

Reorienting Geolocation Data through Mischievous Design

Ben Kirman, University of York

Conor Linehan, University College Cork

Shaun Lawson, Northumbria University

Abstract

The increasing capability of smart mobile devices to use geolocation and networking has resulted in a proliferation of digital mobile computing services that respond to the social and physical places we visit as we move through the world. This chapter reports and comments on a series of four provocative design projects undertaken in order to better understand location data as material comprising complex social, psychological, and physical properties, and to problematise the growing trend of services uncritically built upon these data. We describe how approaching these goals in a playful and mischievous manner allowed us to explore surprising, jarring or under-reported qualities of geolocation data. In each project, the design process began with ideation around the subversion of stereotypical uses of this data. Working prototypes were designed and implemented using contemporary hardware and software services. Through playing, using, or reading about these prototypes in the media, participants raised new questions and new concerns about how location data is mediated by smart devices, which were developed further in subsequent projects. We believe that this series of projects highlights the value of mischief and fun as a valid design position through which to explore sociocultural aspects of new technologies.

Introduction

It is hard to overstate the impact mobile phones have had on our daily lives. In 2005, when the first Funology collection was published (Blythe et al., 2005a), mobile phones still had keypads, polyphonic ringtones and screens that could barely fit a hashtag. Nowadays, phones have moved past mere voice communication, and are essential tools to help us understand how unfit and unhealthy we are (Boulos, 2014), to help us arrange casual relationships (“Grindr”, 2009; “Tinder”, 2012), to measure how good we are in the sack in those relationships (Apltraum, 2016), to bring us beer (Wetherspoon, 2017) after our relationships fail, and in making sure we get a ride home to spend another night alone (Rayle, 2014). Phones have become our closest confidants; they go with us everywhere and are entrusted with our most private secrets.

It is not just phones themselves that have developed, but their surrounding infrastructure of GPS, 4G data transfer, WiFi, Bluetooth and other technologies have also matured. This infrastructure supports the development of the types of location-based, contextually aware, applications long foretold in ubicomp research. Sal, from Weiser’s (1991) famous vision of our ubiquitous future, is indeed now able to use her tablet to remotely spy on her colleagues.

We argue that geo-location services rarely take advantage of the potential richness of the converged capabilities of these devices and data sources. The most common function of geolocation data is in navigation; either egocentric “sat nav” applications, or to get cheeseburgers cycled to our location at a moment’s notice. It is rare that a geolocation service engenders a unique social or emotional experience outside of burgers and bedrooms. Locations are still largely considered, by developers of these services, in terms of their physical positions and the nearby business opportunities, rather than as places with complex social, psychological, and physical properties. Moreover, we are concerned about the effect these crude, non-critical, or unthinking application designs have on our established relationships with these places and our interactions within them. As argued in literature on pervasive games (Márquez Segura, 2016; Montola et al., 2009) and embodied interaction (Dourish, 2004a), these complex contexts of interaction are vital in understanding implications of mobile interaction.

In this chapter, we present a playful exploration of these messy contexts through a series of experimental prototypes. We frame our work as research through design; each design prototype takes a different look at the way mobile phones mediate our relationships both the places we pass through, and with other people. The benefit of this approach is in uncovering affordances of these relationships, revealing the properties of geo-location as a socio-physical material with which we can design experiences.

Mischief making as research

Theorists have devoted much attention to the novel possibilities opened up by ubiquitous computing (e.g. Dourish, 2004a, 2004b). Indeed, location-based services have long been considered the great leap forward in the interaction between humans and computers, allowing us to seamlessly access relevant information and tools, as needed, as we move through the environment carrying out everyday tasks. However, until recently, the reality of location-based services rarely matched the ambition of the theorists. Applications were clunky, flaky and frustrating. They certainly did not blend seamlessly with, or disappear into, our lives. The current generation of smartphones, combined with modern mobile communication infrastructure, allows us to creatively explore geo-location data as a material that we encounter in ‘the everyday.’ We are now in a position to explore not only what geo-location services can do, but also what they mean, and what kinds of novel experiences they can facilitate.

As Research through Design (Frayling, 1993), the objective of the work in this chapter is not to collect empirical evidence about users or specific services, but rather, through practice of prototyping, prodding and poking, to begin to understand the social, psychological, cultural and physical properties of geolocation data. Taking Löwgren and Stolterman’s (2004) perspective of software as material, we seek to understand the unexpected affordances of geolocation data as a material with which to design and craft experiences. Accordingly, our practice focuses on studying artefacts situated in the real world rather than in the user experience lab. Through design practice, we are able to discuss emergent social, cultural and physical properties of geolocation data that may be overlooked through other approaches.

We have also taken a purposefully subversive and playful approach to our design work. Although not explicitly political as in DiSalvo’s (2012) “adversarial design”, our work attempts to use play to

renegotiate, critique and subvert expectations around data and spaces. This approach is grounded broadly in “critical design” (e.g. Dunne & Raby, 2001; Bardzell & Bardzell, 2013), however the interactive prototypes are intentionally ambiguous (Gaver, et al., 2003), inviting open play and exploration around the themes, in contrast to the sharper critique offered by critical games (Flanagan, 2009). We propose this is a kind of “mischievous design” that uses playfulness to push the edge of acceptability without malicious intent (Kirman et al., 2012b). As we will discuss, this mischievousness is brought forth in various ways through the prototypes, but includes asking users to visit crime-ridden areas, behave suspiciously in airports, and wantonly insult strangers. This approach invokes humour, but the humour of discomfort and deviance rather than parody or pastiche.

Each of the four projects has emerged from our ongoing Research through Design (see Zimmerman, et al. 2007; Frayling, 1993) practice around designing for mischief. Typically initially inspired by an encounter with a specific context (airports in Blowtooth), or service (crime data in FearSquare), we engaged in ideation work. The content differed across projects – sometimes we designed game mechanics, sometimes we wrote fictional commercials – but always focused on the interaction of people with context-specific data. We fixated on ideas that made us, as designers, laugh and feel uncomfortable. Secondly, we developed a functioning prototype and released it into the real world, presented as real services rather than explicitly critical pieces. This kind of presentation we found key to engaging users, to avoid the danger of being “dismissed as art” (Dunne & Raby, 2013).

Thirdly, we undertook a process to understand and capture reactions to the prototype – varying from formal user studies, to scraping social media. Fourthly, we engaged in a reflective process, based on the study, which sought to understand exactly what social norms the prototype subverted. We always found that prototypes commented on, criticised, and explored the properties of geolocation data in ways that we had not considered through the design process. Moreover, through the course of these four projects, we began to build a more coherent understanding of the various social, psychological and physical properties of both the data and the spaces it represents.

In the following sections we describe four of these mischievous prototypes, providing some context for the design and discussing reflections and reception for each.

Blowtooth

Airports are curious as places we subject ourselves to, for a few hours, in exchange for leaving them. Rather than a destination, they are a place of transition - a classic example of Foucault's “heterotopia” (1986) – a liminal other space, neither here nor there. They are “non-places” (Auge, 1995; Crang, 2002) that we share with thousands of other travellers, strangers who are temporarily close but soon to be separated by oceans. Ballard (1997) observed that their architecture is “designed around the needs of their collaborating technologies”, each part of the physical layout of an airport is simply one step in a line for the next part of a bigger process; thus “everything is designed for the next five minutes”.

However, airports also have a layer of social complexity that sets them apart from train stations and ferry ports. As we pass the concrete barricades and razor wire, we know we are in an authoritarian space (Kellerman, 2008) watched and studied by a multitude of cameras, scanners, and sniffer dogs. Bizarrely they are part prison, part shopping mall. Airports repeatedly come under scrutiny regarding

security, personal privacy and freedom of movement. For example, Donald Trump’s executive orders in early 2017 led to a whole raft of uncomfortable experiences for those arriving in US airports.

It is this curious intersection of a strongly defined physical space with complex social and behavioural rules that make airports a fascinating place for thinking about design, and indeed what attracted us to working with this space. In response, we created Blowtooth - a game where players are challenged to smuggle contraband through real airport security.

The game is split into two parts – first, during check-in to their flight, before passing through security, players are asked to “hide” contraband on fellow passengers. When approaching likely “patsies”, players are asked to choose from a list of illicit items (e.g. 101ml of liquid, unlicensed cheese, etc.) to conceal. The player is invited to explore this space in order to locate suitable patsies before moving onto the next phase.

Once the player is happy they have concealed enough contraband, they can pass through airport security without worry. After all, the patsies now carry all the risk associated with smuggling the illicit items through the security checks. Once beyond the security check, the second part of the game commences. Players are tasked with reclaiming all the items they have hidden by finding the patsies in the departure lounge. Given the enclosed space contained beyond the security checkpoints, there are limited places the patsies may be. There is also time pressure, as patsies start boarding flights and leaving the airport, unknowingly carrying their illicit cargo. Although the game does not formally “end”, the player’s success at recovering their contraband is recorded and compared against other players at other airports on the website¹.

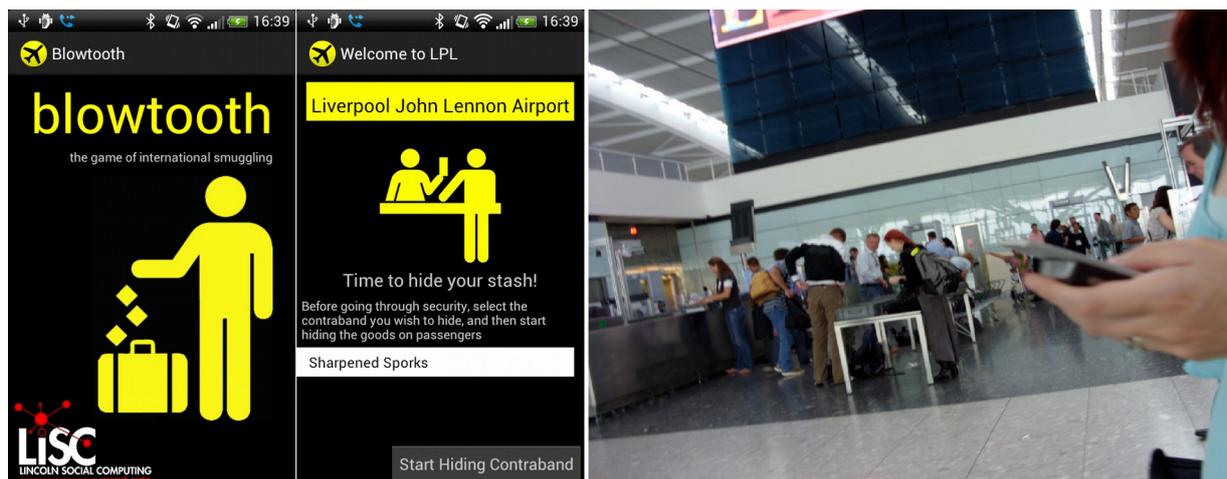


Figure 1- Blowtooth interface and play at Heathrow

Obviously, no actual contraband is involved. It is implemented (see Kirman, et al., 2012a) to use the Bluetooth sensor inside phones to build the list of proximal devices (within ~10m). Although it involves unaware travellers, this only includes people who have set their devices to advertise their presence, and no information other than a hashed identifier is (temporarily) used by the application. This is the same approach many airports and shopping centres use to silently track movement of visitors through those spaces (e.g. Bonner, et al., 2010; Bullock, et al. 2010).

¹¹ www.blowtooth.com

Blowtooth is an interesting design experiment because of the social and physical geography of the space where it exists. It can only be played in airports, both literally, in that the game code verifies this, and figuratively, in that it does not make sense anywhere else. It is specifically built for both the physical geography of airports, but also the transient nature of its occupants and their devices. In the social aspects, as Moore (2014) observes, Blowtooth relies on surveillance. The game invites anxiety by asking the player to “misbehave” in this heavily watched authoritarian space, but also asks the players to engage in surveillance of their fellow passengers. Although not doing anything “wrong”, Blowtooth is provocative in how it asks players to reflect on the weird social rules of the airport as a non-place, and behave in ways that run contrary to these rules, through its subversive narrative.

In terms of the physical location, the design uses the procedural aspects of the air travel experience as core features of the game – the limited space of the departure lounge, and the need to wait, ensures that the player has both the time and space needed to locate their victims. It is tightly predicated on both the specific ways we move around in an airport and the international uniformity of this space. While it can only make sense in an airport, it does so in every airport because all airports are the same place.

In summary, this project demonstrates how through very simple uses, geo-location technology, combined with a coherent understanding of social and psychological nature of a specific environmental context, extremely memorable experiences can be created. In other words, the power of these services is derived not from the cleverness of the application, but from the social rules of the environment itself – and in directing people's attention towards those rules.

Feckr

Where Blowtooth is designed for specific kinds of spaces, it is also interesting to consider how our social experiences change across different places. With Feckr, we aimed to explore both the social geography of spaces and the invisible nature of geo-location data. The concept is a refinement of Casey's (2011) MobiClouds social tagging project, whose users made short descriptive messages (“tags”) to surreptitiously describe specific spaces. In Feckr, rather than tagging spaces, users are able to save tags about the people they are near at that moment. All tags are permanently saved to a global database. The main Feckr screen shows an updated list of the tags that have been applied to people near your current location (see Figure 2).



Figure 2- Feckr website and mobile tagging interface

The app is presented as a playful way to vent frustration at annoying situations where it may not be socially appropriate to make a real intervention. For example, sitting near someone with poor hygiene on the bus, or sitting next to a boring academic at a conference dinner. Rather than stabbing them with a dessert fork, Feckr invites you to slyly tag them as “boring wankers”². The key twist is this act is scattershot – it is not only applied to the individual that raised your ire, but simultaneously applied to all individuals nearby. These tags are only visible to Feckr users, so may never be seen by your target, but are nonetheless permanent. Although the scattershot tagging might seem unfair, over time, tags associated with an individual come to represent the sum of the social environments they have encountered.

It is explicitly social, in that it can only be used in environments where there are other people, but importantly, the tags are communal and not associated with their author. The tags are never displayed as a list of specific individuals with specific tags, but rather a list of tags that have been applied to people near to you at that moment. In this way, users see a cloud of tags that change as they pass through different environments, reflecting their transition through changing social geography along with their change in physical space. As with Blowtooth, Feckr uses the Bluetooth sensor to determine proximal devices, and no personally identifiable information is stored.

The most pleasurable part of using the application is not the act of tagging, which is nevertheless cathartic, but the discovery of tags created by other users applied to the people who you find yourself amongst. In this way, it is revealing how the patterns of tags change around different spaces. This of course reflects the subtle ways our social experiences of moving about the world change between different contexts and situations, but also a shared frustration about the changing social rules and expectations. This is a common experience, and while users understand it can be frustrating they also (hopefully) recognise the reason for those rules existing. The application knowingly points out this tension in its tagline (“the app for closet sociopaths”).

In summary, Feckr provides a mischievous exploration of the invisible-and-yet-permanent nature of the social signals carried by geo-location data. Augmented reality apps have long been heralded as useful, due to their ability to “reveal” information related to an environment or device. Feckr poses the question; who gets to decide what information is associated with which location? If normal users are allowed to create that geo-located information, what does that mean for our social interactions? And, if we allow users to “create content” (Kirman, 2012b), can we expect people to do anything other than call each other wankers?

Fearsquare

The desire by governments, technologists and researchers alike to create digital civics applications and platforms (Olivier & Wright, 2015) has resulted in the public release of a bewildering amount of so-called “Open Data” that was previously only available to government agencies. The well-meaning intentions of this appears to be the flimsy hope that developers and visualization experts will be able to find hidden unforeseen uses for, and patterns in, these datasets that gives insight into societal trends, needs and wants.

Unfortunately, much of the data has limited usefulness, as councils gleefully avail to us their logs of dog shit data (e.g. City of York Council, 2016). However, in 2011 in an astonishing move of openness

² Real tag a user contributed to the Feckr database

and foresight the UK government decided to release comprehensive monthly updates of geo-located crime data in a format easily accessible to developers (Home Office, 2010). The developer community and the general public briefly went crime data crazed (e.g. Brown, 2011), and crime applications rapidly popped up without consideration of problematic implications (Dewey, 2014).

Not wanting to be left behind, we released our own app that worked with location-sharing service Foursquare, and mashed users' recent locative "check ins" with the crime data to show them "how dangerous their lives were". For instance, if someone had checked into their local pub, our app, Fearsquare, showed them how many assaults and robberies had taken place there recently. We built automated league tables to show which the most crime-ridden places were, and which users visited the most, supposedly, risky places³. Nearly 2,500 people registered their Foursquare accounts with our app within the first few months of its release and it was reported widely in media around the world (Garbett et al., 2015).

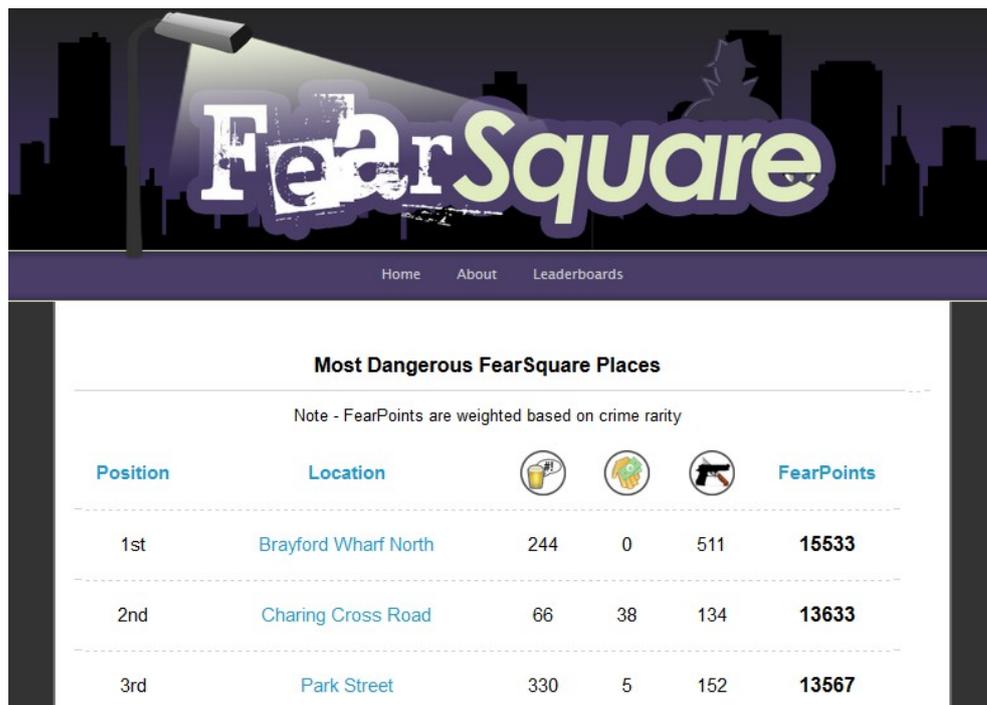


Figure 3 - Fearsquare scores places based on reported crime

We began this project with the intention of exploring whether it was possible to make Open Data sets more personal and relevant to people. When stumbling upon the blank façade of the UK's data.gov.uk website, the average person would quickly return to their filter bubbles on Facebook. However, our design thinking with Fearsquare was that if you could show people, through their own social media feeds, the violent crime committed in their local kebab shop, this makes the otherwise blandness of data as relevant, captivating and visceral as the shop's spicy sauce. It is known that people are drawn to stories about crime and breaking the law (Glassner, 2010); typically however

³ Curiously one of the most dangerous places to check into was a local Police station somewhere on the south coast of England; we assumed that this was due to a local plod entering their own postcode by default each a crime was reported, rather it being reflective of some kind of "Assault on Precinct 13" type incident that may have (repeatedly) occurred there.

there is a distance (literally and metaphorically) between us and the crimes seen on TV and in the newspapers; and in the UK and Ireland, we are actually very unlikely to be witness to, or victims of, crime. The context collapse that is made possible by social media and Open Data allowed us to eliminate this distance and bring real instances of crime ‘home’ to our users, making the crime data much more personal.

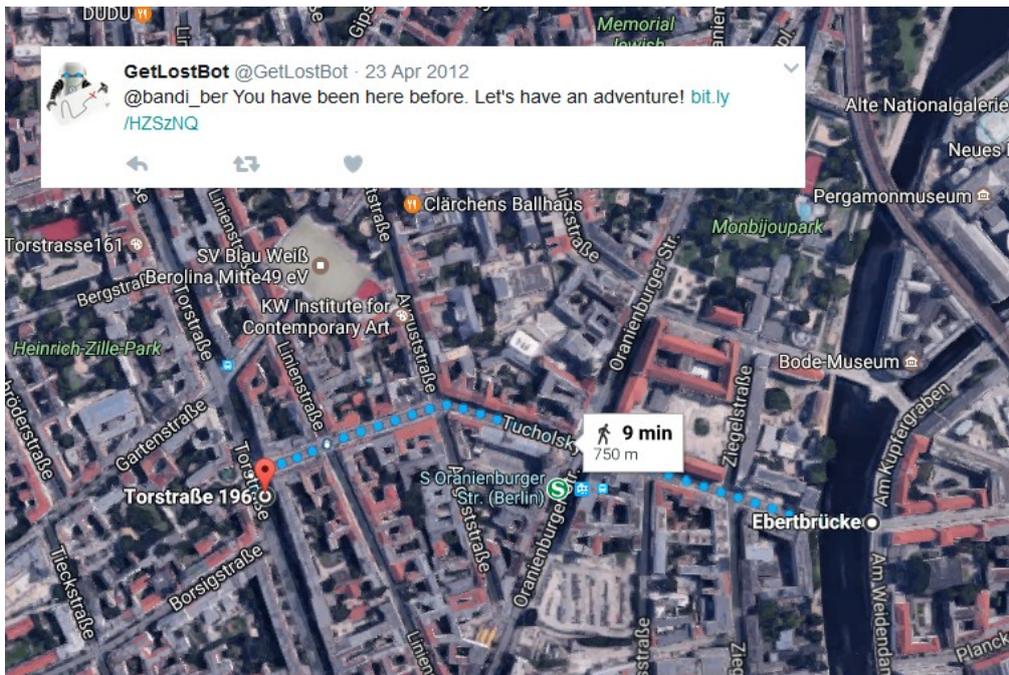
We observed that the enhancing locations with crime data could make people think differently about those places and the subjective experiences they had had there. Not just in terms of unusual reflection of the spaces, but what the data “means”. For example, through its playful leader-board of users who have visited the areas with most crime, Fearsquare implicitly encourages its users to try to visit more “dangerous” places in order to climb the ranking. However, even the most crime-ridden areas, in the UK at least, are still crime-free the vast majority of the time. For example, in most cities, we discover that areas around nightclubs and shopping centres tend to have higher incidents of reported crimes. The publication of this information could quite conceivably cause people anxiety in visiting those locations. However, this increased crime is largely a function of the popularity of these spaces – more people means more crime, but also means more of every other type of social interaction. The subtlety of this point is entirely absent in the data as presented by the government. In essence, Fearsquare criticises the data that is absent from these supposedly “open” and “objective” geo-location based services and the consequences of presenting over-simplified visualisations of geo-location data.

GetLostBot

We rely on our phones a lot in terms of generating new experiences – perhaps finding an activity to occupy feral children, or to discover a new band in a vain attempt at seeming cool – aided by recommender services that have learned about our taste. In a similar way, Facebook and Twitter automatically filter our news feeds to show us stories likely to be important to us, based on our relationships and past interactions (Backstrom, 2013).

With this in mind, we were curious about what the opposite of a recommender system might be. These systems tend to be quite safe – boring but accurate suggestions are preferred over exciting but incorrect ones. For example, a music app recommending “The Beatles” is likely to be correct but ultimately unexciting. GetLostBot is our attempt to interrogate this, by monitoring your movement around spaces, and giving unsolicited advice to visit new places when you fall into a “routine”. For example, if you seem to be going to the same cheap restaurants and bars too frequently, GetLostBot will intervene and suggest somewhere else for you to visit.

There are a few twists to this central function. First of all, the way GetLostBot chooses new locations is purposefully divergent from typical recommendations – it does this by using the Foursquare API to gather recommendations, then removing these from the pool of potential suggestions. It then checks where the user and the user’s friends have been and also subtracts these results from the set. A final selection is made randomly to a similar place (e.g. if at a bar, it will suggest another bar) within 1.5km that is, therefore, neither recommended nor recommendable.



Secondly, GetLostBot is curious since it has no interface, and is rather a responsive system based on the behaviour of users. Users don't interact with it - it interacts with them. Once users register for GetLostBot, with a single click on the website, it quietly monitors the locations they visit, only generating interventions when the user falls into a routine. A "routine" is arbitrarily defined by us as having not visited a new place in the past week. The interventions, as suggestions for new places to visit, are sent to the user via email or Twitter (see Error: Reference source not found).

The final important twist is the way suggestions are presented. Users are never shown the name of their destination, but are instead given a web link to walking directions provided by the Google Maps API. In this way, users are given a "treasure map" and asked to take the application on trust, and not pre-judge the suggestions that it generates. Of course, since they don't know where they are going, they also don't know when they have arrived. This is an intentional attempt to bring ambiguity into the journey that is supposed to be about discovery and exploration.

This framing of "exploration" is important. We call it a "serendipity generator", in that it aims to help users become more adventurous and engage with a spirit of discovery. It seems that this idea is very compelling - we all like to think we are adventurous spirits - and as a result GetLostBot gained some notoriety through its selection as a finalist in the Guardian's Dream Factory competition (Dunlop, 2012), where it received tens of thousands of votes, and came second place, in the national competition for innovation. It was also covered widely in the press, including being featured in popular science magazine *New Scientist* (de Lange, 2012), and a later book (Brooks, 2016), praising how it represented a revival of the 19th century urban "flâneur" (Shaya, 2004).

Despite the critical acclaim, when speaking to users about their experiences, a slightly different picture emerged. The responsive aspect of GetLostBot received the most criticism. People were unhappy that they would get challenges at strange times, rather than at a time they felt they were ready to explore. In addition, since GetLostBot monitors all movement, often it would make suggestions to change routines that users felt they could not change. For example, a participant who worked in a hotel complained that GetLostBot would regularly suggest they skip work and go to the

pub. Another user complained that they received challenges at church every Sunday. GetLostBot insisted that they should visit a mosque instead.

These complaints are fascinating because they nearly all referred to the explicit design of the application. In other words, they were complaining about exactly the features they signed up for. It seems that, although people register for the application with a spirit of exploration, when it actually comes time to put that spirit into practice, they are often reticent.

It is this dissonance between the “idea” of how people engage with different spaces and the reality that is the most interesting aspect of GetLostBot. It is highly personal and reflects only the individual’s particular experience of moving through the world. Indeed, since it purposefully excludes locations that friends have visited, it is arguably anti-social. Perhaps it should not be surprising users feel affronted when the application accuses them of, essentially, being boring. All the same, just as it is uncomfortable to be reminded of your drunken exploits the morning after a big night, it is uncomfortable to be reminded that your self-identity as an explorative and exciting soul is often not wholly honest. In this way it uses evidence of your own behaviour to demand some personal reflection.

Discussion

In this chapter we have presented four prototypes that mischievously explore the design space around locative and social mobile interaction. We have chosen these prototypes to serve as examples of different ways we can interrogate and build with geolocation data as a design material, since they approach that material from different but complementary perspectives. Through our ongoing design practice, we have come to consider location and sociality as the two key dimensions of how designers can understand “places”. In addition, we conceive that both dimensions can be understood in both singular and plural aspects – for example, we can see location as both specific places (such as airports) and the transition between many different places, and we think of sociality in terms of how an individual interprets the social aspects of their environment and also how groups of people do collectively. The matrix in Figure 4 shows how the prototypes fit into this perspective.

This understanding is not necessarily comprehensive; however we have found it valuable in guiding

	Place	Transient
Personal	Fearsquare	GetLostBot
Social	Blowtooth	Feckr

Figure 4- Matrix of position and sociality

design since it aligns with the sensing apparatus available on mobile devices. In terms of place, we consider Fearsquare and Blowtooth concerned with specific spaces – this is obvious in an airport, but also how we consider specific locations differently through the lens of crime data. Contrariwise, both

GetLostBot and Feckr and more transitory, and about the composite patterns reflected in our movement. In terms of sociality, both Fearsquare and GetLostBot are both very personal, since they are concerned directly with the user's individual perception of places, where Blowtooth and Feckr are centred on the social dynamics and psychology of spaces.

Throughout this chapter, we have talked about a guiding attitude of “mischievous design” that has informed most of our work, both here and more broadly. This simple perspective has become an important strategy in helping direct work optimised for engaging academic and public audiences in how (e.g. mobile) systems are designed, and the implications of those design decisions and the wider technology upon which they are built.

The foundation for this is in Critical Design, a loose but important field within design research centred on provocation, in that it is explicitly situated against what Dunne and Raby (2001, 2013) call “affirmative design”, or designing to “maintain the status quo” (ibid). Critical designs aim to “make consumers more critical about their everyday lives” (Bardzell & Bardzell, 2013), using artefacts to expose ideas about the future. However, critical design has itself been criticised for failing to recognise its own privilege (Prado & Oliveira, 2014), and, despite the audience being “consumers”, having a conceptual opaqueness and focus on aesthetics that “normalizes a pretentious taste regime” (Tonkinwise, 2015). Our perspective is that, with a few exceptions, critical design is simply not fun.

In the spirit of “Funology”, we see mischievous design as critical design with an accessible edge – engaging through its playfulness, yet still offering critique through its function. As Blythe and Wright (2005b) discuss, this playfulness allows the extension of established work to “encompass enjoyment”. This is hopefully clear in all of the prototypes we have described, which, although Blowtooth is the only “game”, all reflect a strong streak of playfulness.

This mischievous approach has been successful in drawing attention to this work. As mentioned, GetLostBot was featured by New Scientist, the Guardian and others. Fearsquare was picked up by news organisations across the world, including the New York Times and Wired, and proved especially popular in Brazil. The controversial aspects of Blowtooth attracted similar press coverage and continues to make the authors extra nervous every time they fly.

Conclusions

In this chapter we have reported on a series of projects that use a mischievous design attitude to explore the affordances of the geolocation capabilities of modern mobile devices. We are concerned by the relatively dull way that such capabilities are used by contemporary applications. In particular, how applications confuse position with place, and fail to take advantage of the tremendous potential of the entwined social and physical landscape.

We present four projects in this space – Fearsquare, Blowtooth, Feckr and GetLostBot. Each project takes a different perspective on location data, from Blowtooth's concentration on the specific environment of the airport, through to GetLostBot's subversion of location-based recommender systems. Together the prototypes demonstrate a range of alternative and critical twists that problematise the readily available functionality on modern mobile devices. In particular, we document the “mischievous design” attitude with which each was developed, that uses irreverent

playfulness as guiding principles in building engaging work that helps explore location data as a material of design, and offer critique of the way this material is used in contemporary applications.

Acknowledgements

Special thanks to Andrew Garbett, the lead developer on Fearsquare, and all other former members of the Lincoln Social Computing Research Centre (LiSC).

References

- Alptraum, L. (2016) Apple's Health App Now Tracks Sexual Activity, and That's a Big Opportunity, Motherboard Oct 23rd 2016. Retrieved from: https://motherboard.vice.com/en_us/article/apples-health-app-now-tracks-sexual-activityand-thats-a-big-opportunity
- Auge, M. (1995) *Non-places: An Introduction to an Anthropology of Supermodernity*, Verso: London.
- Backstrom, L. (2013) News Feed FYI: A Window Into News Feed. Facebook. Retrieved from: <https://www.facebook.com/business/news/News-Feed-FYI-A-Window-Into-News-Feed>
- Ballard J.G. (1997) *Airports: The True Cities of the 21st Century*. Blueprint (Sept. 1997). <http://www.utne.com/politics/homeiswherethehangaris>
- Bardzell, J., & Bardzell, S. (2013). What is critical about critical design?. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 3297-3306). ACM.
- Blythe, M., Overbeeke, K., Monk, A.F., and Wright, P.C. (Eds.). (2005a). *Funology: From Usability to Enjoyment*. Kluwer Academic Publishers.
- Blythe, M., & Wright, P. (2005b). Introduction: From usability to enjoyment. In *Funology* (pp. 13-19). Kluwer Academic Publishers.
- Bonner, B.B., Hjelm, C.T., Jones, T.A., John, E.O.I. and Perkins, D.B., Sunrise R&D Holdings, Llc, (2010) Method of tracking the real time location of shoppers, associates, managers and vendors through a communication multi-network within a store. U.S. Patent 7,739,157.
- Boulos, M. N. K., Brewer, A. C., Karimkhani, C., Buller, D. B., & Dellavalle, R. P. (2014). Mobile medical and health apps: state of the art, concerns, regulatory control and certification. *Online journal of public health informatics*, 5(3).
- Brooks, M. (Ed) (2016) *Chance: The science and secrets of luck, randomness and probability*. Hachette UK
- Brown, M. (2011) Police.uk shows street-by-street data on local crimes. *Wired UK*, 1st February 2011. Retrieved from: <http://www.wired.co.uk/article/police-uk-crime-maps>
- Bullock, D., Haseman, R., Wasson, J. and Spitler, R. (2010). Automated measurement of wait times at airport security: deployment at Indianapolis international airport, Indiana. *Transportation Research Record: Journal of the Transportation Research Board*, (2177), pp.60-68.

- Casey, S. (2011) Tagging amongst friends: an exploration of social media exchange on mobile devices. PhD thesis, University of Lincoln, UK.
- City of York Council (2016) Fixed Penalty Notices - Dog Fouling. [Dataset] Retrieved from <https://data.gov.uk/dataset/kpi-fpn01a>
- Crang, M. (2002) Between places: producing hubs, flows and networks. *Environment and Planning A*, 34, 569-574.
- Dewey, C. (2014). The Many Problems with SketchFactor, the New Crime Crowdsourcing App that Some Are Calling Racist. *Washington Post*, 12.
- DiSalvo, C. (2012) *Adversarial Design*. MIT Press
- Dourish, P. (2004a). *Where the action is: the foundations of embodied interaction*. MIT press.
- Dourish, P. (2004b). What we talk about when we talk about context. *Personal and ubiquitous computing*, 8(1), 19-30.
- Dunne, A., & Raby, F. (2001). *Design noir: The secret life of electronic objects*. Springer Science & Business Media.
- Dunne, A., & Raby, F. (2013). *Speculative everything: design, fiction, and social dreaming*. MIT Press.
- Dunlop, H. (2011) Honda and Guardian News & Media team up to find cultural engineers of the future. Retrieved from: <https://www.theguardian.com/gnm-press-office/gnm-team-up-with-honda>
- Flanagan, M. (2009). *Critical play: Radical game design*. MIT press.
- Foucault, M. and Miskowiec, J. (1986). Of other spaces. *diacritics*, 16(1), pp.22-27.
- Frayling, C. (1993). *Research in art and design*. RCA Research Papers 1:1
- Garbett, A., Wardman, J.K., Kirman, B., Linehan, C. and Lawson, S. (2014). Anti-social media: communicating risk through open data, crime maps and locative media. In *Proceedings of HCI Korea (HCIK '15)*. Hanbit Media, Inc., South Korea, 145-152.
- Gaver, W. W., Beaver, J., & Benford, S. (2003). Ambiguity as a resource for design. In *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 233-240). ACM.
- Glassner, B. (2010). *The culture of fear: Why Americans are afraid of the wrong things: Crime, drugs, minorities, teen moms, killer kids, mutant microbes, plane crashes, road rage, & so much more*. Basic books.
- Grindr (2009). Grindr – Gay Chat, meet & data. [Mobile Application Software] Retrieved from: <https://www.grindr.com/>
- Home Office (2010) ASB Incidents, Crimes and Outcomes [Dataset for England, Wales and Northern Ireland, 2010-2017] Retrieved from: <https://data.police.uk/about/>

- Kellerman, A. (2008). International airports: Passengers in an environment of 'authorities'. *Mobilities*, 3(1), 161-178.
- Kirman, B., Linehan, C., & Lawson, S. (2012a). Blowtooth: a provocative pervasive game for smuggling virtual drugs through real airport security. *Personal and Ubiquitous Computing*, 16(6), 767-775.
- Kirman, B., Lineham, C. and Lawson, S. (2012b). Exploring mischief and mayhem in social computing or: how we learned to stop worrying and love the trolls. In CHI'12 Extended Abstracts on Human Factors in Computing Systems (pp. 121-130). ACM.
- de Lange, C. (2012) Let's get lost: Apps that help you wander to happiness. In *New Scientist*, August 2012. Online: <https://www.newscientist.com/article/mg21528792.500-lets-get-lost-apps-that-help-you-wander-to-happiness/>
- Löwgren, J., & Stolterman, E. (2004). Thoughtful interaction design: A design perspective on information technology. Mit Press.
- Márquez Segura, E. (2016). Embodied Core Mechanics. Designing for movement-based co-located play. *Uppsala Studies in Human-Computer Interaction* 3. 174 pp. Uppsala: Department of Informatics and Media
- Montola, M., Stenros, J., & Waern, A. (2009). Pervasive games: theory and design. Morgan Kaufmann Publishers Inc..
- Moore, K. (2014) The Passenger and the Player: Blowtooth and the Subversion of Airport Space. *Media Fields Journal*, 1:8
- Olivier, P., & Wright, P. (2015). Digital civics: taking a local turn. *interactions*, 22(4), 61-63.
- Prado, L., & Oliveira, P. (2014). Questioning the 'critical'in Speculative & Critical Design. Medium. Retrieved from: <https://medium.com/a-parede/questioning-the-critical-in-speculative-critical-design-5a355cac2ca4>
- Rayle, L., Shaheen, S., Chan, N., Dai, D., & Cervero, R. (2014). App-based, on-demand ride services: Comparing taxi and ridesourcing trips and user characteristics in san francisco university of california transportation center (uctc). University of California, Berkeley, United States
- Shaya, G. (2004). The Flaneur, the Badaud, and the Making of a Mass Public in France, circa 1860-1910. *The American Historical Review*, 109(1), 41-77.
- Tinder (2012) Tinder [Mobile Application Software] Retrieved from: <https://www.gotinder.com/>
- Tonkinwise, C. (2015) Just Design. Being Dogmatic about Defining Speculative Critical Design Future Fiction. Medium. Retrieved from: <https://medium.com/@camerontw/just-design-b1f97cb3996f>
- Weiser, M. (1991). The computer for the 21st century. *Scientific american*, 265(3), 94-104.
- Wetherspoon (2017) Wetherspoon Order and Pay [Mobile Application Software] Retrieved from: <https://www.jdwetherspoon.com/pubs/order-and-pay-app>

Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research through design as a method for interaction design research in HCI. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 493-502). ACM.