

A Sweetspot for Innovation:

Developing games with purpose through student-staff collaboration

Robin J.S. Sloan, Dayna Galloway and Iain Donald

© 2014 IEEE. Personal use of this material is permitted. Permission from IEEE must be obtained for all other uses, in any current or future media, including reprinting/republishing this material for advertising or promotional purposes, creating new collective works, for resale or redistribution to servers or lists, or reuse of any copyrighted component of this work in other works.

Sloan, R.J.S., Galloway, D. and Donald, I. 2014. A sweetspot for innovation: developing games with purpose through student-staff collaboration. In: V. Camilleri, A. Dingli and M. Montebello, eds. *2014 6th International Conference on Games and Virtual Worlds for Serious Applications: VS-Games 2014*. 9-12 September 2014, Msida, Malta. Piscataway, NJ: IEEE. pp.123-130. [online]. Available from: <http://dx.doi.org/10.1109/VS-Games.2014.7012027>

A Sweetspot for Innovation:

Developing games with purpose through student-staff collaboration

Robin J.S. Sloan, Dayna Galloway and Iain Donald

School of Arts Media and Computer Games

Abertay University

Dundee, UK

r.sloan@abertay.ac.uk, d.galloway@abertay.ac.uk, i.donald@abertay.ac.uk

Abstract—Within industry as well as academia, developing games that have wider impact on society has been of particular interest in the last decade. The increasing use of terms such as ‘games with purpose’, ‘games for good’ and ‘serious games’ has been mirrored by a flurry of activity in games research. Broader applications of games beyond entertainment are now well-understood and accepted, with universities and companies excelling in creating games to serve particular needs. However, it is not explicitly clear how undergraduates of game design and development courses can be directly involved in serious game creation. With most undergraduates inspired by commercial games development, and the games industry requiring that universities teach specific technical skills in their courses, balancing the research aspirations of academics with the educational requirements of an appropriate undergraduate course can be a difficult balancing act. In this paper, the authors present three case studies of games with purpose developed through collaboration between undergraduate students and academic staff. In all cases, the educational value of the projects for the students is considered in relation to the research value for the academics, who face increasing demands to develop research outcomes despite a necessity to provide a first-rate learning experience and nurture future game developers.

Keywords—*games with purpose; serious games; educational games; games research; games education*

I. INTRODUCTION

Universities have an established track record in the development of games for serious applications. This has much to do with both the academic environment that researchers work in and the socioeconomic environment in which universities operate. Games Development departments exist within a larger academic context, which means that researchers with expertise in game design and development are likely to foster working relationships with researchers in fields as diverse as History, Psychology, Fine Art, Medicine, and Environmental Science. This interdisciplinary working environment is a particular strength of the university campus and of the wider university network. It is a strength that greatly benefits the development of games for serious applications. Furthermore, the social and economic drivers of university research are likely to stimulate development of serious games. On the one hand, serious games can be used to benefit society through education, training, and public engagement. Seeking to educate, communicate complex ideas, and contribute to society

and culture in meaningful ways are understandable goals for any university researcher. At the same time, these are precisely the outcomes that university funding agencies want academics to achieve, and so proposals to develop games for serious applications are likely to be looked upon favourably. The terms ‘serious gaming’ and ‘gamification’ have become so widely used in academia, that funding bodies are increasingly looking to target research that makes use of game design and technology in domains other than entertainment. This includes the prestigious EU research fund Horizon 2020. With a budget of approximately €80 billion available from 2014-2020, Horizon 2020 has a funding call labelled ‘Advanced digital gaming/gamification technologies’ [1].

However, when it comes to subjects such as Games Development (that are fundamentally skill-based), the primary aim of academics is often to facilitate high-level teaching of undergraduate students rather than to conduct original and innovative research in the domain. For some universities that specialize in computer games education, the development of models for computer games education has been the focus of academic staff efforts, rather than the design of innovative games. In Games Development as in Art and Design more broadly, many academics see their research interests as being pedagogical (driven by the fact that they are principally concerned with developing new and highly capable practitioners in the field) and treat practice within their subjects as a separate activity. This has largely been the case for Games Development academics at Abertay University in Dundee, UK.

In 1997, Abertay was the first university in the world to offer students a named degree in ‘computer games’. By 1999, Abertay had undergraduate programmes in both Computer Games Technology and Computer Arts, enabling students with artistic and computer programming skills to interact. More recently, Abertay has launched the first interdisciplinary professional Masters programme for game designers, the MProf in Games Development. Overall, Abertay has concentrated its attention on the provision of excellent teaching and learning in computer games, from game design to programming, and from content creation to production management. This has resulted in a highly knowledgeable, experienced, and professionally minded undergraduate student cohort, with graduates progressing to distinguished careers in industry.

While excellence in student education is noteworthy, a strong focus on teaching provision can limit the capacity for Games Development academics to investigate the innovative application of games and contribute to the advancement of the medium. The relationship between games and the arts, sciences, and education is increasingly discussed in both the press and in academic circles, with serious gaming the central topic of numerous conferences and journals, including of course the VS Games conference. With this in mind, it is clear that there is a need for university Games Development departments to grapple with questions related to the role of games within society. However, balancing the provision of high-level skills development with innovative research projects and experimentation in game design can be an exceptionally tricky undertaking. Logistically, it can be difficult to increase the research time of Games Development academics without subsequently degrading the depth and breadth of university teaching.

At the same time, it is apparent that many higher education institutions have suffered from a disassociation between teaching and research. This can be reflected in the fact that some universities may be seen as primarily teaching-focused (including many universities that specialise in Games Development) and that the focus on research in many other universities has led to reduced teaching provision and quality, as identified by UK universities minister David Willets in 2013 [2]. Some institutions, such as UCL most recently [3], have suggested that an all round better experience for both students and academics would be a shift towards research-based rather than research-led teaching. Ultimately, this would mean involving undergraduates in the research activities of their academic tutors from day one. In UCL's case, it is suggested that this might mean archaeology students doing fieldwork or humanities students reading from special collections within weeks of starting their course.

With this in mind, the current paper seeks to disseminate case studies of three games that were developed at Abertay with the explicit aim of reconciling student education with academic research interests. The three games each had a different application; one educational in nature, one designed to satisfy a societal need, and one designed to raise awareness. The case studies presented in this paper were all joint endeavours between staff and undergraduates. As such, the intention of this paper is to reflect on the delivery of a curriculum that not only fosters an environment for innovative serious games research through student-staff collaborations, but that also ensures students acquire the relevant technical skills applicable more widely across the games sector.

II. BACKGROUND

A. Games Development Education

Tertiary education in Games Development is typically evaluated in terms of the expectations of the games industry. In the UK, Creative Skillset provides accreditation of courses in computer games, underpinned by the requirements of professional game developers and experts [4]. Accreditation from Creative Skillset indicates that a course is facilitating learning that is of relevance to industry practices. The types of

skills required by the industry have been broadly categorised as 'abilities', 'technical skills', 'supporting knowledge areas', and 'contextual fluency' [5]. For instance, students may be expected to show a technical understanding of software and a professional knowledge of development roles, but may also need to develop core abilities in art, mathematics and physics (as identified by the Livingstone-Hope report [6]) and demonstrate an understanding of other subject areas that inform good design practice.

Generally, it could be argued that the industry's expectations of graduates are substantial. The very best game developers need a wide range of creative, technical, and transferable skills, as well as core knowledge in a range of diverse subject areas. And increasingly, there is an expectation that graduates will have applied experience in creating and even releasing games before they enter employment [7]. As some studies have shown, these high expectations combined with the complexity of professional game development means that there continues to be a shortfall in what universities provide [8][9]. Consequently, when integrating staff research interests into degree courses in games development, there is a need to be sensitive to the demands from industry regarding the education of the student. Even when courses are fully focused on the development of abilities, skills, and core knowledge, it is clear that it can be challenging for academics to provide sufficient training and experience opportunities for students.

B. Game Design and Educational, Social, and Documentary Applications

In discussing general definitions of serious games, a reasonable suggestion would be that these are games that have some form of deeper meaning and purpose. However, game design academics have traditionally stressed the importance of meaningful play to *all* game design, not just to those game applications that have a proposed purpose beyond entertainment. Salen and Zimmerman [10] state that design is fundamentally the "process by which a designer creates a context to be encountered by a participant, from which meaning emerges" (p 41). As good game design principles are effectively the same regardless of application, the development of serious games within a game design curriculum ought to be just as conducive to student preparation for industry as the development of commercial games.

Nevertheless, serious games have become more and more prominent within commercial games development. Innovative games created by forward thinking designers and delivered on entertainment platforms such as Steam are increasingly looking to achieve wider sociocultural objectives. Many of these games draw upon Bogost's [11] discussion of procedural rhetoric – the notion that game systems can communicate an argument through meaningful interaction, and that games can have social and educational impact beyond audio-visual presentation. As such, and with the context of the current case studies in mind, it is important to consider how games that focus on educational, social, and documentary objectives fit within both academic study and professional practice.

Educational games are one of the most pervasive and well-tested forms of serious game. Examples include games that

have sought to engage students of History [12], Geography [13], Computer Science [14], and Mathematics [15]. Determining the value of such games in relation to other methods of learning has been a key research question. A 2013 survey concluded that educational games generally have a positive effect on learning, with the authors noting “if they are not always superior to other types of learning material, the evidence that serious games can be effective learning materials in their own right is quite strong” [16]. In the context of games academics developing innovative educational games, whilst the subject specialism (e.g. Physics, Biology) is not within the domain of the academic, designing games to teach players most certainly is. Indeed, teaching players is a fundamental principle of game design, in particular in level design [17]. Developing educational games that make use of best design practices when it comes to teaching players is therefore an interesting area of study for both games academics and undergraduate games students alike.

Social impact games are a second form of serious game that has received substantial attention within game studies and experimental game development. Studies have shown that gameplay motivation can promote civic and social engagement [18]. A major resource for social impact games is the organisation Games for Change [19]. The organisation states that it aims to “leverage entertainment and engagement for social good”. Notably, McGonigal [20] has discussed the value of games, and underlined the capacity for games to be meaningful. One of the core facets of her thesis is that games can provide a connection to wider society, and that this is fundamental to serious games because the “single best way to add meaning to our lives is to connect our daily actions to something bigger than ourselves – and the bigger, the better” [20]. The principle of connecting game design to a bigger picture is an important one for all serious game design, and therefore a core area of research for Games Development academics. Furthermore, the increase in the number and success of commercial indie games that aim to provide social commentary – for example *Cart Life* and *Papers, Please* – demonstrates that experience designing and researching social impact games is valuable for Games Development students.

Games that draw on historical fact or current events in order to raise awareness of issues or put forward an argument have been closely studied in recent years [21][22][23]. One of the most well known examples of academic experimentation with the documentary game is by Newsgaming.com, led by Gonzalo Frasca. Games such as *September 12* and *Madrid* aim to react to current events (in these cases, the post-2001 Western intervention in the Middle East and the terror attacks in Spain in 2004) by offering critical perspectives communicated through play. From an academic perspective, it is clear that the documentary game is in need of further study in order to understand how best to handle historical information within an interactive setting and how to communicate facts through both production and gameplay design. For students who will be looking to enter the industry, working on documentary games as part of a Games Development curriculum can help to broaden their appreciation of the role of games as an expressive and rhetorical art form, and also prepare them for the risk of working with real world facts when producing interactive

media. For example, the controversy that followed the announcement of Atomic Games *Six Days in Fallujah* [24] demonstrates the need for industry professionals to understand their responsibility in working with facts and real world events, in particular when it comes to understanding how audiences may react.

III. GAMES DEVELOPMENT THROUGH STAFF-STUDENT COLLABORATION

As identified in the Introduction, the means by which games were developed through staff-student collaboration had to be sensitive to the need to reconcile the research objectives of academic staff with the specialist Games Development education required by undergraduate students. The aim was to ensure that a high quality of student education was maintained (including technical and professional skill development) whilst also incorporating student practice into academic research. This was achieved using two routes; one in which 3rd year undergraduates work in teams to develop game prototypes, and one in which individual 4th year undergraduates realise their own creative projects and produce a research dissertation.

In the case of the former, the 3rd year team projects typically comprise of approximately 200 undergraduate students drawn from the design, art, programming, and audio courses within the School. These students are broken down into teams of 8-12 people, with each team provided with a brief presented by an expert client. Around half of the clients are professional game studios while the remaining clients are typically experts from other disciplines (e.g. History, Health, Education) who are looking to produce experimental game prototypes for serious applications. These clients write their project briefs in conjunction with academic staff, to ensure that briefs will provide sufficient scope for students to learn professional and technical skills, whilst also identifying a research problem to be addressed through iterative game design. Over the course of the academic year, the teams design and rapidly prototype a solution to the problem identified in the brief. They are supported by weekly supervision meetings with a named member of academic staff, and receive feedback from the expert client through email and Skype communications. They also formally present progress to the expert client at four points throughout the year, in order to gain more in-depth feedback, to ensure that the project is addressing the stated problem, and to confirm that their design accurately draws upon and makes use of discipline-specific knowledge. Student assessment accounts for their development of technical expertise in their field (e.g. programming, design, art), their professionalism (exhibited through engagement with their team mates, interaction with clients, and production of documentation) and their creativity in developing a solution to the problem and undertaking individual and team-based research.

On the other hand, 4th year projects in game design place more emphasis on student leadership. Upon entering the final year of study, students are required to formulate a project proposal and generate appropriate research questions. Over the course of the first semester, students are supported in developing their principal project aim, conducting a review of the literature, developing an appropriate methodology, and

creating pre-production materials. In semester 2, students then undertake the project and write a supporting dissertation. Through mentorship and later through direct supervision by an appropriate member of staff, final year undergraduate students are encouraged to explore the creative use of games design, technology and aesthetics, and to engage with current trends and research problems discussed in the academic literature. By the end of the year, the student is expected to demonstrate technical mastery appropriate to their desired route into industry, as well as development of research and critical thinking skills. Consequently, within the 4th year projects, there is sufficient scope for advanced skill development for the students through one-to-one supervision and regular peer and staff feedback sessions, and scope for academic staff to guide project students towards appropriate research questions.

Using the two routes above, a series of experimental games were designed and developed in the 2012-13 academic year. From these games, three have been selected as case studies for this paper. These three games demonstrate a range of serious game types (educational value, social value, and documentary value) that have been developed through collaboration between staff and undergraduate students. The three games are; *Brain Ops* (an educational shooter game that seeks to communicate knowledge about brain surgery to the player), *Far From Home* (an adventure game designed to engage vulnerable young people who are within the care system), and *9.03m* (an experimental art-empathy game that explores the aftermath of the 2011 Japanese tsunami). Both *Brain Ops* and *Far From Home* were developed as part of the 3rd year team projects (and thus had expert clients in the fields of Neuroscience and Social Care), while *9.03m* was a 4th year project.

All three games were nominated for the TIGA 2013 Games Industry Awards in the Student Game category [25].

IV. CASE STUDIES

A. *Brain Ops*

Brain Ops was originally pitched by a Consultant Neurosurgeon, Prof. Sam Eljamel, who was interested in developing a proof of concept puzzle-shooter game on the theme of the brain. The premise behind the concept was that the game would serve as a learning tool for advanced high school pupils and first year students of colleges and universities. Specifically, the concept of *Brain Ops* was that it would educate players on brain function and structure, and that it would present them with examples of illnesses and diseases that could affect the brain. At the same time, the pitch was sensitive to the potential pitfalls of creating games with a strong emphasis on education: i.e. that the lack of a refined gameplay experience could degrade the capacity for the game to entertain, and that an overemphasis on education at the expense of entertainment would discourage audiences from progressing through and replaying the game. As such, the overarching goal was to create a navigation-based game (where the player would explore the brain) with balanced and increasingly challenging gameplay. It was broadly understood by all stakeholders that accurate educational content in itself would not ensure an effective serious game: *Brain Ops* had to be as fun, stimulating, rewarding, and aesthetically pleasing as

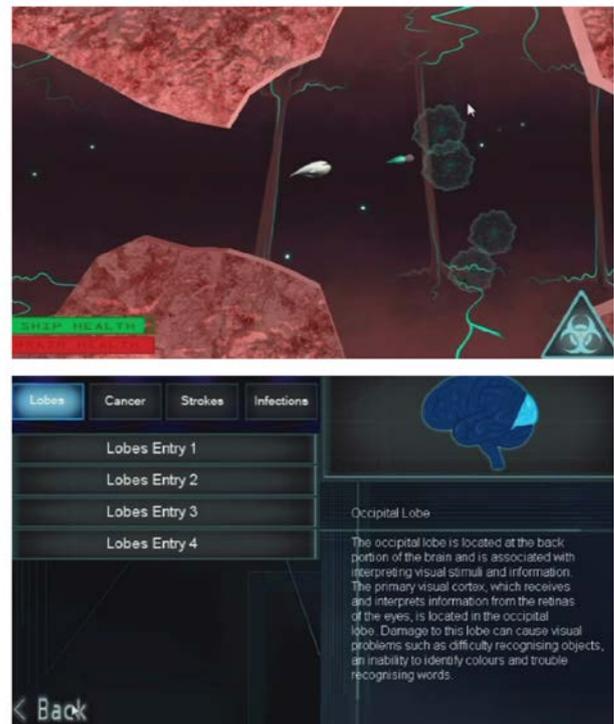


Fig. 1. In-game screenshots of game play in *Brain Ops* (above) and unlocked information in the codex (below).

any other puzzle-based shooter that the target audience might download and play.

To this end, the student team rapidly produced and iterated on a range of concept development materials. Visual style research involved examination of hard and popular science-fiction genres, literature on nanotechnology and the use of robotic technologies in medical procedures, and retro sci-fi themed shooter games. This research informed the development of an aesthetic that would appeal to the target market, mixing accurate organic imagery with science fiction enhanced tools and technologies. At the same time, level and puzzle design was informed by examination of classic game designs, with paper prototypes used to test and iterate on level layouts. The team along with their academic mentors drew upon the expertise and knowledge of Prof. Eljamel over the course of the project. Prof. Eljamel acted as a scientific advisor, ensuring scientific terminology and interactions were accurately represented.

The final game prototype for *Brain Ops* was a 2-dimensional multidirectional shooter-puzzle game, in which the player assumes the role of a young neurosurgeon tasked with guiding a high tech, microscopic device through the brain in order to diagnose and combat a range of medical problems (see Fig. 1). The game was designed to educate players about the five core areas of the brain and their functions. It achieved this by presenting action-orientated gameplay and puzzles based on scientifically accurate facts, and through the use of educational zone selection screens and a codex populated by unlocked data.

Most puzzles throughout the game require the player to complete an activity which illustrates or educates them about the functions of that area of the brain: for example, logic puzzles within the frontal lobe (which is concerned with planning, reasoning and problem solving) or colour based physics challenges in the occipital lobe (which is concerned with processing visual information). Success is measured using two metrics; Ship Health (damage taken by the player) and Brain Condition (the state of the brain, negatively affected by enemies and accidental damage caused by player action, and positively affected by removal of puzzles and enemies)

In order to solve puzzles, the player has a limited array of tools and weapons to work with as they navigate through the brain. More upgrades become available through progression, allowing the player to complete more varied puzzles and mechanics. These abilities are derived from actual interactions that are performed on the brain in order to examine and manipulate tissue. This includes a laser scalpel, forceps, injections, gamma wave attacks, and sonar beams. The abilities can be used on both encountered enemies and other objects. Enemies are presented as dynamic forces that oppose the player and pose a danger to them throughout the game. They include malignant cancer cells, bacterial infections, and viral infections that are actively causing harm to the brain. As with other design elements, the enemies are based on scientifically accurate information about disease and infections and the consequences for the brain. The quantity of enemies is determined by the condition of the brain; the lower the Brain Condition, the more enemies the player encounters. In addition to hostile cells that must be defeated, the player can encounter a variety of obstacles and objects which they will need to dispose of or interact with in order to progress. These are primarily integrated into the puzzle design, and include elements such as various types of barrier (blood clots, arterial embolus, and membranes) and triggers (such as neurons and nerve fibres).

As the player progresses through the game defeating enemies and completing puzzles, contextually relevant and scientifically accurate information is unlocked and added to the codex, which the player can access at any time. Players are notified of new codex entries, and can pause gameplay in order to examine the information in more detail. Linkages between gameplay and codex information are clearly established: for instance, solving puzzles that involve removing blood clots can unlock information about thrombosis (the formation of blood clots which in turn disrupts blood flow to the brain), and how this can lead to conditions such as strokes.

At the time of writing, the success of the *Brain Ops* game has generated sufficient momentum in order to consider further development. In its current version, *Brain Ops* is representative of a successful interaction between an expert client (with a defined problem to be solved by game designers), games academics (with research interests in the balance of gameplay design and scientifically accurate information), and student teams (who developed both research and industrially relevant technical skills through the execution of the project).

B. *Far From Home*

In a similar vein to *Brain Ops*, the social impact game *Far from Home* was started as a 3rd year team project that was initiated by an external client, Sarah Wilkie of the Care Inspectorate (the independent scrutiny and improvement body for care services in Scotland). The intention of the project was to engage with efforts to make the National Care Standards easier for young people to understand. Often confused, hurt, and scared, young people coming into care find themselves trying to make sense of a very new way of life. The expression “I may as well have been on another planet” was a common sentiment, and as a result ‘Sid the Alien’ came to represent the experience of going into care for the first time. In 2009, the former Care Commission worked with Who Cares? Scotland to develop a website for Sid. Its purpose was to give young people in care easier access to information, in a format suitable for them, about the quality of care they are entitled to, and to promote the National Care Standards. By 2012, the Care Inspectorate along with Who Cares? Scotland and Aberlour Childcare Trust's young people's group were looking to update Sid in ways that could re-engage with young people. They created a challenging creative brief for a 3rd year student team to develop an action RPG to help re-launch the Meet Sid website. Using characters and approaches conceived by young people in care, the game *Far from Home* was developed. The proposed game was not purely about entertainment: the brief was specifically aimed to utilise games as a means to address complex social issues with a specific audience that is often very difficult to reach.

Creating any game, never mind one which deals with serious and complex issues, can be a challenge. For the students, they had to take responsibility for all aspects of the development including steering the client through the unfamiliar territories of game design and development, and learning new technologies and skills whilst building on existing ones. Balancing their own learning activities with what was required for the client, the student team evaluated different game engines, chose appropriate technologies to work within a multi-disciplinary team, and developed an art and audio style to update the previous incarnation of Sid. Sid was originally conceived as a fun and friendly character to engage youngsters living in care, and to help communicate their rights under Scotland's National Care Standards. The students experimented with, iterated on, and developed a new visual identity for Sid whilst ensuring that the design reflected evolution rather than revolution.

In the final game (which can be played online [27]), the player takes control of Sid, who has crash-landed on Earth and needs to find replacement parts to fix his spacecraft (see Fig. 2). The production design was informed by a need to make the environment visually unsettling and unfamiliar, in order to reflect the feelings of children who find themselves in care. This included the use of images and text that were difficult to decipher – in other words, the language of the world is alien to the player/child. The game world is entirely set within a dark and stylised city, populated by strangers that the player needs to either avoid or interact with to make progress. The characters fall within two types: NPCs that provide dialogue



Fig. 2. Screenshots from the web-based version of *Far From Home*.

options and that are related to quests, and enemy characters styled as Men in Black who pursue Sid.

While the visual and audio design of the game is in keeping with the desired aesthetic and atmosphere, it is the gameplay design that engages with the core message that the Care Inspectorate wanted to communicate. Drawing upon Bogost's [11] thesis of procedural rhetoric discussed in the project background, the concept was that the actions and decisions that the player would make would relate to the emotions and experiences of children in care, and in turn offer both empathy and encouragement through play. For example, the first quest that the player encounters is to find an item that two characters are looking for: one a shady looking character standing under a light outside a dingy bar (see Fig. 2) and the other a homeless man on a bench. In their speech, the shady character comes across as more imposing and unlikeable, whereas the homeless man is friendlier and more helpful. While both characters at first sight might seem unapproachable, the player must make a decision to cautiously approach, interact with, and then determine who to help. When the item is found in a nearby skip, the player hands it over in order to make progress. This interaction, whilst seemingly simple, illustrates the need to be critical of requests from strangers and demonstrates the importance of making sensible decisions about who and who not to trust. At the same time, simply avoiding all contact is not helpful and will make it impossible for the player to make progress out of their unfavourable situation. Later in the game,

the player does encounter characters that are dangerous, and where avoidance is essential. Here, the use of a stealth mechanic reflects the need to be cautious and avoid danger on the streets.

Overall, the design of the game explores issues of trust, consequences, danger, and unfamiliarity. What developed from a rough prototype was an experience that connected not just with the client but also with the target audience. With specific feedback and engagement in the design and development from young people that had experienced the care system first-hand, the prototype emerged as an engaging and creative product. However it was clear that the product lacked sufficient breadth and polish to be fully realised. The Care Inspectorate was suitably impressed to provide funding to complete the game for release. This enable the student team to gain further experience in games development, including of course the experience in completing a game from concept through to release (as identified earlier as a core requirement of a good Games Development curriculum). Additionally, academic staff were able to explore the use of meaningful mechanics through an applied project, linking interests in game studies to game design practice and execution.

C. 9.03m

9.03m began as part of a final year undergraduate honours project and dissertation on the BA(Hons) Game Design and Production Management programme at Abertay University. Its designer, Karl Inglott, was initially intrigued by a variety of research exploring how media affects people. Utilising Gerbner's *Cultivation Theory* [28], and McLuhan's body of work in *Medium Theory* [29] as a starting point for the research, Inglott proposed to explore and demonstrate how videogames can be used as a medium for inspiring and impacting upon people. To achieve this aim, the project grew to encompass an iterative approach to design and development that would explore a broad range of gaming experiences to underpin the development of an insightful and useful critical framework for the design of meaningful interactive media.

Interactive media and games which explore challenging content or aim to present players with complex and powerful emotional experiences is not a new field as such, however they are not the most prevalent. A key influence on the inception of *9.03m* is Brenda Brathwaite's *Mechanic is the Message* series [30], which includes *Train*, an experimental, non-digital game that uses simple game mechanics to deliver meaning to the players of the game. In the case of *Train* players are encouraged to efficiently load a train with passengers and transport the train to its destination. Through participation in the rules and mechanics, the player becomes complicit in the world of the game and is therefore presented with a range of emotions upon the upturn of a card that reveals the train's final destination as a Second World War Nazi death camp. The fact that a non-digital game can present a sensitive yet powerful portrayal of an aspect of the holocaust provided the justification and confidence to explore challenging, real world events in the context of digital games.

After ethical considerations, Inglott chose the Japanese tsunami of 2011, an event of both global and personal

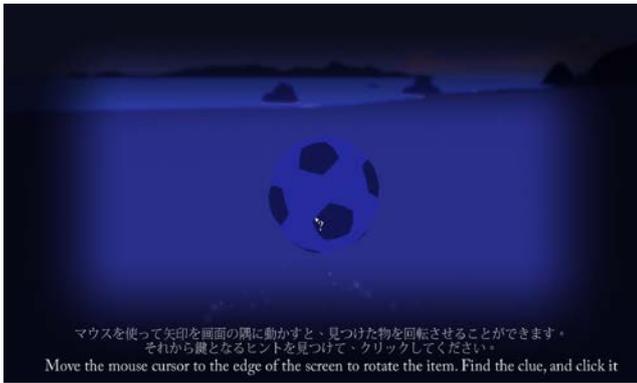


Fig. 3 The Rothko-inspired setting of 9.03m. Manipulation of found artefacts (above) leads to information about the owner, before a butterfly emerges from the object and ascends toward the sky (below).

significance, to form the inspiration for developing an inspiring, impactful interactive media project. It was intended to develop a game to highlight the tsunami, in which over 12,000 people died, to bring attention to the tragedy, raising awareness of the importance of family and friends, the transience of life and material possessions, and the uncompromising power of nature. The proposed piece was also intended to provoke players into understanding the scale of the tragedy from a more intimate, personal perspective than that of statistics.

During the conceptualisation and pre-production stage of the project, a focus on realism emerged with regard to the visual style. As the proposed game was to take place in reconstruction of a real-world location and in response to a real-life event, it is easy to identify how this decision was reached. Simultaneously, the project was also looking to explore meaning and metaphor to assist in communicating both the story and some form of affecting message to players. This led to competing and contradictory design elements that needed to be resolved through a process of initial prototype development. A key challenge was the initial intention to put the player in a situation whereby their progression through the experience led to a rise in dramatic tension which culminates in the player being confronted with a horrifyingly, realistic simulation of an actual Tsunami. Firstly, as a lone developer this presents a challenge as water simulation is a field of research in itself, and massive waves of water are relatively

rare in video games due to the demands on processing power. However, the second issue with this design, and perhaps the defining moment for the entire project, was that the inclusion of such a scene would actually undermine the original, authorial intentionality of the piece, which was to elicit an affective, positive, and contemplative response from players.

The prototype that evolved through student-staff discussion, iteration, and experimentation takes the form of a first-person exploration game that places the player on a stylised, Rothko-esque visual representation of Baker Beach in San Francisco. The player is left to freely explore the beach and is drawn towards silhouetted figures that are placed at specific points across the sands. Upon approaching these figures, they fade away leaving behind an object in their place. The player must then investigate and manipulate each object to discover a small symbol that unlocks a reward in the form of details of the owner of the object, before a symbolic butterfly emerges from the object and poetically ascends away from the player's position (see Fig. 3). This gameplay loop of locate, inspect and reward repeats for several objects until the final object triggers a symbolic and emotive cutscene animation featuring a majestic display of butterflies ascending into the skies. The entire experience takes under ten minutes to navigate and complete, but the emotional experience is heightened by moments of contemplation between finding each object and the mood that is established by the visuals and the melancholic piano score working in harmony.

The finished prototype version of 9.03m demonstrated clear potential to be developed further and in the latter half of 2013 a new company named Space Budgie was established to develop the game into a full retail release. Through the addition of specialist roles in audio, programming, and art, Space Budgie achieved the capacity to deliver a polished and complete production that fully delivers on the original vision and intentionality of its designer. The team have provided us with a beautiful and haunting interactive experience that strikes a perfect balance between authored storytelling and freeform exploration. Every aspect of the game, from its minimalist Rothko-esque art style to the expanses of empty beach to traverse has been designed with the purpose of provoking contemplative play and the personal construction of meaning. For a new studio it is heartening to see such a confident and bold approach with regard to how they communicate with the player and draw them into the experience by providing just enough information to lead to interaction. The dynamics that emerge from the player's inquisitive navigation and manipulation of the world serve the dual-purpose of being the currency of the game (the motivation and reward for exploration and interaction) and the emotional heart-beat of the overall experience through affecting musical composition and sublime cut-scene animation. Within the space of one year, 9.03m has grown from an initial proposed project in experimental game design by one undergraduate student, to a successful retail game that has established a promising new, indie start-up of six talented, young developers. As an undergraduate project, 9.03m allowed associated academic staff to discuss and have input into a highly creative documentary game, satisfying research interests, while the fact that the game is now available to play through channels such as

Steam demonstrates the value the project had on student professional development within the final year curriculum.

V. CONCLUSION

It was the goal of this paper to examine how the research interests of academic staff in a Games Development department could be integrated into the curriculum of undergraduate students whilst continuing to support the needs of games industry employers by providing appropriate opportunities for student learning. Through the case studies presented in this paper, the authors hope to show the importance of integrating experimental serious games research into undergraduate teaching, and to demonstrate the usefulness of creative collaboration between undergraduate games students and games researchers. Since the completion of the projects discussed in this paper, further formalisation of academic research in experimental game design has been carried out at Abertay University through the establishment of the Abertay Game Lab. While the objectives of the Abertay Game Lab will primarily be to develop and study experimental and innovative games, it is anticipated that the facility will help to strengthen knowledge exchange between academics and games industry professionals, and to generate research activities for undergraduate students to work on in collaboration with researchers and professional clients.

ACKNOWLEDGMENT

The authors would like to thank Ninewells Hospital and Medical School in Dundee and the Care Inspectorate for acting as expert clients on the *Brain Ops* and *Far From Home* projects as well as Karl Inglott of Space Budgie.

REFERENCES

- [1] European Communities, "ICT 2014: Information and communication technologies," available at: <http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/90-ict-21-2014.html> (Accessed 5th March 2014), n.d.
- [2] D. Willets, "Robbins revisited: Bigger and better higher education," Social Market Foundation, 2013.
- [3] H. Else, "Research to start on day one of degree course," Times Higher Education, available at: <http://www.timeshighereducation.co.uk/news/research-to-start-on-day-one-of-degree-course/2011855.article> (Accessed 5th March 2014), 2014.
- [4] Creative Skillset, available at: <http://www.skillset.org/games/> (Accessed 8th March 2014), n.d.
- [5] M.M. McGill, "Defining the expectation gap: a comparison of industry needs and existing game development curriculum," FDG '09, pp. 129-136, 2009.
- [6] I. Livingstone and A. Hope, "Next gen. Turning the UK into the world's leading talent hub for the video games and visual effects industries," NESTA, 2011.
- [7] H. Else, "Video games industry 'wary' of interns," Times Higher Education, available at: <http://www.timeshighereducation.co.uk/news/video-games-industry-wary-of-interns/2011803.article> (Accessed 10th March 2014), 2014.
- [8] B. Ip, "Fitting the needs of an industry: An examination of games design, development, and art courses in the UK," ACM Transactions on Computing Education, Vol. 12, No. 2, Article No. 6, 2012.
- [9] J. Kasurinen, S. Mirzaeifar, and U. Nikula, "Computer science students making games: a study on skill gaps and requirement," Koli Calling '13, pp. 33-41, 2013.
- [10] K. Salen and E. Zimmerman, Rules of Play: Game Design Fundamentals. Cambridge, MA: The MIT Press, 2004.
- [11] I. Bogost, Persuasive Games: The Expressive Power of Videogames. Cambridge, MA: The MIT Press, 2007.
- [12] J. Huizenga, W. Admiraal, S. Akkerman, and G. ten Dam, "Mobile game-based learning in secondary education: engagement, motivation and learning in a mobile city game," Journal of Computer Assisted Learning, vol. 25, no. 4, pp. 332-344, 2009.
- [13] M. Virvou, G. Katsionis, and K. Manos, "Combining software games with education: Evaluation of its educational effectiveness," Educational Technology & Society, vol. 8, pp. 54-65, 2005.
- [14] M. Papastergiou, "Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation," Computers & Education, vol. 52, no. 1, pp. 1-12, Jan. 2009.
- [15] S. Main and J. O'Rourke, "New Directions for Traditional Lessons: Can Handheld Game Consoles Enhance Mental Mathematics Skills?," Australian Journal of Teacher Education, vol. 36, no. 2, p. 4, 2011.
- [16] P. Backlund and M. Hendrix, "Educational games - are they worth the effort? a literature survey of the effectiveness of serious games," Games and Virtual Worlds for Serious Applications (VS-GAMES), 2013 5th International Conference on, 11-13 Sept. 2013.
- [17] R. Kremer, Level Design: Concept, Theory and Practice. Natick: AK Peters.
- [18] F. Dalisay, M.J. Kushin, M. Yamamoto, Y-I. Liu and P. Skalski, "Motivations for game play and the social capital and civic potential of video games," New Media & Society, doi: 10.1177/1461444814525753, 2014.
- [19] Games for Change, available at: <http://www.gamesforchange.org/about/> (Accessed March 4th 2014).
- [20] J. McGonigal, Reality is Broken: Why Games Make Us Better and How They Can Change the World. New York: Penguin Press, 2011.
- [21] T. Fullerton, "Documentary games: putting the player in the path of history" in Playing the Past: Nostalgia in Video Games and Electronic Literature, Zach Whalen & Laurie Taylor, Eds, Nashville: Vanderbilt University Press, 2008.
- [22] J. Raessens, "Reality play: Documentary computer games beyond fact and fiction," Popular Communication: The International Journal of Media and Culture, vol. 4, no. 3, pp. 213-224, 2006.
- [23] D. Galloway, K.B. McAlpine and P. Harris, "From Michael Moore to JFK Reloaded: Towards a working model of interactive documentary," Journal of Media Practice, Vol. 8, No. 3, pp. 325-339, 2007.
- [24] Gamasutra, "Konami drops controversial Six Days in Fallujah," available at: http://www.gamasutra.com/php-bin/news_index.php?story=23367 (Accessed February 20th 2014).
- [25] TIGA 2013 Conference & Games Industry Awards, available at: http://awards.tiga.org/awards_categories.php (Accessed 5th March 2014), 2013.
- [26] Care Inspectorate, available at: <http://www.scswis.com> (Accessed 16th January 2014), n.d.
- [27] Sid - The Game, available at <http://meetsid.co.uk/sid-the-game/> (Accessed 12th March 2014), n.d.
- [28] G. Gerbner, "Cultivation analysis: An overview," Mass Communication and Society, Vol. 1, No. 3-4, pp. 175-194, 1998.
- [29] M. McLuhan, Understanding Media: The Extensions of Man, Cambridge MA: The MIT Press, 1994.
- [30] B. Brathwaite, "Gaming for understanding," TED, available at: http://www.ted.com/talks/brenda_brathwaite_gaming_for_understanding (Accessed 2nd March 2014), 2011.