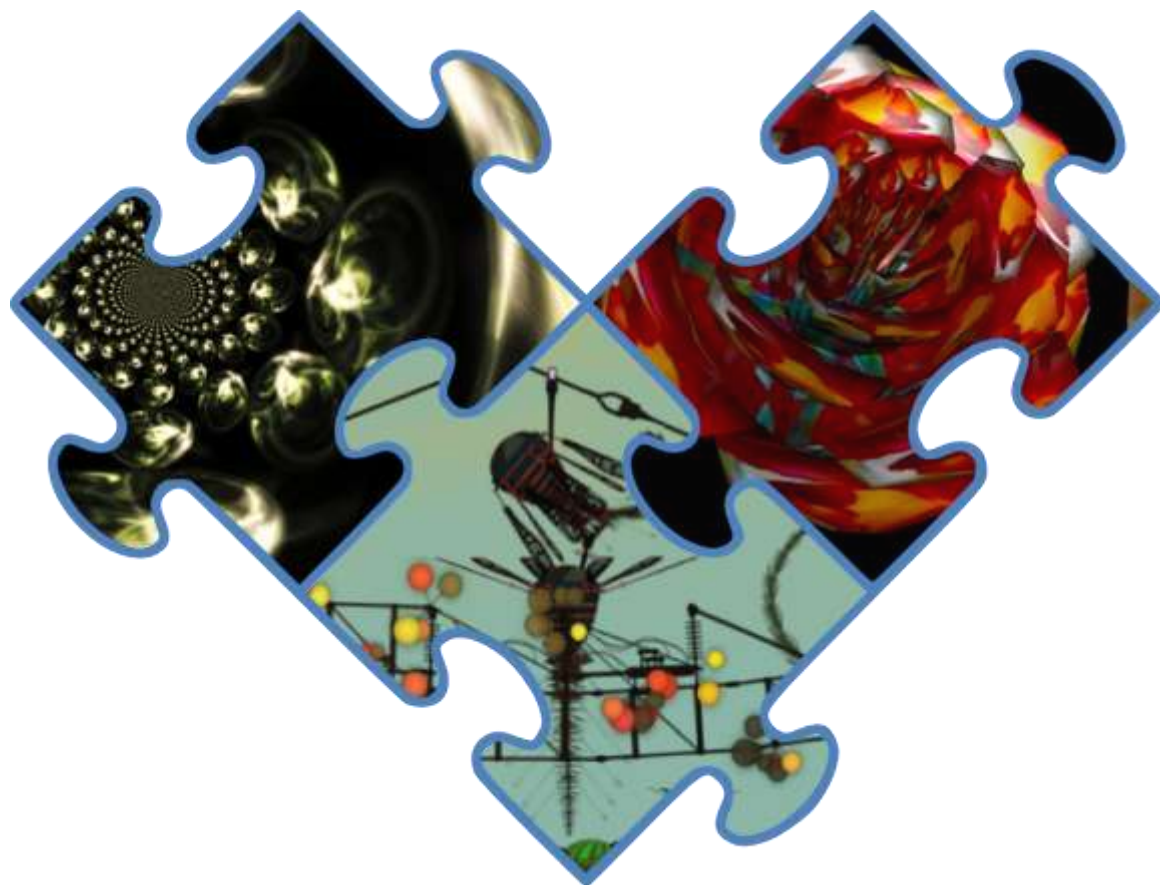# The Preservation of Complex Objects

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Preserving Interaction

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Introduction

As early as 1992, Brenda Laurel noted that the operation of computers is a performative activity (Laurel, 1993). The use of digital technologies to create interactive and immersive artworks is continually increasing as hardware and software becomes more available and affordable to artists and the conceptual and aesthetic opportunities offered by digital media continue to inspire. Interaction with technology is the virtual and conceptual equivalent of a man walking across Peter Brook's famous 'empty space' (Brook, 1968) and is both performative and ephemeral. In terms of their inherent characteristics, digital arts are very similar to performing arts; artistic experiences that are manifested physically yet do not rely on a static materiality to communicate meaning or emotion, that have a life beyond the moment of their enactment, and that, crucially, require active interpretation and interaction. As such, it is useful to consider interactive artworks through a dramaturgical framework and to draw parallels between their similar challenges for documentation and curation and the preservation of these art forms into the future.

Interaction as performance

Like the performing arts, interactive artworks are characterised by **ephemerality, variability,** and an individual and two-way mode of perception that defines their **interactivity**. Ephemerality refers to time-based enactment and the audiences' experiences of it. Any live or interactive work of art is irreproducible, each experience is unique and cannot be replicated in another space or time, even if both the work's author and the audience/user (or 'spect-actor' to borrow a term from Augusto Boal's Forum Theatre) wishes it.

Variability refers to the separation of the concept of the artistic work from the physicality of its manifestation. Just as there have been many thousands of performances of A Midsummer Night's Dream with different casts, sets, and even text (not one of which can be considered to be the 'original' or definitive performance), the core of software art is typically much more about what it does rather than what it is made out of. Function has primacy over material, performance and behaviours are more important than format. This reinforces the idea of art as being something you *do*, not something you *make*.1

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1 Cf. Richard Rinehart, "Artworks as Variability Machines" and Simon Biggs, "Make or break? Concerning the value of redundancy as a creative strategy" presentations at the Preservation of Complex Objects Symposium (Software Art, Glasgow, 11-12 October 2011) http://www.pocos.org/index.php/pocos-symposia/software-art. Variability is discussed more fully in Rinehart's upcoming book (Rinehart & Ippolito, New Media and Social Memory, 2011).

Interactivity is about a mode of perception that leads to active influence on the artwork. Whilst multiple interpretations of a 'static' artwork such as a film or painting are certainly possible, the artwork itself remains unchanged by these interpretations. Software art often moves the interpretation of meaning outside the mind of the spect-actor and incorporates it as an inherent part of the enactment of the work, with the work itself changing and adapting to user inputs. Depending on the design of the artwork and the technological framework surrounding its delivery, interaction may be crucial to the aesthetics and semantics of the work, or a much more subtle influence. Furthermore, both performance and interactive art are shaped by the audience's tacit knowledge, hidden decisions, and learned behaviours (for example an audience clapping or a user double-clicking). In fact, interaction itself is a performative activity, requiring an audience to willingly suspend their disbelief (deliberately ignoring the technology of the proscenium or computer screen) in order to engage with the work in an active and ultimately rewarding way. One of the principal goals of interactive artworks is to motivate the audience to take action (Utvich, 2004, p. 225).

Interactive art, therefore cannot be defined as discrete objects – the type of computer monitor or a text file containing the code – but as an "arrangement of possibilities" or "sum of possible narratives" (Grau, 2003, p. 205); their ephemeral and malleable nature becomes a deliberate feature of the artwork. The work becomes less about delivering a particular message and instead about creating a system of communication.

> *"Ultimately the creative process itself becomes an open-ended work: production and reception merge into a single, mutually conditioning cycle." (Hagebölling, 2004, p. 16)*

As the framework of the artistic experience, software develops these characteristics further than much of live performance as it can offer a non-linear or segmented, hypermedial experience, often requiring further competencies from spect-actors such as navigation, decision-making, and individual action. The form or narrative of the work may only develop through incremental actions by users, based on individual motivations or by other interactive inputs such as live data streams. It is at these points of interaction that the dramaturgical design of the work becomes most clear. Furthermore, as dramaturgy is a formative, aesthetic, and communicative lens and above all creates the overall experience for the audience, (Hagebölling, 2004, p. 9) it is useful to apply this framework when considering the design of interactive artworks.

Interactive works can also add further layers of narrative and aesthetic complication when making use of networks which can overlay spaces (e.g. two remote users occupying the same virtual space, or a mixture of physical and virtual space), time (e.g. replaying the effect of an interaction long after the user has gone), and identities (e.g. when a user takes on a different character in order to engage more fully with the work). Of course, it is these very characteristics and complexities that make documentation and curation of both performance and interactive media artworks so challenging.

> *"Only fixed artworks are able to preserve ideas and concepts enduringly… an open work, which is dependent on interaction with a contemporary audience, or its advanced variant that follows game theory – the work is postulated as a game and the observers, according to the "degrees of freedom", as players – effectively means that images lose their capability to be historical memory and testimony. In its stead, there is a durable technical system as framework and transient, arbitrary, non-reproducible, and infinitely manipulable images. The work of art as a discrete object disappears." (Grau, 2003, p. 207)*

Complexities of interaction and documentation challenges

Spect-actors experience interactive works through a two-way, iterative process of reception, interpretation, and action. Interactions themselves are extremely problematic to document, as they are typically based on a decision made within the user's brain and whilst techniques exist for documenting the interactions themselves (for example recording mouse clicks, data input, tracking eye movements, or even full body motion capture within 3D environments), it is more difficult to capture the user's intent; why a particular action was undertaken and what sparked that decision.

A deeper understanding of the types of control spect-actors have over technology-based environments can reveal clues about their hidden thoughts and emotions. Taking physical or conceptual movement through a virtual environment as an example, there are three ways in which users navigate through virtual environments: exploration, search, and manoeuvring (Kulik, 2009, pp. 23-25) which can be usefully expanded to interactions in non-Euclidean, conceptual spaces as well.

Exploration in physical or 3D environments is typified by a user 'looking around', frequently changing direction whilst observing his environment. This indicates that the user is covering distances without knowing the target destination. In artworks based on a model of conceptual (rather than physical) navigation, for example, using hyperlinked media, a spect-actor's exploratory behaviour might be similar to Web browsing; a meandering path through the work with frequent observation and assessment of his current situation, and use of navigational tools that support exploration, such as a browser's back button.

Search behaviours result from a user knowing in advance her final destination (or discoverable item) and attempting to find the most efficient route to this specific condition of satisfaction. In movement-based and conceptual environments, a user may 'select' a destination and be taken directly to it, for example clicking a hyperlink or 3D object and being taken to it without the need for manual navigation techniques.

Manoeuvring (which could be called 'investigating' in conceptual environments) describes behaviours which aim to discover more about a particular item. In 3D environments this would be typified by walking around an object, viewing it from different angles or perhaps picking it up and directly manipulating it. In a conceptual environment, a user might investigate the functionality or information presented by a particular discrete part of the work, for example, pressing buttons, reading text, or methodically examining specific parts.

In this example, documentation which records these behaviours and can allow for classification can indicate particular intentions from the interactors from a position of quantifiable knowledge. As mentioned above, techniques do exist for capturing complex data about user behaviours however it tends to be very expensive and time-consuming. The alternative is to embrace qualitative, subjective methods of capturing tacit knowledge, opinions, and intent such as conducting feedback interviews with spect-actors, but this is similarly resource-intensive. Each approach has its own challenges and demands from even the most expert of documenters and the choice of approach (or balance between multiple methods), preparation, and resources required are all factors which need to be considered well in advance.

As well as the fine detail of audience-user interactions such as the examples mentioned above, it is useful to consider an overview of the entire experience that spect-actors have with software art. The concept of **trajectories** has emerged in recent HCI research into interactive applications. A trajectory through an artwork is the whole user experience, the

'narrative' of the work as defined jointly by the work itself and its interfaces, and spect-actor knowledge and choices. Mapping these trajectories of interaction and the reasons why the experience unfolded as it did (i.e. the dramaturgy of the interactive experience) is, again, a serious challenge for documenters.

Trajectories are of course, partially defined by the works and their creative and technological framework; "journeys are steered by the participants, but are also shaped by narratives that are embedded into spatial, temporal and performative structures by authors" (Benford *et al.*, 2009, p. 712). A user can be manipulated into moving at a particular speed through the arrangement of possibilities open to them (one unsubtle example would be a game-like scenario, searching for something against the clock), or even forced to engage with certain elements of the work at certain times (for example, pre-timed events which do not rely on user action to occur or automated control mechanisms which override user actions). Designing how much free exploration of the work an audience can undertake is, of course, part of the process of creating any interactive experience. Trajectories can be applied to spatial and temporal experience, as well as the shifting roles and identities of the spect-actors. For example, a visitor to a gallery could spend some time watching another visitor interacting with a work before making the decision to directly interact herself, using knowledge built through this observation and in turn creating an effect on other spectators (Benford *et al.*, 2005). Many artworks are designed to deliberately encourage this type of passive engagement – and the documentation of these effects adds yet another layer of complexity on understanding these works.

Typically, the creator of an interactive work will have an 'ideal' trajectory in mind for participants: a starting point, an end point which allows the spect-actors to disengage, some experiential goals, and an expected time-range for the process of interacting. Spect-actors can diverge (in space, time, or type of engagement) from the expected path and the creator could choose to encourage divergence or encourage (or even force) them to re-converge, using a variety of dramaturgical or technological techniques built into the interaction design of the software framework.

Defining the essence of interactive works

After centuries of the development of knowledge of conservation sciences, it is easy to fall into the trap of treating the curation of interactive artworks as similar to other pieces of art. In archival terminology, a curated painting must have both authenticity (i.e. it is what it purports to be) and integrity (i.e. it still communicates the basic 'essence' of the original artwork). However, given the inherent variability of software art installations – and the fact that often the essence of the artwork itself exists wholly outside of tangible objects, this object-based approach cannot possibly preserve interactivity. Simply put, there is no single 'authentic' version of a work which depends upon user actions to come alive. Attempts to store interactive works as authoritative, static, self-contained objects that are anything other than examples of the framework of possibilities set out by the software are doomed to failure.

> "The idea of capturing a static snapshot as a faithful (or even reasonable) representation is somewhat incongruous. Moreover the possibility that one viewpoint or interpretation could be valued over others and presented as the single authoritative account by virtue of being archived is strongly opposed." (Abbott, Jones, & Ross, 2008, pp. 83-84)

Therefore, the question becomes: how then can we define (and communicate to future audiences) the essence of interactive works? The essence of an interactive work is defined by both the artistic intent of the creator and the implementation of that intent; its physical or ephemeral manifestation. It may rely on physical objects but is not those objects. It may rely on interactions from human users or other actors (e.g. underlying operating systems, real time data streams) but is not those interactions.

Interactions lead to inherent variability at the level of the manifestation of the artwork which must be somehow captured and represented – or at the very least acknowledged – in curation efforts, but too much variability in representations may lead to a loss of coherency and therefore reduce the integrity of the essence of the work. As well as in its ephemeral manifestation, part of the essence of interactive artwork lies in its trajectories of user experience. Appraising what aspects of user experience to capture to most accurately represent the core essence of the work (e.g. enacted actions such as mouse clicks as mentioned above or descriptions of user intent and reactions via feedback) is a very skilled documentation task. Furthermore there are interactions that can affect the aesthetics or function of software art that are not defined by human actors. Machine interpretation of, for example, a section of code is more easily defined, predicted, and repeated than that of human actors, and as such the technical and procedural aspects of curating software art can occlude the other aspects of a work's integrity: its core essence. Again, there is a danger of relying on the heritage of conservation studies and fixating on the curation of the more manageable, tangible and static aspects of the work at the expense of the more difficult (and resource-intensive) but more meaningful representations of essence.

Automated interactions can raise other important issues. For example, *System 1.6*, a work created by boredomresearch[2] showed sprites moving around a monitor screen. The speed of the movements was an important aspect of the work's visual and sonic aesthetic and at the time was limited by the graphical processing power of the technologies used, so in terms of coding the sprites' behaviour instructions were to move "as fast as possible". Enactments of the curated version however have much greater underlying processing power which results in increased speed described by the creators as "comedic" and "manic" (Smith & Isley, 2011). The lack of hard-coded behaviour leads, therefore, to a **reduction** in the integrity of the curated work over time: too much variability. This raises the potentially controversial issue of whether curators should make changes to the components of an interactive work in order to preserve, as best they can, its artistic essence. If behaviour is more important than material and function/interaction has primacy over the code, should a curator edit the original code to enforce a maximum speed closer to the first manifestations of this artwork? Other interactive works draw in external interactions which form an intrinsic part of their essence, for example data from the Internet, gallery environment, or specialist data feeds. Is it necessary to record these data streams alongside other representations of the work (and perhaps to document how the data interacts with the framework to produce a particular manifestation observed in say, a video recording)? Or is it enough to simply acknowledge the fact that data form an inherent ingredient of the work? A particularly important scenario is when an artwork collects data from user interactions as it runs, each user's interactions feeding into future experiences and adding to the overall artwork. When user influence is crucial not only to their individual experience but is captured and accumulates as an inherent part of the work, questions are raised about not only the 'richest' version of the work (e.g. is the last

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[2] System 1.6, http://www.boredomresearch.net/system16.html: Presentation available online at http://vimeo.com/31447537 (accessed 16/11/2011).

enactment any more valid than all those that came before it as it benefits from the accumulated interaction data of previous instantiations) but also of authorship and ownership.

One final issue of how to define and document the essence of interactive works is the relationship between single works and the whole body of work produced by a particular artist, group, or institution. The importance of communicating and curating an ongoing artistic practice is much wider than simply considering interactivity, however to remain focussed on this particular aspect, interactive behaviours can evolve and be learned over one or multiple instantiations, changing the user trajectories both within one artwork and over several pieces by the same creator. Spect-actors integrating knowledge of specific control mechanisms to achieve particular interactions can be clearly observed in computer games and their sequels but from the perspective of the user can be hard to identify – in fact these learned behaviours can seem so natural to users with previous experience that they are baffled when new users demonstrate a lack of interaction knowledge. Given that creators of interactive art are, almost by definition, 'expert' users of their own interactive frameworks, there could be a risk that over-assumption of the mechanics of interaction in their audiences leads to unintended user trajectories, which may well occlude the intended artistic experience. Whilst the dramaturgy of the experience is a core concern for most software artists, not all are, or wish to be, expert interaction designers in terms of specific input/output mechanisms. One danger of removing an individual work from its context in place of the artist's body of work is a failure to acknowledge that this act could inherently change the modes of interaction an audience has with the work.

So, capturing interaction is a task which requires high levels of skill and understanding in both the artistic and curatorial domains in order to document both intent and manifestation of a work, avoid misrepresentation, reflect variability and adaptation over time, and acknowledge variation in human and machine behaviours. The essence of the interactive work may exist simultaneously in multiple layers of reality: a live gallery space, a virtual space, and a networked or conceptual environment[3]. These challenges lead to an incredible burden of documentation and uncertainty about who (if anyone) has the responsibility for ensuring the integrity of interaction is preserved.

Strategies for approaching documentation

Research into digital representations of various types of live artworks has shown that academic researchers value documentation about the process of creating artworks as highly as documentation of the artwork itself (Abbott & Beer, 2006, pp. 31-32). Both performance and interactive art never reach a state of completion, both are open-ended creative endeavours, experienced uniquely, and continually being re-formed as part of an ongoing creative process. The decisions of the creators in setting up these works are as critical to inform future understanding as are the decisions of the participants who shape the work on each instantiation. Museums and galleries have understandably struggled with the curatorial strategies necessary to create collections of media or interactive artworks at both a conceptual and a practical level (Grau, 2003). Therefore, the preservation of these art forms has been neglected until relatively recently, and even if

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[3] For example Day of the Figurines and other work by Blast Theory (1991 – present) which blurs the line between performance, interactive art and gaming, existing simultaneously in gallery spaces, outdoors, and on mobile devices and the network (http://www.blasttheory.co.uk).

communities are actively embracing the conceptual challenges, there are still financial and organisational issues to overcome.

Simply put, it is impossible to capture every aspect of an interactive work. This means that creative and interpretative choices are a necessity in order to appraise the artwork and define which of its many facets are the most important, or the most representative, and can be used to give future audiences an accurate sense of the work, yet working within the confines of the time, money and expertise available for documentation and curation. This process of realistic appraisal is one that demands a deep understanding of the work, and is arguably best performed by the creating artist, although it is noted that the perspective of someone without close ties to the work can be exceptionally useful in helping to define how best to capture particular elements. Appraisal is itself a time-consuming task, therefore a useful strategy for managing documentation is to define the drivers for documentation, and choose on which to focus curation efforts. Some common drivers and the questions that surround them are outlined below.

- **Preserving the essence of the work.** It is taken as a given that a major driver is to preserve the integrity of the artwork over time. Issues here include how the artist wishes the work to be preserved and what is the most 'accurate' way it can be captured (which may sometimes conflict), which (if any) stage is the most important (e.g. process of creation, live enactment, subsequent interpretation), behaviours and aesthetics, context including place and significance in the artist's wider practice and society in general. Recording one instantiation of interaction could be critical, as could suggesting how the work 'might have been'.

- **Establishing rights and permissions for re-use and curation.** Clear statements of intent about if and how the artist wishes the work to be re-used in the future, and what rights a curator may have to make changes in order to preserve the work. Once ingested into any sort of collection, the creation of preservation documentation for long-term curation is also a driver.

- **Enabling reconstruction or adaptation.** This could apply to near or far future enactments, or instructions for installing the artwork in another physical or virtual space, or by another artist. What are the crucial/desired/irrelevant elements of the work and what information must be recorded to facilitate reconstructions? The desire or need to collaborate with other artists or technologists is a major driver here (for example, providing clear comments in software code is necessary for other people to understand or adapt it).

- **Extending the reach of the work.** Good documentation that clearly communicates the essence of an interactive work can be used as a research tool, even if the work is itself not re-enacted. This driver encourages the production of high quality documentation that would significantly help a curator. It can even be seen as useful to introduce new creative elements into representation that are a 'surrogate' for the type of interaction experienced in the work, although artists must be aware of the limitations of documentation (e.g. the impossibility of including a frozen pea: (Gray, 2008, p. 414)).

- **Increasing reputation and building a portfolio.** A major driver is for artists to have a collection of past work on which to draw in ongoing practice but also to demonstrate their particular skills and artistic concerns. Interactive and other live artworks pose a particular challenge as they are only represented by their documentation which can be as resource intensive as the initial enactment.

- **Facilitating further work.** Attracting funding for further work is another major driver for interactive artists and relies not only on presenting a portfolio seen to be valuable by the funders, but potentially on documentation which helps to validate previous work, such as project reports and budgets. In addition, reusability of elements of the work (e.g. a section of source code) can be of particular importance to save the artist time in the future.

As can be clearly seen from the examples above, adequate documentation must be an ongoing process, throughout all stages of the creation, instantiation, interpretation, and even curation of an interactive work. Documentation is not a task that can be left until the 'completion' of a work or installation. Commenting code is an ongoing task, not something that is easy or useful to undertake several months later, and retroactive documentation is in many cases simply impossible; if preparations are not made in advance to capture, for example, users' behaviours and reactions when interacting, this information is gone forever. Therefore, a useful strategy is to give thought to not only the most important drivers for documentation well ahead of time, but to plan the timeline of creative documentation decisions: when will particular elements be recorded, collected, or reflected on; who can/will take on the task; who will be responsible for storing (and possibly adding metadata to) the documents; are there any skill gaps for desired evidence collection; how will each documentation decision relate to the overall representation of the work and its context?

Another critical element of documentation is to increase the value of representations by striving for **transparency** in the creative decision-making related to appraisal and ongoing documentation processes already mentioned. Returning to the example of System 1.6, the creators noted that without contextual information, a current audience has no way of knowing that the speed of the sprites' movement is not actually what was intended. A curator could therefore choose to encode a speed limiter to preserve the integrity of the aesthetics of this work, however it is crucial to document this change as a curatorial process; to acknowledge that some of the work's ingredients had been altered, and how. In the same way that a file format migration would be recorded as part of digital preservation, transparency of more subjective curatorial choices is not only necessary to demonstrate or validate some level of archival authenticity for curated works, it also helps to illuminate the curation process which can only be valuable in bring different communities of expertise to a shared understanding.

In a situation where there is an almost infinite amount of information that could be collected, the strategies above will help artists and curators to analyse and prioritise those aspects which will be most meaningful in the preservation of interactive art. As our understanding of the critical issues in this domain grows, so does the opportunity to create higher quality representations with greater long-term value. Nevertheless the issue remains that documentation of interaction is a considerable drain on the resources of artists and curators alike. The first step therefore should always be to investigate ways to **share the burden** and to maximise use of existing work, resources, services, methodologies, and expertise in this field.

Researchers into interaction design have identified a notable gap in the techniques, tools, and expertise to assist documenters in capturing and preserving interactive works (Benford *et al.*, 2009, p. 717). However, recently developed tools and techniques are opening up those areas which have been neglected by a 'traditional' understanding of archiving works and addressing notions such as the documentation of process; collaborative, shared, or networked artworks; and multiple intents, interpretation and user

experiences. For example, the Media Art Notation System offers a conceptual model similar to that of a musical score, that is, a non-proscriptive, structured set of information about works, which explicitly allows for multiple subjective interpretations (Rinehart, 2007).

Furthermore, the development of holistic, high-level curation strategies in recent years, such as the Digital Curation Centre's Curation Lifecycle Model (Higgins, 2008), offer a structured approach which is more appropriate to open-ended works such as performance and interactive artworks. The explicit acknowledgement of an ongoing cycle of curation which includes elements of transformation[4] is particularly useful for addressing the challenges of work in this domain.

Several national initiatives in the UK offer resources designed to reduce the burden of documentation and curation for practising artists and much of the information provided could be extremely useful for planning and achieving efficient and high quality documentation processes. The resources available range from the highly technical (e.g. file formats and standards, registries of representation information) to general best-practice guides, case studies, and briefing papers aimed at non-experts. There are also a range of templates for planning documentation and preservation (e.g. data management plans, usage rights declarations).[5]

Finally, the DOCAM Research Alliance has a series of research outputs and practical resources aimed specifically at the documentation and conservation of media arts heritage. They span cataloguing, conservation, the history of relevant technologies, and a complete documentation model based on the whole lifecycle of the artwork. These resources are an excellent starting point for planning the best possible ways in which to preserve interactive works.

Conclusion

Documentation of interaction, whether 'real' or virtual can be difficult, time-consuming, and expensive, often leading to the production of data that is just as complex as the artwork itself. It is crucial to have a clear and realistic strategy for producing appropriate, accurate, and evocative representations of interactions within artworks and their relationship to the aesthetics, form, function, and context of the overall work. Professional artists and curators have different skills and knowledge and must work together on this challenging task with a clear understanding of both the reasons for producing documentation, and the creative decision-making that underlies the entire process. Creating an interactive artwork is an open-ended activity and includes documentation strategies within it. To successfully open up the possibilities for future interpretation, re-use, and preservation of interactive works, artists and curators alike should be familiar with both the intellectual and practical challenges of documentation, as well as the existing methodologies and resources that can be used to produce the best possible outcome.

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[4] Cf. Digital Curation Lifecycle Model: http://www.dcc.ac.uk/resources/curation-lifecycle-model
[5] Examples of freely available resources can be found at http://www.dcc.ac.uk/resources; http://www.jisc.ac.uk/whatwedo/services.aspx; http://www.dpconline.org/; and of course http://www.pocos.org/

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