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Relating Theory, Practice and Evaluation in Practitioner Research

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ABSTRACT

The authors have developed a model of practice-based research from observations and studies of practitioners undertaking Ph.D.s in digital art and specifically interactive art. Trajectories of research and practice have been identified that have common elements but are driven by different practitioner goals and preferences. The authors present a model of practitioner research that represents the relationship between theory, practice and evaluation, and they describe how different trajectories of research and practice lead to the development of theoretical frameworks by practitioners. Whilst the common features of the trajectories are important to identify so that the characteristics of practitioner research can be understood more generally, the authors believe that having scope for individuality is vital to such research.

While research as part of art practice is not a new idea, formal research by artists, designers and other creative practitioners is becoming more and more a familiar part of university doctoral programs. Bolt points out that theorizing based on practice is very different from applying theory *to* practice [1]. Both can form part of a practice-based research project, but it is important to be clear regarding how theory and practice can each lead to developments in the other. This study addresses that issue in a particular context. Sullivan discusses art practice as research and identifies one context that frames the concerns of this paper. He calls it "Making in Systems," which he defines as moving "beyond discipline boundaries and into areas of inquiry that interact and intersect and require new ways to conceptualise forms and structures" [2].

Having closely observed creative practitioners who might be said to be "making in systems" undertaking Ph.D. studies over many years, we believe that it is now possible to describe some general features of the way such practitioners undertake their research and, in particular, how they develop theoretical frameworks that inform and guide the making and evaluation of the outcomes of their practice. In this article, we describe a model of practice-based research that represents the relationship between theory, practice and evaluation in cases where the practitioner follows a specific trajectory or route influenced by individual goals and intentions.
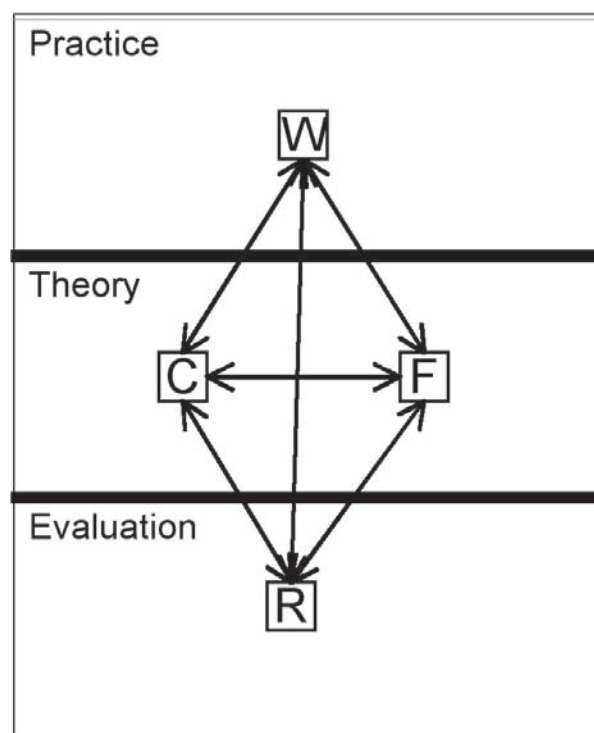
In a trajectory of practice and research, there are three elements: Practice, Theory and Evaluation. Each element involves activities undertaken by the practitioner in the process of making physical works, developing conceptual frameworks and performing evaluation studies. The practitioner's *framework* is a conceptual structure that is used to inform evaluation and the development of practice. Practice may equally inform the development of the framework and, hence, theory.

In addition to the general characteristics of the model, we describe different trajectories followed by practitioners and the way in which the conceptual frameworks play a central

Fig. 1. Trajectory Model of Practice and Research. (© Ernest Edmonds) Trajectory Model of Practice and Research shows the three main elements that make up a practitioner trajectory of practice and research: Practice, Theory and Evaluation. Each element has outcomes and involves various kinds of activities. From Practice, the main outcomes are Works (W), i.e. artifacts, installations, exhibition, performances, etc.; from Theory, the main outcomes are Criteria (C) (design strategies) and Frameworks (F); from Evaluation come Results (R).

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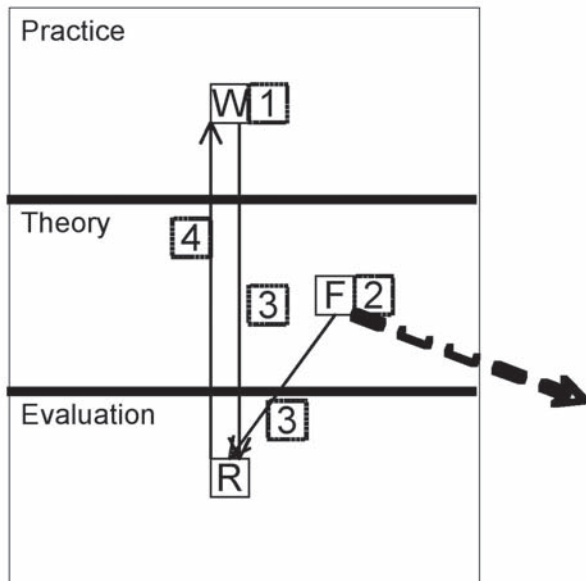
Fig. 2. Trajectory Example 1: Theory Drives Practice. (© Ernest Edmonds) Theory drives Practice for the most part in the research process of this particular practitioner.
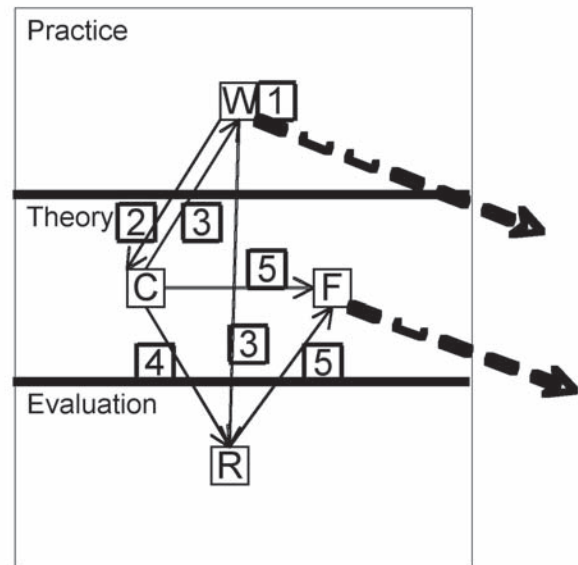
Fig. 3. Trajectory Example 2: Practice Drives Theory. (© Ernest Edmonds) In this example, creative practice is the main driver of the research, although it has to be noted that theory about sound synthesis and physical modeling was important to the practitioner's design of the works.

role, illustrated by specific cases from recent Ph.D. programs. The practitioners referred to work primarily within the field of interactive art systems using digital technology to create experiences that enable audience participation in the creation of visual and sound artworks. The research was undertaken at Creativity and Cognition Studios [3] and Beta_Space, a public exhibition space in a major museum where interactive artworks are exhibited to the public and audience experience is evaluated [4]. Exhibitions are mounted presenting interactive artworks that, while technically finished, are not fully developed until audience interaction has been incorporated.

TRAJECTORIES OF PRACTICE AND RESEARCH

A large number of projects have contributed to the ideas in this paper, but the model was specifically developed from a detailed study of 10 projects. We investigated each project by conducting semistructured interviews and by reading material produced by the researchers. In conjunction with the research, we drew maps of the individual research trajectories and, as a result, were able to build the composite model presented here. Four of the cases are used here to provide example illustrations of the application of the model to complement the description of the research processes employed.

Figure 1 shows the three main elements that make up a practitioner trajectory of practice and research: Practice, Theory and Evaluation. Each element has outcomes and involves various kinds of activities. From Practice, the main outcomes are Works [W], i.e. artifacts, installations, exhibitions, performances, etc.; from Theory, the main outcomes are Criteria [C] (design strategies) and Frameworks [F]; from Evaluation come Results [R].

The trajectories of practice and research can work in a number of different ways. Where the primary driver is theory, a framework is developed that draws on theoretical knowledge and is used to shape the evaluation process and the creation of works. A second type of trajectory is one in which practice drives the development of theory. In this case, research questions and design criteria are derived through the creation of works, which leads to the development of a theoretical framework used in the evaluation of the results of practice. In both cases, the process is cyclical, and there is often a tighter iterative sub-process in which framework and practice develop together.

It is important to note that a trajectory of practice and research, while a time-ordered path, is far from a linear, step-wise set of activities that moves inexorably toward an intended goal. In reality, even under the time constraints of a

research program, practice is interwoven with the other two elements: theory and evaluation. Sometimes the theory comes first, but often the need for it emerges as the practice process continues. The role of theory and practice in creative arts research is relatively familiar, but that of evaluation, as we characterize it, is perhaps less well known and can be seen as representing a novel approach in this field.

Table 1 shows the main elements, activities and outcomes of the trajectory model.

Practice is a primary element in the trajectory, providing as it does the motivation for conducting research as well as generating the activities for creating and exhibiting tangible outcomes such as artworks, exhibitions, installations, musical compositions and creative software systems. In practice-based research, experiencing these works is usually necessary for a full understanding of the practitioner's contribution to new knowledge. For that reason, the role the works play in evaluation is vital.

Theory, as it is understood in the context of practice-based research, is likely to consist of different ways of examining, critiquing and applying areas of knowledge considered relevant to the individual's practice. If, for example, the practitioner seeks to create a software artifact that can be used in ways analogous with the function of a conventional musi-

Table 1. Main Elements, Activities and Outcomes of Each Trajectory

Elements	Activities	Outcomes
Practice	*create, exhibit, reflect*	**Works**: consisting of physical artifacts, musical compositions, software systems, installations, exhibitions, collaborations
Theory	*read, think, write, develop*	**Frameworks**: comprising questions, criteria, issues
Evaluation	*observe, record, analyse, reflect*	**Evaluation**: findings leading to new/modified works and frameworks

cal instrument, then being able to select and adapt relevant theoretical knowledge of the physical modeling of sound is a necessary role for such "theory." On the other hand, practitioner theory may consist of an untested opinion (or hypothesis) that the artwork will be able to elicit certain emotions or qualities of experience in an audience or "user"; this will remain a personal "theory-in-action" until it is subjected to a more rigorous form of study that involves investigation of the opinion's validity beyond an individual viewpoint. For practitioners, this is often referred to as design criteria or strategies operating as working theories in the creative process. Within the formal constraints of the doctoral research process, these working theories are developed into more rigorous forms through the exploration of theoretical knowledge and the examples of other practitioners.

Evaluation, which informs practice, has a particular role defined by practitioners themselves in order to facilitate reflections on practice and a broader understanding, for example, of audience experience of artworks. It usually involves direct observation, monitoring, recording, analysis and reflection as part of a semi-formal approach to generating

understandings that go further than informal reflections on personal practice. An important difference is that the outcomes should—indeed, for the Ph.D. *must*—be accessible to other people and therefore be available in a documented public form. In the context of interactive arts, the fields of human-computer interaction (HCI) and ethnography are rich sources of inspiration and practical help. Practice-based researchers who wish to carry out evaluation often find that the demands of methodology are much heavier than anticipated [5].

PRACTITIONER FRAMEWORKS

When practitioners carry out research in parallel with making works, they develop frameworks that guide their practice and the evaluation of the outcomes of that practice, that is, artifacts that are submitted along with a written text. This is an essential part of the generation of insights and understandings that contribute to the final outcome of the Ph.D. and may be considered an original contribution to knowledge.

Practitioner frameworks are defined by whoever invents them (e.g. an artist) and the purpose they serve (e.g. to shape the

developing artwork). The practitioners whose work is provided here by way of example work primarily within the field of interactive art systems using forms of digital technology to create experiences for direct audience participation in the creation of visual and sound artworks. These practitioners are engaged in doctoral research involving a cyclical process of putting theoretical knowledge into practice and revising theory as a result of the outcomes. Theory and practice are intertwined in the development of their art. Research questions and issues come naturally from the practice, and it is often a small step to articulate the context and methods associated with practice.

A framework consists of a conceptual structure used to influence practice, inform theory and, in particular, shape evaluation. A framework may consist of many different things according to the individual practitioner's goals and intentions. Among the practitioners referred to here, common descriptors exist: for example, types, modes, qualities, categories, indices, etc., which may refer to similar concepts. At the same time, the methodologies that are developed will have an impact on the way the framework is applied and how it is altered in the light of experience.

Some examples of framework types are:

- classifications for assessing the ways in which audiences respond to particular works
- criteria for guiding the design of a new artifact or installation
- questions expressed as working hypotheses, to be explored using theoretical knowledge.

In the cases we describe below, evaluation forms an integral part of the research process. Each practitioner devises individual frameworks that are used to guide the making of works and shape evaluation studies of audience experience and engagement with works. The outcomes of practice for the practitioner may often be seen as steps on a path or quasi-experiments in a larger and longer

Fig. 4. Andrew Johnston, *Spheres of Influence*, 2008. (© Andrew Johnston. Photo © Rosanne Hodgekiss.) Trombonist Ben Marks performs *Spheres of Influence* by Andrew Johnston.

personal process. The other outcome important for creative practice is the framework, which is a living entity that can guide making, evaluating and interpreting. Practice, theory and evaluation all impinge upon the framework that may be developed, over long periods of time, in relation to extended series of artworks.

EXAMPLE 1: THEORY DRIVES PRACTICE—A FRAMEWORK FOR INTERACTIVE EMERGENT EXPERIENCE

Jennifer Seevinck is a visual artist interested in interactive art, emergence, perception and the Gestalt, tangible computing, virtual reality and medical simulation [6]. Seevinck is exploring how her artworks might stimulate emergent experience in audiences, that is, the appearance (to the viewer) of new forms not explicit in the source work. As an artist, she is continually making artifacts, and we can assume that for her and other practitioner-researchers, no research process begins without the prior existence of works that may or may not be included in the ongoing research process.

An analysis of Seevinck's research process indicates that she follows a trajectory in which, for the most part, theory drives practice. This is a conscious choice on her part. Her practice and research trajectory is represented in Fig. 2; the summary below draws out the main elements and pathways:

1. Practice: As Seevinck created artworks she considered whether or not they fulfilled her expectations with regard to the audience or viewer. Underlying this process was a stream of inquiry about emergence and how an audience's emergent response may be influenced by interaction with works of art.
2. Theory: From an analysis of the theoretical literature on emergence, she derived a set of categories of properties for describing the compositions and shapes observed in audience interaction.
3. Evaluation: Having derived this first framework, she then evaluated her existing works. These works had been designed to stimulate emergent responses in audiences according to a working hypothesis. The qualities of emergence were structured according to origin (e.g. perceptual or physical) or intrinsic or extrinsic structures (e.g. in which the emergent part changes or does not change the source).
4. Practice: The results of the evaluation and the refined framework were used to inform and guide the making of the next work.
5. Theory: The initial framework provides a contribution to the ongoing studies and is now in the public domain [7].

With each iteration in practice, the artist moves toward her goal of creating artworks that stimulate particular responses in the audience; much like a scientist, she is testing the hypothesis embodied in the work under consideration at the time. Supporting her "experimentation," theory provides the ingredients of her framework for evaluation of audience experience. By focusing on emergent properties, she seeks to create opportunities for a more open interaction experience in which the user becomes a creative collaborator with the system. In this case, the framework both informs the art-making process and also provides a means of interpreting audience response and behavior through evaluation. Once fully tested and refined, the framework will be expected to contribute to theory in this domain. Color Plate A shows Seevinck's *+-now* installation.

EXAMPLE 2: PRACTICE DRIVES THEORY— A FRAMEWORK FOR INTERACTION WITH VIRTUAL INSTRUMENTS

Andrew Johnston is a musician and software developer living in Sydney, Australia. In 2004 he commenced work on a Ph.D. investigating the design and use of software to support an experimental, exploratory approach to live music making. The resulting audiovisual performance work for trombone and "virtual musical instruments," *Partial Reflections,* co-created with Ben Marks, premiered at the Sydney Opera House Studio in 2006 [8].

An analysis of Johnston's research process indicates that his creative practice is the main driver of the research, although it has to be noted that theory with respect to knowledge about physical modeling was important to his approach to the design of his works. His process is encapsulated in a trajectory in which practice drives theory development.

Johnston's practice and research trajectory is represented in Fig. 3 and can be summarized as follows:

1. Practice: Johnston designed and implemented software artifacts called "virtual instruments" that allow musicians to "play" using the sounds of their familiar acoustic instruments. The virtual instrument–making process occurred in collaboration with composer Ben Marks.
2. Theory: As part of this collaborative process, Johnston generated initial criteria for design through a weblog diary that recorded his reflections on the activities as they evolved.
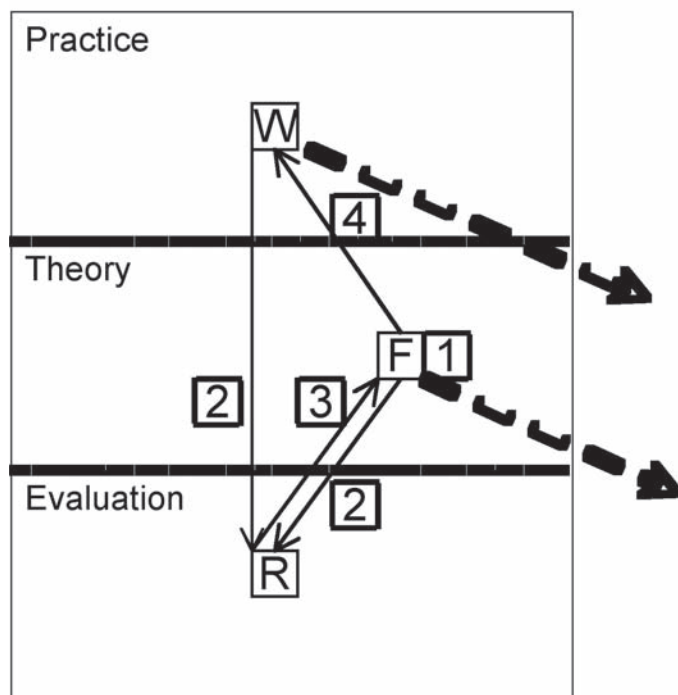

Fig. 5. Trajectory Example 3: Theory-Practice Reflexivity. (© Ernest Edmonds) The trajectory of practice and research here, although theory driven in many respects, is characterized by a strong reflexive relationship between theory and practice.

3. Practice: The criteria that emerged from this consciously documented reflective practice were used to guide the next iteration of the design of new works so as to ensure that the virtual instruments would be usable with a variety of conventional musical instruments and have attributes that were perceived as natural, consistent, interesting and motivating from a player's point of view. The criteria were intended to help the practitioner achieve qualities in the virtual instruments that would have particular effects upon the players.

4. Evaluation: Once the virtual instruments were at a stage where they could be confidently handed over to other musicians, it was then possible to carry out a user experience study in which the instruments were evaluated against the initial criteria. The instruments were played and evaluated by other experienced musicians in a process that was observed and recorded by the practitioner with other observers. The study examined what happened when the instruments were played in real practice: Were the initial criteria satisfied? What else happened that was unexpected and relevant to satisfying the criteria?

5. Theory: Based on results from the study, the criteria were refined and extended. More significantly, new understandings emerged in the form of a theoretical framework for interaction that contributed to new knowledge in the domain. In addition, the relationship between the criteria and the framework was established more clearly.

From this example we can see how a practitioner framework was made more focused and strengthened for future use in practice. First, the practitioner criteria drove the design that, in turn, raised questions about the knowledge being used; making progress required further exploration of theoretical knowledge. The instruments were modified and then given to musicians to use under observation, and the design criteria were tested and modified where appropriate. Finally, a new conceptual structure, a framework for interpreting user interaction, was derived. The framework consisted of three modes of interaction: instrumental, ornamental and conversational. These modes provided further insight into how certain forms of desirable interaction could be achieved. The "conversational" mode of interaction was, from the practitioner's point of view, the most interesting but at the same time posed the biggest challenge. Finding a balance between control and complexity is, he argued, a key issue in facilitating "conversational" interaction [9]. The practitioner went on to design and create new virtual instruments and put his theoretical outcomes into the public domain in the form of a Ph.D. thesis and published journal papers.

In Fig. 4, trombonist Ben Marks is seen performing Johnston's *Spheres of Influence.*

EXAMPLE 3: THEORY AND PRACTICE REFLEXIVITY— A FRAMEWORK FOR COLLABORATIVE CURATORIAL PRACTICE

Lizzie Muller is a curator, writer and researcher specializing in interaction, audience experience and interdisciplinary collaboration [10]. Muller has developed an "experiential" approach to her role as a curator of interactive art and in her Ph.D. research sought to develop this as part of collaborative practice with selected artists. The tools and methods used were evaluated using a "reflection-in-action" technique [11] with a view to providing a model for other curators wishing to practice in this emerging field. The trajectory of practice and research here, although theory driven in many respects, is characterized by a strong reflexive relationship between theory and practice: see Fig. 5.

The practice and research trajectory can be summarized as follows:

1. Theory: Theoretical knowledge drawn from the field of HCI was adapted for use in an artistic context and used to derive a framework consisting of tools and methods for understanding audience experience.

2. Evaluation: The framework was then applied to two case studies of her collaboration with artists who were developing and exhibiting their work in a public space, and the results were analyzed.

3. Theory: From the results of applying the tools and methods to the case studies of the collaboration between the curator-practitioner and the two artists, the practitioner was able to refine her understanding and generate a revised critical framework consisting of a set of qualities of audience experience.

4. Practice: The practitioner used the refined framework for further curatorial activities and found it effective for interpreting the nature of the interactive artworks, including

Fig. 6. Brigid Costello, *Elysian Fields***, installation, 2006. (© Brigid Costello)**

Edmonds and Candy, Relating Theory, Practice and Evaluation
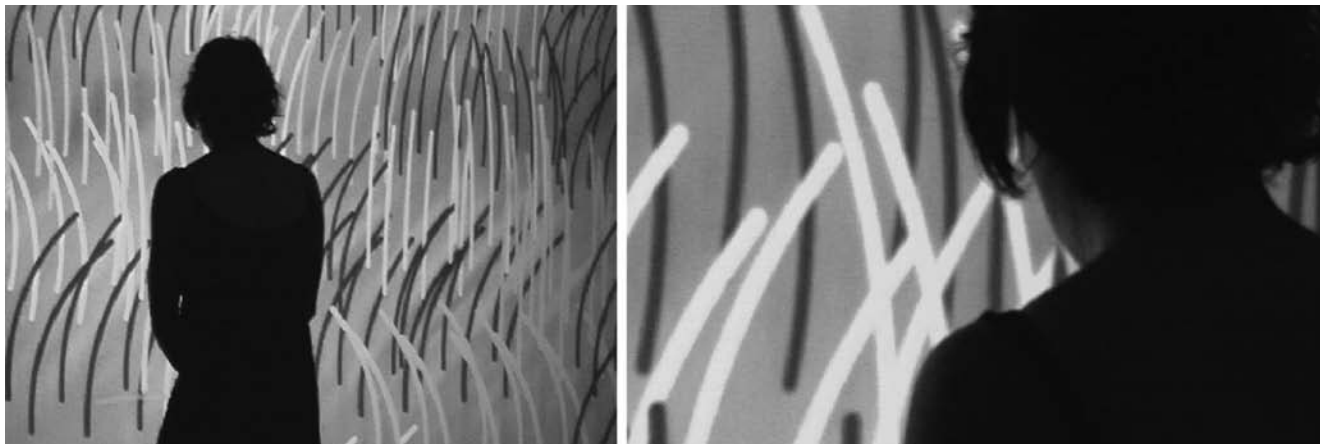
the artist's response to the audience experience.

5. Theory: The framework was enlarged to embrace three principal themes (control, complexity and mirroring), which were used to shape a discussion of the effects of the particular interactive artworks on audiences. The framework will be available in the public domain in the form of a Ph.D. thesis. Further exhibitions curated by Muller have also taken place as ongoing examples of this form of curatorial practice.

This example provides a unique insight into a practitioner-researcher's approach combining a theory with practice in curatorial experience in a dynamic reflexive relationship. The exhibition as a work outcome has often been documented via a catalogue, making available a kind of record different from conventional academic publications. On a broader scale, this kind of practitioner interpretation ventures beyond providing a model of practice into a discussion of the role of interactive art and cultural change.

EXAMPLE 4: PRACTICE AND THEORY—A FRAMEWORK FOR INTERACTIVE PLAY EXPERIENCE

The fourth example combines art practice and qualitative research methods in a cyclical process of artifact creation and evaluation. Brigid Costello is a practicing multimedia artist with expertise in interaction design, programming and visual design. She has also worked as a cinematographer. As part of her Ph.D. research, Costello has developed ways to enable playful experiences for audiences interacting with her artworks *Elysian Fields* (Fig. 6), *Sprung!* and *Just a Bit of Spin* [12].

Her trajectory of practice and research takes this artist-researcher through several stages of creation and evaluation: from formulating the main research question and generating design strategies that are tested with existing artifacts to the creation of new works using the tested (and modified) strategies (Fig. 7).

1. Practice: Costello created a number of interactive works that enabled her to explore audience experience using criteria for design ("strategies," to use her term)

to shape her works so that they engendered or encouraged play. These criteria arose from reflections about her earlier work as well as that of other interactive artists.

2. Theory: From an exploration of theoretical literature about play and related phenomena, she developed a framework of play based on 13 pleasure categories.

3. Evaluation: The works created using the modified criteria were studied and the framework was used to support the evaluation of observational data gathered from audience-experience studies.

4. Theory: From the results of the audience studies, new understandings about the capability of interactive works for play experience were derived, and the framework was refined.

5. Theory: A relationship between the refined criteria and the final version of the framework was established. The "play framework" of 13 pleasure categories provides a structure for both creation and evaluation of works. It is not intended to be an exhaustive set of categories of playful experience and makes no claims to be so [13].

The practitioner framework here provided new ways of thinking about creating works in terms of different qualities of audience experience. Such experiences might include pleasure derived from creating something during interaction or difficulty encountered that poses a challenge and provides pleasure in its overcoming. The framework's main purpose is to create a common language between artist and audience for communicating about play experiences. Although the framework has a crucial role in evaluating audience experience, it was intended primarily to be a way of framing creative thinking in terms of the kind of experience the artist wanted the work to create: "When designing you have to imagine the audience response. You create interaction possibilities with the hope that they will have a certain kind of effect" [14]. The framework provided this artist with an invaluable thinking tool.

Creative practice was the central driving activity throughout the practice and research of this artist, and on the face of it her approach could be said to fall within a trajectory in which practice primarily influenced theory. However, this example provides us with a strong variant of that trajectory in which theory and practice at first operate independently but eventually become entwined. The trajectory, in which practice and theory initially took separate paths, contributed to evaluation in a two-way feed. This was followed by a change such that the theoretical framework influenced practice and evaluation. The practice and results of evaluation then led to revisions in the theoretical framework and to a rethinking of the practice.

IMPLICATIONS FOR RESEARCH AND PRACTICE IN THE ARTS

The practitioner frameworks described above represent different outcomes of Ph.D. research by creative practitioners.

Fig. 7. Trajectory Example 4: Practice-Theory Reflexivity. (© Ernest Edmonds) The trajectory of practice and research takes this artist-researcher through several stages of creation and evaluation: from formulating the main research question and generating design strategies that are tested with existing artifacts, to the creation of new works using the tested (and modified) strategies.
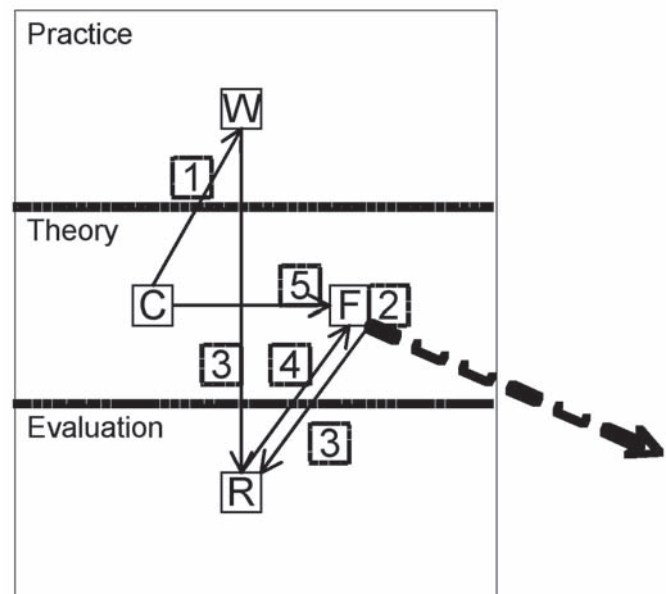
The trajectories represent different kinds of relationships between theory, practice and evaluation. While it is helpful to distill the main elements of the practice-based research process in this way in order to compare and contrast them, it should nevertheless be pointed out that there are considerable variations in the way the frameworks were developed and applied. In each case, the interplay between practice, theory and evaluation involved many iterations and much interaction between the elements as the creative process drove a continuous process of change. The model applies to each case but also enables the different trajectories that were taken to be compared. The fact that such variation can occur within the highly structured approach to practice-based research that the Ph.D. environment demands is indicative of how individuality, so important to creative people, can be accommodated. Each practitioner developed a unique appreciative system that was used to guide the evaluation function within both practice and research and is likely to be a valuable tool for ongoing creative work. All the practitioners acknowledged this as a long-term outcome of engaging in Ph.D. research.

The field from which the examples are taken in this paper is that of interactive digital arts, which has its own special conditions, because the works produced fully exist only once the audience is engaged. It could be argued that interactive art by its very nature invites the creation of frameworks, because understanding audience response is fundamental for its practitioners. As the cases above illustrate, a critical question for people making interactive works is how to understand the nature of creative engagement where the audience is an active participant in the manifestation of the work. In order to achieve progress, there is a need to develop individualized methods for evaluating audience experience and interpreting the nature of that experience in relation to the characteristics of the works themselves.

CONCLUSION

We have attempted to articulate how research and practice interrelate in the process of developing practitioner frameworks. The outcomes, we believe,

can be valuable to others pursuing practice-based research. Practitioners such as those described set out with the expectation that developing an interpretive framework is an integral part of the reflective creative process. It is important to note that there is no universal or standard framework. In fact, the trajectory followed is often one that involves modifying or extending an initial framework.

In addition to the publications by the practitioners discussed in this article, a number of special issues and articles by CCS researchers are available, including first-hand accounts by other interactive artists in special issues of *CoDesign* [15] and *Design Studies* [16], an article by Bilda, Candy and Edmonds [17] and a discussion of engagement research by Edmonds, Muller and Connell [18].

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