist made possible by the medium of code. In 'Splinter' sculpture, the acrylic shards are fundamental to the work as is the programmable lighting system:

'*I see programming as a complex material that can interpret and extend light movements. It is a way to analyse the structures of movements inside the drawings with the intention of making connections between physical and programming structures'* [9] (Fig. 1).

Fig. 1. 'Splinter', Light installation, acrylic and programmed LEDs (Cube Gallery Phoenix Leicester 2015)

Another example of art making is to combine the digital with the physical and exploit the combination of media. Augmented Reality Art is one such area of new media art practice [10]. Augmented Reality refers to superimposing digital (virtual) images onto a view of a physical (real-world) environment. A typical augmented reality scenario might be visiting an art gallery and viewing paintings through a mobile phone camera to see information texts or images overlaid on the screen image of the works.

In Augmented-Mixed Reality Art, the intrinsic properties of the medium are revealed through what it makes possible - what it enables. In Ian Gwilt's work, *Save_as* (2007/8), the video facilities on a mobile phone/device are used in conjunction with image recognition computer code, to place digital content in direct relation to a physical object in a gallery space. In this instance the augmented object is an acrylic model of a partially opened folder which is a large scale, physical representation of a typical desktop folder icon. When observing the wall-mounted folder through a handheld monitor the viewer is able to see 'virtual content' superimposed over the image of the physical object. The artwork is programmed so that when the camera of the handheld device is held up to the

physical object the image software within the device recognises the object and where the viewer is standing. In this case the image of the wall-mounted folder is overlaid with digital texts that appear in the viewing screen of the mobile and appear to sit in front of the folder. In the screen, the audience sees a computer-generated graphic consisting of a pair of words, drawn from two different lists. The software randomly selects one word from each list and the words are combined on the screen, to create statements such as: 'save them', 'cut me' and 'delete her' [11] (Fig. 2).

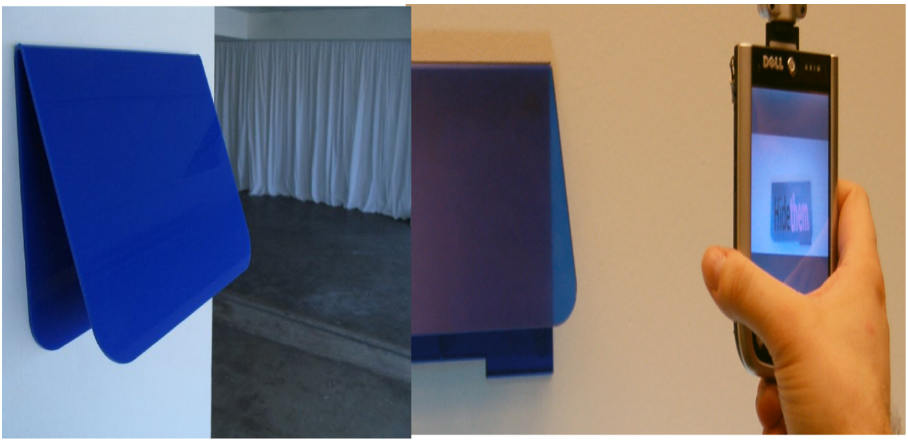

Fig. 2. *save_as* (2007/8) acrylic model *Image Ecologies*, University of Technology, Sydney

'Live Coding' is movement in sound art whereby the practitioners write computer code during music performances. The code created 'live' is displayed to the audience who then experience the sound and visual effects simultaneously. It is a relatively novel kind of digital as medium which, it could be argued has some way to go. The imbalance between audio and visual in which "the visual part is more cerebral than the sound" [12] is but one issue to be addressed if the form is to be embraced more widely. Nevertheless, this conscious attempt to make the code visible during creation highlights the computational engine as a core medium of creativity.

3.3 The Digital as Mediator

As well as acting as tools and media for creative work, digital technology can also be used to enable a more complex relationship between people and machines. We can think of this as being the difference between using the technology as an instrument (like a sewing machine) and a facilitator for creating an experience (like a cinema). Digital technologies can enable mediation between a practitioner and an environment. This mediation implies a relationship between two or more parties. The parties participate, interact, experience, inhabit, enact within a set of conditions or constraints. To facilitate mediation between performer and digital system, the key ingredient is interaction. To enable the interaction, you need suitable technologies to create the appropriate conditions

and spaces. Mediation technology enables interaction between different parties whether as practitioner-performers or participating audiences, co-located or distributed, real or virtual. They can be used to contribute to the creative process as key elements of audience experience in body sense detection interactive works and in interactive performances.

George Khut makes art as embodied experience and studies the process through sensor-based interactive digital systems. Digital technology has been integral to George's practice and underpins his thinking, making and evaluation of different sensor based interactive and embodied experiences. He creates interfaces for testing and modifying his art installations under construction. By paying close attention to his own inner body experience, the creative practice is amplified, in particular, it enhances his capacity to judge what to change in order to transform the mind-body experience: '*With the body focussed interactions I want to draw people's attention inwards, and to frame these very subtle changes in nervous system orientation that can be difficult to notice. To develop the form for these works I have to pay a lot of attention to these changes inside myself, and then reflect on how the dynamics of the sounds and visuals can reflect this felt experience*' [1].

Sue Hawksley's dance artistry affords new insights into creative thinking and making through the mediation of digital technology. The amplification to her practice that this approach brings allows her to better understand the mediated experience of dance, both as a choreographer and a performer. As she says: '*Technological mediation can open up amazing possibilities to augment and extend how this material is experienced'*.

Crosstalk is an interactive collaborative work performed by Sue Hawksley in collaboration with artist technologist, Simon Biggs and sound artist, Garth Paine. The performance begins with two dancers speaking descriptions of each other, and then setting up a score for operating as part of the system. Using voice-recognition software their words are written and projected onto a screen, and existing as virtual 3-D text-objects in the interactive virtual space. When the performers touch the virtual text-objects this causes them to move. As the texts collide with one another, new texts and sounds are created by an interpretative and generative grammar engine that shapes the interaction between all participating elements [13].

Within this mediation technology there is no technical difference between the way the algorithm treats the people, the texts, graphical objects and sounds. Technology designed to capture movement or speech data from the human performer can be a very effective way of enriching the system's knowledge but, whilst this may serve the purposes of developing a better, more autonomous system, it can constrain the human control of the performance environment. In this case, the two dance performers have a stronger influence on how the work evolves. The intention is to enable awareness of their agency which may lead them to form intentions while performing. But the technology does not have its own intentions and its responses are generated through a complex ecology of system interactions.

Mediating technology can provide a sense of agency throughout the making and performing of a work. In a sense, it extends the idea of an agent that acts on your behalf to one closer to a partner who brings independent thought and action to the collaborative mix. However, for it to be a true partner as far as the practitioner is concerned, this will depend upon the ability of the technical system to respond in ways that are appropriate

to her intentions but at the same time contribute in unexpected ways. In other words, if there is no parity of response the relationship is unlikely to become a partnership. But what does it take for a digital system to be considered more of a partner than a mediator?

3.4 The Digital as Partner

When creative practitioners refer to digital technologies as partners, this raises a wider question about what it means to be a partner in a human to human sense. The word is widely used in personal and social contexts and seems to imply some form of parity between the parties even if it does not assume sameness. You can be equal but nevertheless different, and it is often the differences that bring people into partnership for mutual benefit. Is it any different, however, when it comes to human and machine partnerships? For example, from the human point of view, does being partners imply that there must be agency on both sides? Does a partnership require a demonstration of autonomy in thought and action? Is it enough to think of a partner as the other half of a duet engaged in the same activity?

In contemporary digital practice, the sense of partnership has evolved to a degree that even far-sighted pioneers did not fully envisage. What is more, this relationship is dependent on how the systems have been designed to interact. If their role is to assist the human in completing a task, this will elicit different behaviour than with a more responsive 'symbiotic' relationship, and here is where the word partner can seem more apt.

Andrew Bluff works at the Animal Logic Academy at the University of Technology, Sydney and collaborates with Stalker Theatre dancers and actors. He creates software systems that mediate live theatre performances working in close collaboration with the people directly concerned. He records observations in close collaboration with performers throughout the development of all works when designing and implementing software. In order to understand how well the mediation has worked, he carries out post performance interviews. This all relies on qualities of a human to human relationship based on a high degree of cross-domain empathy. For Andrew, the creative process also involves shaping the program to match how he thinks. He distinguishes between using digital tools and his creative coding: *Then the software application that comes out of this coding, does act like a creative partner in an artwork. There is artistry and design on two separate levels; there is artistry in creating an interesting entity and then there is artistry in partnering with it to create an actual artwork. When you are heavily involved in both stages, the trick is to spend at least as much time partnering as you do creating* [1].

Andrew uses a range of digital technologies from readymade (3rd party) tools to programming environments. 'Storm' is the name given to the suite of software tools and media for use in live performance. It includes several different purpose-built apps which connect to each other and can be installed on the same or different computers. For example, a motion capture app detects physical movement of performers/audience, another converts the motion capture into physical forces on fluid and body simulations, another renders the graphics from the physics app onto the screen (or can be multiple screens with networked computers). To create these applications, he uses for example, XCode/Visual Studio, the C++ language, Open Frameworks, an open source library to help with rendering and image processing, and Pure Data, a visual programming

language which controls some of the logic and user interface. To make the graphics and sounds which go into each individual performance he uses Photoshop for photo editing, Blender for 3d modelling, Cubase for linear music composition, amongst others.

By creating his own set of tools for enabling the live performances, Andrew can exercise closer control over features and capabilities. Bringing his own thinking style together with coding skill is fundamental to creating creative interactive art systems. At the same time, as he observes, it is a two-way street: "*you also shape the program you are making to adhere to your own unique way of thinking*". It is as if the software he creates to suit his needs becomes a collaborator in making a work. This imbues the human to computer relationship with a sense of partnership, but one in which the human has freedom to create in whatever way he wants, by contrast with the restrictions of ready-made tools [1].

A second example of partnering with the digital is that of Benjamin Carey who created '_derivations', an interactive digital system for in musical improvisation. The system 'listens' to a performer and uses this information to respond in a musical dialogue as happens when human musicians improvise together. This digital instrument is programmed to produce responses that are not easily predictable but nevertheless reflect qualities that are compatible with the expectations of the performer. With a non-interactive system, one that for example, generates 'pre-set' responses, the performer can control the start and stop moments and the system responds in an entirely predictable manner. The kind of digital instrument that is an obedient accompanist is often to be found providing sound tracks for musical performances in concert halls and on the street.

There is of course, an important difference between the performance with a digital instrument and create the instrument yourself. Benjamin Carey does both: he writes the code that defines the system's behaviour (as a digital medium) and in performing with it (as a digital partner), he is able to evaluate whether it responds appropriately. The fact that he writes and tests the computer code does not mean, however, that he can anticipate exactly how it will respond to his own playing. A software system that responds in an unpredictable way too often does not feel right because its human user has a sense that this is purely random and therefore not very engaging. In Benjamin's own words:

> *…you don't want it to go off on its own tangent and not be able to relate to things it's heard or to be able to provoke something that's in the style or context of what is going on now. If I'm testing it and a surprise happens, and then another surprise happens, and another and there's no consistency between the algorithm's output then it becomes random* [1].

The qualities Benjamin finds most effective for a musical partnership require the system to have a measure of autonomy. This means that how the system behaves is not easy to predict and yet at the same time it should be responsive to what the human performer presents it with in a way that feels right and is interesting to work with. Interestingly, Benjamin's wish for a measure of predictability-what he refers to as 'coherence'- was stimulated by his experience of unpredictability and the dissatisfaction this led to about the performance qualities he could achieve. This is a feature of musical improvisation where a creative tension arises as you respond to sounds heard in a musically intelligible way but also look for and make sounds that are different to what came before. The music

is constantly changing but the style should be consistent so that features such as timing, dynamics and timbre are recognisable to the performers. If, on the other hand the human performer cannot relate to what is coming from a software performer that continually produces surprising responses, this feels too randomised and it is difficult to improvise satisfactorily.

As we have seen from the examples described above, the ways in which practitioners talk about and relate to the digital in their creative practice are diverse. This kind of practice is evolving rapidly as new technologies become available and practitioners expand their ambitions. In the next section, a classification of the current ways that digital technologies are used by creative practitioners is presented.

4 Differentiating Digital Technologies in Creative Practice

Digital technologies are amplifying the creative process in many ways. They can be at once a tool designed for a specific purpose, a medium that is exploited according to its particular properties, a mediator that facilitates a range of experiences or a digital partner that works together with a human.

Table 1 sets out each of these categories of digital technology in terms that describe their purpose, the context of use, qualities or attributes and the capability needed to use or work with them. The terms can be applied to any creative work or creative process by asking how what you are using fits in relation to the context of its use, its characteristics, traits or qualities and what human capability is needed to make it work. The table classifies creative works according to these criteria: it is a work in progress.

Table 1. Categories of creative uses of digital technology

	Tool	Medium	Mediator	Partner
What	Device	Material	Facilitator	Relater
Why	Fit for task	Matched to artefact/work	Sets up conditions	Mutual Benefit
Context	Tailored to task	Properties exploited	Experiential	Based on parity
Character	Effective Efficient Inflexible	Adaptable Malleable Controllable	Adaptable Constrained Flexible	Reciprocal Open Coherent
Capability	Skill Training Practice Proficiency	Sensitivity Talent Know how Experience	Feedback Learning Reactive Collaborative	Complex Autonomous Dynamic Evolving

4.1 Tool v Medium

The primary difference between tool and medium is that the first is a device and the second is a material. A tool as device is intended to fulfil a specific purpose; it has been

designed to be effective and efficient; to be most effective it requires skill, training and practice on the part of its user. A medium is a material which can be exploited according to its intrinsic properties, its qualities and character; it is adaptable and controllable but in need of sensitivity, knowledge and talent in the sense of artistic capability.

Digital tools, like image blending and manipulation applications, are tailored to carry out specific tasks for visual art creation. In both David Hockey and Anthony Marshall's cases as described previously, the artists have unquestionably amplified what they do through full use of the functions of the digital tools they have identified for their work. It is arguable how much this actually transformed the nature of their art, but that is an issue for a more extended discussion. However, what is apparent is that neither have the opportunity to make fundamental changes to the tools themselves, nor do they appear to wish to do so. This is not a problem for many tool users but for others it can limit their possibilities. As Andrew Bluff says: '*if you are using one of these digital tools, you don't feel like you've got complete control to do what you want to do'* [1]. In other words, you are bound to work with the feature set included by the tool designer and have to work within those constraints.

The constraints that apply to tool use are different in the case of the digital as medium. Whilst a digital tool to make a work could, in principle, be replaced with another tool, in the same way as substituting a roller for a brush to paint, the same cannot be said for a medium. The cellula automata in Paul Brown's algorithms, generates shapes that are determined uniquely even to the way it can produce unpredictable outcomes. Equally in Esther Rolinson's 'Splinter' sculpture, the programmable LED lights that move through the acrylic shards are fundamental to the concept and experience of the work and the software that drives them is designed specifically to meet the artist's intentions. In Ian Gwilt's augmented, mixed reality art, the medium is the heart of the concept itself and the exhibit could not exist without it.

4.2 Mediator v Partner

A mediator can be defined as a facilitator that sets up conditions for mediated creative experiences in which parties participate, interact and perform. Mediation technology enables interaction between the different parties whether as practitioner-performers or participating audiences. At the heart of the digital as mediator is its interactive nature because this extends the practitioner's creative process: it is an enabler of particular forms of art. A partner, on the other hand, is better described as a 'relater' whose role is based on parity. This is a more open, complex and reflexive relationship. The degree of flexibility and responsiveness between the partners is crucial to a genuine sense of partnership and expectation of mutual benefit.

The difference between mediator and partner technologies depends upon the roles they play. The mediated situation requires flexible adaptation whereas in a partnership there is a greater degree of openness and reciprocity. The qualities most effective for a partnership require the system to have a measure of autonomy which means that how the system behaves is not easy to predict. At the same time, it should be responsive to what the human performer presents it with in a way that feels right and is interesting to work with. If, on the other hand, the human cannot relate to what is coming from a digital partner because it produces responses that feel too randomised, this does not make for a

satisfactory relationship. A partner whether human or artificial that continually behaves in unpredictable ways, appears fickle and is therefore not easy to work with. What applies to human to human partnerships is quite likely to apply between humans and machines. Those practitioners who create the computer code themselves are able to shape the digital partner so that it becomes a better partner from their point of view.

In Sue Hawksley's example, the manner in which the technological and human elements interact within the system are 'equivalent' (a form of parity perhaps) and each has attributes that the other does not. There is no technical difference between the way the Crosstalk algorithm treats the people, the texts, graphical objects and sounds. However, this does not imply they are the same and in the performance environment, the dancers have more influence over how the work evolves. It is arguable that a true partnership between human and digital system implies appropriate responsiveness in parallel with unexpected behaviour as one might expect from a human partner. This is the kind of balance that other practitioners, such as Benjamin Carey, seek in designing systems which have sufficient agency to offer surprising responses but at the same time do not produce random behaviours. In the end, the relationship between human and digital is conditioned by the nature of the human intentions and the design attributes of the system, including its capacity for autonomous, or seemingly autonomous behaviour. Practitioner approaches are very varied and different patterns of ideas interleave with rich and diverse creative practices.

5 Conclusions

For practitioners, a journey from the digital as tool or medium to mediator or partner is not uncommon as they explore and experiment with new technologies that extend and transform their practice. It almost always is the case that creative practitioners will be drawn into expanding their knowledge in a quest to meet the challenges as well as the opportunities the technology affords. It might mean a continual quest to find the best available tools for completing the tasks need to produce visual images for exhibition; it might mean experimenting with different levels of agency in a digitally mediated performance environment; it might mean exploring different programming languages for combining sound and images for an interactive installation; it might involve creating your own digital partner whose characteristics complement or disrupt the performance or are designed to satisfy and extend the repertoire of possibilities. Over the life-time of a practitioner, digital technologies will be absorbed into creative practice in different forms and perform a large variety of functions depending on the degree of amplification they bring to the process and is highly dependent upon the intentions of the practitioner.

Digital Technology is often portrayed as influencing and shaping human behaviour as if it is mainly a one-way process. But in the creative sphere, that relationship is a reciprocal one. The human encounters the technology, tries it out and in doing so expands their expectations and ambitions and demands more of it. The technology is then extended in response and the human goes on to amplify what they were doing. Expanded ambitions and expectations arise from creative activities that include creating and controlling the technology. Far from superseding human creativity, there are powerful signs that human creative capability is being supersized. The partnership model in particular provides

opportunities for the kind of creative exploration that lends itself to extending human capabilities and knowledge, and developing smarter systems that evolve in parallel. This is where the most exciting possibilities for fostering our relationships with the digital lies. My hope is that this could be the start of a more productive way of approaching the relationship we have with digital technology and especially those forms that challenge our confidence in our ability to shape and control what we have created.

We can take a lesson from Gary Kasparov chess grandmaster who was defeated by 'Deep Blue' in 1997, marking the very first time a world champion had been overcome by a computer. The effect on him was enormous but rather than concede the ground to the machine (which by the way had been programmed by some very smart humans), he channelled his energies into finding ways of rescuing the game he loved and had devoted his life to. Instead of bowing to the apparent superiority of the artificial system, he turned to a new model for playing chess: 'Advanced Chess' involved a human and a chess program pitted against another human with a chess program or a solo computer. In promoting this model of chess playing, he was making a partner of the machine. And there were significant gains that were much more important than beating the computer. By harnessing the power of the machines, people could not only outplay them, they could also become more skilful through analysing their moves, identifying mistakes and devising new strategies and plans in partnership with the computer. Human computer cooperation has similar benefits across many domains.

What can we do today to promote this model of human-machine cooperation with its supersizing effects? Apart from being determined about what you want and can do, if you are a creative practitioner, there are many doors open to advancing your capabilities and knowledge. Practice-based research is revealing insider knowledge in new and exciting ways. It is important to identify inspiring models and mentors, a process greatly assisted by first-hand accounts by creative practitioners [14].

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