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Traveller engagement with aircraft flight tracker applications

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Abstract: In exploring flight trackers through a mobility lens, this study is situated at the nexus of the movements of people and objects, near real-time location-based navigational technologies, cartographic and mobile digital applications, and flows of information. Flight tracking applications (apps), allow users to see where aircraft are at any given moment from digital devices such as smartphones, yet little is known about their use, a gap which this paper starts to fill. This qualitative survey provides new insights into people's actual day-to-day use of flight trackers. Within the context of critical mobilities and the right to information and movement, findings indicate (un)equal access to, and use of, flight trackers. Implications for the travel industry, particularly airports and airlines, include effectively integrating flight tracker and other information, through the digitalised and co-ordinated development of a seamless door-to-door journey, to enhance the experience for all travellers.

Key Words: *aircraft flight trackers, flight status, mobile applications (apps), smartphones, smart airports, airlines, aeromobilities, digital mundane.*

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Introduction

Airlines and others in the travel and tourism industry are increasingly developing apps incorporating flight trackers which allow people to locate and identify aircraft remotely and in near real-time (Wang et al., 2011; 2012; Flightradar24, 2024). Despite this, very little is known about people's use of flight tracker apps. This gap is surprising, given the extensive reporting of the technical development of aircraft flight tracking capabilities (e.g. Sidorov et al., 2018; Braeken, 2019), and a rapidly developing area of research on mobilities, including tracking tourists (Shoval and Ahas, 2016; Hardy et al., 2020; Lewis et al., 2021;

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Chen et al., 2024), 'following people' (Breines et al., 2021) and 'things-in-motion' (Hui, 2012). There is also now an extensive literature on the general use of smartphones and mobile applications (apps) in travel and tourism (Florido-Benítez & del Alcázar Martínez, 2015; Dorcic et al., 2019; Mehraliyev et al., 2020; Birenboim et al., 2023). Yet, to our knowledge, this paper is the first to explore people's use of flight tracking apps, the key outcomes of their utilisation on the behaviour of users and the implications for the travel and tourism industry.

Our exploration of the use of flight trackers is situated in the wider context of interactions between technology, mobility and society (Sheller & Urry, 2006; Sheller, 2021). In viewing flight trackers through a mobility lens, this work is positioned at the interface of the movements of people and objects (such as aircraft), near real-time location-based technologies (flight tracking), cartographic and mobile digital applications (flight tracker apps), flows of information, and their impacts on key travel and tourism operators, particularly airlines and airports. At present, there are multiple calls for a better integrated, more seamless, multi-modal, end-to-end (OECD, 2020)/door-to-door [D2D], experience for travellers that is underpinned by advanced digitalisation (Halpern et al., 2021; Halpern, 2022), of which flight tracking is an integral part. Such an enhanced experience for travellers entails closer cooperation between mobility producers, services, and shared digital platforms (World Economic Forum, 2014; Taneja, 2019, 2020; Kluge et al., 2020; OECD, 2020).

Furthermore, within the setting of critical mobilities and mobility justice (Massey, 2005; Hannam et al., 2006; 2014; Verlinghieri & Schwanen, 2020), we reflect on issues related to the exclusionary capacity of technologies (Agur & Babones, 2021; Adey et al., 2024), such as: (un)equal access to flight tracker apps, about who does/does not use them, and how these might impact on the greater uptake of flight tracking location-based navigation and associated services. These are directly related to both the equal 'right to movement' and the 'equal right to information' (e.g. Massey, 2005; Frenzel, 2022), particularly how these may be realised in future developments in the use of near real-time flight status information, and removal of existing barriers, to make it accessible for all.

Rossetto (2021) reports on how maps convey movement of both humans and non-human objects and are encountered as tools which help people navigate spaces. Flight tracking locates specific objects (aircraft) and by extension people travelling within them. It is distinctive in tracking aircraft (mostly) in the air from below, rather than tracking a ground-based mode of transport. Our work complements already well-developed studies of tracking and the mobile mapping of ground-based transport modes such as ships (including cruise liners), buses and taxis in terms of user engagement and accessibility via digital devices and smart mobility (Buhalis, & Amanranggana, 2015; Hunter et al., 2015). It also complements recent research on tracking individual tourists' movements at tourist destinations (Hardy et al., 2020; Lewis et al., 2021).

Surprisingly, the map and mobility nexus has rarely been acknowledged, despite the use of maps via (often portable) digital devices becoming a common part of our everyday lives (Rossetto, 2019, 2021; Liu & Chen, 2023; Hanchard, 2024). Hanchard (2024) states that digital maps 'anchor' the movement of humans and objects in everyday life, albeit partially. Rossetto (2021) and Hanchard (2024) both highlight the need for more research into the different ways in which maps and digital maps are used. Our study of flight trackers not only provides insights into users' engagements with them but also further illustrates the 'digital mundane' (e.g. Jansson, 2022), defined by Leszcynski as the "ordinary and taken-for-granted digital objects, practices, productions, and sites that significantly both mediate and are mediated by everyday lives and spatialities" (Leszczynski, 2020, p. 1194). That

flight trackers and people's engagement with them have been overlooked is in itself an indication of the digital mundane operating 'in plain sight' and under the research radar.

In adopting and applying qualitative techniques in the study, we delve into the detail of individuals' use of flight trackers. This approach enables us to listen to, and hear, the voices of flight tracker users about their engagement with, and perspectives on, these apps. It provides insights into the 'how and why' of their use, which can have spatial (movement) and temporal (time) impacts during transit. Our work seeks to better understand facets of tourists' and others' journeys, which impact on immediate travel experience (e.g. journey planning) and, more widely, on travel experiences *en-route* to the destination. It is also well-positioned to address recent calls by McKercher et al. (2021), to use qualitative techniques to advance understanding of tourists' use of time, and why they do what they do while travelling.

Thus positioned, the principal aim of our study is to understand how and why people use and interact with aircraft flight tracker apps. Key objectives are to identify which, and how, flight tracker apps are used, and explore people's perspectives on them. We start with the intersections between flight tracker apps and mobile apps in travel and tourism, before presenting our results and discussion of the implications for the travel and tourism industry.

Contextualisation

Flight trackers have novelty, not only as concept to inform about which and where planes are flying, but also through cartographic innovation (showing pictorial images of planes moving along their flight trajectory), in real or near real-time. Their creation and delivery modes as apps, have generated new and readily available sources of locational-based information about flights. Flight tracker apps provide yet more evidence of how technical innovation creates new spaces of interaction, particularly between people and digital technologies, such as smartphones and apps (Crampton, 2009; Wilson, 2012). They also, as do other forms of digital maps, present opportunities for new social and cultural practices and for the reconfiguration of current means of knowing and doing space (Hanchard, 2024).

The development of flight tracker apps is positioned within the context of rapid growth in the use of smartphone apps in travel and tourism (Budd & Vorley, 2013; Lu et al., 2015; Dorcic et al., 2019; Kang et al., 2020; Birenboim et al., 2023). In 2012, there were 300,000 apps in Apple's App Store (the pioneer commercial developer of location-based services) (de Souza e Silva & Frith, 2012) and more than 150,000 apps in the Android Marketplace (Shanklin, 2011). By March 2021, in Apple's App Store, travel apps ranked 7th (3.76%) in terms of popularity, by share of Apple Store apps (ca. 67,680 apps) (Statista, 2021).

Flightradar 24 established in 2006 in Sweden, has become "the world's most popular flight tracker" (Flightradar24, 2024). It is the leading travel app in over 150+ countries, with 75+ million app downloads. It is also the number one app in the App Store in over 130+ countries with 4+ million users per day (Flightradar24, 2024). Over 200,000 flights per day are tracked and it is also the most used flight tracker by users in the aviation industry (including Airbus, Boeing and Embraer) (Flightradar, 2024). FlightAware, set up in the USA in 2005, claims to be the largest tracking provider in terms of users, with over 10,000 aircraft operators and 13 million passengers (FlightAware, 2024). Other prominent flight tracking businesses include FlightView, Plane Finder and Flight Stats. Some travel apps, such as Flight Board, TripIt and GateGuru, have in-built features designed to provide flight tracking, in addition to features such as airport maps, and plane seating plans.

Richardson (2020), and Rose et al. (2021), have argued that people's interactions with apps are always embodied, while others have pointed to the temporal and spatial implications of technology-people interactions (Elwood & Leszczynski, 2013; Kitchin, 2019; Liu & Chen, 2023). Apps in general have become deeply embedded in everyday life, are centrally positioned within many people's daily habits and routines and are a facet of the digital mundane (Leszczynski, 2020; Lupton, 2020; Clark & Lupton, 2022). Our research seeks to provide insights into how flight tracker apps are being used in facets of people's travelling (and other) lives and are being integrated into routine mobile practices associated with air travel.

We suggest that flight trackers offer opportunities for exploring a fundamental gap in knowledge and understanding about the spatiality of the movement of planes (and by extension, people) in the air, and the implications of observers on the ground 'seeing from below'. In comparison to the scant attention given to 'seeing from below', there is an extensive literature (Budd, 2011; Wilts, 2020) on the ways and implications of viewing the world from the air, i.e. 'seeing from above' (Adey et al., 2007, p.776). In one of the rare theoretical explorations of the impacts of flight trackers on people, Curtis (2013) reports that the search for what planes are flying overhead, the carrier, flight number, and number of passengers is an example of the translation of a person's environment into their choice of mode of information seeking. Enabled by location aware and located mobile devices, flight trackers thus create opportunities for a person's individual 'ego-centric' (Meng, 2004) utilisation of spatially enabled technology and mobile maps, in which they use available data for their own specific purposes. However, to the best of our knowledge, no research has so far attempted to identify why people engage with flight trackers and how they may add to the overall travel, or other, experience.

Although flight trackers are incorporated into an array of travel apps (Budd & Vorley, 2013), they are sometimes not referred to as flight trackers *per se*, but as software providing information about 'flight status'. Such flight location information is available for use by those engaged in travel activities, and interested others (such as plane spotters), through airline, airport and more general travel apps or as stand-alone flight tracker apps. Moreover, flight trackers are readily available for general browsing, as well as information finding, if people seek, and have access, to use them. By extension, the use of flight trackers is not only a way of tracking planes, but also a means through which the whereabouts of those travelling may also be tracked, with all its implications (e.g. Shoval & Ahas, 2016; Pentaraki & Speake, 2024).

One of the characteristics of air travel, as with other modes of transportation, is the way in which the spatial and temporal linearity of the journey also includes stop-start activity with intermittent breaks and waiting (Bissell, 2007; Schindler, 2020). Time and timing features prominently as travellers move along the spatial trajectory towards their destination (Bissell, 2007; Schindler, 2020). From the start of their journey until the end, travellers look to the future, their anticipatory actions and activities being contingent on where they should be and when. From the commencement of their journey until they have arrived at their destination, the spatial and temporal nature of their travel is determined by flight status such as expected times of departure and arrival. Changes to flight status can impact on, for example, (pre-booked) taxi or rail connections or other people waiting for them throughout their end-to-end journey. Access to and use of appropriate information regarding flight status contributes to current and future actions. Flight tracker apps are one such information source which can help inform travellers and enable them to adjust to changing travel circumstances if needed. Ayaß (2020) has reported that periods of mobility inactivity/waiting are part of future-based action based on an in-order-to motive. In the case of air travel this can relate directly to flight status.

During a traveller's journey, periods of immobility and waiting occur. However, this waiting including for flights, is one of many everyday waiting scenarios which have tended to be overlooked by researchers (Bissell, 2007; Ayaß, 2020; Schindler, 2020). What people do whilst waiting can be mundane with various technologies being co-opted (Bissell, 2007, Schindler, 2020, Murphy et al., 2023), of which flight trackers are an example. It has been reported that at airports, the use of digital devices by travellers to surf the internet, watch movies etc. are popular ways to spend, use and not waste time (Blichfeldt et al., 2017).

When such activities, whether whilst waiting or on the move, include the search for information it can be multi-faceted, involving the quest for facts, detail and self-absorbed busyness. Curtis (2013) equates this to finding something to do when in crisis or bored. Like Curtis we draw on Heidegger's concept of *Dasein*, of 'being there' and the 'always-in-the world' relationship between human beings and the world in which they live (Heidegger, 1996), to do something, find out more, and to make things (sometimes more uncertain and sometimes risky) feel better and more controlled. Since smartphones and mobile technologies have become part of many people's lives, they are clearly part of people's everyday 'being in the world' and impact their engagements with and reactions to it. For example, Liu & Chen (2023) reported that people's everyday engagement with digital devices and technologies are associated with emotions and that unforeseen changes, such as information related to flight punctuality and delay can both contribute towards as well as alleviate anxieties associated with people's mobilities.

Similarly, in their study of affect and emotion in air travel, Xu et al. (2024) identified that worry and anger are particularly involved by flight delays. Re-appraisal of a delay scenario may mitigate a traveller's adverse emotional responses and the provision of updated information including those provided by flight trackers may be a means by which travellers can better cope with associated unexpected wait times and flight status changes– both at airports and at other points along their journey.

For most air travellers, their journey is typified by stop-start mobility/immobility and waiting with its accompanying uncertainties. Their journeys are often far from seamless and smooth even though seamless mobility has been largely sorted for top-end travellers (Taneja, 2019, 2020) and the question how can this be done *for all*? remains. We suggest that there is a long way to go in equalising the contrasting experiences of the business user and those travelling 'economy', to deliver an equally seamless digital customer experience *to all*. The OECD (2020) calls for the engagement of the travel and tourism industry, notably airlines, airports, travel providers and tourism services, in the management of the total process. However, as Schmalz et al. (2021) have suggested, the attainment of seamless travel may be hindered by rivalry between powerful service providers as they compete for control over travellers' knowledge and the maximisation of profits.

Conceptualisation: Envisioning integration of flight tracker information in air travellers' end-to-end journeys

In this section, we develop and present our conceptual framing on how flight tracker information can play an integral part in air travellers' end-to-end journeys. Our conceptualisation centres on the utilisation of flight tracker information for travellers themselves and those engaging with travellers at specific points during their outbound and inbound journeys. In this conceptualisation, we suggest that flight tracking/flight trackers and (by association) flight status information occupy a pivotal and central role in air travellers' end-to-end journeys.

For airports and airlines, the relationships between people and technologies, including location-based services during this time of swift technological change, are being reconceptualised (Taneja, 2019, 2020; OECD, 2020; Halpern et al., 2021; Sheller, 2021; Halpern, 2022; Şahin, 2024). Questions emerge including, first, about how airports and airlines might develop their information sources, given the increasing diversity of information now available to travellers and other users. Secondly, how to optimise the opportunities for convergence of digital technologies between individual and collective use, as part of the current cultural and commercial environment (Florido-Benítez and del Alcázar Martínez, 2015; Urry et al., 2016).

In terms of information and instruction, given the paramount importance of safety and health issues in the aviation industry, it is crucial to find the most appropriate and uncompromised balance between the vital real (for service providers) and novel virtual (increasingly expected by users). We argue that in time, and in line with software developments in the filtering of information, the use of cookies, and personalised, targeted information (Pariser, 2011; Curtis, 2013; Taneja, 2019, 2020; Şahin, 2024), flight trackers will continue to provide alternatives to, be used in addition to, and even replace, other sources of locational and travel information, both on the ground and in the air.

For travelling users (those flying), currently information about flight status is principally available to them whilst on the ground, for example, whilst waiting for flights. However, when in-flight, and especially when using airlines without in-cabin flight tracking displays, the travellers themselves have less information about their location and flight details, than flight tracker users who are themselves not flying, but tracking flyers' journeys for purposes such as meeting travellers on arrival. Thus, currently, the ability to 'see from below' (when on the ground) is, in many cases, greater than the ability to 'see from above' (when in the air). Moreover, technological advances may lead to more air travellers being able to access such information individually, via apps, whilst *in* flight. Already, apps such as The Flight Tracker and Inflighto enable passengers to follow their route and other flight details when airborne.

It is at airport terminals, both inside and in immediately proximate locations, such as car parks and drop-off/pick-up spaces, that the use of location-based services, including flight trackers, interfaces with public space and its users. One emerging challenge for airports and airlines is how to better integrate the (less regulated) individually accessible information from the flight tracking providers, with their own (more regulated) non-digital information for travellers. How this is achieved is important to maintain critical baseline information for all travellers, regardless of whether, or not, they have access to flight tracker apps and other near real-time location-based services. Ensuring 'equal right to information' for all, during the digitalisation of air travel and increased provision of near real-time flight status information, is vital.

For airports, in which individual access to digital flight-status information is increasing but not available to all, there is still the need to provide fundamental, collectively accessible, flight information. This includes the identification of what key information should be provided, for example, via information boards, arrival and departure times, and gate numbers. In time, upgraded systems and integrated digitalised information platforms, which incorporate flight tracking/flight status-based data, should be freely available for all. Our work stipulates that this should include detailed information about estimated time of arrival (ETA), based on the current location of inbound planes (from flight trackers), with accompanying reasons for early arrival/ delay etc. (from other sources). Such upgrading of collectively and individually available information about flight status and location information would also be of benefit to airport ground staff and air crew, some of whom

already use commercial flight tracker apps to supplement more conventional flight information made available to them by the airport and airlines.

Nair (2020) highlights the importance of the interface of services with flight precision time. Around this, other air travel stakeholders such as taxis, public transport, hotels, aim to provide the right services at the right time – not just by flight number but by passenger (Kluge et al., 2020). This complete service starts from the pre-trip and planning stages and extends throughout the journey and beyond (as in the provision of planned itineraries for tourists' activities and related travel at the destination) (Lewis et al., 2021).

Figure 1 envisages the conceptual framing of this work about how flight tracker information can play an integral part in air travellers' end-to-end journeys. Our conceptualisation centres on the utilisation of flight tracker information for travellers themselves and those engaging with travellers at specific points during their outbound and inbound journeys (e.g. taxi pick-up/drop-off, friends and relatives tracking flights).

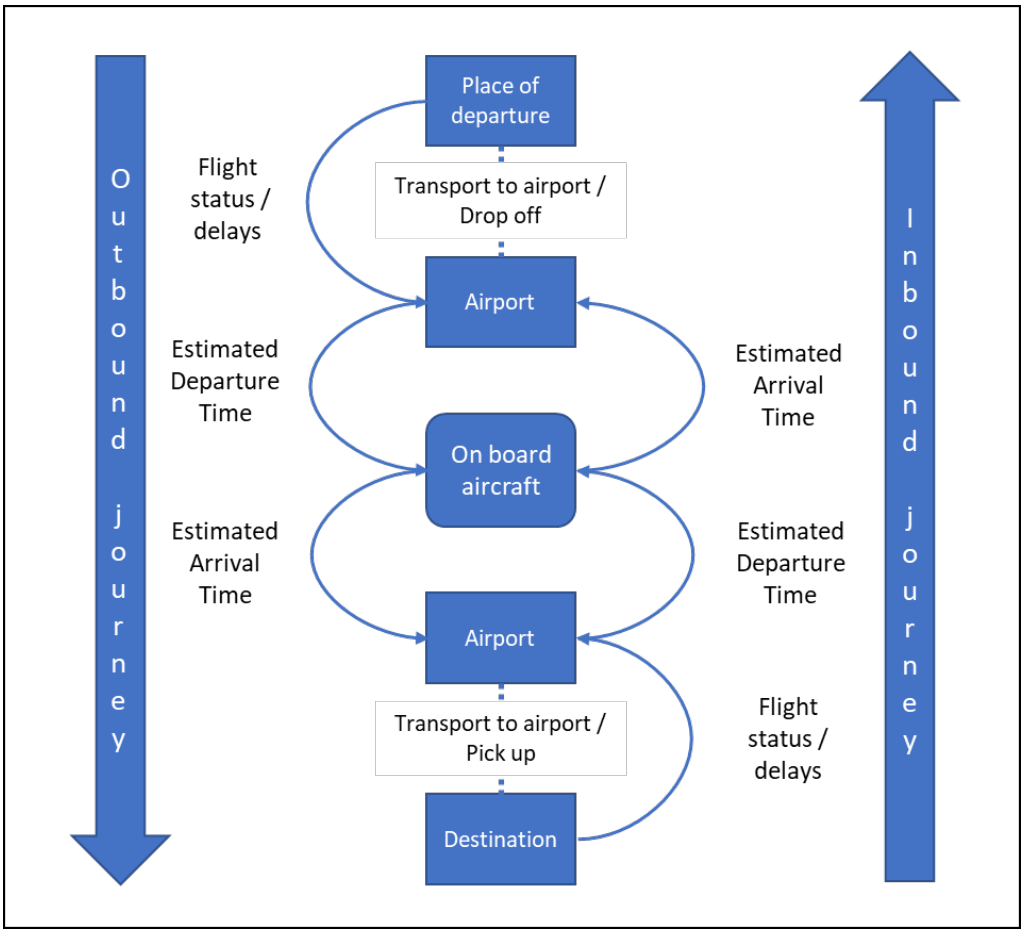

Figure 1. Integration of flight tracker information in air travellers' end-to-end journeys

Figure 1 illustrates how the use of flight trackers intercepts and intersects at various key points within the traveller's journey when the need for locational information from flight trackers may arise. At its core is mobility as service, within the setting of the traveller's complete end-to-end journey with flight-status information playing a key role, suggesting a need for integrated information.

Multi-modal transportation information needs in general, as well as more specific elements such as flight information display systems (FIDS), are centred on integrated information. The detail needed is often related to travel status (i.e. flight status, flight updates), a point also highlighted by the OECD (2020). Streamlining integrated information mitigates the impacts on movement of unexpected incidents such as delays, through more efficient use of time and space throughout an end-to-end journey for travellers, service providers and others.

Despite the logic of these framings, and the overarching context of mobilities associated with the movement of people, objects and technology, there is a lack of empirical material to illuminate the nature of the real-world use of flight trackers generally and more specifically, within the setting of travel and tourism. In the next section, we outline the approaches taken in our exploration of the use of, and perspectives on, flight trackers.

Methods

Informed by previous research into the attitudinal dimensions of navigational technologies (Axon et al., 2012; Speake and Axon, 2015), we focus on the perspectives of users as an evaluation reaction to the utilisation of flight trackers, as well as their experiences of using them. Ethical clearance for the project was obtained from the relevant University prior to the commencement of the research. This qualitative study identifies and explores people's use and interactions with flight tracker apps principally by using qualitative techniques and descriptive statistics. A researcher administered paper-based questionnaire survey was conducted in Liverpool city centre, UK, between mid-January and mid-February 2018, with a total of 400 respondents. Two locations in the city centre, Church Street and Whitechapel, were chosen in order to obtain an indicative set of results from a diverse adult population (over 18 years of age), using convenience sampling as a form of non-probability sampling (Etikan et al., 2016).

The key tools were primarily qualitative thematic analysis (Braun & Clarke, 2006, 2023), as well as descriptive statistical analysis. The thematic analysis of participant responses to the open questions involved tabulation of results and themed coding by the researchers. There was cross-checking between the researcher coders to ensure consistency and accuracy in interpretation. In reporting the results, the words of participants are narrated and are attributed in abbreviated form of their numerical and anonymous attribution (for example P10 is the tenth person, in ascending chronology, to participate in the survey).

Results

The outcomes of the research are presented in three sections: participant flight tracker app use, their perspectives on the apps, and the perspectives of flight tracker non-users.

As a demographic overview, of the 400 participants who completed the questionnaire (35.5% n = 142) said that they use/had used, and 64.5% (n = 258) that they had never used a flight tracker app. Of the latter category, approximately one third did not know what they

were and the remaining third knew what they were but had never used one. A total of 54.4% (n = 218) were female and 45.5% (n = 182) male. Most participants were within younger age categories i.e. 18-29 (30.5%) 30-39 (19.75%), 40-49 (22.75%), with fewer in older age categories 50-59 (18.75%), 60-69 (6.25%) and over 70 (2%) (Table 1).

Table 1: Demographic overview

Sample characteristic	Frequency	%
Gender		
Male	182	45.50
Female	218	54.50
Age (years)		
18-29	122	30.50
30-39	79	19.75
40-49	91	22.75
50-59	75	18.75
60-69	25	6.25
Over 70	8	2.00
Flight tracker use		
Use/have used	142	35.50
Don't use/have never used	258	64.50

n=400

Flight tracker app use

Travellers and/or flight observers used a flight tracker to locate *specific* flights and did so relatively infrequently, on average between four and six times a year, when they themselves or when someone they knew was travelling. They also used flight trackers to find out details of aircraft, routes, speed and altitude, as well as plane-spotting, although only two participants described themselves as a 'plane spotter'. FlightRadar24 was both the most frequently used (by 37%) and the preferred flight tracker, followed by Plane Finder (18%) and FlightAware (14%). This broadly reflects the market pre-eminence of these flight tracker providers. Other flight trackers mentioned included airline apps such as easyJet (using Flightradar24) and Emirates and on travel planning apps like Trip It and Kayak. The reasons for using their flight tracker of choice were them being crystal clear, ease of use and having good graphics. However, 24% did not know what apps they had used, which may suggest, amongst other reasons, that they did not use them often enough to become familiar with them.

Most participants accessed flight trackers via apps on mobile phones (89%), rather than other digital devices, largely for portability and ease of use. If not able to access flight information via these preferred means, the most frequently used alternatives to flight tracker apps were internet-based airline and airport sources (35%), although just over a quarter stated that they would use airport information boards if a flight tracker app was not available. Nonetheless, flight tracker apps and airport departure and arrival boards serve different purposes. Airport information boards provide information to travellers on what they need to do and when and where to go (such as check-in and go-to-gate). This information informs travellers and ensures the airport runs efficiently by moving people through the system as quickly and effectively as possible.

Main forms of flight tracker use

In their preference for using flight trackers on smartphones, users show how digital technology is being utilised in day-to-day activities (Agur & Babones, 2021; Gössling, 2021). Users' main interest in flight tracker apps was to find out what is happening to *specific* aircraft, for example, knowing the *exact* location of the plane. Other reasons for flight tracker use included journey planning and whiling away time at an airport. Three main themes associated with participants' use of flight trackers were: checking flight status for themselves or others, checking a friend's or relative's flight, and knowing a flight's arrival time.

Theme 1, checking flight status, i.e. 'knowing plane location' for themselves or others, was the main theme, with for example, over 80% of participants stating checking for delays to a flight was very important or important. With a flight tracker app, users can see exactly where a plane is in near real-time and hence gauge its departure time. Situations in the airport, where people know they are going to be delayed, but do not know for how long, can be frustrating without such information. With the flight tracker information, they can plan time better. Much of this, as found in studies of user engagement with other digital mapping technologies and mobile devices (Speake, 2015), may be associated with their perceived knowledge, sense of control and power in unpredictable circumstances.

Theme 2, tracking friends or relatives' flights, was classified by 51% as 'very important' and 32% as 'important' to them (almost twice the percentages for tracking others, including business contacts). One of the reasons suggested for the concomitant 'peace of mind' and that 'they are 'safe', is that users could see where the plane was and know when it landed. While the phrases 'generates peace of mind' and 'creates a sense of security' are similar, participants indicated that they used the apps more for generating peace of mind, rather than to create a sense of security. This may be because flight trackers provide up to date information on the whereabouts of the plane (and therefore the traveller), thereby alleviating potential anxieties. As P284 perceptively stated, it *'doesn't actually mean that they are safe'* and, as P22 commented, it can *'give a false sense of security'*.

Theme 3, knowing a flight's arrival time, was considered as important for planning to meeting people (both business and recreation linked) on landing. Without flight trackers or access to online flight updates, flight delays or early arrivals might not be known about beyond the airport. With a flight tracker, the location of the plane can be seen, its landing time gauged and the time for passenger pick-up be better arranged. The person meeting the passenger thereby has, and feels they have, more knowledge and hence, control. Given recent increases in airport parking charges, and the abolition of many free drop-off and collection points in the UK and elsewhere, having an accurate ETA at the airport can be crucial, both in terms of time and money. The use of flight trackers for identifying ETA for users when travelling themselves was barely mentioned. When in flight, people often have no way of communicating their location and ETA to people on the ground. This is only possible if Wi-Fi is available on the plane and/or if the plane has in-flight entertainment screens showing the route/position of the plane in flight.

When asked how they would feel if they could not use a flight tracker app, most stated they would feel 'fine', or 'not bothered'. Those expressing concern, said that they would be 'worried' about the person on the plane. Other common responses included, 'inconvenienced', 'frustrated' and 'annoyed'. These affective reactions, are in line with research on other digital mapping and navigation technologies (Speake & Axon, 2012; Speake, 2015; McCullough & Collins, 2019), and suggest reliance on the technologies associated with the flight tracker app. Not having it implies having to find other (less convenient, less accurate) ways of gathering the information needed. These observations

open up areas for further study on the behaviour and alternative actions tourists and others would take if their smartphone apps were unavailable.

Main forms of flight tracker use

Participants were asked to rank (from three to one in descending order) the importance of positive and negative attributes of their experiences using the flight tracker app and to suggest any improvements that they thought were needed.

Positive aspects of flight tracker use

The most positive aspects of flight trackers (Table 2) related to the technical capacity of the flight tracker to report flight information in near real-time, updates on flight status and details about the plane and route. The next related to operational characteristics, such as ease of use and convenience. Financial costs were at the bottom of the list.

Table 2. Positive aspects of flight tracker use

Positive aspects	Rank 3	Rank 2	Rank 1
Real time	54	35	23
Flight status	22	22	10
Airplane details and route	14	13	11
Ease of use	10	4	5
Allow to plan for pick-up [at airport]	7	3	9
Fun	6	6	10
Convenience	6	8	4
Peace of mind	5	6	3
Price	1	1	2

Excludes no answer
n=142

First, in terms of technical capacity of flight trackers, most of the positive aspects were related to, for example,

(a) the provision of live flight information, [it's] … '*real-time …true, not giving incorrect details which often happens in airports*' (P2);
(b) updates on flight status giving '*more accurate arrival time*' (P24), '*ability to track flights which people I am expecting are on*' (P40), '*Tracking family flights taking off … tracking where the flight is and if it's safe*' (P250), '*know that if a friend/family is going to be delayed or arrived safely*' (P122);
(c) details about the plane *'[I] get to see lots of details about cool planes*' (P76);
(d) the route '*[I can] see where the plane is on a map*' (P41), '*see instantly where the plane is in the sky*' (P305).

Secondly, on operational features, users made comments such as '*ease of access'*(P36), '*it's at my fingertips*' (P33), it is '*graphically appealing*' (P60), and '*Don't need to be at airport to know status of flight - can be accessed from anywhere*' (P397). Others indicated that they were fun to use – both in operation and details shown. Finally, price was ranked

last, possibly reflecting that the flight trackers used by most participants were free to use, not precluding the costs associated with smartphone use and data roaming.

Negative aspects of flight tracker use

The main negative dimensions (Table 3) can also be grouped into three categories; technical issues, operational issues, and issues surrounding safety. First, technical issues included the update of features such as flight status being slow, as exemplified by the following participants who commented about, for example, '*the apps crashing*' (P122), that the tracking is '*sometimes unreliable*' (P130) and that it can be hard to '*find the right plane*' (e.g. P123 and P139). There were also observations such as, [it] is '*not always easy to find the flight number where one route has different flight tags for example a Delta and Virgin flight could be DL or VS*' (P263). Other comments included, that the '*flight[is] not always on tracker even though listed*' (P262) and that '*take off is not always visible [and] it's easy to lose the plane you're tracking*' (P275).

Table 3. Negative aspects of flight tracker use

Negative aspects	Rank 3	Rank 2	Rank 1
Slow to update	24	7	7
Crashing [app or mobile device]	10	0	2
Ease of use	9	8	5
Needs Wi-Fi or data	8	6	4
Poor graphics	5	1	0
Privacy	4	1	0
Cost	3	2	2
Adverts	3	2	2
Battery drains	5	2	4
Other	5	2	3

Excludes no answer
n=14

Beyond the performance of the app itself, there were also negative comments about the technical capacity of the device onto which the apps are loaded, for example, the apps '*use up a lot of mobile data*' (P373), are '*battery hungry [when] using via smartphone*' (P178), frequent other comments about battery drain (e.g. P183 and P181), and implications for updating and data upload. The issue of app users and others having sufficient available free of cost opportunities to recharge batteries when travelling, is an important one and often under-catered for by travel providers, especially at some airports.

Secondly, operational issues such as '*… poor graphics when using map function, sometimes a delay when landing, does not continue to track flight when closed down and then reopened*' (P171) and that the picture on tracker is not accurate to the location (P383). Occasionally information on the flight tracker did not correspond with information available at the airport (P304). P278 also reported that flight trackers in use could be '*… a bit of a time stealer … start looking at other flights than the one you are really interested*

in'. That flight trackers could be a distraction whilst passing time in airports, was also noted.

Thirdly, safety concerns about flight tracking were raised from time-to-time, for example, P289 commented on the '*safety aspect and that tracking any flight is unsafe*'. Participant P333 was concerned with privacy relating to private jet owners, another (P182) that they could be dangerous in the wrong hands as '*military and sensitive flights could show up*'.

Ways to improve flight tracker applications

Users' suggestions for ways to improve flight tracking apps were clear (Table 4). Recommendations related to technical and operational dimensions, such as making the apps customisable, providing personal updates and simplifying them (i.e. the enhancement for an individual's specific use) and providing faster flight information updates.

Some examples of these suggestions are, to have a '*Flight tracker/airline combined app*' (P2), a '*database to track what planes I have seen*' (P3), a '*simpler user interface*' (P21), more instruction (P63), to '*make sure info is kept more updated – for some far-away places the app is very slow to get up to date info*' (P148), '*get notifications for specific flights*' (P194), '*Customise colours of planes*' (P261), '*use user's GPS locations as a quick button to see aircraft*' (P271). In the light of the observations about the non-use of flight trackers, one user suggested '*a TV channel for people without smartphones*' (P386).

Table 4. Ways to improve flight tracker apps

Improvements	Rank 3	Rank 2	Rank 1
Customisable/personal updates/simplify	20	6	0
Faster updates	14	3	1
Accuracy	3	2	0
Cost	3	0	0
Better graphics	6	2	3
Use less memory	3	0	0
Combine with airline apps	2	0	4
Other	5	3	0

Excludes no answer
n=142

Non-users of flight trackers

In exploring non-use of flight trackers, we start to address the call by Dorcic *et al.* (2019), for more insights into non-use of diverse digital technologies. In all, 65% (*n*=258) of the 400 participants in this study did not use flight tracker apps. Of the non-users, 54% were male (*n*=141) and 45.3% female (*n*=117) – almost identical in terms of percentage split to users. Just over half (55%) of non-users had never heard of flight trackers or flight tracker apps. Of the others who knew what a flight tracker was, 73% did not know the name of a specific flight tracker app, although those that did, named Plane Finder and/or Flightradar24.

The principal reason for not using flight tracker applications was that '*I am happy getting information at the airport*' (62%). Other reasons included the primary one of not owning/using a smartphone. Following explanation of flight tracker apps, non-users were asked if they would consider utilising them in future, 64% said that they would. The chief reasons given were to check flight delays and for tracking the journey during someone else's flight. Notably these were identical to reasons given by flight tracker users.

Overall, our key findings are, that people are curious about aircraft flight tracking and its capacity to enable them to find out about the location, and other attributes, of aircraft in near real-time. Those who used flight tracker applications, mostly did so to watch specific flights, their own or others', for reasons including creating peace of mind about the safety of a friend or relative, or as an aide to plan an airport pick-up. Few were interested in using flight trackers to see random flights, or flights unrelated to travel, except to those who were generally inquisitive about what is happening in the skies, and/or considered themselves to be 'plane spotters' or plane enthusiasts. The average (mode) frequency of flight tracker use of 4 to 6 times a year, could be attributed to travelling for holidays and/or business trips. Overall, perspectives on flight tracker apps were positive and knowing the exact location of the plane was considered the most beneficial aspect. The fewer negative comments were associated with users experiencing occasional glitches with the application software or performance. Many participants wanted the apps to be personalised, so that they could, for example, 'save' certain flights and get specific updates on them, such as push notifications. Most participants had not used flight tracker apps, and many did not know what they were. Principally, non-use was attributable to not having a smartphone, or being content to get information at the airport, although 64% thought that they would consider using a flight tracker app in future.

The survey of the use and non-use of flight trackers has revealed dimensions of their use, and perspectives about them, which have impacts on how, why and when people access information. In the following section, we discuss in more detail the implications of the findings, including those for the travel and tourism industry.

Discussion

This paper contributes new insights into the use of flight tracker apps. Prior to our study, research into people's use of flight trackers had been 'under the radar' of academic exploration. That this gap existed during the time of increasing uptake and use of flight tracker apps, is another indication of how such new technologies are incorporated, 'disappear', or are absorbed, into everyday spaces and use (de Souza e Silva & Frith, 2012), so much so, that, as part of the digital mundane we rarely think about (or study) them. Nevertheless, despite the negative connotations of 'mundanity' and the hitherto overlooked engagement of people with flight trackers, as we have illustrated the rising use of flight tracker apps has impacts on how and where people find the information they seek, and also on how information providers, such as airlines and airports, respond to such changing information-seeking behaviour.

As Adey et al. (2007) observed, through the generative relationship between human practice and technology, people's engagement with 'airspace' is continually 'beckoned' into being. In the case of 'airspace', this largely relates to the engagements of travellers, principally of air travel service providers and various technologies, including flight tracker apps. In a similar vein, Gössling (2021) relates how particular technologies affect the travel experience and give new meanings to places and travelling.

The provision of reliable, near real-time, location-based information associated with flight tracking and flight status, is intrinsic to the upgrading of the air travel industry to meet the passenger's complete mobility needs (Taneja, 2019, 2020; Kluge et al., 2020; Halpern, 2022). Bagie (2020), reports that the triad of people, process, and technology are key to successful transformation of airlines. Moreover, smart airports and new technologies are shaping the future of the air travel industry and de-complexing it (Taneja, 2019).

We have shown that within the overall air travel experience, flight trackers are often used on the ground 'in anticipation', whilst waiting for an event, such as flight take-off/flight-landing. The use of flight trackers provides both practical and emotional utility. Flight trackers create a sense for a person to be able to 'do something' to help themselves during waiting. In the context of airspace and airports, Serres (1995) likens people who are 'waiting' for information, to being in a state of suspension. Bissell (2007) similarly, refers to the experience of being in waiting and suspense. It equates to what Bull (2000, p. 43) has called the 'management of cognitive contingency', in aiding people in their traversing of spaces not entirely within their own control (Curtis, 2013). This aligns with what Heidegger (1996) calls a tranquillising effect, a feature alluded to by some travelling users in our study whilst they were waiting at or in airports or elsewhere. Also, as posited by Curtis (2013, p.137), it reflects *Dasein,* wherein bodies and practices are shaped as people seek to find out more and do things to ameliorate and take control during situations of uncertainty.

During users' waiting time, flight trackers' provision of near real-time information has impacts on users' sense of control, through being able to find out the whereabouts of a plane, its ETA, etc. and hence may influence subsequent actions. However, this wealth of information may create poverty of attention (Simon, 1971). Avoiding information overload and its accompanying condition, in which users are unable to make 'critical sequential interpretation' and/or 'emotional elaboration of the other.' (Beradi, 2009, p. 183), is important. For providers of flight information, this equates to making sure that vital information is clear and unambiguous, such as the use of globally uniform signage. Information providers need to tread a fine line between providing what is collectively necessary in the real and virtual worlds, and the detail, which individual users are becoming accustomed to accessing in the virtual world. Within the context of the use of flight trackers, the evolving synchronisation of near real-time data into travel behaviour is an area ready for further exploration.

We have highlighted that obtaining location related information during multi-modal travel, is currently an important role of flight trackers in passenger drop-off and pick-up (see Figure 1). Furthermore, flight tracker users' frustrations of having to use a variety of different travel apps on mobile devices, during one journey have emerged. Frustrations, which the introduction of more integrated travel apps to meet total mobility may begin to address. Our findings, and evidence from elsewhere (Gretzel et al., 2015; Kluge et al., 2020), suggest that people want more control over their travel and more personalised content. This is reflected in the notion of *smart experience* (Gretzel et al., 2015), which considers tourism experiences that are technology-mediated, as well as enhanced by personalisation, context-awareness, and real-time monitoring (Buhalis & Amaranggana, 2015). Kluge et al. (2020) report that people are drawn to operators of 'experience focused travel' platforms to meet their total mobility needs. Such an integrated platform approach needs to break down boundaries even more, through intelligent engagement platform(s)/contextual based suppliers, to enable managed, seamless, and consistent experiences for travellers. This also means doing more with phones and the 'pushing out' of reliable, accurate information such as 'a single version of the truth' relating to flight status (Taneja, 2021). Such channels of communication are important in the case of delayed

flights, rerouting and transfers between travel modes (Kluge et al., 2020), and which cut across different service providers. They also discuss the scenario of a near future app [note the use of the singular 'a'] which offers a time saving, connected personalised passenger journey throughout the whole travel chain. At its core, is the strategic relationship between airlines, airports, air traffic management, service providers, along with supportive political frameworks.

In sum, we contend that flight status precision, acquired through flight trackers, lies at the core of current and future development by service providers of a seamless air travel experience for tourists and others. Our study paves the way for future research on diverse dimensions of flight tracker use. These might include further exploration of flight trackers within the contexts of: Moving maps (Mills & Speake, 2021); maps on the move (Rossetto, 2021); user smart experience (Gretzel et al., 2015); surveillance and coercive control (Pentaraki & Speake, 2024). Finally, given the critical mobilities framing of our study, we call for more research to be focused on the removal of barriers to digital services and information in air travel (Sheller, 2021) so that they become equally accessible to all.

Conclusions

In exploring flight trackers through a mobility lens, this study is positioned at the intersection of the movements of people and objects, near real-time location-based technologies, mobile digital applications, mobile mapping, and information flows. We have acquired new insights into people's actual day-to-day use of flight trackers and identified how and why they are used, or not. We identify some implications for travel and tourism operators, particularly airlines and airports at a time of rapid digitalisation in the travel industry, in which flight trackers are an integral part of the digital infrastructure of air travel.

Despite the burgeoning literature on the use of mobile technologies and apps in tourism, until this study very little has been known about people's use and perspectives on flight trackers. Our study contributes detail on, and insights into, this surprisingly hitherto under-researched location-based information technology. Moreover, it adds another dimension to the areas of 'things in motion' (Hui, 2012) and 'following people' on the move (Hardy et al., 2020; Breines et al., 2021; Lewis et al., 2021). Flight tracking locates specific objects (aircraft) and people travelling within them and is akin to the tracking of other transport modes such as ships (including cruise liners), buses and taxis. Our work therefore also adds a new facet to this body of knowledge. Furthermore, flight trackers are distinctive in their tracking of aircraft (mostly) in the air, rather than tracking a ground-based mode of transport, which has been the primary focus of other studies to date.

Detailed information on flights and flight status is increasingly available to individual users, including travellers, airline, and airport employees who have access to smartphones or other mobile devices. We are moving towards a situation, as observed in wider travel contexts (Greenfield, 2017), where traditional wayfinding navigational and travel aids, such as public signage, are becoming less emphasised by designers and planners. These creators and constructors of physical spaces and places are factoring the increasing use of individualised mobile sources of information into their designs and extending links with location-based social networks (de Souza e Silva & Frith, 2012; Arup, 2021) in the drive towards, smart, digital, seamless, interconnected travel. Through these processes, the construction and use of physical spaces for travellers is being reconfigured. It has been suggested by design company Arup that the future air terminal will be smarter and optimise

passenger experience without expensive infrastructure, i.e. adopting a 'terminal light approach' (Arup, 2021).

Our insights into the use of flight trackers, within the context of a critical mobilities approach and the right to information and movement (Massey, 2005; Hannam et al., 2014; Verlinghieri & Schwanen, 2020), suggest that there is (un)equal access to flight tracking information. In part, this is because accessing it (especially when-on-the move) requires use of a smart mobile device (Sheller, 2021). Although the smartphone may be ubiquitous, it is by no means universal, due in part to (still) high financial cost implications for users (Traxler et al., 2022). Inequality of access to information may impact on expected greater adoption of flight tracker apps, other location-based information and their associated services. It also has repercussions for the uptake of individualised, smart, integrated, digitalised and seamless air travel initiatives which are currently under development. Implications, particularly for airports, include important location-based information remaining collectively accessible through, for example, flight information display systems, as the provision of individualised information for all travellers who seek to use it becomes more sophisticated.

Our work contributes to recent calls by Papatheodorou (2021) and others, for the extension and development of knowledge about the relationship and interfaces between air travel and tourism. It is also well-positioned in advancing understanding of tourists' use of time, and why they do what they do while travelling McKercher et al. (2021). Through qualitative research, we have contributed to providing a complementary approach to the current predominant focus in tourism on broad studies analysing big data sets - sometimes at the expense of the human dimension (McKercher et al., 2021). Applying qualitative techniques, we have listened to and heard the details of individual flight tracker users' perspectives on these apps. We obtained insights into how and why they are used, and have discussed their impacts, both spatially and temporally, on behaviour during transit associated with air travel. We are now in a better place to understand facets of tourists' (as well as and others') use of flight trackers, which impact on travel behaviour and planning throughout an entire journey from pre-trip, whilst *en-route*, to arrival and beyond.

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