

# Research as Design-Design as Research

**Andrew J. Stapleton**

Swinburne University of Technology  
Hawthorn, Victoria  
Australia 3122  
+61 (0)3 9214-8415  
astapleton@swin.edu.au

## ABSTRACT

This paper details a research methodology that emerged during an inquiry into game design aimed at promoting conceptual learning in physics. The methodology, *Research as Design-Design as Research* (RADDAR), is outlined and a case study example is provided as means to illustrate its application.

## Keywords

game, design, research, methodology, RADDAR

## DEFINING GAME DESIGN

In developing a research approach for game design it would first seem necessary to define ‘*game design*’ itself. This task, however, is non-trivial as game design appears “a mysterious process” [3] with “as many definitions of it [...] as there are designers” [6]. Nevertheless, a working definition of game design can be successfully constructed and utilised. Salen and Zimmerman [12] offer the following definition:

*[g]ame design is the process by which a game designer creates a game to be encountered by a player from which meaningful play emerges. (italics added) [12]*

Consequently, game design inquiry aims to ‘demystify’ the game design *process*. However, since this process “is not a mechanical or deterministic one” [4], no universal method for designing games exists. Rather, the process is more like a “conversation with the materials of the situation” [13], namely an “ongoing dialogue between the designers, the design and the testing audience” [18] manifesting itself through a “rapid cycle of building prototypes, testing them, scrutinizing them, and redesigning them” [14]. With no universal approach to design available, researching the game design process entails the development of a *methodology*, a number of methods, practices and techniques, that can be combined and utilised within the context of any one inquiry rather than a single, unique research method.

An appropriate methodology would also need to successfully inquire into a variety of knowledge domains spanning the arts and sciences since:

*[d]esigning games is a craft [...as] [a] game contains both artistic and functional elements. (italics added) [11]*

Further, since “[m]any game ideas begin as dreams” [11], and with the design process itself is

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both “[p]artially a conscious activity [...and] partially intuitive” [3], a suitable methodology would need to include dreams and informal, tacit knowledge alongside knowledge from the formal domains of the arts and sciences. Finally, given that this knowledge is both brought to, and learned during the design process, “[t]he design process is also a learning process” [9]. With game design being “complex and multifaceted [...and] requiring the understanding and implementation of a range of skills and knowledge domains” [9], the task of developing an appropriate methodology for inquiry into game design, necessarily entails ‘demystifying’, or ‘unmasking’, its multifaceted nature.

## DESIGN AS RESEARCH

Recognising game design activity as complex, and multifaceted, suggests that a clear aim of any inquiry is to “demystify the [design] process” [17]. While early design research approaches “promoted a ‘scientific method’ [...d]esign research is not as quantifiable as science [...and alternatives such as] *interpretive* research [...appear] better suited to the behaviour and sensitivities of human beings” [17]. As qualitative researchers, interpretive researchers are “committed to the naturalistic perspective and to the interpretive understanding of human experience” [1]. Furthermore, they adopt a variety of methods and approaches which “[crosscut] the humanities and the social and physical sciences [...and] can be combined in the same project” [1]. Accordingly, qualitative research provides appropriate means for investigating the craft of game design as it can span the arts and sciences within a single inquiry.

At its most fundamental, design follows an iterative decision sequence of problem—analysis—synthesis—evaluation, however the process is fluid, with “no [...] firm route through the whole process” [7]. Further, it is the key moment of *synthesis*, “when all the problem parts are brought together in a holistic solution” [17], that sets it apart from research in the scientific sense. In short, “[design is] concerned with “synthesis”, while science is concerned with “analysis”” [15]. Design, therefore, focuses on generating *solutions through synthesis*, whereas research, from a traditional (scientific) viewpoint, focuses on solving *problems through analysis*. And, whereas the solution-focused strategy of design primarily relies on intuition, a “right brain way of processing [...] non-verbal, visual/spatial holistic thinking” [17], scientific research relies on “left brain [...] deductive and sequential reasoning” [17]. Consequently the intuition, creative insights, and tacit knowledge clearly evident in design activity lie beyond the domain of empirical science and therefore, cannot be legitimised as (scientific) research.

From the idea of design as a problem-solving *performance*, an activity in which all the elements come together as a unified whole, comes the view that “[t]he design process is a research process” [17]:

[t]he action of designing is the same moment of synthesis that occurs in all forms of research (*serendipity*, as many social science researchers call it) and in design this synthesis may be expressed as visual spatial knowledge *in action*. [17]

Understood in this way, design, as a research process, has a clear focus on *action*, and it’s this concept of *action* which ultimately fuses the process of design with the family of research approaches termed *action research*. Simply put, action research involves the “simultaneous achievement of action (that is, change) and research (that is, understanding)” [2], and requires the following conditions to be met:

[f]irst, its subject matter is normally situated in a social practice that needs to be changed; second, it is a participatory activity where the researchers work in equitable collaboration; and third, the project proceeds through a spiral of cycles of planning, acting, observing and reflecting in a systematic and documented study. [17]

Comparing the conditions for action research with design activity reveals striking similarities. Both can be regarded as activities for changing social reality as, in the case of design, designers “[devise] courses of action aimed at changing existing situations into preferred ones” [15] and in action research is “normally situated in a social practice that needs to be changed” [17]. Further, both are cyclical and emergent, with action research having a *plan–act–observe–reflect* cycle and design a *problem–analysis–synthesis–evaluation* cycle. Action research, as a qualitative methodology, can also successfully *combine* both *qualitative* and *quantitative* approaches that are necessary to investigate the craft of game design. In all, these similarities between action research and design activity have inspired a view that “it would only require a few words for theoretical frameworks of action research to make it applicable to design” [17].

Despite these similarities, applying “the second and third conditions of action research to the design field (i.e., emancipatory participation and systematic reflection) [is...] more challenging” [17]. Consequently, developing a methodology for design inquiry means adopting these conditions, namely that “the users of design should be genuine *collaborators*” [17], and demanding “public accountability and visible self-evaluation [...through] ‘systematic and documented study’” [17].

#### **FOURTH GENERATION EVALUATION**

Understanding the deep connection between design and action research ultimately requires the identification of an *appropriate* action research methodology, one that could suitably resolve the unresolved issues of emancipatory collaboration and systematic reflection. The methodology would need to take into account the contexts of design practice, the various experiences, knowledge domains and types, including tacit knowledge, that the designer both brings and learns during the process, together with the subjective, reflective and conversational nature of design. During my own inquiry into game design and conceptual learning, I recognised *Fourth Generation Evaluation* [5], an action research methodology with its roots in *constructivism*, as an appropriate methodological approach.

With its roots in “genetic epistemology” [10], *constructivism* is a view of learning in which learners actively build, or ‘construct’, knowledge based on their prior knowledge and experiences of the world. Founded on constructivist principles, *Fourth Generation Evaluation* is a qualitative, action research methodology “organised by the claims, concerns, and issues of stakeholding audiences” [5]. Unlike the methodology of the conventional paradigm of scientific inquiry, constructivist inquiry adopts:

a hermeneutic [or interpretive] methodology [with...] a continuing dialectic of iteration, analysis, critique, reiteration, reanalysis [...] leading to the emergence of a joint construction of a case. [5].

The task of the constructivist researcher is to explore the various *constructions*, or “created realities” [5], of participants within the research context, ultimately joining, or synthesising, them with other information to form a consensus. Dialogue plays a key role in the process via the

“hermeneutic dialectic” which propels the inquiry forward through comparison and contrast of various participant views, including the views of the inquirer. Further, unlike the conventional paradigm of science, tacit knowledge, including “intuitions”, “dreams”, “insights” and the like, all form part of legitimate constructivist inquiry. Ultimately, successful constructivist inquiry:

aims to change constructions [...] is contextualised within a naturalistic setting, uses an action based cyclical process of a hermeneutic dialectic out of which a synthesis view emerges, and where all participants are empowered and educated as part of the process. [16]

Further, the constructivist researcher *must* adopt: (i) a naturalistic context, (ii) the inclusion of tacit knowledge, (iii) the human as the instrument of inquiry and (iv) the use of qualitative methods [5]. Once these entry conditions have been satisfied, the inquiry proceeds by selecting appropriate respondents to enter the hermeneutic dialectic circle through *purposive sampling*; namely a “sample from which one can learn the most” [8].

It is within the hermeneutic dialectic process where a “continuous interplay of data collection and analysis” [5] occurs through the comparison and contrast of participant views and ultimately a *joint construction* emerges that is *grounded* in the realities of all the respondents. The joint construction, therefore, “differs from the individual constructions originally offered by respondents, and [...] from that] entertained by the investigator at the beginning of the study” [5]. In addition, the *research design* is emergent since “as the design proceeds, the constructivist seeks continuously to refine and extend the design—to help it unfold [...] until there is consensus” [5]. Achieving consensus, rather than signalling the end of the inquiry, allows for the possibility for future inquiry via the introduction of “new information or new levels of investigation” [5]. However, when consensus is not possible, then the inquiry process can help identify key areas of difference for future negotiation.

The final deliverable of any constructivist inquiry is a “*case study report* [...] which provides] the joint construction [...] through] thick description that not only clarifies the all-important context but that makes it possible for the reader to vicariously experience it” [5]. And since the case study report details the methodology adopted, it is “possible to judge the extent to which goodness criteria have been met” [5] and ultimately the quality of the inquiry.

## **RESEARCH AS DESIGN-DESIGN AS RESEARCH (RADDAR)**

It was during my own doctoral case study that I synthesised ‘design as research’ with ‘constructivist inquiry’ and ultimately came to both a new understanding and a methodology for game design research; RADDAR. During this synthesis, I reinterpreted and modified constructivist inquiry to better account for design contexts. Additionally, I developed further associations between design and research, ultimately helping to resolve the key challenges of emancipatory participation and systematic reflection needed for game design to be fully understood as action research.

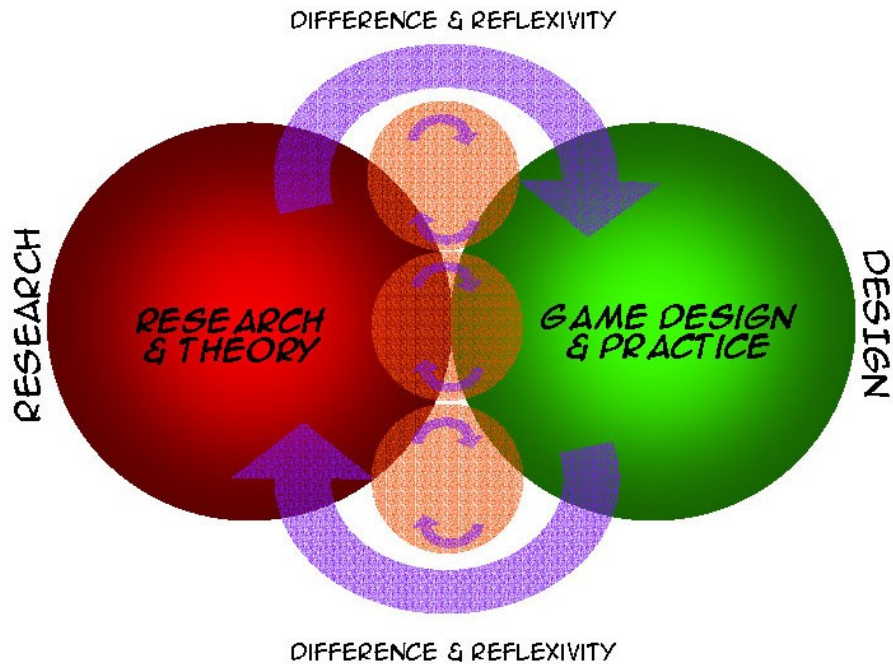
A key insight in synthesising the methodology was the reinterpretation of ‘participant’ within constructivist inquiry. Originally, ‘participant’ referred to a human respondent that could engage in dialogue through the hermeneutic dialectic process. However, understanding *design as a conversation*, I extended the idea of participant to design contexts, and thereby include the design materials themselves. Subsequently, sketches, design documents, notes, photographs,

prototypes, programming code, storyboards and so on, were all regarded as ‘participants’, and consequently they supplemented the human dialogue within traditional constructivist inquiry.

Further, this new understanding of ‘participant’ necessitated a reinterpretation of the rigid, hermeneutic dialectic process of asking a human respondent to nominate another with contrasting views necessary for a dialectic, something not possible with materials. Consequently, my new interpretation of the hermeneutic dialectic was more organic in which differences arising during *all forms of dialogue* led to a more fluid form of collaboration and greater possibilities for inquiry. I also recognised this form of collaboration as both a form of conversation, and a core feature of prototype development within game design as “to succeed in its purpose, a prototype [...] has to be community property” [14]. Collaboration, therefore, is a core aspect of both constructivist inquiry and game design. And in the case of game design it provides a means for developing joint constructions, manifesting partly within the design itself through prototypes, as well as facilitating power-sharing between participants. Ultimately, by reinterpreting ‘participant’ I had come to resolve the issue of emancipatory collaboration.

The final challenge in developing a methodology appropriate for design inquiry was resolving the issue of systematic reflection. Even though reflection is integral to the notion of design as a reflective conversation, the need for design research to embrace “systematic and documented study” [17] remained. I resolved this through the very nature of constructivist inquiry itself, in which the final deliverable is a case study report. As the case study report both provides the *context* of the inquiry, and aims for readers to *vicariously experience* it, the design case study describes the design context in concert with thick, rich descriptions of the various conversations, events, dreams, prototypes, views, experiences and the like that shaped the outcome. Accordingly, embracing constructivist inquiry as a means for investigating game design, resolves the remaining challenge of systematic reflection by including of a case study report that complements the final artefact, as well as offering an established set of criteria exist for measuring the quality of the case study for design inquiry.

Resolving the issues of systematic reflection and emancipatory collaboration meant that the design process could both be understood, and validated, as one of research; namely *design as research*. However, the definitive synthesis of the methodology into a unified whole occurred only when I incorporated the notion of constructivist research having emergent design; namely (constructivist) *research as design*. Within the context of this newfound methodology, both research and design became entangled and inseparable; (constructivist) *research is* a design process and (game) *design is* a research process. This insight led me to name the methodology *Research as Design-Design as Research* or RADDAR, from which serendipitously emerged a metaphor for understanding and implementing it. Like the term *radar*, which relates objects and events through a physical process of reflection, RADDAR provides means for understanding the relationship, and collaboration, between objects including people, materials, and artefacts, and events, during design inquiry, through a dialectical, reflective process that aims to unmask the design-research process and move toward some form of understanding (see Figure 1)



**Figure 1:** A visualisation of the RADDAR methodology, showing three themes of inquiry (smaller circles).

Visually represented, RADDAR involves an ongoing dialectic between (constructivist) research and theory, the realm of (academic) researchers, and game design, the realm of design practitioners. The large circular arrows represent dialogue between ‘research’ and ‘design’ whereby differences are continuously reflected upon and interpreted, thereby creating a hermeneutic dialectic circle. Further, RADDAR is effectively ‘open source’ and multi-method allowing for various methods, both qualitative and quantitative, to be employed during various stages of the inquiry as a means to investigate questions or themes of inquiry as they arise for the researcher. In the figure above, the RADDAR inquiry illustrates three unspecified themes of inquiry each of which undergoes a hermeneutic dialectic process (see Figure 1).

### **CASE STUDY EXAMPLE**

The clearest example of RADDAR’s application lies within the context from which it emerged; namely, a doctoral inquiry into the design of a game to promote conceptual learning of special relativity within undergraduate physics students. During the design process I collaborated closely with Jacob, a physics lecturer and researcher at Eastern States University (ESU)<sup>1</sup>. During our discussions of prototypes, sketches, and so on, Jacob’s involvement with the project led him to reflect on alternative representations of relativistic concepts, his own teaching practice, the learning environment at ESU, the role of others (colleagues and students) within his teaching practice, and his views of curriculum and assessment. Engaging in this process eventually led him to change ESU’s undergraduate physics curriculum. Key issues for this inquiry, then, were the themes of *representation*, *curriculum and assessment*, and the role of *others*. At various

<sup>1</sup> ‘Jacob’ and ‘Eastern States University’ (ESU) are pseudonyms.

stages of the inquiry, a variety of methods were employed to aid the inquiry, including personal experience methods, ethnography, interviews, surveys and participant observation of students playing the game during its various stages of development. Further, as a designer-researcher, I was continually reflecting and interpreting the various data sources including participant views, sketches, documents, code, insights and prototypes, all of which drove the inquiry forward. Ultimately, all these data sources help to form the case study that accompanied the game; a report that was eventually judged using the goodness criteria of Fourth Generation Evaluation.

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