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Beebots-a-lula, where's my honey?: Design Fictions and Beekeeping

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ABSTRACT
The honey bee is a powerful cultural motif that remains an important symbol for the future. Their role as pollinators, alongside a myriad of other species, is critical to the continued diets of humankind. This Future Scenario explores a possible near future where human intervention poses new risks to their survival. Drawing on folklore and contemporary beekeeping practices, *Mr Shore's Downfall* tells a tale of discovery and loss as a young beekeeper is introduced to the world of honey bees. Three imagined artefacts are revealed through the story and discussed with consideration of their cultural context, desirability and relation to socio-economic factors. Themes from *Mr Shore's Downfall* are examined, and the potential of writing practice for design fiction practitioners is considered.

Author Keywords
Design fiction; future scenario; design artefacts; beekeeping; environment; design methods.

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H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Our world is changing, and the role of design and designers is changing too – from problem solvers to problem seekers [6, 13] and in adding value across supply chains and complex value constellations [41]. Global societal challenges such as climate change "require new design approaches informed by different value sets and knowledge" [24]. Food security is one such challenge, with pollination, and the honey bee in particular, attracting significant attention. The honey bee also operates as an indicator for environmental health [35]; this may become vitally important when we consider that, according to the British Beekeepers Association (BBKA), "one in three mouthfuls of the food we eat is dependent on pollination at a time when a crisis is threatening the world's honey bees". Changing post-war agricultural practices in the UK, have led to a reduction in hedgerows along with the amount and variety of forage available for pollinators,. The use of pesticides may also have profound implications for the honey bee and other pollinators [48], potentially contributing to colony collapse disorder (CCD). Recently proposed UK legislative changes to allow limited use of neonicotinoids [9] generated much media debate. Beekeeping itself has changed radically since the advent of the varroa destructor (a parasitic mite), with beekeepers adopting more proactive management practices to combat disease. These conditions correlate with a rise in new narratives and practices among beekeeping communities.

This paper presents a future scenario, *Mr Shore's Downfall*, that draws on and extends such narratives, infusing them with folklore and archive material, to envisage a world where the honey bee is central to social, economic and cultural value systems. We present three conceptual design artefacts arising from this world: Loc-Bands, TanGo, and Pherodrones; situating them in past and present beekeeping and technological practices.

BACKGROUND & RELATED WORK

Contemporary studies on bees are often the province of science, such as Karl von Frisch's work on bee communication [47]. However, bees and beekeeping are also popular subjects in the arts (e.g. [15, 22]). Yet bees are steeped in folklore too – the well known practice of 'telling the bees' meant colonies being told of deaths in the

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beekeeper's family to prevent them swarming or getting sick. Another example is 'tanging a swarm' by making metallic and/or banging noises to attract a swarm of bees to land nearby.

The authors' engagement with Scottish beekeepers (via interviews and codesign workshops) found such tales still in in existence, along with new stories being shared by word of mouth. Oral culture is by its nature mutable [16], changing to reflect new values. Traditional beekeeping knowledge is also changing, with the rise of urban beekeeping, hive inventions (e.g. the Flow Hive [14]) and new books about beekeeping (e.g. [4, 46]). The Bee Lab Project [32], used an Open Design process with beekeepers to construct and iterate the development of open source hive sensor kits, enabling the gathering and sharing of data . We argue that design, design fictions, and imagined artefacts offer a way to think through and reflect on the changing values and knowledge systems of beekeeping.

Coined by Sterling [43], Design Fictions often centre around diegetic prototypes that attempt to reveal or question accepted thinking [5, 13]. Franke describes Fictional Design as a "medium for articulating a possible world," [17] where design objects prompt reflection beyond the object itself to wider societal issues. This is in contrast to "Visionary Design Objects" [17], "Visioning Film" [25] and "vapour fiction" [25] which are seen as "thin" [36], and lacking "diegetic texture" [25]. The former is driven by an intent to explore via the fictional world and its objects, and the latter presents a dislocated and sterilised vision that projects desires onto an audience. Auger [3] uses the term "speculative design" due to its connection with the present; speculation must refer to the place and time from which it is drawn. He [3] finds the terms Design Fiction [7], Discursive Design [44], and Design Probes [33] problematic because they presuppose certain characteristics and ascribe intent to objects. The focus of speculative design is to "think about the future" and "critique current practice" [3]. This aligns with our practice, although our work is also intended to be discursive and probing.

Franke [17] identifies two ways of working with Design Fictions. In one, the objects are used to draw out the world and provoke ethical questions about that future. In the other, the world is "presented", using objects to support the structure of the world. Both have the potential to create a "discursive space" [23, 13]. Our scenario follows the latter, by painting a picture of a world and establishing ethical and social conditions. This echoes speculative fiction like Margaret Atwood's *Maddaddam Trilogy* [1] where the existence of "CorpSeCorps", "Mo'Hairs" and "garboil" help to present hierarchies, values and politics. "Presenting" offers a glimpse into a suggested future, from where discussions can begin. On the other hand, "imagining" may offer a more open space from which to consider a society that could produce such artefacts or a world that is produced as a result of the imagined artefacts.

The design fictions and future scenario documented here emerged as part of a multi-method research project that took a Research through Design [18] approach to better understand how knowledge is produced and passed on in UK beekeeping communities. It explored creative ways to codify and repackage beekeeping knowledge as imagined future folklore prototypes in order to stimulate reflection on beekeeping in the past, present and future.

The multidisciplinary research team worked with Scottish beekeepers and a community partner (Tay Landscape Partnership). Data was collated in the form of 1) archival material on beekeeping management practices, folklore and creative texts; 2) qualitative interviews and participatory observation with beekeepers across Scotland; 3) a series of codesign workshops with beekeepers and traditional storytellers in Scotland. The knowledge generated in this phase fed into a series of workshops with beekeepers, designers, storytellers and other participants. Through storytelling and making activities, the codesign generated concepts to develop as interpretation at public events.

This immersion in the world of beekeeping and folklore provided a rich context for the authors to reflect, from a design perspective, on what the future of beekeeping might be like [26]. Furthermore, in this paper we ask: How might existing scientific and tacit knowledge and beekeeping management practices be deployed as a design fiction?

METHODS

We adopted an agile, iterative and cyclical writing process to produce our future scenario, which we considered as a Research through Writing component of our broader Research through Design (RtD) collaboration. We engaged with "writing as creative design" [39], as a means to gain insights into the characteristics of speculative and design fictions. Our experience confirms Hayles' [23] claim that design fictions can be used as a methodology.

A collaborative online document provided space for sharing and generating thoughts, notes, and references, such as the UN's Food and Agriculture Organisation's forecast for 60 years of harvest [27]. This was used to cluster possible story themes, and enabled us to establish principles for the emerging storyworld. These were listed in a shared document called "Our World" and, although not fixed, they provided a context for the more fluid narrative elements. In line with our collaborative approach, we adopted an exquisite corpse model, each author taking turns to write a 200-300 word section. To aid continuity, we used a journal format not least because of its recognisable style (e.g. Orwell's *Nineteen Eighty-Four* [30]). During the writing process, we read science and speculative fiction, to explore aspects of language, tone, and genre. Key influences included: Margaret Atwood's work [1,2] (the final section of *The Handmaid's Tale* [1], takes the form of Symposium proceedings); Jeff Noon's *Vurt* [29] trilogy about the blackmarket in illicit bee products. Burgess' *A Clockwork*

Orange [8], Gibson's *Neuromancer* [20], and Stephenson's *The Diamond Age* [42] informed style and period.

Over a week, the story and world began to evolve, each author relinquishing control in turn. Each story block offered a set of design constraints for the next author to respond to alongside the storyworld principles. This restrictive space might, we anticipated, lead to an interesting thread of interpretations and linked stories, and also, as Sharples suggests [39], provide "the source material for creativity". Unlike the game that inspired our writing approach, there were no rules imposed on where the next fragment of the story might go, drawing simply on the context of the previous entry for its inspiration. As the storyworld gained focus, the artefacts materialised. On completion of the writing we reflected on the story: its problems, potentials, and (in)appropriateness as a design fiction or speculative fiction. One author then redrafted to instil a consistent voice and respond to the group's critique. This writer edited several versions drawing on feedback from colleagues with writing and editing experience. Each iteration was shared for further feedback. Questions that arose about the world and its artefacts helped to shape design decisions. The world and its society became much clearer and its incongruences became more obvious. We also experimented with writing a series of connected future folktales based on our imagined artefacts. We intend to pursue this further in future work. The writing process provoked reflection-in-action [38] on our shared understandings of beekeeping futures, consolidating knowledge and sparking questions. The designed artefacts and the story (an artefact in itself) add weight to the fully realised prototypes generated through the wider RtD process of the project.

FUTURE SCENARIO: MR SHORE'S DOWNFALL

LanBot34F intercepted the following transcript. Please advise….

Entry 1

I've been promoted from the Service Team for the Foragers' Ball tonight. I can't believe it. One of the Keeper Apprentices is ill and they've asked me to take her place. I've been timing my breaks so I can chat to the Keepers, and the Head Beekeeper noticed so now he's giving me a chance. I've learnt quite a bit already, but I can't wait for my very first look at real honey. Of course, I remember seeing the solitary bees that Dr Shelker keeps as pets, but that's not the same thing at all. I'm so excited – I'll get to help out with the demonstrations and use some of the antique tools – and then at end of the evening I'll get to see the whole hive and some of the bees on the forage flight.

Entry 2

I've chased around all day. Everyone has. The house is buzzing. Mx Carmichael is darting all over the place like a surveillance beebot, sticking her nose in here and there and stressing everyone out. "Everything must be perfect," she says. "The collection needs sponsorship". I wish she'd disappear so we can actually get things done.

Entry 3

My head is spinning with everything I've seen today. Mr Shore took me to the Orangery to go over things for this evening. The place was still swarming with people. Engineers were monitoring the aquaponics system, checking the nutrigels dispersal to the wall sconces. The gardeners were tending to the blooms and the microclimatologist was programming sunlight paths and breeze fluctuations. I was knocked back by the colour and scent – walls, ceiling and floor thick with flowers; purples, pinks, yellows, all primed to reach peak bloom in a few hours. Bells, tubular shapes and wide open faces; a playground for bees to explore. As I closed my eyes and breathed in, I could almost imagine how things had been before.

Then I saw them. The hives. I recognised the shape of the boxes but I wasn't prepared for the sound. The humming resonated throughout my body, it was so powerful. I learned how to move near the hive, gently, so I didn't make the bees angry. Then Mr Shore removed the wooden sides, uncovering glass panels and I could see the bees, crawling and clustering over the comb. He showed me the sleek, long body of the queen, surrounded by workers tending to her and the hive. They were so beautiful – their stripes glowing gold with a single band of iridescent violet, my favourite colour. Mr Shore lifted my hand to the glass and I felt the heat. The bees were mesmerizing. He passed me a magnifier so I could take a closer look. The dark shiny compound eyes stood out against the head and body thick with tiny hairs. Then my eyes were drawn back to the first stripe on its abdomen. I grew up with those infomercials showing our region's Loc-band colour, going on about our duty to report "foreign bees" and the penalties for trafficking bees and importing queens. Nothing prepared me for seeing the violet glow for real. I could have watched all day – but we had a lot to do.

Mr Shore laid out the tools he would use for the demonstration and showed me the order I had to pass them to him. He let me try the antique smoker but it's so hard to see what you're doing and I don't like the smell. I prefer the Pheropumps and Pherodrones. The Pherodrone felt like a smooth metal stone in my palm, but it was heavier than I'd expected. I had a go at launching it but it wasn't primed with pheromones. Mr Shore will fill them later. I threw it gently up and watched it burst into life as gravity kicked in and it broke open as its drone blades whirred. I didn't try to control the movement 'cos I didn't know the commands. I just watched it hover. The motor is so quiet you'd barely know it was there, ready for dispersal. I think it's a much nicer way to calm the bees. Besides they can get into all the hard to reach places where a swarm settles and are so quick to use. Mr Shore says he likes the old smoker but the

Pherodrones are much better for bringing the bees back to the hive than the vodka infused with dead queens they used in the old days, and if you use a few Pherodrones together you can almost herd the swarm. Next he showed me where to stand for the Forage Display and how to assist if a guest panicked. Last of all he showed me the handheld tanging device, or TanGo, for emergencies. I'd heard about it before. One of the keepers said it was like magic, watching the bees drop like a stone in a 'tang'. He told me the low frequency pulse is like thunder so it triggers the bees' defences and they drop to the ground to cover and protect the queen. Mr Shore twisted and pulled open the metal canister so I could see the array of hexagons that focus the pulse. He showed me how to point it towards the swarm. It's easy. Just a twist and pull to set the pulse, squeeze the base and they'll all drop. Much easier to collect them up then.

Mr Shore told me about the other tanging devices used on the estate but we didn't have time for demonstrations. I can't wait to see the 'tinytang' array on top of the garden wall when they pollinate the rare fruit in the heritage orchard. I've heard the low rumble when it's switched on but I've never seen it in action. It's meant to be like an invisible wall, the frequency of the vibration pushes straying bees back into the enclosure, kind of like an electric fence but much more gentle, more like a breeze. Only two hours 'til it starts and I still have to get my suit on and find the other Keeper Apprentices. I'm told the guests are beginning to arrive already, but it will take them a while to get through biosecurity – no one wants to risk contaminating the hives and the colony. I must get on!

Entry 4

The evening started well. The dancers were brilliant. Their energy was infectious – even I was drawn in by the waggle dancers' joyous steps and I'd seen it rehearsed. They're so graceful but when they waggle their backsides I want to laugh. It looks so odd as they mimic the bees. I'm glad we don't have to communicate that way.

Around the room, guests helped themselves to tiny hexagons of synth pollen. Each tray looked like a colour swatch of oranges, yellows and greens; cells of bright yellow dogwood beside orange dandelion and pale green thistle. I saw a young business-type in a designer suit who seemed to be trying everything. He was moving from tray to tray inhaling pollen. He barely tasted it. You could see he was just there to get a hit. Idiot. Then, when I was trying to prepare for the bees a lanky blonde woman walked past the flower-walls with a short woman in tow. I couldn't decide whether the short woman was either stupid or bored, all she did was keep nodding at the tall woman's loud and obnoxious comments. The tall one came over and bombarded me with questions about venom treatments. Her perfume was so heavy it made me want to sneeze. I know all the guests were warned that bees don't like strong smells. I didn't have a clue about venom treatments and had to point her to the therapists. She didn't look impressed.

Mr Shore called for me to assist and I think I did OK. I didn't drop any of the tools and none of the guests seemed frightened or panicked. I watched Mr Shore as he carefully opened the observation hive and released the prepared scout bees. He counted them out. We all watched as the twenty bees stood on the edge of the wooden ledge, several of them 'scenting' the air, abdomens raised, so that their fellow bees would find their way back. A thrill ran through the room as the first bee took to the heavens. I stumbled back as I watched where she went. The microclimatologist had done her work well – the first bee went straight to the array of flowers. The other nineteen bees quickly followed and we tracked their progress, pointing and murmuring.

That's when it went wrong. The guy in the expensive suit took off his jacket; he was very red and sweaty. He'd taken way too much pollen, though like everyone he had been warned to be careful. His face and throat swelled. He collapsed and as he fell he caught the hive and it crashed down. It looked like he was in shock. There was chaos. Thousands of angry bees poured out of the hive. It was terrifying. The air was thick with flying, noisy bees. Some people screamed and ran to get out; others tried to stay still. A bee got caught in the blonde woman's hair and she tried to swipe it away and was stung. More followed and stung her. The man on the ground was also stung, but only once because Mr Shore got to him and launched a Pheropump to calm things down around him. The queen bee led the swarm across the room. She settled on a wall sconce, and was quickly surrounded by a cluster of bees, the air still full of disorientated worker bees. Mr Shore was righting the hive and calling medics to the man on the ground. I was closest to the tanging device and twisted it. The shock of the vibration brought people up short and caused the bees to drop to the ground like a stone. Mr Shore launched a cluster of Pherodrones to encircle and calm the mass of bees while the guests were guided quietly into the next room. I went to secure the door. Four or five people were in a huddle, looking dazed. One man was crying. The others were quiet but OK. When the bees were peaceful Mr Shore called them back to the hive. A medic gave nanodrugs to the man on the ground. You could actually see the swelling go down. We collected the bodies of the dead bees while Mr Shore talked quietly to the hive calming them with pheros. We counted 100 violet-gold bodies. Each had to be accounted for. It was devastating. Mr Shore scanned the hive against the database and secured it in the apiary. We stayed to clear the pollen from an upturned tray. It caught the light as it hung in the air. I didn't wear a filter and could feel my heart starting to race. I sneaked a tiny bit.

Entry 5

This morning we had a debrief. Mr Shore thanked us. He said we coped well. He tried to joke that it was good we didn't try to tang by firing a gun like they did in the old

days. We smiled but things were still a bit tense. Management are in meetings – about separating therapy events and forage flights. Mr Shore says the therapy stuff is "a distraction". He calls SweetStupor "sweet stupidity" – he just cares about the bees. He says merchandising puts too much pressure on the bees – **"**a waste of real pollen". Mr Shore thinks that pollen should be eaten and used by bees, not sold as SweetStupor to health freaks and "pollen junkies".

Entry 6

After work I went for a walk through the orchard. The beebot pollinators were out in force. You couldn't go 20 paces without coming across one of their black, solar-charging hives. The Keeper Apprentices reckon they listen to our conversations while they're pollinating the apple trees and the flowers in the garden.

Near the perimeter I caught sight of Mr Shore and tried to catch up with him to ask him about our hive. He disappeared down an overgrown path to the wood at the bottom of the estate. I was surprised 'cos we aren't supposed to go there. It's not safe with the old mines. I wasn't sure whether to follow but then I heard a sound. A buzz. I froze. I heard it again. And then I saw her –- a beautiful, shiny, perfect bee. She landed on my shoulder and I stood still while she crawled down my arm. My mind was going crazy. It was incredible to see and feel the bee on my skin but I couldn't understand how it had got out. And then I realised. No violet band. No Loc-Band at all. Just brown and golden yellow stripes. Before I could think, she took off and flew away. I had to follow her. The sound grew louder 'til it was overpowering. It was coming from a tree. The hollow trunk was alive with wild bees. Mr Shore looked up at me and immediately stood in front of them, as if to hide the nest.

I backed away. I said I was sorry and that I hadn't meant to come this far down the path but I'd just seen a bee. It didn't look like the others. He seemed to take a while to consider this, and then cautiously beckoned me over to the tree. The branch and trunk were heavy with a beard of clinging bees trying to cool off. I peered inside the hollow and Mr Shore pointed to thousands of bees busily working. As my eyes adjusted, I saw the bees shifting and moving and I caught glimpses of the patchwork comb. First I saw pollen packed in matt-colour hexagons, then, as I moved, I could see the shiny, gooey honey on the other edge. There was activity everywhere. For as long as I can remember, I've been taught that natural bees are too weak to survive, but these didn't look weak or sick at all. "There's no demand on these wild bees to produce", Mr Shore said, "and they're doing well." I just watched, hypnotized. Apparently, he has kept them hidden for six months, somehow diverting the surveillance beebots. I think he hacked a black market Pheropump.

I know I should report them but I won't, even though I'm frightened. I can't believe the lies we've been told about natural bees. All the rubbish about beebots saving farming. The investors just want to make money from their private armies of flying bots. The apitherapists are no better, keeping bee numbers low so they can charge a fortune for venom and royal jelly. These wild bees could change things. If they're left alone to pollinate crops the whole dirty system could come crashing down – no more pet bees – no more beebots – no more ridiculous beejazzling – no more pollen-cell-parties.

Entry 7

It's chaos. It's the middle of the night and everyone is awake. Police and security are everywhere. Mr Shore has been taken away. Our violet bees have been stolen. It was a set up. The incident at the Forager's Ball wasn't an accident. The man who fell planted a device under the hive to hack the lock. I can't believe he deliberately overdosed. What a dangerous thing to do. He must have been paid a fortune. One of the security guards was in on it. He smuggled the device in and disabled the sensors and tracking. The police say it's a professional gang. They'll be miles away by now. Security will be searching with surveillance beebots but it's too late. The police are asking where Mr Shore was. They want to know why he wasn't on duty. It must have happened when we were with the wild bees. I know he won't say and I won't tell. I have to find a way to get back to tell the wild bees that he is gone. It's an old fashioned superstition but Mr Shore would do it.

Entry 8

What an awful day. I couldn't risk the same path back to the tree. I took the main drive but doubled back when I was through the gates. As I approached the clearing I knew something was wrong. It felt different. There was no sound, no vibration in the air. I walked right up to the hollow tree. The wild bees were gone. I couldn't believe it. All I could do was gently pick up a dead bee I noticed lying on the grass. I placed her inside the hollow tree to mark her small tragedy to the colony. My fingers caught some honeycomb. Indescribable sweetness.

Transcript ends.

MR SHORE'S WORLD

Mr Shore's Downfall considers a world in *extremis*, where synthetic bee robots (beebots) run on solar power, charging up at black solar 'hives'. These swarms of beebots represent the future of cloud computing – stuffed full of sensors to pollinate and provide an all-powerful surveillance network; now you really can be a fly on the wall. In this world the honey bee is an exclusive and lucrative source of health and leisure products. The potential economic benefit of beekeeping was enough for Playfair to argue in 1804 for a dramatic increase in British beekeeping to "make a fortune by Bees", enough to wipe out the national debt [34]. With an understanding of their role in biodiversity and

agriculture, a bee-based economy suddenly seems plausible. Key themes running through the future scenario are: 1) control; 2) ownership and responsibility; 3) social, environmental and economic value. These have direct relevance for beekeepers but also environmental futures more broadly as we consider the rights of non-humans, and the impact of economic systems on the environment.

Control

The bees in *Mr Shore's Downfall* are controlled using a range of technologies, which have been refined over generations to keep the bees safe and content enough to produce honey. The scenario amplifies existing questions of control, by adapting contemporary tools and beekeeping techniques. The artefacts discussed below transform low-tech, traditional, management solutions into futuristic scientific instruments. With honey bee behaviour managed ever more tightly, their physiology has been affected. Bees no longer fly large distances, and with forage brought close, they do not need to constantly seek new sustenance, raising questions of domestication and dependency. However, as the story shows, they have not fully lost their wild nature.

Ownership and Responsibility

In the story there are blurred boundaries between commercial and conservation enterprises. The scenario's colony collapse has greatly increased the value of bees so that ownership of feral bees is enforced by the state, and private colonies are closely guarded against theft and disease. Today, ownership of bees swarms is a contentious subject in online discussions, resonating with an age-old understanding of their agricultural status. Although they can be perceived as semi-domesticated, bees are considered wild in law, and their behaviour reinforces that 'wildness'. Bees do not rely on beekeepers to feed them, although this is often the case thanks to the UK's unpredictable weather. Domesticated bees can and do swarm, leaving their keeper. While feral bees exist in the UK they are rare and sought after; having survived without varroa treatment they are potentially resistant to disease. Thus, can a beekeeper ever be said to truly own their bees? Fundamentally, bees require forage, a steady supply of nearby pollen and nectar sources. What is our responsibility in maintaining an environment in which bees can thrive? While we grapple with questions of ownership and responsibility, criminality threatens to undo the practices that have evolved to safeguard bee health and biosecurity. Organised thefts, like the one in the scenario, are increasing [28] and beekeepers are turning to technology in response. Sensor-laden hives with accelerometers and GPS receivers detect movement, so if a hive is knocked over by weather or animals, or intentionally moved by a would-be thief, beekeepers can tell remotely if their hives are in danger.[1]

[1] See Arnia's sensors: http://www.arnia.co.uk; Open Energy Monitors: https://openenergymonitor.org.

Values

Bees are increasingly valued as producers, symbolising industriousness, wellbeing and healthy environments. *Mr Shore's Downfall* accentuates many of these themes. The world presented is decades after the Collapse, when disease and farming practices decimated bee populations. Colonies and hives are all but extinct. This has created new markets for "real bees" and their produce (resonating with current illegal trade in rhino horn). Hives exist within private estates or "conservation centres", where visitors pay to take part in a range of bee experiences, made desirable through their rarity. These include health treatments and interactive performances. As high value commodities bees are kept in climate-controlled indoor spaces where all aspects of their lives are regulated. They have become objects of desire, and popular culture is strongly invested in mimicry and symbolism. Meanwhile, the environmental value of bees has not been forgotten and farming has adapted by inventing artificial pollinators in the form of beebots.

IMAGINED ARTEFACT 1: LOC-BANDS

Non-commercial beekeeping in Scotland and the UK is often led by local associations, who encourage would-be beekeepers to attend courses and work with experienced mentors. Beekeeping itself has changed radically since the advent of varroa destructor, a prolific mite that feeds on the blood of brood cells, first discovered in the UK in 1990s. Beekeepers have been forced to adopt more 'hands on' management to keep infestations in check. One response has been to only acquire local bees, thus minimising disease spread and maintain localised adaptive advantages. Whilst not uncommon, the practice of importing queens from abroad is abhorred by many beekeepers; one interviewee stated, "It's important [to] get your bees locally, and under no circumstances get them from much further afield or over the internet, that's just disaster." Varroa is endemic in the UK, with bees and beekeepers alike striving to adapt. Other global diseases also threaten local populations, and the spread of varroa acts as a useful warning. There are on-going national efforts to map the locations and identities of UK colonies to ensure disease testing and quarantine zones are maintained. The kept bees in the story are easily identified by their Location-Band, or Loc-Band – a striking violet coloured band on each bee's abdomen. As regulated by the (fictitious) International Apiarist Committee (IAC), each geographic region has a unique colour on the visible spectrum, available to view as an international colour chart by application to the IAC. Simple gene-splicing ensures that each mated queen's progeny replicates her Loc-Band, regardless of which drone fertilises the egg. Loc-Bands enable beekeepers and inspectors to monitor the location of bees, thus preventing disease and contamination. The colour identification of the Loc-Bands is not so farfetched. Synthetic biology provides new material practices for designers, and whilst this may not yet extend to genetic engineering of bees (although see [21]), the colour of bees naturally varies. The native Black Bee for instance, is

larger, darker and hardier, and often more aggressive than the Italian bee, more commonly kept in the UK.

IMAGINED ARTEFACT 2: TanGo

The beekeeper's aim is to minimize swarming and the loss of valuable colonies; however even experienced beekeepers can struggle to predict and prevent swarms. Whilst many beekeepers today clip the queen's wing to ensure that she is unable to travel more than a few feet, there are many for whom this is undesirable or impractical. One ancient technique that ostensibly prevents bees from swarming is the practice of 'Tanging'. A picture in the Moir Rare Book Collection [12] c.1669 illustrates an upturned skep-style hive, with a beekeeper bashing kitchen pans beside it. For some, the 'tanging' sound asserts a claim on a swarm in flight [37]. For others, tanging recreates the sound of an approaching thunderstorm, causing the bees to seek shelter and gather around the queen in order to prevent her getting wet, cold or lost in the impending weather. Our interviews with beekeepers report awareness of tanging, though there is debate about its efficacy. There seems to be some continuity between historic and folkloric tales and the practices of contemporary beekeepers. James Petrie [31] wrote in 1769 that he had "not lost a swarm for the space of fifty years" by "discharging a pistol" into the swarm. One of our interviewees recounted how a gamekeeper he knew would fire a 12 bore shotgun 6ft below a swarm in a tree, causing it to "drop like a stone onto the ground". He also remembered a story about a swarm returning to its hive when a Blackburn Buccaneer fighter jet roared past at low level. The concept of tanging continues to provoke curiosity: the same interviewee considered conducting experiments with fireworks. Another beekeeper described a bowl-shaped stringed musical instrument that she plans to attempt tanging with. This curiosity may be driven by social, economic and environmental implications of swarming. Worries about food and biosecurity have led to schemes to track bees to understand their movements and monitor behaviour changes that might signal a problem. These concerns are central to Thomas Thwaites' extreme speculation, *Policing Genes* [45], whereby the pollen that bees collect is automatically analysed for evidence of genetic modification (GM).

In the world of *Mr Shore's Downfall,* swarms are rare, unless incited deliberately (e.g as part of a breeding management plan). Therefore tanging devices such as the TanGo are only used in exceptional circumstances to regain control of a swarm. In contrast to the unpredictable nature of past tanging practices, tanging has become a scientific field in our future world, with technical equipment spawning new markets. The TanGo is a small portable device that emits a loud, low frequency pulse, causing a swarm of bees to drop to the ground. The purpose is control, either by deterring flight or bringing a swarm to ground, from where it can be collected. Other designs include ground-mounted and airborne omnidirectional tanging devices. The wall-mounted 'tinytang' array is used when bees are taken out to pollinate high value heritage orchards – echoing the current use of bees to create a security fence [11]. Through the tanging device, we address themes of industrial farming, food security, control, ownership, value and the domestication of animals. We consider swarming at a time when the value of bees is derived from scarcity. The current economic value of colonies, and the social responsibility for preventing and controlling swarms, which is now incumbent upon beekeepers (particularly in urban settings), has resulted in a range of commercially available devices and apps, which aim to detect an imminent swarm. Consequently, it is not difficult to imagine the development of similar devices for managing swarms.

IMAGINED ARTEFACT 3: PHERODRONES/PHEROPUMP

Beekeepers often use hand-held smokers to calm a hive. However, in keeping with the trend towards natural beekeeping, where intrusive procedures are limited, we envisage a time when using smokers is frowned upon. By comparison, the queen controls a colony through the use of scent. Honey bees naturally produce pheromones to change physiology or behaviour, for example the queen is known to produce a calming pheromone. There are pheromones for alarm, brood recognition, egg marking, orientation and controlling the ratio of nurse to forager bees. In folklore, bees are often said to be sensitive to smells; disliking those of black dogs and horses, for example. The beekeepers at the project workshops had mixed views on the accuracy of this, but they did claim that bees tended to react badly to strong deodorants and fabric softeners. Greek and Roman texts [10] record bees being angered by strong perfumes. In our story, the woman with the sneeze-inducing scent gets stung multiple times by the swarm. The power of the queen's 'scent' has been known for centuries – an advert for Daniel Wildman's 1772 exhibition describes a standing horse rider, wearing a "mask of bees on his head and face" [37], and firing a pistol to send the bees back to their hive. Today it is common for beekeepers to store dead queens in vodka, using a few drops of the infused alcohol as a swarm trap or to bait a hive. Meanwhile, research on synthetic pheromones that mimic those emitted by queens resulted in a patent in 1991 [40].

The world of *Mr Shore's Downfall* is one of monitoring and control connected to the value of bees. The Pherodrones and Pheropumps present a future in which beekeepers purchase and hybridise chemical compounds for ultimate control of hive life. In our world each honey bee pheromone has been synthetically replicated and enhanced as a means of hive and production control. They are deployed through dispersal devices called Pheropumps and Pherodrones. Both are available in different designs. In the story, the first Pheropump to be activated was a floor-standing pump that can be used in a similar manner to contemporary bee smokers. Instead of directing smoke into the hive, however, the Pheropump disperses its contents over a wide area, lacing the air with a pheromone

engineered to calm the bees. Immediately after the TanGo brought the bees back to ground, Pherodrones were launched to call the bees to the hive. They can be flown to particular locations or hurled, grenade-style above the swarm, where they hover until directed to move via a series of personally programmed words or sounds. They are the subject of many tales in which they are used to herd bees, with lesser or greater success depending on who is doing the telling. So much so, that 'One Beekeeper and their Pherodrone' (1xBPh) has become one of the most popular e-sports on the planet. This possible future is already suggested by contemporary practice. Whether natural beekeepers would welcome pheromone-based methods is debatable, but they could enable a far more precise means of hive control, likely to be in demand in an age where bees are a valuable commodity.

INTENTIONS AND USES OF MR SHORE'S DOWNFALL

Mr Shore's Downfall presents a world of imagined characters and artefacts, with the intention of suspending disbelief in order to discuss the environmental, political, economic and social values suggested by that world. Storytelling has been an integral part of our wider Research through Design process. *Mr Shore's Downfall* was a collaborative experiment in which the multidisciplinary team could speculate and consolidate individual complex knowledge sets and reflections in a cohesive storyworld. Whilst the fiction has already served a valuable purpose through its creation process, we intend to use *Mr Shore's Downfall* in community workshops, inviting participants to respond to and critique the world through envisioning new artefacts. We also intend to prototype artefacts (i.e. TanGo and Pheropump) to explore how medium and materiality affect the response and world creation for our user communities of designers, storytellers, beekeepers, and makers.

REFLECTIONS

Mr Shore's Downfall reflects current global challenges. It draws on contemporary and past knowledge of beekeeping to consider interspecies dependencies, changing value systems and environmental change. *Mr Shore's Downfall* offers a wider examination of stories and artefacts as catalysts for knowledge generation, using the act of writing in the same way that we might design other artefacts as a "route to discovery." [19] Insofar as it was a collaborative, iterative process, with no single author nor pre-agreed narrative arc, we allowed the story to take us on an imaginative journey. In this way, we pulled at story threads that resonated across our different research interests and disciplines, enabling knowledge exchange beyond the immediate focus on bees and beekeeping.

The research through writing process allowed a form of analysis to unfold: learning and thinking through writing as a collaborative activity consolidated and realised each author's knowledge – knowledge gleaned from interviews, workshops, literature, and participant observation. This shaped and iteratively crafted the narrative, allowing design artefacts to arise through engagement with the storyworld and its needs. Each artefact is therefore a future projection of a research theme and each went through iterative imaginings. The process was novel to us and we were surprised by the satisfaction we felt working this way.

Much research in Design and HCI focuses on problem-solving, and while the emergent field of Design Fictions embraces various media forms there is often a focus on materiality. Blythe's fictional user studies [6] provides a precedent for exploring anti-solutionism potential use cases of designs through scenario creation. *Mr Shore's Downfall* functions in a similar way. Our scenario is situated in an exploration and research process and we hope that it provokes new questions beyond our initial intervention – questions about the use of artefacts and their speculative futures, and, in the socio-political context, of policies, regulations, responsibilities, the Anthropocene, and the acceptance of new technologies.

LESSONS LEARNED

Reflecting on *Mr Shore's Downfall,* we suggest there are several lessons for design fiction researchers:

- **A collaborative, turn-taking writing approach can build shared understandings of complex issues and contexts between authors.** All author's voices were included in initial contributions, and the discussion of the individual entries consolidated understanding from work across data sources, including work with beekeepers. It provoked debate about possible politics and socio-economic futures and the technologies they might inspire. While the story was written by researchers from design, ethnography, landscape archeology, English, the writing approach could be adopted with other user groups or stakeholders.
- **Collaborative writing enables group ownership but takes time.** Reconciling viewpoints across multiple authors to create a cohesive narrative style and shared world requires several iterations and is therefore not a quick or easy approach to developing a design fiction.
- **Narrative choices should reflect writing skills.** Writing successful fiction is a highly skilled endeavour. None of the authors are fiction writers. Professionals advised that a first person diary style was the easiest way to achieve a coherent narrative but that it makes exposition more difficult. This makes it harder to describe the specificity of design fiction artefacts without disrupting narrative plausibility. We briefly considered including drawings within the text as illustrative diary entries but as the entries were envisaged as transcripts of intercepted voice logs it did not fit. Using written fictions to explore and articulate design fictions requires careful consideration of the opportunities and limitations of narrative choices from the outset.

- **The structure of the text-based design fiction can facilitate future uses.** *Mr Shore's Downfall* is a relatively short piece of text. Diary entries are bite-sized and lend themselves well to the discrete 'Consequences' style writing process and to live performative reading and group workshops and discussion, to further layer and augment the storyworld and provoke discussion.
- **Writing as a medium for design fiction requires balancing space for ambiguity against prescriptive description.** Much design fiction is based in the material world (e.g. [13, 23]), but design fiction is not a novel, it should provide an opening up of questions, critique, and reassessment. Too much written information and description of designed artefacts fixes their speculative potential. Too little and there is not enough detail to situate or express the author's intention.
- **Writing a design fiction as future scenario requires expression of the storyworld.** The development of the storyworld during writing enables imagined designs to emerge in response to the needs of the world, i.e. design fictions artefacts emerge from and with the creation of the world in a virtuous cycle, each informing the other.

Our work with beekeepers has revealed a range of different styles of beekeeping, reflecting competing and contested philosophical and ethical stances. The future scenario method, with its imagined worlds and artefacts, can posit new human activity systems that are anchored in tradition, folklore and contemporary practice, but which are also uncanny, dystopian and provocative. We intend to further apply this approach as process and output where it can catalyse difficult yet constructive conversations about current beekeeping practices, the future of the craft and the environments that it both sustains and depends upon. Furthermore, the success of the scenario generation process has inspired us to test a new methodology that harnesses the narrative structure of traditional folktales as a medium for exploring and discussing speculative worlds, the artefacts that inhabit those worlds and the ethical, political, social, technical and environmental dimensions they bring.

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