Design Fiction as World Building

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Abstract: Design Fiction has garnered considerable attention during recent years yet still remains pre-paradigmatic. Put differently there are concurrent,but incongruent, perspectives on what Design Fiction is and how to use it. Acknowledging this immaturity, we assert that the best way to contribute to the establishment of an evidence-based first paradigm, is by adopting a research through design approach. Thus, in this paper we describe 'research *into* design fiction, done *through* design fiction'. This paper describes the creation of two Design Fictions through which we consider the relationship between narrative and Design Fiction and argue that links between the two are often drawn erroneously. We posit that Design Fiction is in fact a 'world building' activity, with no inherent link to 'narrative' or 'storytelling'. The first Design Fiction explores a near future world containing a system for gamified drone-based civic enforcement and the second is based on a distant future in which hardware and algorithms capable of detecting empathy are used as part of everyday communications. By arguing it is world building, we aim to contribute towards the disambiguation of current Design Fiction discourse and the promotion of genre conventions, and, in doing so to reinforce the foundations upon which a first stable paradigm can be constructed.
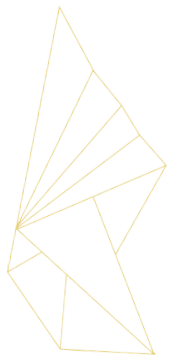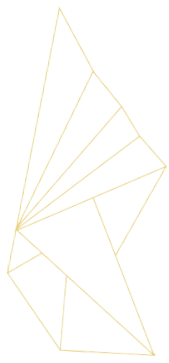
Figure 1. Voight Kampff Machine Design Fiction inspired by the Film Blade Runner (sketch by Paul Coulton).

A Tall Story

Bruce Sterling, best known for being an author of science fiction and cyberpunk literature, coined "Design Fiction" almost incidentally to articulate how design has impacted upon his literary work (Sterling 2005). Design fiction is "more practical, more hands on [than the] hand-waving hocus pocus [of science fiction]" and it "reads a great deal like science fiction; in fact it would never occur to a normal reader to separate the two" (Ibid). Some years later, after collaboration with Julian Bleecker and members of The Near Future Laboratory, Sterling refined his thinking and in an interview about Design Fiction said, "Design Fiction is the deliberate use of diegetic prototypes to suspend disbelief about change" (Bosch, 2012), which has subsequently become something of a *de facto* definition. Within this description the concept of 'diegesis' is of particular relevance, and is, in its own right, an intriguing topic. Diegesis found its way into the Design Fiction discourse via Julian Bleecker's influential essay, a text which took the then-nascent concept of Design Fiction and aligned it with several other theories, and musings from a number of extraneous sources (Bleeker, 2009). Bleecker integrated 'diegesis' into his discussion by drawing upon David Kirby's research on how science informs and is represented in cinema (Kirby, 2010). Diegesis, as Kirby uses the word, simply means 'in the fictional world'. Kirby uses fiction to suggest a quality of unreality. So, inheriting this meaning, the 'diegetic prototypes' in Sterling's definition would be simply prototypes which

exist within the unreality of a fictional world. However, if we trace the etymology of diegesis, we see that its roots are in the concept of 'narrative' which arguably has led to an over emphasis on the importance of story and narrative (Tanenbaum, Tanenbaum, and Wakkary, 2012) as the foundation upon which to create Design Fictions. Whilst this argument may seem subtle to some we believe the consideration of world building mitigates the promotion of what Dourish (2006) refers to as "genre conventions" imposed by storytelling and narrative that can stifle the flexibility of Design Fiction as an approach.

A second highly relevant factor, that is somewhat easier to articulate, is the diversity of different media and formats used to create Design Fictions. Responding to the expansiveness of this variety and wanting to reduce the ambiguity inherited from the word diegesis, Lindley and Coulton adapted Sterling's classic elucidation of Design Fiction, saying it could be better defined as 'something which creates a story world in which something is being prototyped' (2015). Although distancing itself from 'the diegesis problem', this definition also imports some essence of narrative by using 'story world'. Considering etymology again, 'story' may refer to the concept of 'unreality', but it is also synonymous with 'narrative'. Thus, Lindley and Coulton's attempt to cut through the ambiguity within Design Fiction discourse is diluted by their clumsy use of 'story world'.
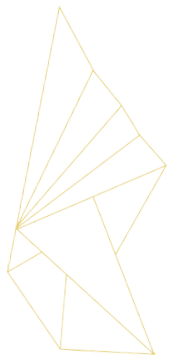
The problems associated with subtleties of meaning are also true of the word 'fiction': at once it may mean 'made up' or it could mean 'literature'. If it means literature, then it infers a link to story, and probably narrative too. So it seems that Design Fiction has ambiguity 'baked in' and hence questions around its nature abound. What is the connection between Design Fiction and narrative? Does 'fiction' denote unreality, or does it refer to story? If a Design Fiction's diegesis is its 'story world' what does the word 'story' refer to? Does this application of 'story' refer to something that is a fabrication, fictitious, made up, or does it refer to narrative, literature, or plot? Whilst we could attempt to respond to these inexpungable vagaries through desk-based research and a close examination of literature, as designers we were more drawn to a practical engagement. We concur with Sterling's more recent note about Design Fiction that "The best way to understand the many difficulties of Design Fiction is to attempt to create one" (2014). In concordance with this sentiment, Bill Gaver's discussion of research through design suggests that insights and understandings which emerge from situated practice are particularly relevant for clarifying pre-paradigmatic ideas or methods (2012), of which Design Fiction is one. Thus in the subsequent sections describing the creation of two Design Fictions we reflect upon the aforementioned questions.

"It tells worlds not stories"

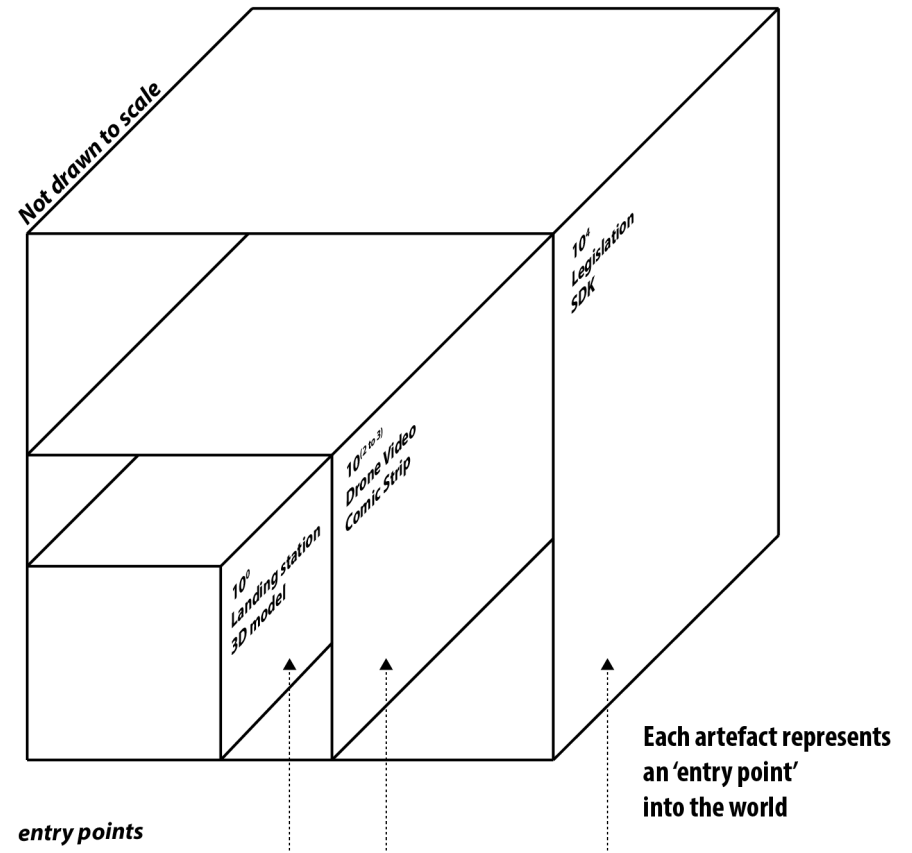In the same interview where the oft-cited definition of Design Fiction

Figure 2. The artefacts that build design fiction worlds represent views of those worlds from a range of scales while also acting as 'entry points' to the world.

originates, Sterling *also* said "It tells worlds not stories" and these worlds are imbued with a rhetorical intentionality by their creators (Coulton and Lindley, 2016). The creation of rhetoric within a world rather than through a story allows those interacting with the world
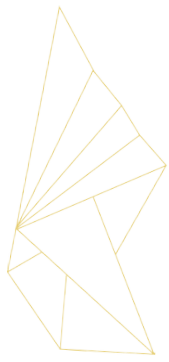
to explore the rhetoric of that world rather than being forced down a prescribed path (Coulton, Burnett and Gradinar, 2016). Through reflections upon the research described in this paper, we argue that framing Design Fictions as 'built worlds' is more useful because, unlike stories, the frame can be applied to *all* Design Fictions. Articulating the process of how such insights emerged, what the insights actually are, and describing the projects from whence the insights bloomed, is an immutable problem for 'research through design'. On this occasion, before discussing the creation of two example Design Fictions here we offer some 'pre-reflections' as these will help clarify our later discussion.

Through our practice we consider the 'appropriate' use of the word fiction, in Design Fiction, in the same way as David Kirby used it to explain diegetic prototypes in unreal world, thus severing the direct tie to narrative. Kirby highlights particular properties of these unreal worlds, and of the diegetic prototypes that live within them. Diegetic prototypes are consistent from the moment that they appear on screen in that they are naturally situated within the whole 'diegetic world'. In that world they become part of 'everyday life' and in that world they are 'real' (2010). While Kirby was solely referring to film as the media container for diegetic prototypes, Design Fictions invoke such worlds and prototypes through the crafting and sculpting of a miscellany of different media and forms. Unlike cinema whose diegetic prototypes are a by-product of storytelling, in Design Fiction the diegetic prototypes are the primary focus. Thus,

we assert creating the *world* is the principle task of the designer when creating a Design Fiction.

In practice, within a single Design Fiction, the specific selection of forms and media used manifest themselves as a number of standalone artefacts, which together build the world. We suggest two metaphors for describing how the individual artefacts relate to the world. First, let us imagine a Design Fiction world as a distinct entity, one that we can see the overall shape of, but whose complex internal structure is hidden from view. What we *can* see, however, is a series 'entry points'. Each artefact that contributes to making up this Design Fiction plays its role as a metaphorical entry point to the fictional world as shown in figure 2. The second metaphor, which works harmoniously with the first, is inspired by Charles and Ray Eames' film about relative size of things in the Universe, 'Powers of 10'. The film shows a number of frames of reference (literally drawn as squares in the film) starting with a 1 meter squared section of an image that includes a couple sitting having a picnic, but then zooming out and increasing the visible area by one power of 10 every 10 seconds. This changing scale is a device that encourages the viewer to constantly reconsider the scene being viewed. Although we are not suggesting adherence to the configuration '1 power of 10 per 10 seconds', the basic concept of shifting scale can be applied to Design Fiction worlds and the artefacts that create them. We can think of each individual artefact that constructs the world as a representation of that world, but at a different
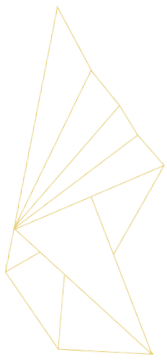
scale (see figure 2). We will now use this consideration to reflect upon two specific Design Fictions.

Game of Drones

Our first Design Fiction example is 'Game of Drones', which is made up from a number of artefacts, all of which fit into two 'containers', they are a fictional research paper and a 5-minute demonstration video. A notable curiosity related to this project is that although the research paper is a fictitious account of a research project that never happened, it was submitted, reviewed, and accepted for presentation at an international conference on Human Computer Interaction (Lindley and Coulton, 2015a). Whilst the fact that this happened raises intriguing questions about the ethics of Design Fiction that deliberately deceive its audience (Coulton, Lindley, and Akmal, 2016), we do not extend that discussion in this paper. Instead we focus on the paper, the artefacts referred to in the paper, and the accompanying video. Collectively these items built a world that was plausible enough for reviewers, and some conference-goers, to believe it was real.

Game of Drones portrays a world in which a technical trial of a 'Drone Enforcement System' (DES) is taking place in the UK city of Lancaster. The trial is premised upon a supposed change in legislation which allows Unmanned Aerial Vehicles (forthwith, 'drones') to help local governments deliver services to the public. Specifically, the DES is a 'gamified' system in which retired members of the police and armed services act as remote drone pilots helping to enforce by-laws relating to parking offences and dog fouling in the city. The whole interaction, between operator and drone, takes place through a game-like interface and points are awarded for catching other citizens infringing upon the rules.

It was important that the individual elements contained in the paper, which help contribute to building the fictional world, were plausibly consistent with each other. As research papers in this field usually conform to tropes of style and structure, it made sense to imitate these when packaging the artefacts that defined the world into the research paper. The paper comprised an introduction which explained a (fictional) change in UK legislation that would make this system a legal possibility. Much of the rest of the world building pivoted around altering and augmenting the existing legislation with the statutory safety requirements for operating drones in a civic-enforcement context. Although only a small part of our more comprehensive Design Fiction world, this change in legislation is a Design Fiction prototype in its own right, and was arguably a portend to the US Federal Aviation Administration's subsequent implementation of compulsory drone registration and mandatory certification for commercial pilots

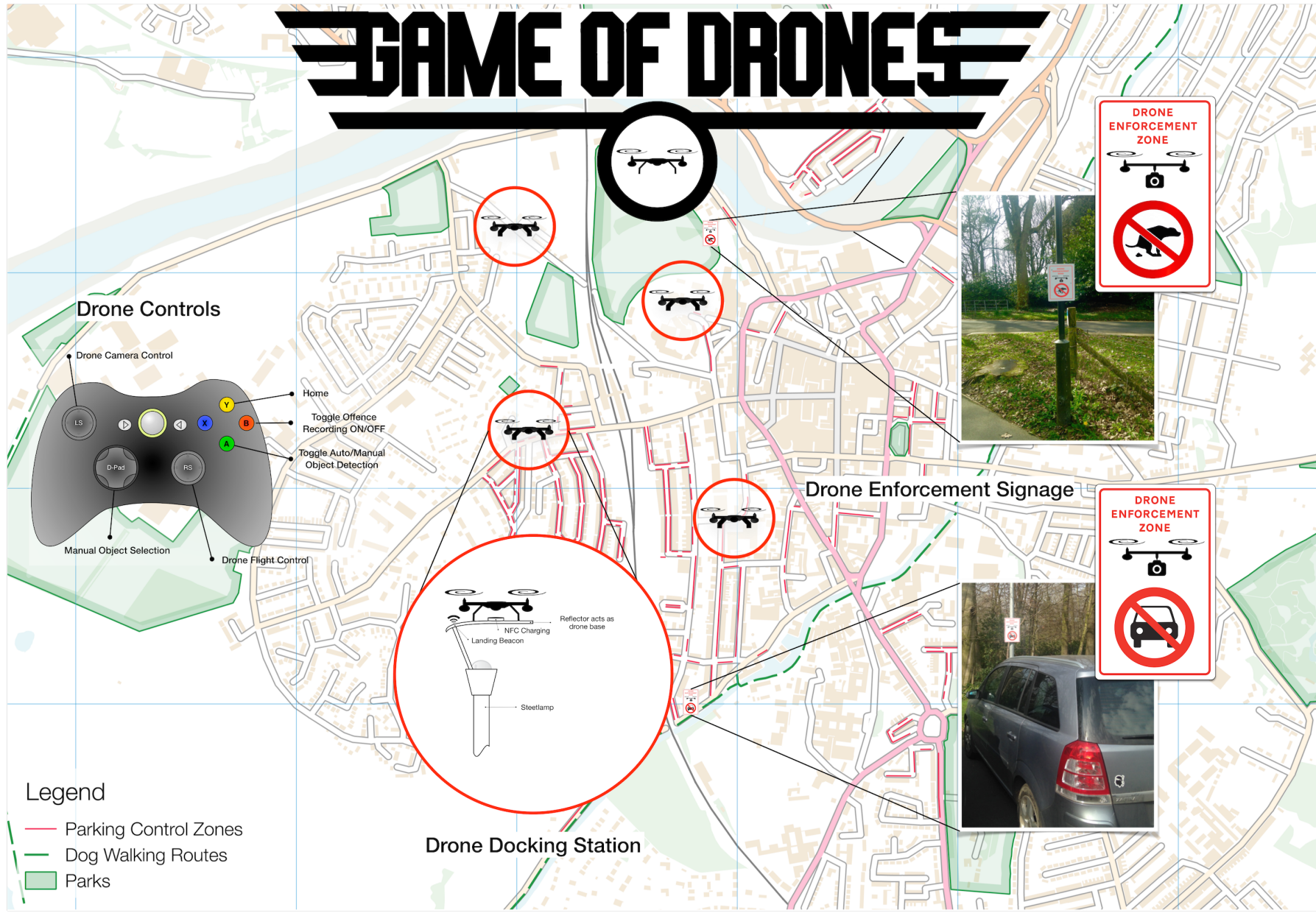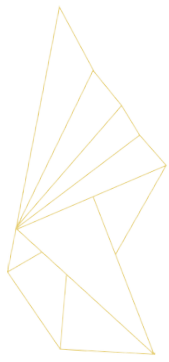The subsequent section of the paper details technical aspects of the

Figure 3. Game of Drones Design Fiction: featuring Trial Location Map, Drone Controller, Drone Docking Station, and Drone Enforcement Signage.

DES including the specific drone hardware used to facilitate the trial, and blueprints for the hardware required to make the system viable (see landing stations and control system in figure 3). A map of the trial city, designed using real mapping data, is included and highlights the parts of the city covered by the trial and the locations of landing stations throughout the city (figure 3). The 'gamification' aspect to the system was framed in terms of existing research into the potentially problematic aspects of gamifying, for instance, potentially over-zealous pilots. The penultimate section of the research paper details specifics of the user trial including the participants of that trial (ex-military and ex-police personnel), data collection and protection policies of the trial (in accordance with guidelines from the Information Commissioner's Office), and also includes designs for signage that – according to the new legislation in the fictional world – must inform members of the public that they are in a 'drone enforcement zone' (figure 3). The conclusion of the research paper offered a brief overview of initial findings. The supporting video (https://youtu.be/6b_30d7yW2s), submitted alongside the paper,comprises of real video footage recorded from a drone in the trial city, and had a game-like interface (showing points being awarded, battery status, location status, and system-generated notifications) composited over the original footage in post-production.

Reflections on the world we built

Each of the elements that made up this world were carefully considered so as to appear plausible to our audience (who we assumed would primarily be HCI researchers). It was also important to ensure that each element was consistent with all the other aspects of that world. For example, the public signage we designed dovetailed neatly with the fictional legislation covering drones, and the technical limitations of the drone hardware the trial used segued aptly with the designs for landing stations, and where those landing stations were placed married neatly with the actual layout of the real city. Small details, based upon fact rather than fiction (such as the charging technology used on the landing stations) were included to bolster the plausibility of the fictional world. We note that subsequent to writing the paper, Amazon filed for patent US009387928 in July 2016 which describes a remarkably similar lamppost-based docking station for drones to the one we proposed. Throughout the process there was an interplay between aspects of reality and aspects of the fictional world, with one constantly informing and galvanising the other. An interesting example of this was the drafting of fictional data that was supposedly collected during the trial of this system, each data stream was also attached to a persona. Although this data (figure 4) was not included in the published Design Fiction, it was still a valuable resource for us to draw on and facilitated a deeper engagement with the world we were building prompting us to ask questions such as: would there be less enforcement done on Sundays; would different users prefer to do long-but-infrequent flights or shorter-more-frequent flights; would more
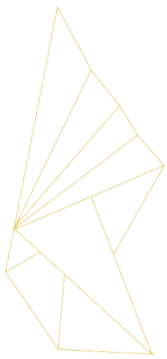
opportunities to score points motivate the pilots?

Finally, it is worth noting the video component of the Game of Drones world. Although in many ways this part of the world is the 'most real' – it is clearly made using bona fide aerial footage – it is also the most tongue-in-cheek, containing several light-hearted elements (quite frequently a feature of Design Fictions). As with all the other aspects of the world we built, there was an interplay between the creation of the video and the other artefacts, forcing us, as world builders, to confront some difficulties with the concept: how would the system deal with verbal (or physical) attacks aimed at the drones; what weather sensing systems could ensure the (not waterproof) drones would avoid moisture damage; how would points scoring rules work; with forward-only cameras, how would pilots ensure avoidance of obstacles? These difficulties aside, the video contributes to the overall world building by explicitly showing the audience the world 'in motion'.

Applying these reflections to the broader discussion about Design Fiction's definitional angst and its relationship with narrative, it should be clear that in this project there is no 'narrative' core. This Design Fiction is not unique in its lack of narrative of story and the Near Future Laboratory's 'Ikea Catalog From The Near Future' is another notable example. Narratives do *input* into the world building activity, for instance the narratives implied by the fabricated data and the personas of the pilots who generated the data. Similarly, narratives may also
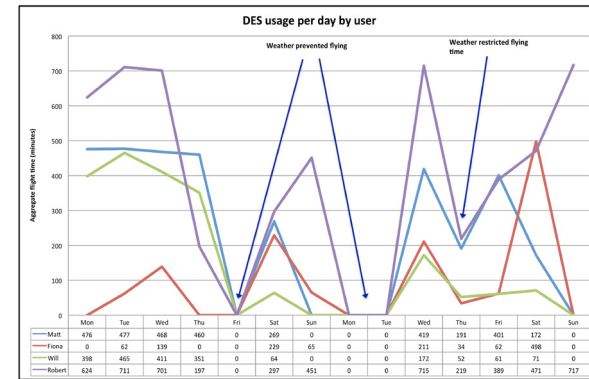

Figure 4. User Trial Data for Drone Enforcement System.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Matt	476	477	468	460	0	269	0	0	0	419	191	401	172	0
Fiona	0	62	139	0	0	229	65	0	0	211	34	62	498	0
Will	398	465	411	351	0	64	0	0	0	172	52	61	71	0
Robert	624	711	701	197	0	297	451	0	0	715	219	389	471	717

emerge from the world, for example, the narrative associated with the user trial and communicated through the research paper. It's also the case that we *could* have used a story as an entry point, however, in this case, we did not. So, what *defines* this Design Fiction is not narrative, but the world in which the prototypes, users, the trial city, and the related narratives, exist. Referring back to figure 2 we see this Design Fiction also demonstrates how an unreal world can be built using a wide variety of different artefacts, for example signs, maps, hardware blueprints, new legislation, and a user interface. In this case a single 'container' artefact, the research paper, linked all of these elements together. Each of these individual elements, which in aggregate tell a world not a story, represent 'entry points' to that fictional world. In the context of the world itself, some of the elements operate at very different scales to others. The fictional legislation, and the research paper itself, are in a 'zoomed out' position while the blueprint landing station, signage, and fabricated flight data are all very much 'zoomed in' (figure 2).
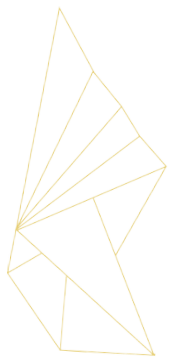
The Empathy Engine

Ridley Scott's 1982 film Blade Runner (based on Philip K Dick's 1968 novel, Do androids Dream of Electric Sheep) explores the importance of being human in a technological landscape. The Voight-Kampff machine, a prop and narrative object in the film, is a device that measures changes in bodily responses (e.g. respiration, blush response, heart rate and eye movement) when subjects are asked emotionally provocative questions (Sammon, 1996). The test's primary purpose is to establish if test subjects feel empathy. Using physiological measurement and machine learning algorithms to automatically detect human emotions and empathy has moved out of the realm of pure science fiction, and although not currently a viable technology, *is* actively being researched (Asada, 2015). Inspired by the concept of a Voight-Kampff test and buoyed by the plausibility of the technology, we set out to create a Design Fiction world that would characterise a future in which algorithms for detecting empathy have become a major component of digital communications. This empathically-enabled future is a response to today's communication channels, which often limit opportunities to leverage our innate ability to be empathic. This shortcoming possibly encourages more critical and confrontational interactions; hence empathic computing has huge potential worth. As with the Game of Drones world, this Design Fiction is concocted from a number of constituent elements: a software Development Kit (SDK), a crowdfunding campaign video, hardware


Figure 5. Digital Empathic Language SDK Libraries..

prototypes (3D models, and 3D prints), and a comic strip depicting a particular application of the technology (Sturdee et.al, 2016).

All computer hardware is controlled by software, the most common way to make the abilities of the hardware available to programmers is via an SDK. In this Design Fiction the SDK is dubbed the Empathy Engine which enables programmers to create applications through the 'Digital Empathic Language' (DEL). Software libraries comprise many thousands of lines of code, which would not provide an evocative or accessible medium for using an SDK as an entry point. In fact, the majority of programmers have no idea what the code that sits behind the SDK actually looks like. Instead they are informed about the functionality of the SDK via its documentation. Hence, we created documentation for the DEL (figure 5), which subsequently served as scaffolding, to support the creation of other artefacts.

Unlike Game of Drones, which had a very specific audience (hence the
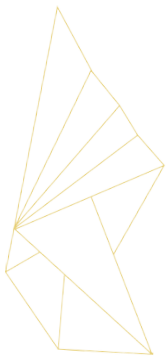
decision to focus on the research paper as the 'container' for the world we created with that project), this project aimed to have a universal appeal. While hugely useful as tool to help us, as world builders, immerse ourselves in an empathy-enabled future, the DEL SDK is not a particularly 'readable' artefact for general audiences. In recent years crowdfunding has become a common way of funding the research and development of emerging technologies and typically involves the creation of a concept video. Hence, we elected to create such a crowdfunding video in order to help the Design Fiction world become more accessible. The video (https://youtu.be/64GntbVwIGw) shows the 'scientists' behind Empathy Engine discussing the need for empathically aware computing, how the technology could achieve this, and what the possible implications of the technology would be. In the video they describe a series of plausible scenarios and use cases to illustrate the Empathy SDK's potential (e.g. disambiguation of text-based chat, weaving emotions into telemedicine, smart devices such as cars modifying their behaviour based users' emotional states).

The design of the Voight-Kampff machine, as depicted in Blade Runner, was of its time, a briefcase-sized device which clearly echoed design tropes of the computers and polygraph machines in that mid-1980s era. Today, in an age of ubiquitous computing, and where the majority's primary personal computing devices are mobile, it is more plausible to imagine an empathy detecting device working with a smartphone (either as an integrated sensor or as a peripheral device). A series of 3D models were created (figure 6) drawing upon both the original Voight-Kampff machine and contemporary smartphone accessories in order to illustrate how the device would appear and also to provide a tactile and tangible entry point to the world.

We could have created a video to demonstrate a use case, but we were motivated to explore using alternative media in Design Fictions, so with this in mind we created a comic strip (figure 7) that depicts how the smartphone add-on, which uses the empathy SDK, has been incorporated into a dating app. As well as layering scenarios and personas atop the Design Fiction world, using the comic as medium required exploring various parts of the system we had previously not considered (e.g. configuring the blush response sensor). Although different media have pros and cons, one apparent benefit to communicating elements of this world with a comic is that it cajoles readers into properly considering the content of each panel. While video is a very easy to digest format this quality arguably reduces the criticality and potential for new meaning to emerge, while the comic strip arguably encourages it.

Reflections on the world we built

Before exploring specific reflections on this world it is worth pointing out some differences between this Design Fiction and our previous example. Game of Drones is a *proximate* future, i.e. the technology required to enable the world is viable right now. In contrast contemporary research
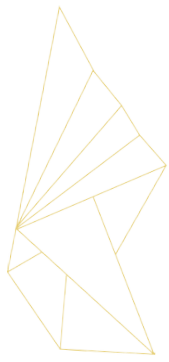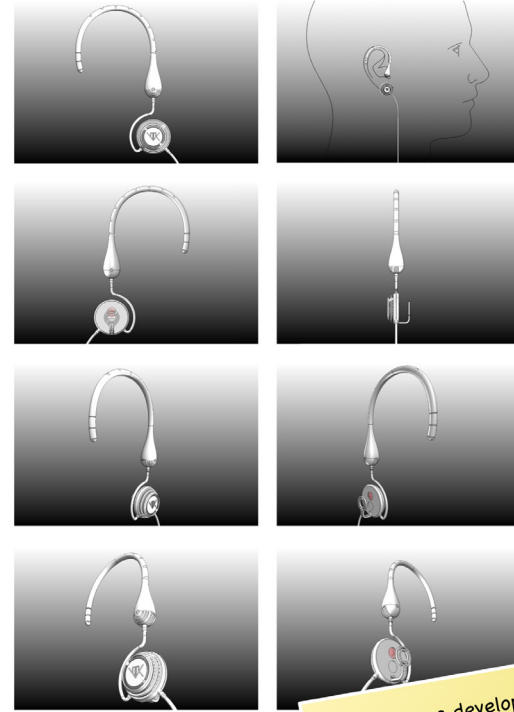
Initial design for camera to obtain pupil response drew heavily from Blade Runner aesthetic but was felt to be to evocative of the 80's when film was made.
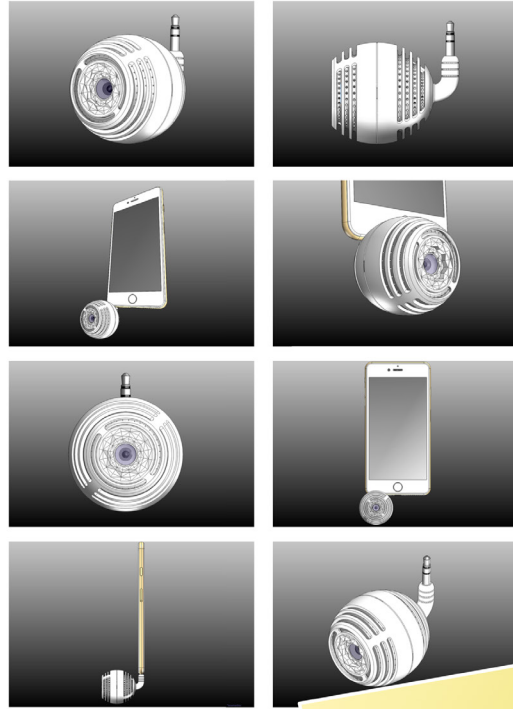
Second design was felt more in keeping with iPhone aesthetic but loss of iconic eyepiece detail with red lens was felt problematic.

Earpiece was developed to allow pulse rate to be obtained and for discrete messages to be given to the wearer. Also decided that a future headphone was unlikely to have a wire.

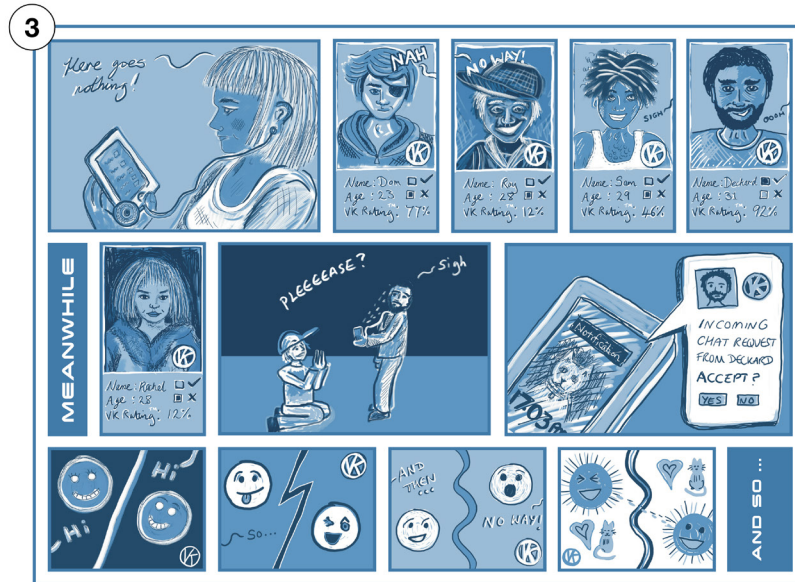**Final Design**

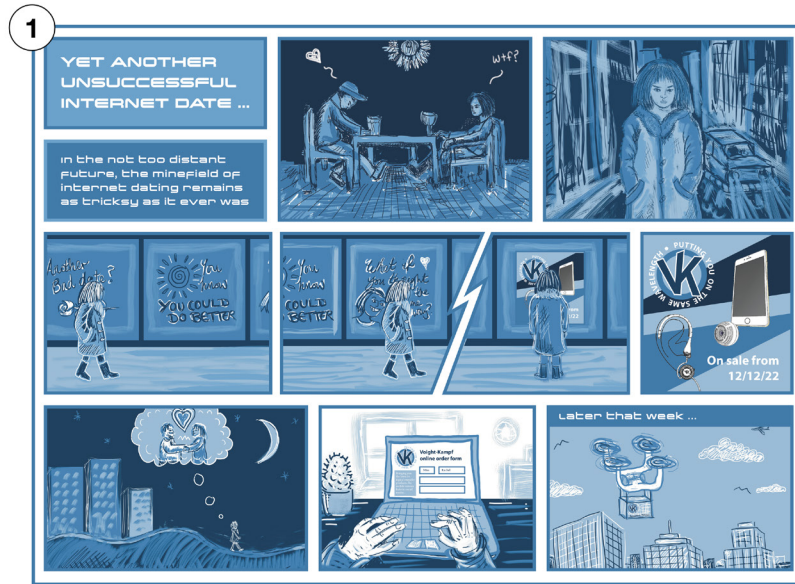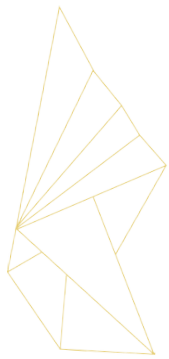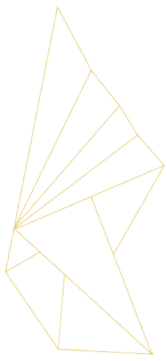Figure 6. Voight-Kampff Machine Design Evolution.

Figure 7. Voight-Kampff Machine Design Fiction Comic.

into empathic computing is still exploratory, and will not be viably implementable for some years (if ever). In addition, the Game of Drones world was built with a specific audience in mind, while the Empathy Engine's world was intended to be accessible to a general audience.

In spite of these contrasts, the practical knowledge garnered from our experience of these design projects supports our position that Design Fiction is best viewed as a world building endeavour. Each artefact created as part of this project fits into our metaphor of entry points. Further, we put forward that each entry point is navigable to, and from, all of the other entry points as illustrated in Figure 2. Also, as with the previous example, each artefact represents a view of the fictional world at a different scale or from a different perspective, but all of these views are mutually consistent and congruent with one another.

The Game of Drones world was believable to academicians, a fact illustrated by the paper making its way through a peer review process successfully (only one reviewer appeared to grasp that user trial and prototypes were ficticious). This 'deception' happened *despite* the following sentence in the paper's conclusion: "The research in this paper and the associated artefacts are part of a design fiction" (Lindley and Coulton, 2015a). The world of the Empathy Engine was not targeted so specifically at a particular audience, and was not bound up in a peer review process, nevertheless when we received an email from a documentary filmmaker asking if he could feature our technology it was clear that the fictional world had conjured an illusion
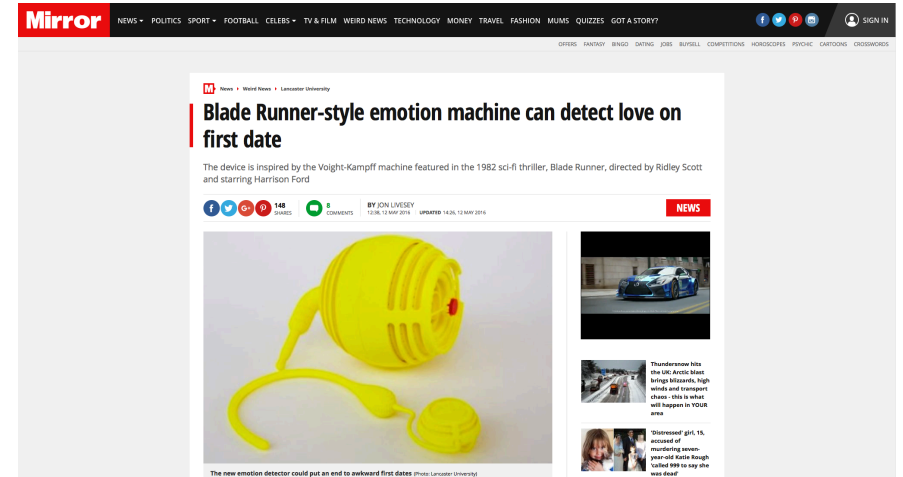

Figure 8. Example media coverage of Voight-Kampff Machine

of reality. Further, this project was reported by a number of international press agencies and reached an estimated audience of 6.5 million people. While the press did report the speculative nature of the designs, it is notable that while the photo of a 3D print was the visual support the articles were all based around the scenario depicted in the comic (figure 8).

Conclusions

We have referred to world building throughout this paper but have largely avoided the question 'what is it to build a world'? World building is the process of constructing an imaginary realm, a process we see regularly in a range of different contexts, each with their own caprices, e.g. cinema, video games, and role-playing games. Applying world building to Design Fiction moves the focus away from storytelling (e.g. narrative, characters and/or
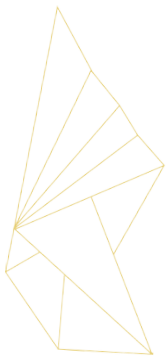
plot) and instead places importance on the cohesion of the world and how things and people within that world interact. In essence a Design Fiction is the map of our fictional world that can be explored in a variety of ways and a narrative, if used, would be a distinct path through this fictional world. In this way a variety of prototypes, situations, and – somewhat ironically – 'stories', can be nurtured on the substrate of the artificially constructed world as demonstrated through the Voight-Kampff comic. A review of literature related to world building yields a myriad of sources relevant to Design Fiction worlds. 'Alternative Reality Games' build worlds that blur the line between reality and fiction in a similar way to Design Fiction, but with an added emphasis on shared experience (Kim, Allen, and Lee, 2008). We can also liken worlds that emerge from multiple artefacts to 'Transmedia Storytelling', where "integral elements of a fiction get dispersed systematically across multiple delivery channels" (Jenkins, 2010). However, Design Fiction does this in order to make an imagined world with multiple accessible entry points, rather than for a 'unified and coordinated entertainment experience' (ibid). Coming from a background in production design and cinema, Alex McDowell describes world building as a design practice in its own right and emphasises believable worlds are a bedrock from which rich and meaningful stories can be assembled (2015). These heterogeneous perspectives on world building, and examples of it, may provide guidance and inspiration for Design Fiction practitioners as the field continues to mature. The conclusions offered here are not translated from another field or induced, but they are a direct result of our design process and our direct engagement with the 'material' of Design Fiction. To

wrap up, we propose that Design Fictions are collections of artefacts, that, when viewed together build a fictional world. The artificially built world is a prototyping platform for the very designs that define it, meanwhile those designs reciprocate in kind and prototype the world. *This* is Design Fiction as world building.

Acknowledgements

References

Asada, M. (2015). Towards artificial empathy. *International Journal of Social Robotics*, 7(1), 19-33.

Bleecker, J. (2009). Design Fiction: A short essay on design, science, fact and fiction. *Near Future Laboratory 29*.

Blythe, M. (2014). Research through design fiction: narrative in real and imaginary abstracts. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 703-712). ACM.
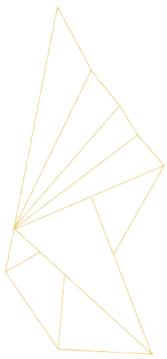
Bosch, T. (2012). Sci-Fi writer Bruce Sterling explains the intriguing new concept of design fiction. *Slate*, March, 2.

Coulton, P., Burnett, D., and Gradinar, A. I. (2016). Games as speculative design: allowing players to consider alternate presents and plausible futures. In P. Lloyd, & E. Bohemia (Eds.), P*roceedings of Design Research Society Conference 2016*. (pp. 1609-1626).

Coulton, P., & Lindley, J. (2016). Game vaporware as design fictions. In *Proceedings of the 20th International Academic Mindtrek Conference* (pp. 341-349). ACM.

Coulton, P., Lindley, J., and Akmal, H. A. (2016). Design fiction: does the search for plausibility lead to deception?. *In P. Lloyd, & E. Bohemia (Eds.), Proceedings of Design Research Society Conference 2016*. (pp. 369-384).

Dick, P.K. (1968). *Do Androids Dream of Electric Sheep*, Doubleday.

Dourish, P. (2006). Implications for design. *In Proceedings of the SIGCHI conference on Human Factors in computing systems* (pp. 541-550).

 ACM. Jenkins, H. (2010). Transmedia storytelling and entertainment: An annotated syllabus. *Continuum: Journal of Media & Cultural Studies*, 24(6), 943-958.

Kim, J. Y., Allen, J. P., & Lee, E. (2008). Alternate reality gaming. *Communications of the ACM*, 51(2), 36-42.

Lindley, J. and Coulton, P. (2015). 'Back to the future: 10 years of design fiction'. in *British HCI '15 Proceedings of the 2015 British HCI Conference*. ACM, New York, pp. 210-211, British Human Computer Interaction Conference, Lincoln, United Kingdom, 13-17 July.

Lindley, J. and Coulton, P. (2015a). Game of drones. In *Proceedings of the 2015 Annual Symposium on Computer-Human Interaction in Play* (pp. 613-618). ACM.

McDowell, A. (2015). The Evolution of World Building as a New Design Practice. *Paradigms in Computing: Making, Machines, and Models for Design Agency in Architecture*, 143.

Sammon, P. (1996). *Future Noir: The Making of Blade Runner*, It Books, pp 79-80.

Sterling, B. (2005). *Shaping Things* (Mediaworks Pamphlets).

Sturdee, M., Coulton, P., Lindley, J. G., Stead, M., Ali, H., & Hudson-Smith, A. (2016, May). Design Fiction: How to Build a Voight-Kampff Machine. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 375-386). ACM.

Tanenbaum, J., Tanenbaum, K., & Wakkary, R. (2012). Steampunk as design fiction. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1583-1592). ACM.