8 Tracking via Bluetooth and Wi-Fi

What this chapter will cover:

- The process of collecting big data via WiFi and Bluetooth.
- Methodological limitations on both methods in terms of capturing media access control (MAC) addresses.
- The contributions that these forms of data have made in understanding sequential visitor movement, crowding and its applicability both indoors and outdoors.
- The limitations with these forms of big data.
- The ethical issues associated with tracking via Bluetooth and WiFi.

Introduction

The technique of tracking tourists' mobility using Bluetooth and Wi-Fi technology has emerged as a reliable and viable option for tourism planners and researchers (Shoval and Ahas, 2016; Musa and Eriksson, 2012). Recent studies have employed Bluetooth to measure the time it takes for people to pass through security (Bullock et al., 2010); assess movement flows at festivals (Versichele et al., 2012); and explore movement through cities (Verischele, 2014). Bluetooth has also been used to track high speed movement, such as car and cyclists, whereas

Wi-Fi scanning, which takes a longer time to capture a signal, has been used to assess the flows of slower moving objects, such as tourists on foot, or other pedestrians (Abedi et al., 2013).

Tracking using Wi-Fi or Bluetooth offers researchers the ability to track vast amounts of data on movement in a relatively short period of time. Verischele et al., (2012) describes the scanning of Wi-Fi and Bluetooth signals as 'non-participatory' research because individuals are not required to sign up and participate to studies of this nature, nor are they aware they are being tracked. The advantage of this approach is that tourists do not change their behaviour because of the knowledge that they are being tracked.

This chapter will now review these forms of tracking technology, along with their advantages, limitations and ethical implications.

How tracking using Wi-Fi and Bluetooth works

All devices with Bluetooth and Wi-Fi functionality have a unique media access control (MAC) address (Kurkcu and Ozbay, 2017). These MAC addresses can be picked up by a Wi-Fi/Bluetooth scanners that are equipped with an SD memory card to store the data. Each form of tracking will now be addressed.

Bluetooth is known as a technology that uses low power, is robust and low cost (Song et al., 2008). It is estimated that between around 8-12% of mobile phone users can be detected using Bluetooth technology (Brennan et al., 2010). Interestingly, this form of data collection relies heavily on devices such as car-kits with Bluetooth capability that are in discovery mode – when they are trying to pair with a phone or another device (Kurkcu and Ozbay, 2017; Addinsight, 2017). Once a smart phone has paired with a car stereo, for example, it is no longer in discovery mode – this is the reason why Bluetooth scanning only picks up about 8-12% of total traffic. The device only has to be near the scanner for a few seconds to be discovered (Addinsight, 2017).

Wi-Fi scanning is similar in that it uses passive scanners that detect phones when they are looking for an access point. This happens about once every 60 seconds when Wi-Fi is enabled. Therefore in order to

detect a Wi-Fi signal, phones need to be in the range of the scanner for around a minute – this requirement means that Wi-Fi tracking is most suited to pedestrians (Addinsight, 2017). For this reason, the technique of tracking via free Wi-Fi is very common these days – it is provided as a free service, but many providers use the service to collect data on movement through free Wi-Fi zones, provided users give consent when they sign on (see Figure 8.1).

Figure 8.1: A portable Bluetooth and WiFi scanner unit secured to a roadside pole. The battery operated sensors can collect data for several days at a time. This is TrafficBox from Smatstraffic, www.smatstraffic.com.

While it has been argued that Wi-Fi can capture data from phones from about 400m in optimal conditions (Fukuda et al., 2017), but most commonly both forms are cited as being able to reliably connect to phones or other devices from around 10-20 metres away (see Kurkcu and Ozbay, 2017; Oosterlincka et al., 2017). If scanners are carefully deployed to ensure good coverage, then the data can be much more granular than mobile phone tracking, thus facilitating detailed explorations of spatiotemporal behaviors (Versichele et al., 2014). Once scanners connect with Bluetooth or Wi-Fi, they collect data, including the MAC addresses of the phone, the date, time, and the location of the scanner (Arreeras et al., 2019). This data is then stored, or sent from the scanners onto servers in real time or in intervals.