Abstract

Purpose: There is a current need for innovation in research on the fear of crime to move on from general and static representations and instead approach it as a dynamic phenomenon experienced in everyday life, in order to inform or evaluate situational interventions.

Methods: This paper presents a novel approach to fear of crime research using the framework of routine activities theory and environmental criminology to present it as a specific event characterized by spatial, temporal, and personal variables. We suggest and illustrate a new experience sampling approach to data collection, captured via a mobile phone application.

Results: By studying the fear of crime in the environment where it occurs, and focusing on a micro scale geography with the additional dimension of time, new insight into fear of crime can be attained. Results from a data collection pilot demonstrate significant spatio-temporal variation in individuals' fear of crime levels and hence illustrate the viability of such approaches.

Conclusions: We argue that this new insight can lead to the development of situational interventions which target fear of crime hotspots as they move about in place and time, allowing limited resources to be allocated more efficiently to enhance perceptions of safety.

Introduction

Fear of crime affects both those who have and those who have not been victimised, making it more prevalent than actual rates of victimisation (Warr, 2000). Nationwide, 17 % of British Crime Survey (BCS) respondents were very worried about violent crime. (Jansson, 2007). In the 2010-11 year 43% of Londoners reported their quality of life was affected by fear of crime (D. Gray, Anderson, Smith, & Davies, 2013), and about one fifth of Londoners said that they had felt worried about their personal security in the last three months while traveling (Transport for London, 2013). By affecting overall quality of life and feelings of safety, fear of crime has knock-on effects on willingness to choose active travel modes, (McDonald, Deakin, & Aalborg, 2010; Mitra, Buliung, & Roorda, 2010), walkability (Kelly, Tight, Hodgson, & Page, 2011), older people's willingness to leave home unaccompanied (Loukaitou-Sideris & Fink, 2009), and on constraints to social behaviour (Liska, Sanchirico, & Reed, 1988).

This importance of fear of crime is further reflected in governmental attitudes; "how safe people feel and how much crime they perceive to be occurring has become a priority for policing" (London Transport Committee, 2008), and perception of crime and antisocial behaviour is addressed under the Mayoral goal of improving safety and security on the transport networks in London (Transport for London, 2011). Evidently fear of crime merits its own investigation as an independent event from crime. In order to do this, it is necessary to establish what fear of crime is, and how it is experienced in everyday life by all users of an environment, be they residents, workers, or other users of public spaces.

Analysis of the current state of research

Fear of crime is mostly studied in relation to crime and often framed as rational or irrational in relation to actual (recorded) crime rates (e.g. Lupton & Tulloch 1999). When it is not treated as an add-on to crime it is treated as an add-on to elements of the environmental backcloth associated with crime such as physical/social incivilities and neighbourhood characteristics. However if it is to be addressed independently, it needs to be treated as an independent event. Much like focusing on the crime event has changed the way in which (some) criminologists approach the study of crime, approaching fear of crime as made up of independent events may lead to new insight into fear of crime research.

Measuring fear of crime

The traditional approach to measuring fear of crime has been to use survey questionnaires (Doran & Burgess, 2012; Ferraro & Grange, 1987; Hale, 1996; Warr, 2000). Hence, in surveys, such as the BCS, variants of the question "How afraid are you walking alone at night?" were posed to large numbers of respondents. Based on their responses ranging from 'very', 'fairly', 'not very' to 'not at all', a fear of crime value is then derived to describe the population as a whole, and any differences in fear of crime reported by different subgroups are analysed (e.g. see Hough 1995).

Scholars now argue that when measured this way, fear of crime becomes equated with a perceived risk based on subjective probability rather than a reflection of actual experience (Jackson, 2013), omitting many of the complexities involved with individuals experiencing fear of crime as a part of their everyday lives (Gray, Jackson, & Farrall, 2008; Jackson & Gouseti, 2013). For example, measured this way, the resulting fear of crime value would not take into consideration variations in

fear experience caused by perceived seriousness of crime and victimization (Jackson, 2011; Warr & Stafford, 1983), sense of control over the specific event (Jackson & Gouseti 2013), or any other non-static variable associated with it. Instead this value reflects emotionally tinged 'attitudes' towards risk (Jackson, 2006) or future-oriented anxiety (Gray, Jackson, & Farrall, 2010; Sacco, 2005), presenting a static picture of fear of crime, and over-representing actual rates of fear when presented as everyday experiences (Bernard, Killworth, Kronenfeld, & Sailer, 1984; Farrall & Gadd, 2004; Fattah & Sacco, 1989; Yin, 1980).

To attain a more accurate picture of fear of crime as an event experienced within a context, questions about frequency and intensity were introduced in the 2003-4 sweep of the BCS (see Farrall, Bannister, Ditton, & Gilchrist, 2007; Farrall & Gadd, 2004; Gray et al., 2008, 2010). These new measures focused on instances of 'worry', referring to concrete mental events of concern (Farrall & Gadd, 2004) rather than the 'anxiety' of a more diffuse mental state (Gray et al., 2010). This movement towards measuring fear of crime as an event experienced in everyday life rather than merely an underlying attitude or anxiety shows a shift in focus. Hence, it presents a picture that reveals more accurately what people 'live' as they go about their everyday activities. This focus is closer to a situational perspective, putting fear of crime events into the context of people's everyday activities and the larger societal systems.

The situational perspective to crime events

Routine activity theory shifted focus from criminal motivations to the criminal event (Felson & Cohen, 1979). For the first time this approach considered the spatial and temporal aspect of crime together. It appreciated how different activities varied not

only with place but also by hour, “in where people are, what they are doing, and what happens to them as a result” (Clarke & Felson, 1993, p.3). It considered the larger system of activities, and understood a crime event as something which takes place within its context (Clarke & Felson, 1993).

The development of situational crime prevention, which aims to stop crime opportunities by introducing changes to the environment (Clarke & Felson, 1993) arose from acknowledgment of the power of the immediate context in offender’s decisions to undertake crime. Situational methods focus on the crime event itself, emphasizing the fundamental distinction between criminality- a longer term, multistage, complex thing- and criminal events which are the (mostly) shorter processes relating to the immediate circumstance and situation of the crime that occurs (Clarke & Felson, 1993).

Fear of crime as an event

In a similar way, we propose that by focusing on fear of crime as an event, more can be learned about the environmental context associated with these events, which can inform situational crime prevention approaches to reduce fear of crime, and improve public perceptions of safety in the environment.

The ability to locate and contextualise fear of crime events poses a difficulty, as surveys, no matter how event-specific, still present a static picture of something past, and there will always be problems associated with self-reports, such as errors in recall (Warr, 2000). Specific to affective experiences like fear of crime, memories from longer than about two-weeks prior tend to draw on semantic knowledge, based on general beliefs rather than the specifics of the event itself (E. Gray, Jackson, & Farrall, 2011; Robinson & Clore, 2002a, 2002b). Therefore even if experience-based

questions move closer to capturing the more expressive dimensions of public insecurities about crime (E. Gray et al., 2011), results may still not reflect fully the dynamic way in which this is experienced by people over time in their everyday lives as they participate in their routine activities.

It is important to consider fear of crime experiences from a longitudinal perspective, as “we all move in and out of shades of fear over our life courses, influenced by our own experiences and by spatial, social and temporal situation“ (Pain, 2000). It can be assumed that even over a short period of time people will experience different levels of fear of crime. Hence, to examine variation, it is not necessary to follow someone as they progress through different life stages; it should be sufficient to follow them as they move through different spatial, temporal, and social contexts as people do every day. Fear of crime is transitory and situational (Fattah & Sacco, 1989), and while research demonstrates that is experienced differently by people with different static ’social structure’ variables (Smith, 1987) such as age (Lagrange & Ferraro, 1989), ethnic group (Webster, 1995), and gender (Lagrange & Ferraro, 1989), it also varies with dynamic characteristics that change within a person. For example, studies looking at gender often find that women experience higher level of fear of crime than men (Lagrange & Ferraro, 1989), however, in certain situations, it is actually men who show higher fear than women; looking specifically at public toilets, Moore and Breeze (2012) found that men express a more marked concern than women about assault in this specific context.

These generalisations of sub-groups’ experiences with fear of crime come from the way that it is measured; survey questions merit answers which distort towards an ‘average’ experience (Hektner, Schmidt, & Csikszentmihalyi, 2007), and respondents can be affected by a variety of social forces, such as socially desirable responding

(Sutton & Farrall, 2004), and the use of heuristics to answer a difficult question, potentially substituting with an easier question (Kahneman, 2011).

Further, there are a number of other more dynamic personal factors to consider. For example, psychological distance (believing one is likely to fall victim to crime when feeling proximate to a crime event spatially, temporally, or socially) dynamically affects fear of crime as experienced by individuals (Jackson, 2013; Todorov, Goren, & Trope, 2007; Trope & Liberman, 2010). If instead of a global summary measure we were to follow fear of crime experiences of the same individuals over time, we could see within-person fluctuations. This would allow us to propose that personal characteristics beyond one-dimensional groupings such as by age, gender, or ethnicity, have an effect on fear of crime, and give a more dynamic image of fear of crime.

Putting fear of crime in its place

Alongside the move towards a measurement of fear of crime that is more true to everyday lived experiences, this situational event approach allows for investigation of environmental factors that correlate with fear of crime. With the growth of place-based criminology, more research has used the framework of "the criminology of everyday life" (Garland, 2001), which views the criminal event as the endpoint of a decision process (which can be conscious or subconscious), influenced by personal (e.g. readiness to commit crime), and environmental (e.g. suitable target and lack of capable guardian) factors (Brantingham & Brantingham, 1993). As a parallel, a fear of crime event can be experienced by someone with a certain readiness to experience fear of crime, which can depend on a number of factors which the individual brings with them (e.g. age, gender, psychological distance, familiarity with

an area) in the presence of certain cues in the environment (e.g. disorder, graffiti). Scholars emphasize that people's individual perceptions of safety is situated within their understandings of the social and physical make-up of the environment they are in (Jackson, 2004), pointing further to the relevance of the environmental backcloth to fear of crime.

Yet unlike police-recorded crime data, fear of crime events do not come in a table with a time stamp and geographical address, so fear of crime is mapped as a generalised attribute of an aggregate area such as neighbourhoods (Scarborough, Like-Haislip, Novak, Lucas, & Alarid, 2010). For example, Figure 1 maps fear of crime in the city of London, UK, aggregated to borough level, using data from the Metropolitan Police Service Public Attitudes Survey (MPSPAS) (GLA Intelligence Unit, 2012). It is apparent from the figure that a borough is quite a large aggregation level (many boroughs have over 300,000 residents (Bains, Cameron, & Tonkiss, 2013)). It is in fact possible to gain smaller area, neighbourhood level data on attitudes to crime and safety, but mapping this puts into question the scale of aggregation at which this data loses the ability to given a reliable picture. For example, in the 2011-12 sweep, the MPSPAS gained between 268 and 681 responses per borough, demonstrating that it is risky to assume that the responses truly represent the views of the area's population.

[Insert Figure 1: Fear of crime in London by place of residence here]

Conclusions drawn about spatial distribution of crime is very much affected by the level of geography used to approach it, and the way in which spatial crime information is aggregated (Rengert & Lockwood, 2009). It is now more widely accepted to show tight concentration at the micro-level (Evans & Herbert, 1989;

Rengert & Lockwood, 2009; Spring & Bloc, 1988); a focus on higher geographic units such as neighbourhoods results in loss of information and inefficient focus of limited resources aimed at crime prevention (Weisburd, Groff, & Yang, 2012).

Further relevant here is the change in the meaning of what is being measured at different geographic scales. “At the individual level, fear of crime is largely the result of personal experience of crime, whilst at the neighbourhood level, fear is a function of what people experience where they live. At the macro level, fear is understood both as a social phenomenon (…) and as a generalized diffused anxiety…” (Ceccato 2012, p.10). Therefore it is important to consider scale in relation to what it is that we actually want to measure.

Much fear of crime research with a focus on neighbourhoods has studied relationships between incivilities and fear (see Brown, Perkins, & Brown, 2004; Brunton-Smith & Sturgis, 2011; Franzini, Caughy, Nettles, & O’Campo, 2008; Gau & Pratt, 2010; Hinkle & Weisburd, 2008; Jones, Pebley, & Sastry, 2011; Kohm, 2013; LaGrange, Ferraro, & Supancic, 1992; Roccato & Russo, 2011; Scarborough et al., 2010; Swatt & Varano, 2013). Such studies repeatedly emphasize the causal effect of physical incivilities on fear of crime, showing that people consult indicators of incivility and neighbourhood disorder when assessing their safety in the environment (Maxfield & Lewis, 1980, Kohm 2013), and use this as a heuristic device to provide cues about likely levels of neighbourhood crime (Wilcox, Quisenberry, & Jones, 2003).

Disorder and incivilities are, however, likely to vary *within* neighbourhoods. Weisburd et al (2012) found hotspots of physical disorder with significant within-area variability; within many neighbourhoods, streets with high numbers of disorders were

surrounded by streets with lower numbers. By inference, this might imply that fear of crime events are not evenly dispersed in neighbourhoods either, but concentrate spatially at micro level geographies like street segments. Small geographic areas that show significantly elevated rates of the measured phenomena may be rendered invisible by aggregating up (Green, Hoppa, Young, & Blanchard, 2003). Therefore it is important to consider fear of crime events at the smallest possible scale to be able to un-erroneously associate them spatially with elements of the environmental backcloth such as incivilities, crime and disorder.

Another issue with neighbourhood-based fear of crime studies is that they tend to attach people's fear of crime to their place of residence, restricting information to the views of the night-time population. People spend a major chunk of their daily activities outside of their place of residence and even outside their neighbourhoods. Scholars have partially addressed this issue using questionnaires that target specific environments that people encounter, such as workplace (City of London Police & Metropolitan Police, 2009), university campus (Fisher & Nasar, 1992; Nasar & Fisher, 1993), or various stages of public transport (Cozens, Neale, Whitaker, & Hillier, 2003). However, arguably, people can experience a fear of crime event anywhere in their entire activity space, which includes home, work and entertainment, but also various other activities that are difficult to track, as well as during door-to-door travel between these places. It is unrealistic to attempt to locate where people feel safe and unsafe in such a broad activity space using traditional surveying methods.

If it were possible then, much benefit could come from identifying areas that are systematically labelled as feeling unsafe by people, whether residents or non-residents. Ability to cover people's entire activity space would reveal information

about where and when people feel unsafe during the entire journey, and help identify problem areas that may benefit most from situational interventions. Further it might suggest situational prevention measures that may go beyond merely increasing perceptions of safety. For example, it is suggested that women experience more fear of crime than would be expected based on recorded crime rates because they often suffer harassment that is not reflected in these statistics (Lupton & Tulloch, 1999). By identifying fear-of-crime-event-hotspots we might also identify hotspots of these otherwise unreported events, and help reduce their occurrence.

One study where researchers explored fear of crime within the environmental backcloth was done in Australia using retrospective cognitive mapping of areas that people avoid due to labelling them as dangerous (Doran & Burgess, 2012). The resulting maps further support the existence of micro-level geographical variation in fear of crime, showing, for example, high fear of crime along one route, and none in the surrounding areas. However, while this study addresses mapping fear of crime in a smaller geographical scale, it still suffers the issues associated with retrospective questionnaire surveys based on recall. Further, the study focused on areas that people avoided and this may not be reflective of everyday experience, but a perpetuation of existing prejudices (Doran & Burgess, 2012). These cognitive maps continue to present a static image of the area. While findings showed that reasons for fear quoted by participants included transient features of an environment like drug users or intoxicated persons, temporal variation was only represented using the standard dichotomy of daytime and night-time. This does not take into account variation with time of the day or day of the week, with which the presence of these factors are also very likely to vary (e.g. intoxicated people may be more frequent in the weekends, or after 2am when bars close).

Evidently, approaching fear of crime as an everyday experience that varies with changes in the environmental context, made up of micro-spatial temporal and personal variables, moves away from what is possible to measure with traditional survey methodologies.

A new approach

Here we propose a new approach that aims to measure fear of crime as it is experienced by people in the context of their everyday lives across the whole of their activity spaces, in real-time (or as soon as possible after the event). By doing so, the extant literature on fear of crime can be supplemented by situational information that is currently an unknown. We therefore propose a novel methodology incorporating the longitudinal approach of the experience sampling method (ESM) with the crowdsourcing approach of volunteered (geographical) information.

ESM "captures the representation of experience as it occurs, or close to its occurrence, within the context of a person's everyday life" (Christensen, Barrett, Bliss-moreau, Lebo, & Kaschub, 2003. p.54). It offers a method for researchers to seek information about the daily events and experiences that make up people's lives (Csikszentmihalyi & Larson, 1987), and ESM provides a powerful way to understand psychological phenomena as they occur in daily life (Christensen & Barrett, 2003). The use of experience sampling emerged as a reaction to "a large body of research demonstrating the inability of people to provide accurate retrospective information on their daily behaviour and experience" (Csikszentmihalyi & Larson, 1987, p.526). Much like criticisms of the BCS, critics of psychological questionnaires claim they tend to measure people's generalized knowledge or theories about their experiences, rather than the episodic or experiential representations (Christensen et

al., 2003). As retrospective reports distort toward an 'average' experience, a more effective way to "capture emotions, motivations, and cognitive processes is by asking people to describe them at the moment they occur" (Hektner et al. 2007, p.24). The use of ESM allows for a bottom-up approach to studying phenomena experienced in peoples' everyday routine activities. For example in the study of happiness, the use of ESM has allowed scholars to study the proximal environmental factors as well as behaviours and habits that correlate to personal happiness. Survey-research measuring people's happiness levels only once shows happiness as a personal trait, affected by whatever conditions distinguish people who reported being happy from those who did not. Asking participants to complete a questionnaire about their activities and happiness 8 times a day for one week revealed that happiness shows temporal variation with day of the week (confirming 'Blue Mondays') and time of the day (first part of the day being less happy), and also variation depending on activity (with highest level of happiness reported while 'talking with friends') (Csikszentmihalyi & Hunter, 2003). By asking people to report their subjective experiences with fear of crime in a similar way, we can build on their reports to identify trends and patterns.

Downsides to using ESM are the costs, and the extra load on respondents who have to remember to carry the survey with them to complete it at the appropriate time. A solution to these limitations can be found in applying this methodology to use with mobile phone applications. Mobile applications offer a convenient platform to survey people about their every-day activities as they are not an extra burden to carry around, but something that people already have. Further, sensors such as GPS and an internal clock allow (with permission) for the collection of data such as geographic location and time of response without having to explicitly ask the participant to record

it. This feature helps to reduce burden on participants, as well as to ensure greater accuracy by eliminating the opportunity for human error to occur with reporting.

The use of mobile applications to collect data is widely used in exercises involving Volunteered Geographic Information (VGI). VGI refers activities where people offer up their time to collect information that has a geographical component (Haklay, 2013). The use of mobile phones to collect VGI has made it easy to collect data such as GPS, noise or sound levels, while reducing the demand on people. An example of such a tool is a mobile phone software called EpiCollect (Aanensen, Huntley, Feil, al-Own, & Spratt, 2009), which records information submitted by field workers together with GPS data, and has been used to collect a variety of data, for example to monitor the geographic distribution of a certain type of cattle tick (Madder et al., 2012). Mobile phone apps can even make the sharing of VGI possible between those who may not otherwise use the same navigational systems, maps, or coordinates, as is the case with another app, Sapelli, which is used by indigenous communities in Congo to record instances of illegal logging, sending GPS tags to researchers (Stevens et al., 2014).

Closer to home, an example of such an app employing ESM directly is Mappiness, which extends experience sampling to incorporate satellite (GPS) location data by using an app to collect a panel data set from volunteers about their everyday happiness (MacKerron, 2012). In this way, MacKerron (2012) was able to collect a large sample of accurately geocoded responses, calculate particularly good indicators of environmental quality, and make conclusions about momentary happiness and its environmental correlates, extending the earlier work on happiness by adding a spatial element (e.g. higher levels of happiness reported near green spaces). By building such a mobile application to measure fear of crime, we could

gain a new picture of fear of crime at the micro level as something dynamic that varies with place and time alongside personal characteristics.

One issue with VGI, especially when it comes to governments' acceptance of this data surrounds questions about the quality and accuracy of citizen volunteered data, as opposed to data from authoritative sources (Johnson & Sieber, 2013). However questions about data accuracy may be less relevant to subjective perception data. If we want to find out how fearful people feel, the only way to acquire this information is by asking people to reveal their thoughts, independent of the method used. In context, while VGI about crime events may raise doubts about the accuracy of this data, and may be less preferable to crime event data collected by an official body such as the police, unlike a crime event, fear of crime is an internal, experiential event, which can only be recorded by the person who experiences it.

Fear of crime application prototype

To test the feasibility of using an application to measure fear of crime, a prototype was built. The Fear Of Crime application (FOCA) was developed in Java programming language, for use on Android mobile devices. It was written and tested by the first author and is not based on code from any other mobile application. It was created using the Android Software Development Kit in the integrated development environment for Java, Eclipse. The basic functionality of the application was to first present an initial 'pre-experiment questionnaire' that each participant must complete only once, and then 'ping' people periodically, asking them to answer the question "In this moment, how worried are you about becoming a victim of crime?", which is the exact question from the BCS, but with the "past 12 months" replaced with "in this moment". Respondents choose an answer, and the app submits their answer along

with their GPS location, and the time they sent the response, as well as a unique identifier to later link back with information from the pre-experiment questionnaire. The pre-experiment questionnaire collects information about the participant's age, gender, ethnicity, home and work neighbourhood, and asks two questions taken from the BCS to establish a baseline fear of crime level (general attitudes towards risk) and about previous experience with victimisation.

An initial issue with the application was that unlike the topic of other applications, such as happiness with Mappiness, fear of crime events can be associated with potentially dangerous situations. In order to avoid encouraging people to use valuable smartphones in high crime areas, a retrospective annotation option was introduced, to allow participants to get to a safe place before reporting. To ensure ease of reporting, this option provides users with a map that appears on screen where they can find their current location, and trace back their steps. An additional question asks users to report how many hours ago the event took place. Therefore users can submit three types of responses, one in a response to a reminder ping sent by the application, one on their own accord about their current situation, and one about a previous event at a different location (Figure 2).

[Insert Figure 2: FOCA methodology here]

Case studies

In an initial exploration of feasibility of FOCA, six people (from a university setting) were asked to download and use it for the duration of just over one month. The results were analysed and participants informally interviewed to determine whether the app was easy to use, and whether the information collected reflected their actual every-day experiences with fear of crime.

Participants were pinged up to 4 times a day at random times, which provides a representative insight into participants' experiences over time, eliminating issues with sampling specific regular activities only or with participants anticipating the questionnaire (MacKerron 2011). The random pings can be administered either considering the day as a whole, or by stratifying by breaking the day into segments. To determine the best approach both these methods were considered. The first segmented the day into four time slots, based on peak travel times as identified by Transport for London: morning commute (6:30-9:30), daytime (9:31-15:59), evening commute (16:00-19:00), and night time (19:01-6:29). In this scenario, people would be pinged at a random time within the bounds of each time slot, having equal number of pings in each one. The second option was to take the day as a whole, and ping people at entirely random times each day.

To choose between the two methods, a large-scale simulation of hypothetical pings with each method was done. It was assumed that people would offer to receive pings between 5:30 and 8:30 the earliest, and 21:00 and 2:00 the latest, and that at every ping, a data point would immediately be submitted. The resulting graph (**Figure 3**) shows the number of pings in each hour, where the blue line is the scenario with the day stratified into four sections, and the red line is the day as a whole. Random pings throughout the day show an equal distribution of responses over the course of the day, but fewer during the morning commuting hours.

[Insert Figure 3: Simulation of 100,000 participants over 4 weeks here]

Using this, the decision was made to use stratified random sampling, as it represented times of movement more effectively. The day was therefore split into the four sections, and a random number generator was used to pick times within each

time slot for ‘pings’ to be sent out to participants. Participants were able to select the amount of times they were willing to be pinged per day (between 1 and 4, in line with best practice recommendations (Delespaul, 1998)), and were sent reminders accordingly.

The aim is to collect data on people’s experiences at the moment of recording, regardless of the proximity of recording to the original ping. This policy is easiest for participants, and does not risk introducing the biases that ESM is designed to eliminate (MacKerron, 2011). The signal appears in the form of a notification in the user’s notification bar, which, when tapped, opens up Option 1 (respond at the time). Option 2 allows individuals to ‘report something now’ irrespective of whether they have been pinged. Option 3 is used when individuals want to report a previous incident. The distribution of the ways that reports were submitted for the 6 individuals in the case study is shown in Table 1:

[Insert Table 1: Number of reports submitted using each reporting option here]

Of the responses made about fear of crime at the time of reporting 76% were done when the participant saw the notification, and only 24% were done independently using option 2 or 3. Of the reports sent using option 3, which might include incidents respondents didn’t want to report at the time, the majority (91%) were ‘Not at all worried’, suggesting that people were using option 3 to report safe areas or perhaps make up a missed notification, rather than to report fear of crime events. Delays in reporting between the event and the retrospective report were mostly less than an hour (92%), then 1 hour delay (3%), and 3 hour delay (2%). The longest time delay was 12 hours. The total number of pings sent is not known, as participants were allowed to choose, and change at any point during the study the number of pings

they received per day (between 1 and 4) without requiring approval from the researcher.

Initial results demonstrate intra-person variation in fear of crime (**Figure 4**). While most of the time participants did not to worry about crime, there were specific instances when fear was reported, illustrating longitudinal within-person variation in fear of crime, supporting the approach of fear of crime as a dynamic phenomenon.

[Insert Figure 4: One participant's fear of crime over the trial period (1 = Not at all worried, 4 = Very worried) here]

Examining spatial characteristics, , participants did not perceive an entire neighbourhood as safe or unsafe as a whole, but rather certain parts at certain times as safe, and others as less so. For example, Figure 5 demonstrates micro-level geographical variation in fear in one participant.

[Insert Figure 5: Detail in one individual's fear of crime map here]

The data also allows for exploration of inter-personal variation; Figure 5 demonstrates fear of crime fluctuations across the six participants for the same geographical area. Whilst not possible at this stage (it requires significantly large data sets), such data could be used for spatial mapping of fear to explore the potential existence of common 'hot spots'.

[Insert Figure 6: Maps of the same area by all participants here]

Such data presents many opportunities to explore fear of crime, and a number of different analytic frameworks appear viable possibilities. One potential approach to determine the extent to which variance in fear levels is determined by disposition, situation, or interaction between the two would be to apply a social relations model

(SRM) framework (Malby & Kenny, 1986). SRM models three effects, actor, partner, and relationship, but these are generic terms; actor can be perceiver (the individual and their base level of fear of crime), and partner can be the target that is being perceived (the characteristics of the environment that evoke fear (e.g. graffiti)) (Kenny, 1998). The SRM framework should help determine the added-advantage of looking at fear of crime as a person-situation interaction rather than a stable characteristic of the person or the environment. This approach presents one analysis framework for a more robust dataset of this nature to gain new insight into fear of crime as a dynamic event.

To determine the validity of results reflecting actual experiences, short interviews were conducted. Overall participants found the application straightforward and easy to use. Complaints focused on delays and other complications associated with GPS use, but this did not deter participants from using the app. Participants further commented on a map of their reports (e.g. Figure 5) generally agreeing that this was a good reflection of their experiences. One person described it as follows:

"Yes I think so I think that I feel generally quite comfortable everywhere and in particular in university where I'm in familiar surrounding surrounded by people I know or who I can identify with. Whereas at Euston there are slightly more unknowns because lots of people pass through there traveling or shopping or going to the cafe or whatever and it's a lot more transient and it's more difficult to spot things because there are a lot of people moving around."

It was also interesting to find that participants related fear reports to a certain event, but not necessarily something that put the person themselves in direct danger. Below is one example:

"I was on my way into university in the morning, and I was coming into Euston station and there was someone who looked like they were trying to remove a bike from the railings that had been locked in, and they didn't look like the owners of the bike. And then I suspected they were trying to steal the bike, so I reported my fear of crime because it was a specific incident of me seeing what I thought was criminal activity."

Findings like this may support theories such as the effect of psychological distance to crime affecting fear of crime, as it puts crime in the person's mind, and evidently results in a fear event that the participant deemed worth reporting. It also suggests that fear events, like crime events are likely to be a complex interplay between environmental conditions, the indication of violation of a social norm and the perception of the individuals involved.

Discussion

This paper has proposed a new approach to studying fear of crime that regards manifestations to be dynamic and micro-level events, experienced by people as they go about their routine activities in their everyday life. Approaching the study of fear of crime from this angle show promise in the identification of fear hotspots, and their related environmental and social variables in order to propose situational preventative measures that enhance perception of safety. Whilst small, the trial of the FOCApp described here suggests firmly that fear of crime is indeed a dynamic variable that changes within a person over place and time as well as between people. Any data collection procedure that does not recognise this is subject to averaging and aggregation bias and if enquiring about feelings too far in the past, many other forms of survey bias.

There are obvious limitations to the experience sampling approach and the mobile phone app as it is described here. The app itself is in prototype form, and further development is necessary. There is the need for an empirical study that collects data from the app for a large enough sample to enable reliable data analysis, and production of fear-of-crime hotspot maps. There are also other factors to consider, such as the potential consequences of people using this application. It is possible

that people will be encouraged to somewhat “over-report” fear of crime because of the ease of reporting and salience of fear of crime in their minds due to participating in such a study. However the initial indications from the case study are that reports were tied to specific situations (such as the witnessing of a potential bicycle theft mentioned above), and most reports are of people feeling entirely safe. Another consideration is that fear of crime associated with a particular place and time does not necessarily disappear instantly after the event is ‘over’. People may have higher likelihood to report fear of crime again after a first report for example, and this would be very interesting to explore on people’s individual fear of crime trajectories over time in a longer study.

Future work might focus on specific groups of people to explore between-person variation in fear of crime as well as within-person, or focus on specific locations to map on a small scale people’s perception of safety, and explore very local variables that are spatially and temporally related to any emerging fear of crime hotspots. With larger samples there will also be an opportunity to comment on the prevalence of fear as measured experientially and how this differs from results using survey methods. In summary, the methodology proposed in this paper presents a new approach to putting fear of crime in its place in both space and time as a dynamic, everyday experience of people going about their routine daily activities. The arguments made in this paper, along with the results from the case study pave the way for a new approach to surveying and mapping people’s perceptions and subjective interpretations of their environments in terms of fear of crime and personal safety.

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Figures and Tables

Type of submission	Option 1 Response at the time to ping	Option 2 Response at the time of own accord	Option 3 Response at a later time
% of responses	76	3	21

Table 1: Number of reports submitted using each reporting option

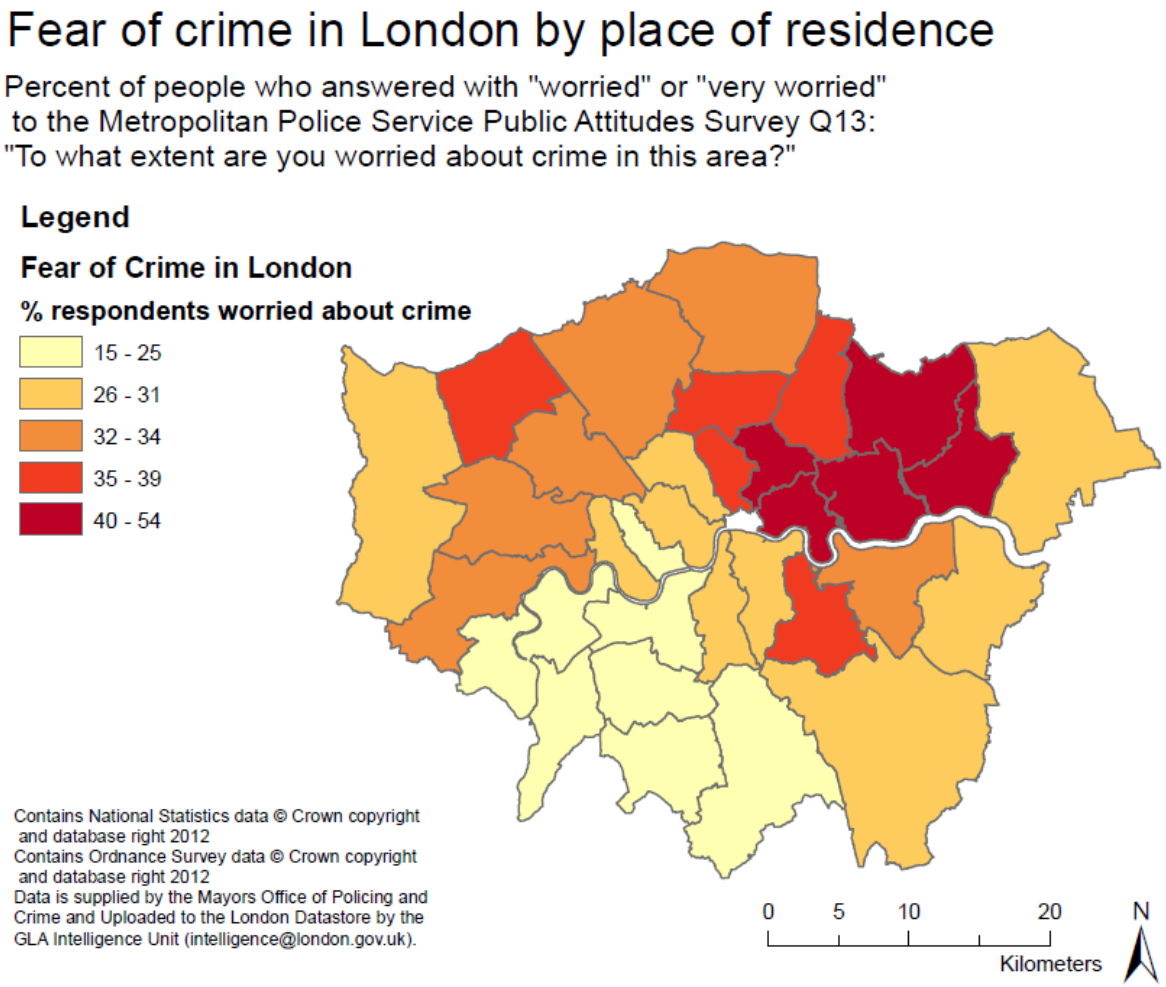

Figure 1: Fear of crime in London by place of residence

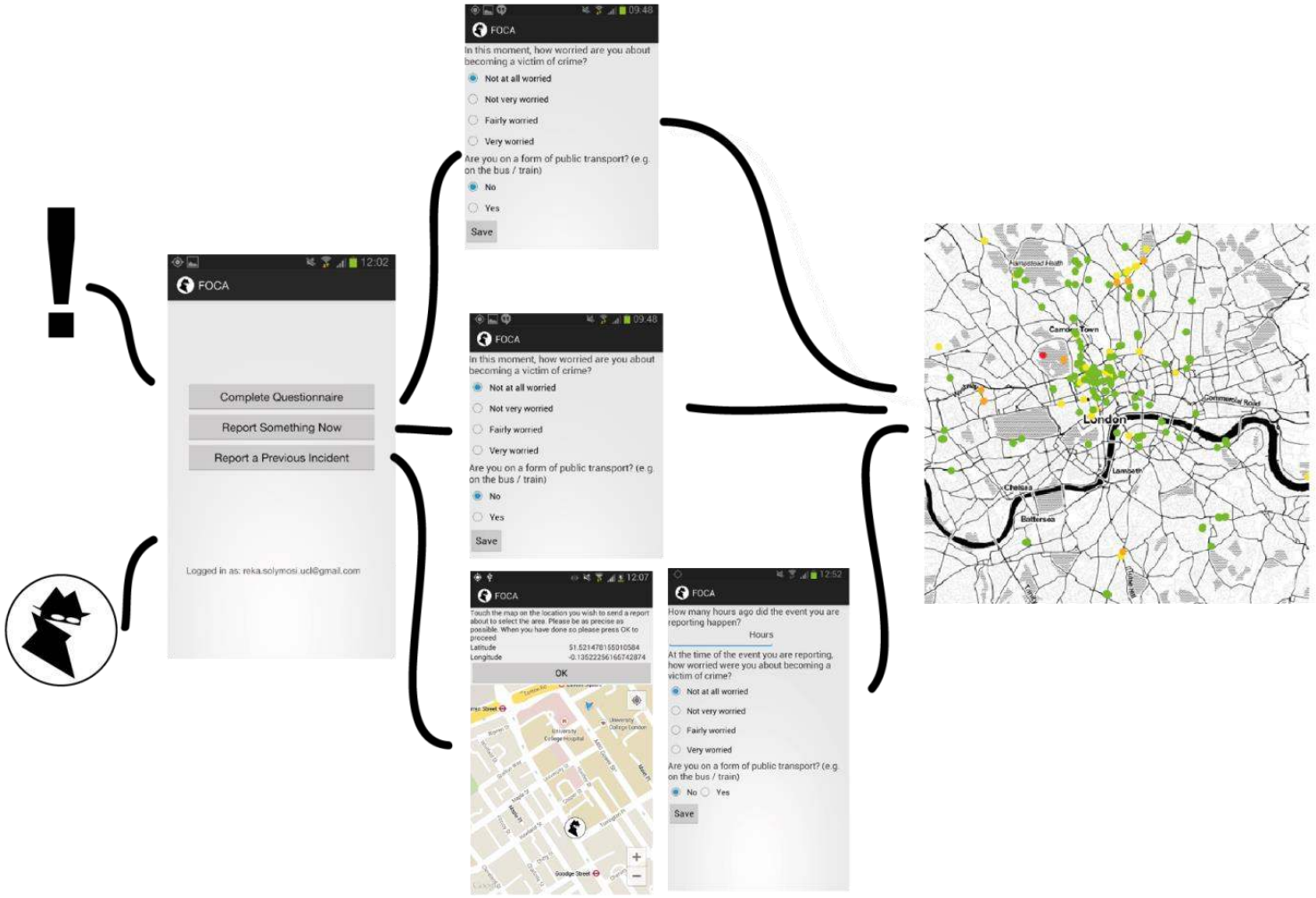

Figure 2: FOCA methodology

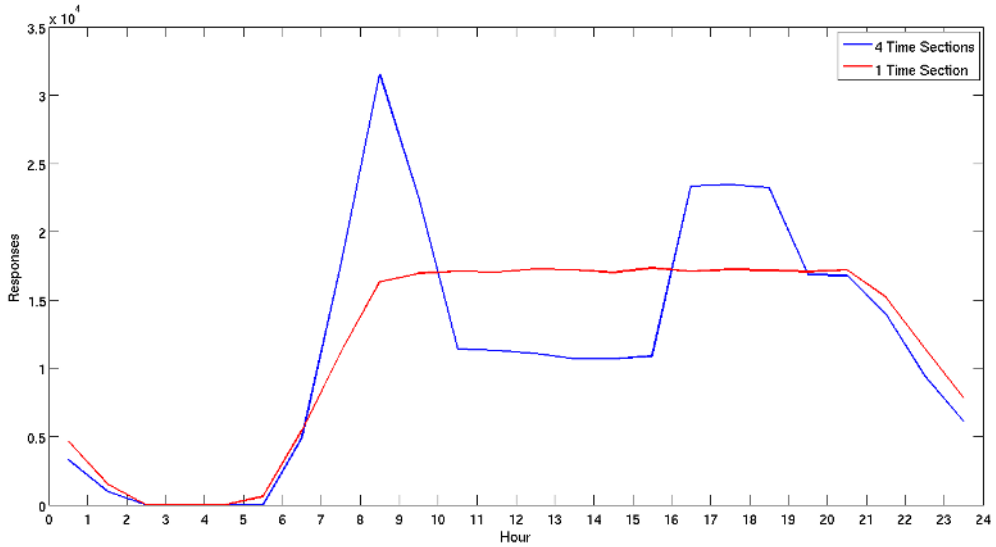

Figure 3: Simulation of 100,000 participants over 4 weeks

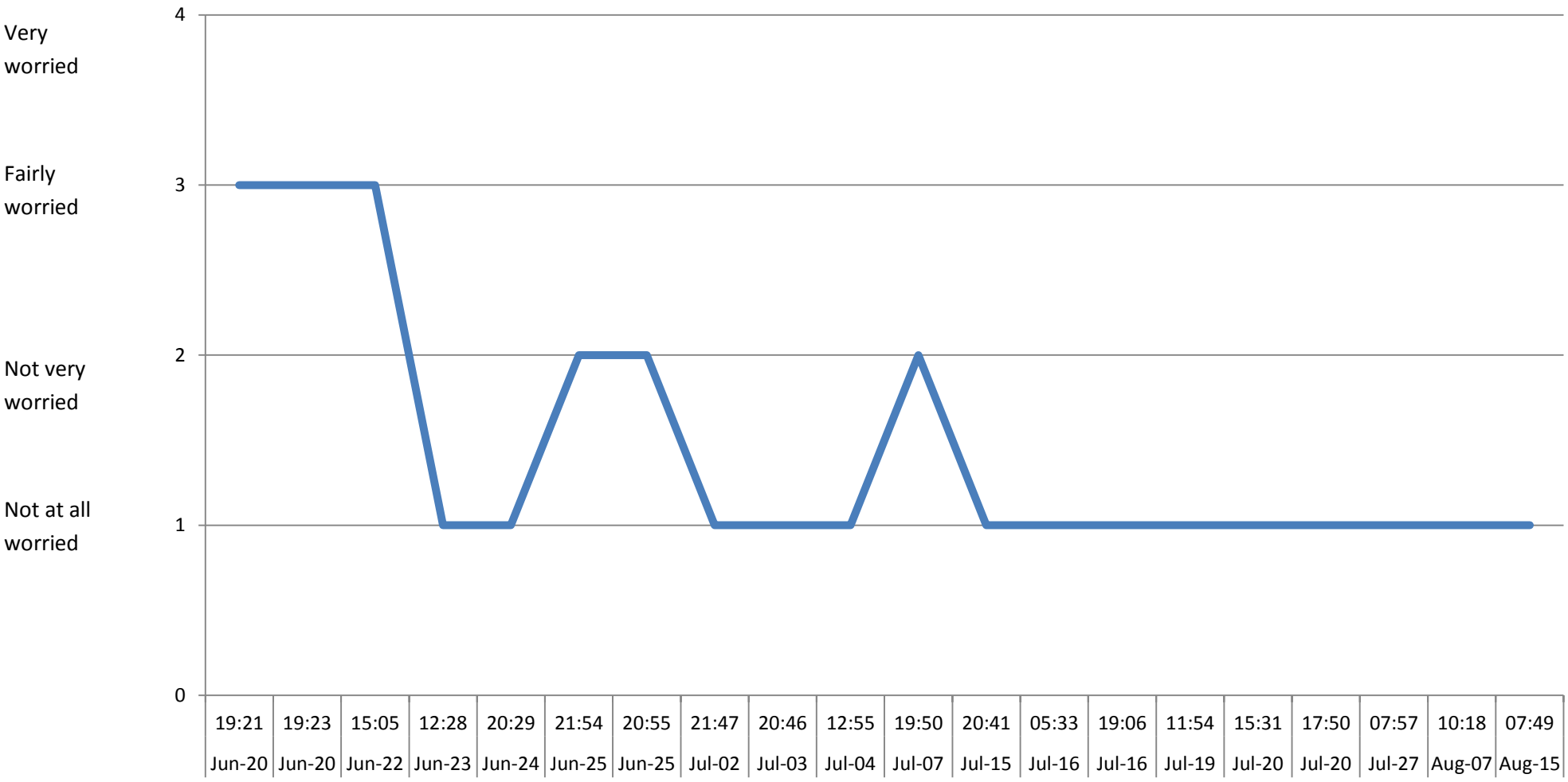

Figure 4: One participant's fear of crime over the trial period (1 = Not at all worried, 4 = Very worried)

Figure 5: Detail in one individual's fear of crime map

Figure 6: Maps of the same area by all participants