

# Collaborative practices of imagining and the engineering of sensations and affect in computer games

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**Abstract:** In a similar way to the neglect regarding the study of affect in relation to cities highlighted by Thrift (2007), the study of digital technologies and systems – which like cities are at the centre of a ubiquity and multitude of affects (Delio 2001) – is also characterised by a lack of attention to what Thrift (2007) terms their “affective register” (Ciborra and Willcocks 2006). While much attention, both in academic research and among practitioners, is devoted to those aspects of the development of digital technologies that involve numerical and textual representations, plans, and schedules, practices of imagining are also crucial to innovation in, and the development of, such technologies. Through an empirical study of practices of imagining encountered at three leading computer games development studios, this article examines the multi-sensory aspects of digital systems design and development and how the developers of these digital games – that range from script writers and concept artists to digital animators and computer scientists – go about establishing – in the wording of the call – a digital “architecture of the senses”. The article examines how difficult to represent and under-determined aesthetic and experiential features of the game being developed are realised collaboratively by temporally varying and cross-specialisation teams of developers and how a creative vision that is intangible and often subjective is translated into a novel and innovative digital product. The article identifies specific practices of imagining involved in the development of computer games and shows the importance in the setting studied of going beyond text and discourse to take into account, not only the visual, but the wider involvement of various material and aesthetic artefacts in performing the kind of engineering of sensations and affect involved in the design and development of digital games.

## ***Introduction***

The computer games sector is characterised by a number of features, which make collaboration challenging but also critically important to competitive success. These include: the importance of aesthetic and experiential as well as functional product features (Roberto and Carioggia 2003; Tschang 2007); “heterarchical” organisational forms (Kellogg et al. 2006; Stark 2009); fast-paced work taking place in temporally varying and often cross-specialisation teams (Kellogg et al. 2006; Sapsed and Salter 2004); and de-centralised decision making. Further, with competition in the marketplace driven by a constant demand for novelty and new playing experiences, there is a continuously innovative character to this area of digital systems development (Green et al. 2007; Lampel and Jha 2008). In computer games development, for example, the functional performance of the software produced is a necessary but by no means a sufficient condition of success. Rather, developers need to take into account and build into the software intangible and difficult to represent aesthetic and experiential aspects in order to appeal to buyers (Roberto et al. 2003; Tschang 2007). Taken together, these features of the computer game development setting create distinctive challenges for collaboration, with innovation being secured through the development of effective collaborative practices amongst professionals from widely diverse backgrounds and with very different types of expertise and skills that go beyond formal approaches based around numerical and textual representations, plans, and schedules.

By examining the collaborative practices found amongst computer games developers with different areas of expertise to secure product innovation, we seek to address the question of how these practices deal with the difficult to represent and emergent aesthetic and experiential features of digital systems development. Through our answer to that question we seek to establish to what extent these practices differ from the collaborative practices identified in studies of other settings such as new product development (Carlile 2002; Carlile 2004; Oesterlund and Carlile 2005) and information systems development (Levina 2002; Levina 2005). The paper argues that, while these studies have shown how collaborative practices help to bridge boundaries between different collaborating groups and forms of expertise, they do not address the type of collaboration involved in the developing of emergent and difficult to represent aesthetic, experiential, and affective features of a digital innovation.

The empirical material presented in this paper shows how such features, while initially under-determined or even unknown, are rendered explicit and knowable through distinctive collaborative practices of imagination as a computer game development project unfolds. The paper argues that a notion of ‘practices of imagination’ has implications for wider debates relating to emergence and the problems of up-front planning and gathering of all requirements presumed in waterfall development approaches to digital systems development and how these issues can be taken into account in development processes (Cotterell and Hughes 2002; McConnell 1996).

The paper will seek to show that as part of the acknowledgment of the notion of an engineering of sensations and affect involved in the design and development of digital systems, analytical attention, both from academic researchers and practitioners, needs to be given to how what is under-determined, intangible, subjective, or even not entirely known previously is dealt with by those involved in processes of new product development and

innovation in such settings, and how an intangible and often subjective creative vision is translated into a novel and innovative product.

### ***Collaboration in studies of innovation and new product development***

Collaboration amongst professionals from widely diverse backgrounds and with very different types of expertise and skills is at the centre of computer games development. As with other areas of new product development and innovation, this involves collaborative practices established around ways of working jointly with others that have acquired stability and persistence resulting from investments made in developing these shared ways of doing things and dealing with particular problems and situations (Carlile 2002; Levina 2005). Such practices have been the focus of a number of studies. In new product development, for example, there have been studies of practices involved in collaborating across marketing, research and development, production, and manufacturing units in organizations (Bechky 1999; Carlile 2002; Dougherty 1992) and within professionally diverse R&D teams (Hargadon and Sutton 1997; Hargadon 1998; Leonard 2007).

One key position regarding collaboration in new product development “in settings where innovation across different functional specialities is a required outcome” (Carlile 2002) is that for collaboration to take place in such a setting, key boundaries of specialist - or domain-specific - knowledge need to be bridged (Carlile 2002; Carlile 2004). Syntactic boundaries, for example, can exist due to the absence of an established shared stable syntax; semantic boundaries emerge out of differences in interpreting the meanings of information that is shared and are seen in the way individuals in different organisational function settings apply different meanings to the same information; and pragmatic knowledge boundaries can arise from the investments made by individuals and groups in their existing practices and expertise and the resulting resistance to change in these areas (Carlile 2002).

Within this view, ‘boundary objects’ (Star and Griesemer 1989) play a vital role in terms of generating such mutual understanding and hence bridging knowledge boundaries. This emphasizes their functional properties in relation to knowledge-sharing, with less attention paid in this analysis to the form of the object itself.

Much of this literature is, moreover, situated within a specific setting in which innovation requires problem-solving within well-defined product development structures and with clearly identifiable bodies of specialist knowledge (Carlile 2002; Carlile 2004). This results in a focus on existing knowledge boundaries and the transformation of existing knowledge as these boundaries come up against each other in relation to the new entity being developed and the negotiations regarding the implication this has for existing bodies of knowledge and functions (Carlile 2002; Carlile 2004).

While sharing many characteristics with new product development in general, recent studies have suggested that information systems and information technology development settings are characterized by less rigid and well-defined boundaries of specialized knowledge (Kellogg et al. 2006; Sapsed et al. 2004), with importance also being attached to ‘envisioning’ future information technology use practices (Levina 2005). More generally, with the growing economic importance of services (Hargadon et al. 2003) and of sectors in which “a single optimal solution may not exist” (Okhuysen and Bechky 2009) and where progression towards the completion of tasks or an output is difficult to plot and assess (e.g. software and interactive design) (Kellogg et al. 2006; Kraut and Streeter 1995), and

boundaries of organisations and functions are increasingly blurred (Hargadon et al. 2003; Kellogg et al. 2006; Scott 2004), there has been a questioning of the importance of boundary crossing in collaboration (Kellogg et al. 2006; Sapsed et al. 2004).

Kellogg et al. (2006), for example, have argued that much of the literature on collaboration across boundaries, with its emphasis on the construction of common knowledge through the use of boundary-crossing mechanisms such as routines, languages, repositories, and models that are arrived at through negotiations and the forging of agreements among clearly defined occupational groups, may be of less relevance in relation to organisations characterised by “non-hierarchical and shifting contexts, where criteria of worth are contested, and where areas of jurisdiction are blurred”. Instead, they propose “practices of display, representation, and assembly” as more relevant in relation to collaboration at fast-moving heterarchical organisations such as the web-based interactive marketing firm they studied (Kellogg et al. 2006). Pointing to exchange interactions observed at an interactive marketing firm rather than the sharing of knowledge, Kellogg, Orlikowski, and Yates – drawing on the work of Galison on physicists (Galison 1999) – refer to the constituting of “trading zones” rather than “common knowledge” (Carlile 2004). In these “trading zones”, distinct occupational communities “align their activities without homogenising the inherent diversity of their community interpretations, identities, and interests ... without global agreement” (Kellogg et al. 2006).

The existing views of collaborative practices in innovation and new product development presented above and which adopt a perspective based on knowledge boundaries that emphasise the importance of existing knowledge and the need to bridge boundaries, with problem-solving happening at interstices, only partially deal with the kind of emergence found in settings that involve shifting product specifications or future use practices. Furthermore, the analyses developed therein, while addressing organizational artefacts, focus principally on their instrumental dimensions (e.g. their role as boundary objects) rather than their multi-faceted involvement in collaboration. As Rafaeli and Vilnai-Yavetz note, however, organizational artefacts can be defined in terms of multiple dimensions, which they term ‘instrumental’, ‘symbolic’ and ‘aesthetic’ (Rafaeli and Vilnai-Yavetz 2004). The observation by Rafaeli and Vilnai-Yavetz is valuable in recognizing the multi-faceted role which objects may play. Thus objects may play both instrumental and expressive roles within organizations. Such concerns fit with a broader interest in the bringing together of non-explicit and aesthetic as well as technical forms of expertise and the development of theorisations aiming to link collaboration with creativity and innovation (Ewenstein and Whyte 2007; Ewenstein and Whyte 2009; Hargadon and Bechky 2006).

Looking at collaboration more specifically in the field of information systems development (ISD), Levina (2005) also introduces the notion of “IT use practices” defined as a set of “recurrent interactions among agents using and modifying an IT artefact” whose interactions are “situated in a social and historical context” and “bounded by physical surroundings and technological artifacts”. Explicit objects are then produced by information systems development participants (e.g. the IT artifact, system documentation, orally expressed ideas, use scenarios, etc.) to help represent these envisioned IT use practices (Bodker 1998; Levina 2005). For Levina (2005), “the constantly changing envisioned IT use practices represented through these objects” is central to what constitutes information system development. By introducing the notion of *IT use practices* and linking it to ISD, Levina’s approach flags-up the importance not only of dealing with the crossing of boundaries of function and existing bodies of knowledge, but also dealing analytically with the emergence encountered in

information systems design and development processes and the rendering of such processes of envisioning IT use practices in ISD as a collective endeavour rather than a practice of individual reflexion (Levina 2005).

While acknowledging the importance attached to boundaries of function and existing knowledge and their bridging, in this paper we seek to show how analytical attention also needs to be given to how what is under-determined, intangible, subjective, or even not entirely known previously is dealt with by those involved in processes of new product development and innovation in the setting of computer games development. This is done by exploring how the games developers studied translate an intangible and often subjective creative vision into a novel and innovative product.

It is from this perspective that we view the collaborative practices involved in dealing with the under-determined and difficult to represented aesthetic and experiential features of the development of computer games in a way that also surfaces the materiality of these practices through an emphasis on the role of the objects and artefacts involved.

### ***Research Approach***

The empirical focus of the research was the collaborative practices encountered at three different computer game development studios as they realise their innovative digital technology products. Computer games development was seen as representing an extreme setting in which to study the challenges of collaborative work that involves both highly technical as well as sensory and affective considerations (Eisenhardt and Graebner 2007). Through this focus, the empirical investigation sought to gain a detailed view of the work practices of game developers and the shared objects they interact with during the development of computer games. In this way it would then be possible to show how, in Suchman's words, "a work group distributed in space is tied together through architectural, technological, and interactional resources" (Suchman 1997). Particular attention was given to capturing an in-depth understanding of particular collaborative practices associated with the realisation of under-determined aesthetic and experiential features of the computer games being developed.

### **Data Collection**

In studies of new product development "observing individuals in practice and focusing on the objects they work with and the ends that they pursue" is seen as a more relevant way of accessing the research setting, as it provides "a concrete delineation of what to observe and what to compare in terms of how knowledge is created and structured" (Carlile 2002). Data collection therefore involved a combination of in-depth interviews and observations at three leading computer games developer studios and the accessing of key objects and material entities involved in the development of computer games. Twenty-five interviews were carried out with developers and managers at these companies.

Formal interviews that were more wide ranging and lasted longer (between 1h 40min to 3h) were recorded and transcribed. While a set of headline themes relating to how a game moves from conceptualisation to realisation and what key shared objects are involved in the process informed the questioning, no specific list of questions was used during the interviewing. Informal interviews were used for much more specific questions relating to key aspects of the development process that emerged during the observations. These typically lasted between 15 and 30 minutes and were recorded in hand written notes rather than through voice recordings. The reason for this was because of the need to capture on the spot and at that moment an

explanation from those involved in the activity at that time of a key aspect of the collaboration that was deemed of interest during the observational work.

The observational evidence was recorded primarily in note form continuously during the time at the studios, usually contemporaneously (or very soon after a certain event or encounter of interest). Field notes were supplemented by sketches drawn by the developers as they explained something either to the researcher or to each other, print-outs of key documents used in the development process, screen grabs of computer applications and displays, some photographs taken at one of the studios during observations, and sketches done by the researcher.

## **Empirical setting**

The empirical setting was three leading UK-based computer game developer studios. The UK computer games sector represents an important locus for computer games development internationally, with many globally important computer game design and development companies located on UK territory. While ultimate ownership of a number of these studios may have passed to the multinational corporations that dominate the sector, many of the design and development operations of those companies have been retained in the UK. In addition, a number of independent UK-owned developers continue to maintain important positions in the world market.

The first study site was GamesDevCo (a pseudonym). Since its foundation in 1990 GamesDevCo has grown into a leading independent multi-platform developer employing around 250 people and comprising of five distinct divisions: family games; mature titles; serious games; downloadable games; and games technology. The company develops games under both its own brands as well as on behalf of external publishers and intellectual property rights holders. Field study was carried out at the company's studios and headquarters between October and December 2008 across all five divisions.

The second site was PetName, a pseudonym for a leading games development company that since its formation in 1997 has developed a series of commercially successful, critically-acclaimed, and award-winning strategy, action role-playing, and simulation games. Field study was conducted at the company's studios between March and May 2009 with extensive participant observation of the work of one of the development teams working on a particular action role-play title over a period of two weeks.

The third study site was Dredd (a pseudonym). Since its establishment in 1992, Dredd has, through the acquisition of other UK studios, become one of the largest UK computer games developers; what has started to be referred to in the UK games development sector as a "superstudio". The company produces games both under its own brand and for third-party clients and has enjoyed significant commercial success. It is now a multi-platform and multi-genre developer operating out of four different locations around the UK. In addition to its games business the company also has some print publishing activities. Fieldwork took place during August 2009 across functions at the principle studio of the company.

## **Data Analysis**

Informed by a view of practices as "embodied, materially mediated arrays of human activity centrally organized around shared practical understandings" (Schatzki et al. 2001) that take the form of "recursive interaction among people, activities, artifacts, and contexts" (Orlikowski 2010), the analysis of the empirical material assembled during the fieldwork

initially focused on: a) identifying recursive interactions among developers; and b) associated key objects involved in the repeat interactions found in the game development process across all three of the sites studied. This was then followed by more detailed work concerned with developing a better understanding of the practices enacted jointly with others and the relationship of these practices to the development of aesthetic and experiential features of computer games.

In order to aid this analysis, interview transcripts and observation notes were imported into nVivo – a qualitative data analysis software. nVivo was used primarily as a tool for organizing and structuring the data. Interview transcripts and observation notes were coded in relation to key shared objects (e.g. milestone schedules) and recurring collaborative practices identified (e.g. joint production of representations of the game and its components) across all three sites. Samples of many of these objects had been collected during the fieldwork and their use also observed during the visits to the studios.

### ***Collaboration and imagination in computer games development***

For a computer game to be realised, a whole set of digital objects – referred to as “assets” by the developers – need to be described, made available (either from an existing stock or developed ex nihilo), and assembled together, establishing relations among these objects in a particular way. “Assets”, include digital artwork for the entities – both active and passive – found in the game, 3D models, digital artwork relating to the setting within which the game takes place, maps of levels and locations, animation sequences, artificial intelligence algorithms for entities not controlled by the player, visual textures, special effects, sounds, text and spoken dialogues, music, graphical user interfaces, and many more depending on the game, its genre, and its complexity.

The sequence of actions that takes “assets” from their source form (usually the output of whatever package the developers created them in) to the final data that can be burned on to a disc or cartridge to form part of the finished game, is what is referred to among the developers as the ‘asset pipeline’ (Arnaud 2010; Carter 2004). It was a central common preoccupation of the teams encountered, especially among members in more senior roles, to ensure this “pipeline” is as smooth as possible and that assets are at the right place at the right time and in the right form, both in relation to each other, but also in relationship to the progression of the development process over time and the demands of the computer code at the centre of the game known as the “game engine”. It is the “game engine” that interacts with the hardware of the platform on which the game will be played (e.g. console, PC), translating the elements that make up the game into the code that can be run by the different hardware components (e.g. graphics accelerator chips) of the platform.

It is the rendering of 2D and/or 3D graphics by the game engine that generates images on the screen from a mathematical description of shapes based on geometry, viewpoint, texture, lighting, and shading information. It is the “physics engine” part of the game engine that deals with collision detection and responses by using algorithms to check for the intersection of two given mathematically represented solid objects and then simulates what happens once a collision is detected and without which characters would go through walls and other obstacles. The game engine also deals with sound processing, scripting control for calling-up other software applications within the game, the running of animation sequences and artificial intelligence algorithms relating to the behaviour of non-playable characters in the game, scene graphs that arrange the logical and spatial layout of scenes, and the management of

many technical tasks relating to the game such as networking, streaming, memory usage, and threading<sup>1</sup>.

Across all the three sites studied, it was found that a great deal of effort and attention was being directed towards the organisation and management of this production process, both in terms of time (meeting of deadlines), but also in terms of reducing the likelihood of the failure of a project and ensuring as unproblematic as possible delivery of the final product. This aspect of the work of the development teams is much more along the lines of classic project management and the collaborative practices observed across all three sites resembled those relating to bridging domain-specific knowledge boundaries encountered in past studies of collaboration in new product development. The following table summarises these collaborative practices and the objects involved in their performance.

<b>Collaborative practices</b>	<b>Purpose</b>	<b>Objects involved</b>
Description	Production of representations of the game and its components	Concept book, game design document
Making available	Identification of existing 'assets' and production of new 'assets' to be used	Game design document, technical design document, art design document, milestone schedule, source application software
Assembling	Temporal and relational ordering of assets	Milestone schedule, game design document, art design document, technical design document, assets, game editor, game engine

**Table 1: Summary of collaborative practices involved in the 'asset pipeline' process**

The key shared objects identified as being central to the collaboration of the game developers as presented in the previous table are summarised in table 2 that follows.

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<sup>1</sup> Due to the high cost of developing these functionalities from scratch, game development studios in large part reuse the game engine for a number of different games, often improving functionality and performance incrementally rather than ex nihilo.

Object	Description	Role in Collaboration
Concept book/document	Provides the developers and other stakeholders with an overview of the characters, locations, and relations of characters to each other, to the game world, and the logical unfolding of the game.	Coordinates the work of the developers involved in assembling more formal descriptions of the assets that need to be created and brought together in the GDD, TDD, ADD
Game design document (GDD)	Provides developers with a detailed inventory of all the elements of the game and the distribution of these in the space of the game world. Locations are described using a standard format with document sections that are common to all locations across the game. Quests or tasks are also formally described in a standard format that is common across the game.	Coordinates the work of the developers by specifying through these formal descriptions the assets that have to be developed, how these assets relate to the overall game, and also formal properties for 'assets' they have been assigned to produce.
Technical design document (TDD)	Outlines how the game as described in the GDD will be implemented in terms of programming requirements and limitations.	Coordinates the work of the developers as a whole by presenting to them key considerations such as the polygon count and CPU and memory budgets for each scene found in the GDD. Also coordinates the work of the programmers by specifying changes to software applications, the technical organisation of the production process, and the 'game engine' in order for a particular outcome to be possible.
Art design document (ADD)	Provides high level art concepts and specific detail and style definitions for individual assets, locations, and scenes and information on digital art tools that will be used in the development process and final delivery specifications	Coordinates asset development through the construction specifications for assets such as, the number of bones in a body, the scale, orientation, and measurement units to be used in the 3D art package used, or the data formats to be used for 3D and 2D digital art assets. Coordination in terms of workflow is also provided by specifying locations from which any required in-house and third party plug-ins can be gathered.
Milestone schedule	Draws on the GDD and related documents and staff plans in order to link deliverables to individuals and teams over time. It is also through this schedule that the performance of individuals, teams, and ultimately the company itself are judged, evaluated and rewarded, with payments from clients or internal commissioning entities tied to the attainment of milestones.	Provides the temporal coordination of the game development project, ensuring that the development and delivery of assets and other inputs follows the required sequence.

**Table 2: Summary of key shared objects and their roles and functions in the development of computer games encountered across all three of the research sites**

## Envisioning practices

Despite the importance of the collaborative practices outlined previously, across all three sites, there was unanimous agreement among informants – even some of the most hard-nosed

and completion-driven executives – that there was little point in developing a game that was on-budget and on-time, but no one wanted to play. As a result, there was a great deal of importance attached to aspects of collaboration that involved developing collectively certain difficult to represent sensory and affective aspects of the games.

The practices observed in relation to this aspect of the collaboration among the developers were found to be distinctive from those associated with the bridging of boundaries of domain-specific knowledge found in the new product development literature and also encountered in the more routinised aspects of developing the games encompassed in what was referred to as the “asset pipeline”. It is in relation to these practices associated with the development of the more subjective and difficult to represent qualities of the games and the collaboration that goes into their realisation that a notion of “practices of imagination” was seen as relevant and which we seek to present and elaborate in more detail.

While the planning and scheduling of known and specified aspects of the games being developed were seen as crucial across all three sites and a great deal of effort and resources were directed towards these ends, there was also a realisation that getting that right was not enough, in itself, for the success of a game. A senior producer at Dredd, talking about this, commented characteristically:

*“I’ve got all this paper interaction going on. I’ve got strike teams there. I’ve got people getting deadlines. I’ve got people defining their deadlines to me. I’ve got a waterfall schedule. I’ve got an idea of how many people it’s going to take to make the game. I’ve got an idea of how risky and how complex it’s going to be. ... [But], it’s not just all about planning. These guys make tangible assets, [but also], they create an experience on a screen; and that’s what it’s all about. I provide a beautiful plan, but that’s not going to mean anything to Joe Schmo, who goes out and buys a game on the shelves.”*

In all three cases, the difficult to represent aspects of the game that as a consequence could not be specified readily in project documentation such as the game design document (see Table 2), were dealt with through what was referred to as the “vision” for a game. “The notion of the vision is a difficult one”, explained the development director at GamesDevCo when asked during an interview to explain the frequent occurrence of the word in both interviews, but also more generally in the conversations and interactions of the researcher at the studio. “[It will depend] on the pre-dev stage; that is where the stuff is really born out”, he added. “So, although the vision will probably change massively during that time”, he explained, “as long as at the end of that point you have a pretty much coherent vision nailed, whether it is the same one you started with doesn’t really matter; as long as it is something that everyone has agreed with and everyone is happy to do and follow through during production”. It could be “art-led”, he continued, in which case “the art style then dictates a lot of the design, a lot of the technical requirements”. Ultimately, he explained, it was about “saying this is the kind of game we are creating; this is the kind of mood we want to create for the player; this is the kind of visual feeling we want to create and the visual feedback we want to create; these are the kind of technical limitation we want to break; we really want to take it forward with regard to these, or whatever it is going to be, a combination of all that sometimes”.

As can be seen from the above comment - that also chimes with comments and observations from the other two sites - the “vision” contributes to collaboration by providing an informal and emergent mechanism through which common understandings regarding under-

determined or difficult to represent features can be evoked rather than represented. This initial shared understanding would – in turn – coordinate the realisation of these difficult to represent features of the game by different individuals and groups as they gave a more tangible expression to it by building their interpretation of this initial understanding into the assets they are contributing.

The importance to the collaboration of the game developers of the “vision” that was observed across all three studios is captured in the following comment by the senior executive producer at Dredd:

*“Generally, the more you fragment [the vision], the more difficult it is to keep your entire team understanding what it is you’re trying to create. As soon as you’ve got that fragmentation ... you’ll get cracks; you’ll get mistakes; you’ll get misunderstanding; and you’ll get delays and frustration.”*

The way the “vision” worked across the three sites studied was by evoking within the developers often highly idiosyncratic and intuitive responses through aesthetic and experiential cues. These responses were then externalised through their expression in some kind of material output from an individual or group of developers – either as an asset or a representation. Through this process, previously under-determined features of the game could be captured, judged, and translated into the more formal representations that collaborative practices premised on the bridging of boundaries among existing specialised knowledge, skills, and systems of representation were able to deal with.

A number of objects associated with these practices were involved in the way the “vision” for a game worked, ranging from drawings and other visual references to all sorts of sizes and types of models. External references such as movies, a book, or in some cases, another game were also crucial in this respect. Things such as movies were found to be particularly important in terms of building among the teams studied a shared understanding of what was intended regarding the “emotion” or “visual style” of the game.

The collaborative practices associated with the translation of the “vision” into a novel and innovative product and which we present here are what we refer to as *envisioning practices*. Our analysis identified three key aspects of envisioning practices across our fieldwork sites : surfacing; capturing; and formalising.

### **Surfacing**

Drawings, either on their own or within the context of other shared objects encountered during the research, such as concept books and the games design documents (see Table 2), were found to have a crucial role in making accessible to the members of the development teams many intangible and difficult to represent verbally aspects of the games. A central role in such a process was played by what the developers referred to as “concept art”, as the following comment from the executive producer at PetName illustrates:

*“The more ways that we can do that – communicate exactly what you want [and] for everyone to get and understand it – [the better]. It is like the Holy Grail; because everyone understands differently. If you go visual that helps immensely. ... We have fulltime concept artists. We use a [concept artist] right now who is drawing-up all our levels that will educate far more than any 20-page document about how that level is going to be.”*

Drawings and concept art were seen in a similar light at the other two studios also. The following comment captures, for example, the use of concept art and drawing at GamesDevCo:

*“We try and draw a huge amount of stuff during the project because the cheapest way of getting any visualisations is by drawing. The [art specialists] are trained to draw extremely fast as well, so we spend a lot of time drawing out the environments, drawing out some of the character moves in regards to the animations cycles, drawing out all the characters' weapons, individually style anything else we need, sometimes just drawing with regards to diagrammatic things, saying: 'I want this character to move like this'; or, 'here is one of the character moves and I want it to look dynamic in this kind of way'; or whatever. Some quite functional things like that. So, when we hit production we've got a huge amount of material there.”*

But it was not just drawings that were important in terms of this *surfacing* and then circulation throughout the development team of the “vision” – or part of it – for a game. Within the studios there was wide-spread use of all sorts of sizes and types of models in the development process ranging from miniature mock-ups of landscapes, to small sculpted figures or portraits of characters. Throughout the studios, props and objects could be seen on the desks of individuals and in areas occupied by different teams, but also all around the office space, giving a visually intense feel to the sites as can be seen in the photograph below.



**Figure 1: Models of characters, and other 3D visual references (along the tops of the computer screens and around the room) photographed during the research in one of the studios**

External resources and references were also widely utilised in order to convey to the individuals involved in the development process the particular “feel”, “mood”, or “atmosphere” for a level, quest, or scene. A very interesting occurrence of this was encountered at PetName during a meetings between the design and art teams regarding work on a proto-industrial region in the game being developed and the “feel” and “atmosphere” it

should convey and for which some other external references from the game design document are presented in Fig. 2. Both teams had been struggling in terms of getting the “feel” of the region right. One member of one of the teams had been reading a new edition of *The condition of the working class in England* by Friedrich Engels (Engels and McLellan 2009) and had recommended to the others in the joint working group to also read it and it was felt in the meeting observed that this had provided what was missing in terms of bringing together the “feel” of the region. The importance of such external references is also illustrated in the quote that follows, from GamesDevCo, but also from viewing the pages from the game design document at PetName given in Fig. 2 in which copious visual and other external references were provided:

*“With everything we have created, even if it is ‘true to original’ there is always a movie, or a book in some cases, or another game possibly, that have done something similar or have done something diametrically opposite that we can say: ‘this is really what we don’t want, we really don’t want this vision’. Or, ‘what I am trying to get to is this’, or ‘here is a movie’. Everyone watches the movie and they then hopefully understand what you mean about the emotion of the game or the visual style of the game or whatever it might be. ... Using those ... references, to say, ‘right we really want this’, then ... people come up with ideas and come up with visual styles [and] that’s how [the vision] works; it kind of trickles down.”*



**Figure 2: External references for a proto-industrial region in a game design document from PetName**

At PetName in particular, there was a particular interest in the use of videos as part of the process of surfacing game features, either not fully specified – or specifiable – or not encountered previously. One example concerned developing scenes and animations for the sword fighting in the game. The video itself was of lessons that the animators attended with a professional swordsman. This, in addition to enabling the animators to take the video “and pause it right down” in order to analyse and translate the moves into 3D computer animations, was seen as important also in terms of providing a direct “feel” and “understanding” for the movements and techniques of involved to the development team.

“This is where we took some guys off-site and [sent] them [to a] real-life sword master ... who sword fights and works in the film industry”, explained a development manager on the team. The sword master, it was explained, not only helped both animate the scenes through performing the moves and also contributing to the design of the sword fighting scenes in the

game, but in addition, showed the developers “how to fight with a sword so they knew ahead of time when they came to animate and design that”, what the “real-life experience of sword fighting” was like. And this was as important to the programmers as to the artists on the animation team, because, for example it was important for them to have a “feel” for the weight and mechanics of a real sword.

The use of videos at PetName was part of a more general watchfulness regarding new ways of surfacing, capturing, and making available back to the development team difficult to specify and represent features. One good example of this occurred in relation to the conceptualisation and dramatisation of key scenes in the game that the team observed was developing. The chief of design production of the team explained that “certain scenes need more drama than others and some special attention is given to them in the script”. It started to become apparent to the developers, however, that the usual ways of conveying the drama of the scenes using the game script that forms part of the game design document was not enough. So, a “proper movie script was written instead”. Even then, however, it was felt that the script was not enough in itself to provide the design team with a way of judging what would work dramatically, so it was felt necessary to direct effort and resources towards developing new ways of accessing, making knowable, and then assessing these parts of the game.

Asked whether any other way of doing this had been considered, the chief of design production explained that they initially consider using a storyboard – similar to a cartoon strip – which was something they used in the past both internally but also to convey to external developers of animated videos that link the various levels of the game some of these aspects of the game. Again, however, it was felt that this lacked the ability to surface the way different expressions and tones by the characters convey the drama of the scene and things like “how the timing worked”. It was decided, therefore to take the script, go to one of the main film studios of the UK, hire some actors, and film them trying out the scene in different ways.

While watching the different takes of the scene at the head of design production’s desk, he explained how they would film a scene, then talk about it and work on changing it for about an hour, then do another take and so on until it was felt that the scene was right, videoing the entire proceedings all along. In addition to the tone and expressions of the actors, how the dialogue worked also became much more obvious, especially how it was perceived as being “quite bloated” and “over-wordy”. In total, six takes of the scene were made and “lots of discussion took place” over one day of filming, but this was “much cheaper than doing an entire scene in the game and finding that it didn’t quite work”.

### **Capturing**

It was found that iterations and revisions were central to how the “vision” informed the collaboration among the developers in practice and how emergent or previously under-determined features were captured and shared among the development teams. With “[subjective] features its going to go a bit crazy”, explained a producer at Dredd. “For [such] features you want stakeholders, you need reviews, you need sign offs”, he continued highlighting some of the key stages of such review and iteration processes that were encountered at all of the three sites studied. Within a particular project these iteration and review processes could be either formalised, as in the case of regular and highly structured milestone review meetings, or more ad hoc, relating to collaboration among certain sub-teams on much more specific and discrete elements of the game.

There was general agreement among all the participants across the sites in this research that there was no substitute for seeing how under-determined assets being developed would behave within the ambit of the actual game itself, even if that was a very minimal and underdeveloped version of the expected final polished outcome. In addition, during the observational work undertaken, it was clear that a great deal of time during the working day was spent in meetings of varying degrees of formality and scale of participation – ranging from three or four people around a computer terminal to entire teams in a meeting room – examining in some detail the impact of alterations to assets on the game and whether the desired result in terms of difficult to represent features was achieved by their incorporation into the game.

At GamesDevCo, the importance of such review and iteration processes to the capturing of aesthetic and sensory features was described in the following way:

*“When work starts getting developed, like character scenarios or storylines or character designs or weapons, we can look at those – the leads look at those – and go: ‘this really doesn’t fit ...can we revise it’, or ‘do we have to junk it, or what?’ By going through that process and learning, and by saying: ‘yes, I get it, current design doesn’t fit because it’s got the wrong kind of proportions’, or, ‘the wrong colour skin’, or whatever it might be, and then learn from that and [go], ‘OK, sorry about that I didn’t realise, I’ll revise and redo’. Then next time [it] will be closer and closer until at some point they will hit it; and that is how we go forward. It is important, that kind of iteration and going through the work around and around, approving stuff and going forwards.”*

Milestone review meetings were the most extensive and formally organised and structured of these review and iteration arrangements.

### **Formalising**

Milestone review meetings were central to the transition by groups and individuals from capturing – or “getting” – a difficult to represent feature to incorporating it into their existing collaborative practices and methods of representation. By being the venue in which the human and material entities involved in the development of the game were brought together and confronted with what has been done so far and what was still needed to complete the game, these review meetings were a crucial mechanism through which the boundary between what is know, explicit, and formally represented and what is missing or needs to be further determined and rendered explicit in a way that allows the existing representational practices of the developers to deal with it, was dynamically defined, meeting-by-meeting.

At PetName there was an opportunity to observe an entire review meeting lasting a whole day. Such meetings at this studio took place every six weeks. In addition to checking the delivery by the teams of the outputs agreed for that period, they also provided a forum for the teams participating in the meeting to demonstrate in the game environment the objects of the task being assessed and reviewed.

Central to the performance of the meeting were the printouts of the milestone schedule that participants collected as they came into the room. In the table the 1st column describes the High Level Goals of the project which are divided into key work areas such as “Engine”, “Gameplay”, “Characters & Creatures”, “Regions” and so on and which are then subdivided into smaller tasks and outputs. These had then been allocated to individuals and teams,

identified in two separate subsequent columns, with the concrete deliverables expected described in the column after. A column after that then allowed for comments regarding the work and the outcomes to be added by the teams or individuals involved. This is also where problems being encountered could be inserted and described. Finally there are columns that relate to signing-off with fields for the final 'owner' of the deliverable and comments and notes on that particular sign-off.

In addition to checking progress and managing interdependencies, a key purpose of the meeting was for everyone on the development team to become familiarised with the layout and features of existing and new locations and levels in the game and for participants to understand what kind of inputs might be required from them for the latter. This was not a one-way explanation, however. During the "walk through" of existing and still being worked on levels and quests, quite a lot of interaction between the level designers and all the others in the room took place, with intervening, commenting, and the asking questions taking place on a continuous basis. This way, it was possible, not only for the thinking of the designers to be rendered more explicit and shared with the others, but also for the response of those outside the design team to be elicited, articulated, and also recorded in the notes being taken by the senior members of the production team and if necessary added from there to the project documentation and schedule.

From small issues of unforeseen dependencies to large questions concerning how a particular feature relates to the "vision" for a game or a particular aimed-for playing experiences for the end-user, the milestone review provides the forum for team-wide debate, discussion, argument, clarification, agreement, and the collective entering into commitments. Combined with the fixedness of the milestone schedule and accompanying temporal regularity of the review process, milestone reviews were found to be crucial in terms of rendering explicit issues that may have not been resolved or even considered previously. It is also in the milestone review meetings that the value and worth to the game of particular features was debated collectively and decisions regarding whether to persist or not with them through further investments of resources and time were agreed upon or whether they should be jettisoned instead.

In this way, emergent aspects of the game were translated into the more formal representations that the existing collaborative practices of the developers were able to deal with.

## **Summary**

The account above has aimed to provide an overview of the way the "vision" for the games under development worked across the three sites studied by evoking within the developers often highly idiosyncratic and intuitive responses through aesthetic and experiential cues. Following on from what we termed a process of surfacing, these responses were then externalised through their expression in some kind of material output from an individual or group of developers – either as an asset or a representation. Through this process, previously under-determined features of the game could be captured, judged, and translated into the more formal representations that collaborative practices premised on the bridging of boundaries among existing specialised knowledge were able to deal with.

The account has also sought to highlight the implication of a number of objects and artefacts associated with these practices and involved in the way the "vision" for a game worked. These ranged from drawings and other visual references to all sorts of sizes and types of

models and external affective and aesthetic references such as movies, a book, and other games that were found to be particularly important in terms of building among the teams studied a shared understanding of what was intended regarding the “emotion” or “visual style” of the game.

Surfacing, capturing, and formalising – identified as key aspects of practices of imagination that we refer to as *envisioning practices* in the setting studied – are clearly ways that computer games developers, reflexively, both individually and collectively, “make things, ideas, symbols their own ...” (Frijhoff 1999) or, as reflected in a quote from one of our developer informers, “get it”. When the computer game developer respondents referred to “getting it” they were not talking about simply receiving predetermined concepts, but rather as a way of encapsulating the reciprocal interaction involved in creatively making an aesthetic or affective idea their own. These aspects of the practices of imagination we identify and refer to as envisioning practices contribute, therefore, to a wider process of the appropriation of emergent features by the developers, both individually and collectively as members of broader collaborating groups.

## **Discussion**

By showing the “embodied, materially mediated arrays of human activity organized around shared practical understandings” (Schatzki et al. 2001) that the games developers studied deploy in order to realise difficult to represent and specify game features by evoking, through aesthetic and other experiential cues, embodied intuitions and responses that are then built into “assets”, the research presented gives support to the view that specific practices of imagination we identify as envisioning practices are at play in this setting. We observed and have tried to show the persistence over time and recurrence over time and across sites of the practices observed.

These findings are important because they show that, at least in the digital systems innovation described here, there is a dimension of collaboration which transcends what can be captured and represented formally across shared syntaxes via the establishment of common knowledge (Carlile 2002; Carlile 2004), or through collective reflection in action (Levina 2005). The practices of imagination identified in this research and which we refer to as *envisioning practices* cannot be seen as simply a way of arriving at the kind of common knowledge seen as so central to effective collaboration in the new product development literature (Carlile 2004). In the cases presented here, the collective understanding fostered by the ‘vision’ for a game and the processes of appropriation of that vision by the developers is one that is changing and evolving continuously, drawing on and helping make explicit back to the development team the intuitions of the developers involved.

In addition, in the process of giving form to the ‘vision’, there are no clear syntactic boundaries negotiated, no common language arrived at. No attempt is made to actually represent the ‘vision’, requiring a subsequent translation of this representation across different domain-specific systems of syntax and signification. Instead, the ‘vision’ worked by evoking within the developers highly idiosyncratic responses through visual and other aesthetic, experiential, and affective cues. It is as these responses are then externalised, judged, captured, and translate into the more formal representations, that collaborative practices premised on the bridging of boundaries among existing specialised knowledge have dealt with, that they can be said to have become part of the stock of existing domain-specific and common knowledge of the studio and its developers.

Furthermore, the practices of imagination deployed by the games developers show how in relation to organisations characterised by “non-hierarchical and shifting contexts where criteria of worth are contested, and where areas of jurisdiction are blurred” (Kellogg et al. 2006) it is possible for collaborators to “align their activities without homogenising the inherent diversity of their community interpretations, identities, and interests” through “global agreement” (Kellogg et al. 2006). At the same time, however, the practices observed, show that this is not incompatible with views of collaboration across boundaries premised on the construction of common knowledge and the use of boundary-crossing mechanisms arrived at through negotiations and the forging of agreements among groups clearly defined by specific occupational knowledge. At some point during the development process it was usually necessary to translate the inherent “diversity of the interpretations, identities, and interests” (Kellogg et al. 2006) of the different developers relating to under-determined innovative affective features into the existing and specific systems of representation and knowledge that differentiated groups with different competencies. In rare occasions involving innovative features judged to be of unique value and in relation to which insurmountable obstacles and dependencies were not seen as prohibitive, there were, however, situations in which a transcending of the existing systems of representation and knowledge might be attempted. That is when innovative breakthroughs were achieved.

This raises important issues not only in relation to collaboration, but also regarding views of making the new, as for example discussed by Thrift et al (2000) in relation to the work of Deleuze and the difference in it between the “realisation of the possible” and the “actualisation of the virtual”, or Latour’s concept of “plasma” (Latour 2005), used to refer to all that is outside the narrow channels of existing social relations and the formalisms they depend on. Seen in the light of Latour’s concept, the envisioning practices of the game developers presented in this paper could be considered as a conduit through which the imagined or imaginary – seen as part of the vast unknown hinterland of “plasma” – is made knowable, socialised, formatted, and given shape in order to be articulated with what Latour refers to as “the narrow channels of the social” (Latour 2005).

Our articulation of the notion of envisioning practices as practices of imagination also differs from the problem-solving encountered in the literature on new product development, creativity, and innovation inasmuch as that refers to the articulation of a clearly and inter-subjectively framed problem (Hargadon et al. 2006; Levina 2005). This presupposes the existence of a) some formal shared representation of the problem, and b) some kind of common framework within which different courses of action can - even heuristically – be compared, made sense of, and eventually acted upon. Instead, the practices observed and conceptualised as part of a wider palette of practices of imagination in this study involved the developers taking something intuitive and difficult to describe and eventually presenting it in such a way that the problem-solving approaches found in the existing literature could be brought to bear upon it.

Another important point that is highlighted by the research presented relates to the way that envisioning practices made it possible for difficult to represented and specify features to be developed in an emergent way. While a clear shared ‘vision’ for the game from the early stages of the development process was something that was seen as important by developers, during the observational work it was possible to see at first hand that, although at any particular stage in the development process a ‘vision’ did inform the work of the developers and was temporarily stable, it was not a closed. It was, instead, an under-determined notion that evolved and became more explicit and stable as the game development process unfolded

and the vision started to find increasing concrete expression in the assets and early 'build' stages of the game. Nonetheless, it still served a clear collaborative purpose, despite its own emergence and under-determinacy.

The original contribution that this paper makes is that by proposing the practices of imagination identified as envisioning practices as central but distinctive to the collaborative practices involved in the development of complex IT systems, we draw attention to aspects of collaboration that involve pre-representational and non-explicit elements of the system under development that through the practices we set out to conceptualise are given shape and form in order to become part of the types of explicit conversation and discourses accessible to diverse agents' appreciative systems (Levina 2002). It is through these practices that under-defined and emergent features of the system can either be incorporated into the domain-specific knowledges of the diverse collaborating participants and incorporated into the explicit boundary objects they use, or, alternatively, lead to a process of re-assessing the relevance and applicability of these knowledges and objects. While such practices have not yet been gathered together in what Thrift (2007) calls "formal knowledges of affective response", approaches such as those encountered among the computer game developers studied can be seen as part of a "growing number of practical knowledges of affective response that have become available in a semiformal guise (e.g. design, lighting, event management, logistics, music, performance, etc)" (Thrift 2007). As such, these envisioning practices could be considered as forming part of a nascent engineering of sensation and affect through which while an "affective response can never be guaranteed" it also "is no longer a random process either" (Thrift 2007).

## **Conclusion**

Outside the specific setting of computer games development, the practices of imagination presented in the paper addresses a wider issue regarding how the increasing participation of wider and more diverse specialisations in digital systems design and development (Levina 2005) can be managed more effectively and informally in high-pressure post-bureaucratic organisations (Kellogg et al. 2006; Levina 2002; Sapsed et al. 2004). This not only addresses the involvement of a more diverse array of specialist expertise in digital systems development, but also the way user experience and sensory and aesthetic considerations are increasingly being incorporated in the design and development of software, hardware, and information systems (Bertelsen et al. 2004; Fishwick 2006; Floyd et al. 2007).

There is also a contribution to be made back to practice. During the research we saw that competition in the games development business is increasingly relentless, leading to greater efficiency in production and project delivery. Nonetheless, significant resources and time were still being expended in trying to get the look, feel, mood, atmosphere, and overall user-experience of the game right. Often this is what makes the game a commercial success. By finding ways, through an engineering of sensations and affect, of better understanding and theorising the processes through which creative and difficult to capture affective features are realised, not only in the development of computer games but other complex software also, important competitive advantage could be gained. And it is not just the games studios that can benefit from such new understandings, but also those engaged with important information systems challenges in terms of how to provide software and IT support to such emergent processes and the development of subjective features in systems and software development.

In a small way the games developers studied in this research and the importance to their collaboration of the “vision” and “emotion” of a game and how they deal with these elusive and difficult to represent features of a game in practice provide a glimpse of why the kind of research programme for digital technologies advocated by Ciborra (2006) “in which inner life is as important as surrounding circumstances, where the pre-theoretical is preserved by giving space to the moods, emotions and dispositions not linked to thinking” is of relevance.

It is hoped that the notion of envisioning practices proposed here can provide the impetus for further research and studies into how intangible and difficult to represent creative visions are translated into innovative software and information systems products.

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