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ORIGINAL RESEARCH

Explicating affordances in travel information search: investigating device use in relation to goals and personal characteristics

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Abstract

Despite increasing attention to technology development and its impact on travel information search, research about information search behaviours across multiple devices (i.e., smartphones, laptops, tablets, and desktop computers) has received limited attention. Guided by technology affordance theory, this paper examines the link between device use and information search goals, and the relationship between personal characteristics and device use. The study is based on two independent studies. Data were collected using a mixed-methods approach utilising an online survey and an online trip planning diary. The findings revealed that information searchers were essentially multi-device users and switched between devices based on their information search goals. Moreover, personal characteristics such as demographic characteristics, experience and personality influenced device use. The findings of the research shed light on the elusive concept of affordance to enhance the understanding of the complexity of device usage during travel information search.

Keywords Technology affordances · Information search · Multiple devices, information search goals

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1 Introduction

Understanding device use behaviour during travel information search is important from both practical and theoretical perspectives. From a practical perspective, device use affects when, how, in what form travel information is consumed, and in what fashion it should be provided. Device use patterns must be considered when creating marketing content because content typically displays differently across devices and might be consumed in different ways. For instance, short videos are often watched with the sound off on mobile phones because consumption frequently happens in public settings. A better understanding of device use behaviour also informs the design of information systems and applications to increase usability. From a theoretical perspective, understanding device use behaviour provides insights on how information search is realised and how it evolves over time. The impact of technology and device use on information search has been discussed in tourism literature (e.g., Kim et al. 2008; Tussyadiah and Wang 2016). However, scholars have mainly focused on specific devices, such as the smartphone and its impact on tourist behaviour (e.g., Liu et al. 2022; Kang, Hodice & Norman, 2020; Xiang and Fesenmaier 2020). Although, the emphasis on smartphones is important, recent statistics confirm that individuals are multi-device owners and have an average of 3.4 devices (Flagship Report, 2019). With growing ownership of multiple devices, individuals no longer use only one device, e.g., desktop or laptop, to search for information when planning a trip (Walsh 2014). It is increasingly common for individuals to start their information search on one device and to continue or complete the search on another device (Murphy and Chen 2016).

In addition, individuals select devices based on factors such as their level of comfort with the device, intent, and availability. Furthermore, individuals have diverse expectations of a device's usefulness depending on their goals, characteristics, and context of the use (Leonardi 2011). In this vein, the value of the device is determined by how users perceive the device in relation to their goals rather than being embedded in the physical artefact (Vargo and Lusch 2004). The notion that individuals use different devices to achieve varying goals is the basis for technology affordance theory (Leonardi 2011). Wu, Zhang, Tian, Wang, & Hua (2020) discussed that affordances are relational and therefore arise from human-technology interactions. Affordances are not properties of device artefacts or human users alone but emerge from their interactions (Majchrzak and Markus 2012). This means that the affordances and resulting value of a device are dynamic and perceived individually within concrete contexts.

Despite the importance of technology affordances for understanding travel information search behaviour and device use, there is still a lack of research specifically investigating multi-device use in travel information search from an affordance perspective. Admittedly, affordance theory has received limited attention in tourism. Fesenmaier and Xiang (2017) named affordance as one of the six factors of the tourism "experience production system." Similarly, Tomej and Xiang (2020) discussed the concept of affordances in addressing complexity in tourism service design. Instead of adopting an affordance perspective, the existing literature has tended to focus on technology adoption and acceptance (Wang et al. 2014, 2016). In an effort

to close this gap, this study argues that the selection and use of different devices in the travel information search context is influenced by the affordances that emerge. On the one hand, these stem from the information goals to be achieved, and on the other hand, they reflect user characteristics that impact preferences for and interactions with devices. Consequently, the aim of the study is to examine travellers' device use during travel information search through the lens of technology affordances. In particular, this study targets two research objectives: (a) to explore the connection between device use and information search goals, and (b) to investigate whether a link between specific user characteristics and device use during travel information search exists. To achieve these research objectives, this study employed a convergent mixed methods approach consisting of two independent studies to shed light onto the elusive affordance concept. The implications of this study will provide a window into the complex multi-device world from a travel information searcher's perspective.

2 Literature review

2.1 Affordance theory

Affordance theory was originally introduced by Gibson (1979) to represent capabilities for action afforded by the features of an individual's environment. Affordance theory was adapted by information systems scholars to describe affordances in digital systems (Bloomfield et al. 2010). Technology affordance theory discusses technology use by shedding light on the decisive role of both human interactions and technology features (Leonardi 2011; Orlikowski 2010). Instead of considering particular features as inherent in the technology itself, technology affordance emphasises that human actions and intelligence shape technology use (Lei et al. 2019). Thus, affordances lead to actions depending on the ability of the individual, the history of interaction, the functional characteristics of the technology, and the learning in a social context (Heft 1989).

Technological progress, the amount of effort it takes to act on an affordance, as well as personal experiences influence the extent to which one affordance is more "inviting" than others (Withagen et al. 2012). Importantly, affordances facilitate certain actions and impede actions that are not afforded (Tamej and Xiang, 2020). According to affordance theory, individual user characteristics, goals, and usage context impact on if, when and how technology is used (Faraj and Azad 2012; Majchrzak and Markus 2012). The technology affordance perspective is a recognised and effective framework for examining the interaction between users and technology artefact beyond the artefact's features and capabilities (Leidner et al. 2018). Therefore, an affordance perspective suggests that device use is not simply determined by perceptions of the functionality of the technological artefact. As such, the technology affordance theory clarifies the differences between devices, and how these affordances can be leveraged to generate unique use-cases for individuals.

The most prominent factor considered by affordance theory are goals. User goals in relation to technology affordances are often described in terms of "the possibilities for goal-oriented action recognised by a specific user group" (Carlo et al. 2012, p.

1084). Chatterjee, Moody, Lowry, Chakraborty, & Hardin, (2015) explained that the same technology functions can be suitable for different goals. Moreover, in the context of technology, an affordance is created through the interaction between users and technology features towards achieving a specific goal (Camacho and Barrios 2022). This highlights that device affordances differ based on user goals but also that device use does not necessarily neatly map onto single goals. This potential complexity has been largely ignored by the travel information search literature.

Travel information search is an extended and multi-faceted process with many phases and goals (Xiang and Fesenmaier 2020). It is inferred that perceptions of device affordances change throughout the search process as goals evolve. Not all devices are equally able to cater to specific needs when trying to meet the varying goals. For example, due to the unique features of mobile devices, containing a small interface and available GPS-based navigation, users can look for information on the go to address their spontaneous needs, as well as collect personalised information (Wang, Park, & Fesenmaier, 2012). In contrast, desktops offer users the opportunity to save, organise and retrieve files based on keywords, attributes, and metadata (Singh Atwal et al. 2019). In addition, using several browser windows at the same time is easier on desktops due to the operating system and larger screen size. Similarly, the portability of laptops and tablets offers additional functionality for users both prior to a trip as well as during the trip. These mobility-related functions become more important for the realization of short-term decision-making goals than initial browsing goals.

From a trip planning perspective, two broad goals are usually associated with information search: looking and booking (Wu and Law 2019). Looking represents an act of searching and gathering information for an upcoming trip while booking represents the purchase of a travel product. Affordance theory suggests that device use will differ across these broad goals if devices and their functions do not equally support goal achievement for both goal categories.

2.2 The role of personal characteristics

Device use for information search does not happen in isolation. Individuals may use different devices not only based on their specific information search goals but also their personal characteristics as the latter encompass general user needs, preferences, and broader personal goals. Affordance theory therefore also considers personal factors that might impact the perception and realization of affordances.

An increasing number of studies have investigated user characteristics in relation to technology adoption, particularly for smartphones. For example, Law, Chan, and Wang (2018) classified studies on the effect of mobile technologies on tourist experiences and identified dispositional factors such as demographic and behavioural factors as a major theme. Tourists' demographic characteristics, such as gender, age, education, income, marital status, and occupation are significant determinants of information search behaviour (Lamsfus et al. 2015). Previous studies also showed a close connection between socio-demographic and behavioural factors and technology adoption (e.g., Chong 2013; Lamsfus et al. 2015; Morosan 2015).

Personal characteristics clearly influence device ownership and therefore access to device functions. These personal characteristics also influence the extent to which users can and want to take advantage of functions. The relationships between demographic characteristics (e.g., age and gender) and technology use have been examined by a few studies (Chong 2013; Teo and Pok 2003). Age is considered as the most important predictor of technology acceptance (Phang et al. 2006). Research on new technology acceptance reported that younger users have fewer difficulties processing complex stimuli (Venkatesh et al. 2003) and are more likely to accept new technologies. Similarly, perceived ease of use for new technologies is higher for younger users (Chung et al. 2010). Conversely, older users face some challenges when using smartphones due to their touch screen interface and small screen size (Hwangbo et al. 2013; Mohadisdudis and Ali 2014). In terms of smartphone features and capabilities, studies have revealed that older users had difficulties reading and writing on small smartphone screens due to vision impairment (Mohadisdudis and Ali 2014). Similarly, most smartphones and applications encourage self-exploration and easy recovery from mistakes, but older users lack the confidence to use a trial-and-error method (Mohadisdudis and Ali 2014). As a consequence, older users, due to their technology illiteracy, vision impairment, motor impairment, and lack of confidence, appear to prefer devices with bigger screen sizes and simple, straightforward functions (Culén and Bratteteig 2013).

Since devices have different capabilities, individuals' perceptions of device features impact how they interact and use devices (Pruchniewska 2019; Sun et al. 2019). Studies found that demographic differences such as gender have an impact on users' perceptions and use of features (Camacho and Barrios 2022; Hosseini and Tammimy 2016). For example, female users have been described as more socially oriented (Lee et al. 2014). Females appear to use mobile devices more for social communication, while males use mobile devices for more process orientated tasks (Bisen and Deshpande 2016). Mobile features such as online chat, communication (Ding et al. 2016), and voice commands (Iqbal et al. 2017) are used commonly by females. Females have a stronger attachment to their mobile devices (Bisen and Deshpande 2016) and may prefer to use these devices when searching for information.

Based on the discussion of user characteristics and technology affordances, it is argued that users may also select devices for travel information search based on their travel experience. Less experienced travellers have higher information needs due to greater risk perceptions (Pearce 2011). For example, desktops allow users to sit for longer time periods when searching for information and are more convenient to use with a pen and paper when taking notes. Users can open multiple browser windows and tabs to search and compare information. On the other hand, smartphones leverage app features to provide location-based services, context aware recommendations, flexibility and personalisation. Apps offer personalised services and suggestions based on user information. Apps also provide regular updates about travel information such as hotel availability, booking details, and special offers. Considering smartphone affordances, travellers with greater travel experience may prefer smartphones as they are more likely involved in travel information search and might have more experience with mobile travel apps.

Individuals' frequency and level of technology use may also influence affordance perceptions and, consequently, device use. Most individuals use smartphones daily (Wang et al. 2014), including for communication, entertainment, and information search. This increased level of use has a positive impact on perceived ease of use (Venkatesh et al. 2003) and attitudes towards the use of newer technologies (Eriksson 2014; Saaksjarvi 2003). Technology use is connected with technology familiarity and affinity, which affect performance expectations (Kang and Gretzel 2012). Technology affinity suggests that users can easily switch between devices.

2.2.1 The role of personality traits

Personality can be defined as "those characteristics of the person that account for consistent patterns of feeling, thinking, and behaving" (Lewis et al. 2001, p. 10). An individual's characteristics can be grouped into traits, which vary from one individual to another. Individuals can be categorised according to the degree to which they exhibit each of these traits (Costa Jr and McCrae 1990). The 'Big Five' personality model is one of the most widely cited and validated frameworks of personality traits (De Raad and Schouwenburg 1996; Furnham 1997; Costa and McCrae 1992) described the "Big Five" model as the most comprehensive model of personality. The model identifies five personality factors: extraversion, conscientiousness, agreeableness, openness to experience, and neuroticism (or emotional instability). It is argued that individuals with different personality traits use different devices because of devices' differential abilities to cater to personality-related needs. Previous research has established a link between personality traits and technology use, such as in the context of social media platforms (Chen and Peng 2022), but there is a scarcity of research examining the effect of personality traits on device preferences.

Individuals who score high on extraversion are active, assertive, sociable, talkative and people-oriented (Watson and Clark 1997). They are optimistic, seek out new opportunities, and are energetic (McElroy et al. 2007). Extraverts naturally care about their image and other social consequences of behaviours and place a high value on social relationships and social communication (Devaraj et al. 2008). When it comes to communication, previous research confirmed that extraverted individuals tended to join large size networks (Ross et al. 2009), engage in frequent self-disclosure behaviour (Eskisu & Rasmussen, 2017), and maintain up-to-date profiles (Gosling, Hosoglu & Mason, 2015). Compared to other devices, smartphones offer multiple media for communication, such as photo sharing, video calling and access to emails, which facilitate social interaction for extraverts. Smartphones also provide extraverts with an opportunity to connect with others through social networking apps like Facebook, Instagram, Twitter, and WeChat to share their experiences.

Individuals who score high on conscientiousness are self-disciplined, determined, and tidy. They actively plan, organise and carry out tasks. Conscientious individuals are more willing to consider ways in which the use of technology allows them to perform more efficiently at work (Barrick and Mount 1991). While there are no studies that investigate conscientiousness and device preferences, prior studies have confirmed a negative correlation between conscientious individuals and general social media use (Ryan and Xenos 2011). This might be because they perceive social media

as a distraction from other goals. Therefore, it is argued that desktop devices may be more convenient for conscientious individuals because they allow these individuals to manage and organise their travel information search results and bookings more effectively and without distraction. Desktop computers are more reliable, and offer users the opportunity to save, organise and retrieve files based on keywords, metadata, and attributes, and facilitate searching each file's textual content (Singh Atwal et al. 2019). Opening several browser windows at the same time to support elaborate searches is easier on desktop computers.

Individuals who score high on agreeableness are cooperative, good natured, and sympathetic (McElroy et al. 2007). Agreeable individuals carry a greater desire to achieve social understanding, which leads to a greater level of well-being (Lakhal and Khechine 2017; Devaraj et al. 2008) suggested that a higher score on agreeableness is positively associated with beliefs about the perceived usefulness of technology. Since agreeable individuals are collaborative, they are more likely to share information with others or search information together with others, and it is argued that smartphones facilitate these types of activities.

Individuals who score high on neuroticism tend to experience negative emotions such as anger, fear, sadness, guilt, and depression. Highly neurotic individuals tend to be anxious, self-conscious and have difficulty managing stress (McElroy et al. 2007). Accordingly, it could be argued that when faced with newer technology, these individuals may view technology advances as stressful and threatening in their travel information search. They worry about missing or losing information during information search. Therefore, as explained above, multiple browser windows or tabs provide neurotic individuals with an opportunity to easily compare information to ensure they have not missed any information. Moreover, saving and retrieving files is easier on desktop devices, which is really important for neurotic individuals to make sure that they do not lose any information.

Individuals who score high on openness to experience have flexibility of thought and tolerance of new ideas. They actively look for new, creativity, and educational experiences and value change (McCrae and Costa Jr 1999). Prior studies showed that individuals with openness are more attracted to novel information and experiences (Carpenter et al. 2011). In the context of technology acceptance and use, individuals who are open to experiences are likely to be curious to try newer technologies and appreciate their use. Openness to experience was found to have a positive impact on perceived usefulness of ICT (Lakhal and Khechine 2017; Sanjebad and Iahad 2014). So, the flexibility of thought could mean easy switching between devices and therefore no specific device preferences.

To conclude, affordances vary across individuals and depend on how these individuals interpret the features of devices and perceive their potential uses. In the context of technology, affordance is a user's subjective interpretation of the function(s) of a given technology and perceptions about what the technology allows them to do ((Dincelli and Yayla 2022). Therefore, it is particularly important to understand how personal characteristics impact on users' device preferences. As discussed in this section, this study investigates how users' personal characteristics, specifically age, gender, travel experience, frequency and level of technology use, and personality traits, shape device preferences.

3 Methodology

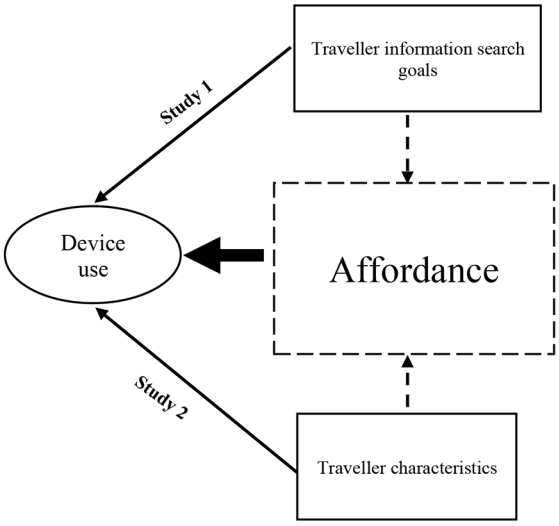
This study explores device use for travel information search through the lens of technology affordance theory. The study was designed using a convergent mixed method approach consisting of two independent studies to support methodological triangulation (Creswell & Clark, 2011). Methodological triangulation is defined as the use of more than one method in studying the same phenomenon under investigation with the aim of increasing the internal credibility of the research findings (Denzin 2017). Methodological triangulation was achieved in this study by using longitudinal data (collected through an online trip planning diary) and cross-sectional data (obtained through an online survey).

Both studies seek to explicate device affordances in the context of pre-trip travel information search, but each explores different factors that influence affordance perceptions. While Study 1 explores the connection between travel information search goals and device use, Study 2 focuses on personal factors as drivers of device use. It must be noted that affordance is a latent concept that cannot be directly measured. Instead, it is assumed to mediate the relationships investigated across the two studies. Figure 1 shows the conceptual framework underlying the structure of the paper.

As far as the relationship between user goals and device use is concerned, we assume that more complex goals with higher risk factors require devices that support stability, fact-checking and comparisons. We therefore formulate the following hypothesis:

H1 Mobile-dominant device use patterns are more likely to emerge in the context of "looking", while laptop and desktop dominant device use patterns are more likely for "booking" goals.

Fig. 1 Conceptual framework



Regarding the personal characteristics of travellers, we assume the following relationships based on existing literature:

H2 The younger the traveller, the more likely the device use pattern will be dominated by mobile devices.

H3 Female travellers are more likely to have mobile dominant device use patterns.

H4 The higher the frequency and level of technology use of a traveller, the more likely they are to exhibit device agnostic use patterns.

H5 Greater travel experience leads to more mobile dominant device use patterns.

H6a-e Extraversion and agreeableness are associated with mobile dominant device use patterns, while conscientiousness and agreeableness are linked to desktop dominant use, and openness to experience increases the likelihood of device agnostic use patterns.

3.1 Study 1: online trip planning diary

The aim of the trip planning diary was to capture detailed information about user goals and device use in a natural travel information search context and to reduce recall bias (Burton et al. 2007) given the often complex and spontaneous nature of device use. A pilot study was conducted with four domestic tourists to evaluate the research design. The participants of the main study started to complete the trip planning diary in the early stage of searching for information. They continued to complete the trip planning diary until a day before their trip. This method captured information regarding the devices used for information search, time spent for information search, and the goals for each session of information search on a daily basis. Respondents received a daily link to the online trip planning diary for their upcoming trip. The researchers checked the diary daily and sent follow up emails to respondents if they failed to complete the diary over three consecutive days. The travel information search processes ranged from two weeks to eight weeks. To ensure completeness of the information, respondents were required to complete at least 80% of their daily diaries, either indicating that they had conducted information searches or not.

Sampling and procedure The final dataset from the trip planning diary included 18 individuals who met the following three criteria. First, leisure tourists were selected because they were more likely to search for travel information themselves. Second, participants were recruited in the initial stages of trip planning to ensure most of their information search processes could be monitored. Finally, participants needed to be actively involved, being the main decision maker or planner searching for information related to their trip.

Participants for the trip planning diaries were recruited through email newsletters and social media. An initial screening survey was conducted to identify qualified applicants. Qualified respondents who indicated their willingness to participate were contacted by email. Compensation in the form of a shopping voucher was provided as an incentive. The unit of analysis for this study was based on the number of information search sessions rather than the number of participants. A total number of 109 trip planning sessions was reported across all of participants, yielding a rich qualitative dataset for further analysis. Data collection ceased when data saturation was achieved; that is when additional data resulted in redundant information (Koerber and McMichael 2008).

Table 1 provides the demographic profile and type of trips for the diary respondents. The final sample included 14 female and four male leisure tourists aged between 23 and 63. The high number of female participants in this study can be justified given that female travellers have been found to be more engaged in information search and trip planning (Kim et al. 2007). The participants were not only diverse in age but also the types of trips they were planning and their professions.

3.2 Study 2: online survey

The overall goal of the online survey was to identify differences among device user groups in terms of their demographic characteristics, travel experiences, technology use and their personality. The survey consisted of four sections: (1) screening ques-

Table 1 Trip planning diary participants' profile

Variable	Frequency	Percent
Gender		
Female	14	78
Male	4	22
Age		
18–29	8	44.5
30–39	6	33.2
40–49	3	16.7
50 or more	1	5.6
Type of Trip		
International	9	50
Domestic	9	50
Variable	**Frequency**	**Percent**
Gender		
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Age		
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50 or more	1	5.6
Type of Trip		
International	9	50
Domestic	9	50

Table 2 Online survey participants' distribution

Variable	Frequency	Percent	Quota Percent
Gender			
Female	340	50.1	50.0
Male	338	49.9	50.0
Age			
18–29	127	18.7	20.0
30–39	133	19.6	20.0
40–49	131	19.3	20.0
50–59	134	19.8	20.0
60 or more	153	22.6	20.0

Table 3 Domestic and International Trips of Online Survey Respondents

	Domestic		International	
Trips	Frequency	Per cent	Frequency	Per cent
None	75	11.2	273	40.3
1	249	37.1	282	41.6
2	181	27.0	86	12.6
3	80	11.9	16	2.4
4 or more	86	12.8	21	3.1

tions; (2) socio-demographic questions, including gender, age, year of birth, state of residence, country of birth and duration of residence in Australia; (3) questions regarding additional characteristics, including travel experience and weekly technology use, percentage of time spent on individual devices when planning trip accommodation in general, and number of domestic and international trips in the 12 months prior to the research; and (4) personality questions.

Sampling and procedure The online survey data were collected in 2018. A total of 678 Australian leisure travellers participated in the survey. The participants were recruited through an online survey panel. This sample was limited to participants who had travelled within the past 12 months and who indicated that they had personally searched for accommodation information. A quota sampling method was applied to ensure the sample was consistent with the demographic distributions (in terms of age and gender) of Australia's population (Australian Bureau of Statistics, 2019). An overview of the survey participants' characteristics along with quota sampling percentages are presented in Table 2.

In terms of travel experience (international and domestic), Table 3 provides a summary of the number of domestic and international trips undertaken by respondents of the survey 12 months prior to the data collection. The number of participants with domestic travel experience was higher than the number of participants with international travel experience (Table 3).

The content validity of the survey constructs was evaluated by assessing the correspondence of the variables with their theoretical definitions (Churchill Jr 1979). To ensure the content validity of the variables in this study, the items were primarily adopted from prior studies. The correspondence between individual items and the concept can be assessed by expert judges (Hair et al. 2013). Two academic experts

and two non-experts were consulted to verify and refine the content and construct validity of the items that were initially generated. A pilot test of the study was administrated to 51 undergraduate and postgraduate university students who matched the study sampling criteria.

Personality was assessed using the "Big Five" personality model adopted from the International Personality Item Poll (Pool 2008). To measure the five personality factors, five self-descriptive sentences were adopted from the International Personality Item Pool (Goldberg et al. 2006; Pool 2008). The items were rated on a five-point Likert scale (from 1 = strongly disagree to 5 = strongly agree). The raw score for each factor was gained by adding the ratings on each factor item. The mean score for each individual dimension was used to classify respondents. Cronbach's coefficient alpha was conducted to test the internal consistency of the scales. Cronbach's Alpha coefficient of 0.866 for extraversion, 0.816 for conscientiousness, 0.847 for agreeableness, 0.848 for neuroticism and 0.785 for openness to experience confirm the alpha values are above the recommended level of 0.7 (Hair et al. 2013).

3.3 Data analysis

The analysis of diaries started as they were being collected and saturation was reached after collecting information from 18 participants. Since the aim of the trip planning diaries was to explore the relationship between user goals and device use, it was important to identify the dominant devices used by participants during each session. The number of sessions varied from four sessions to 34 sessions among participants. Table 4 shows how many sessions were dominated by the various devices. It demonstrates the continued importance of desktop computers for travel information search.

Thus, while there were only 18 participants in Study 1, the analysis is based on over 100 information search sessions. ANOVAs and descriptive analyses were used to explore the relationship between the device that dominated a search session and the goal for that particular session.

The analysis of the survey started by classifying participants based on their device use for travel information search and trip planning. In the survey, respondents were asked to estimate their typical use of smartphones, tablets, laptops, desktops, and other devices for accommodation information search by allocating a percentage to each type of device. Table 5 shows device use distribution among participants. It becomes immediately apparent that single device use was extremely rare. Only 9% of participants indicated that they typically used a specific device for 100% of their information search.

Table 4 Device use session distribution from trip planning diaries

Device dominant group	Trip planning Diary	
	Device use sessions **N = 109**	(%)
Mobile dominant	21	19.3
Laptop dominant	32	29.3
Desktop dominant	43	39.5
Device-agnostic	13	11.9

Table 5 Device use distributions from online survey

Device use for search (%)	Smartphone N=678	Tablet N=678	Laptop N=678	Desktop N=678
0	32.7%	67.1%	34.5%	60.9%
1–20	20.8%	16.7%	17.4%	11.8%
21–40	8.6%	4.4%	7.2%	4.6%
41–60	18.6%	5.8%	13.3%	7.1%
61–80	9.6%	2.2%	9.4%	3.5%
81–100	9.7%	3.8%	18.1%	12.1%
Total	100%	100%	100%	100%

Table 6 Device users per device dominant group from online survey

Device dominant group	Online Survey	
	Device users **N=678**	(%)
Mobile dominant	204	30.1
Laptop dominant	203	29.9
Desktop dominant	116	17.1
Device-agnostic	155	22.9

Table 7 User' goals and device use

Goal	Mobile dominant (%)	Laptop dominant (%)	Desktop dominant (%)	Device-agnostic (%)	Total
Looking	24	20	42	14	100
Booking	0	45	30	25	100

Participants who used a specific device 60% or more of the time were included in the same categories. Therefore, respondents were classified into four groups of mobile dominant, laptop dominant, desktop dominant, and device agnostic. As the number of participants who used tablets was low, tablet users were combined with smartphone users to create a mobile dominant group. Device agnostic users did not show a strong preference for a specific device during information search. Table 6 shows the number of respondents in each device dominant group.

ANOVA and Chi-square tests were used to determine significant differences between device user groups (Netemeyer et al. 2003; Savalei 2008). The ANOVA and Chi-square tests were conducted using SPSS 24.0.

4 Findings and discussion

4.1 User goals

The trip planning diaries were analysed to explore the relationship between user goals and device use. Participants indicated their goals and the device they used to achieve these goals for each session. These goals were then categorised into looking and booking categories. (Table 7).

Table 8 Statistical analysis for Age and device dominant group

Age Group	Mobile Dominant n=204	Laptop Dominant n=203	Desktop Dominant n=116	Device -Agnostic n=155	Tests	Sig
18–25	10.3%	9.4%	0.9%	7.7%	X^2= 113.009	**0.000**
26–35	37.3%	13.3%	12.1%	27.7%	*df=15*	
36–45	21.1%	15.8%	8.6%	27.1%		
46–55	15.7%	21.2%	23.3%	17.4%		
56–65	12.7%	27.6%	38.8%	17.4%		
66 +	2.9%	12.8%	16.4%	2.6%		

The results indicate that mobile phone-dominant information search sessions were exclusively focused on looking. Of the 20 sessions with booking goals, 45% were dominated by laptop use and an additional 30% by desktops. Despite the extensive focus on mobile devices, laptops and desktops still played a key role at the booking stage. The main reason that laptops and desktops were primarily used for booking may be because of the functionality and affordances offered, including larger keyboards, screen size, access to full sites, and the ability to evaluate multiple sites at once with greater ease. This supports the conclusions of Jones, Buchanan, & Thimbleby (2003), who found that searching is more difficult on smaller screens compared to larger screens. Jones et al. (2003) suggested that individuals using devices with smaller screens were 50% less effective in completing tasks than individuals who used devices with larger screens because it is difficult for individuals to make a final decision about the search results collected on small devices. According to Oulasvirta, Tamminen, Roto, & Kuorelahti (2005), smaller screens prevented users from accomplishing more complex tasks. Similarly, Sheldon & Zietlow (2013) stated that laptop and desktop devices were dominant; 79% of purchases were made on a laptop and desktop. The findings of Study 1 therefore support H1 and conform with existing literature.

4.2 Demographic characteristics and travel experience of device dominant groups

Chi-square analyses were conducted to describe demographic differences among device dominant information search groups.

The results of the Chi-square analysis (Table 8) indicate that young travel information searchers are more likely to belong to the mobile dominant group and least likely to the desktop-dominant group. This is consistent with results from other studies (e.g., Chong 2013; Kim et al. 2015; Okazaki et al. 2015). Desktop and also laptop users tend to be older (Global Web Index 2020). H2 was confirmed. However, the results also indicate that all device groups are populated with users of varying age. Just because someone is young does not mean that their travel information search will be dominated by mobile phone use and older travel information searchers are not necessarily all vested in searches on desktops.

Regarding gender, the results of the Chi-square analysis (Table 9) confirmed that the mobile dominant group included more females, thus supporting H3. These findings are consistent with Okazaki et al. (2015), who found that females were more

Table 9 Statistical analysis for gender and device dominant group

Gender	Mobile Dominant n=204	Laptop Dominant n=203	Desktop Dominant n=116	Device Agnostic n=155	Tests	Sig
Female	67.2%	39.9%	31.9%	55.5%	$X^2=55.015$	**0.000**
Male	32.8%	60.1%	68.1%	44.5%	df=6	

Table 10 Statistical analysis for travel experience and device dominant groups

	Mobile Dominant n=204	Laptop Dominant n=203	Desktop Dominant n=116	Device-Agnostic n=155	Tests	Sig
Technology Use (mean hours/week)	3.30	3.51	3.41	3.28	F (3,674)=2.436	0.064
Domestic Trips (mean)	1.99	1.86	1.95	2.09	F (3,667)=0.641	0.589
International Trips (mean)	0.88	0.85	0.66	1.21	F (3,674)=6.224	**0.000**

*Domestic trips are based on the number of trips 12 months prior to this study, **International trips are based on the number of trips 12 months prior to this study, ***Technology used is based on weekly hours.

likely to use mobile technology for their pre-trip planning. Mobile devices may be more convenient for females who are multitasking and caring for others. Flamberg (n.d) stated that mobile devices act as a "Swiss Army Knife" for women to play, communication and work. In contrast, for males, mobile devices play a role as a tool to accomplish specific tasks.

One-way ANOVA analyses were conducted to explore the potential connection between device use and overall technology use and travel experience. The survey results showed that there were no significant differences between device groups based on their general technology use (Table 10). H4 was therefore not supported by the data. Technology use refers to a self-reported estimate of the hours individuals spent on technology per week across all technologies. The sample was generally very avid in terms of technology use: 62.8% of the respondents used technology for more than ten hours per week, 18.1% spent between eight to ten hours, 13% spent between five to seven hours, and 6% spent between two to four hours. This could be a possible explanation for why no significant differences were found.

In terms of travel experience, the statistical analysis shows at the $p<0.05$ level ($F\ (3, 674)=6.224$, $p=0.000$) that the device-agnostic group ($M=1.21$) has more international travel experience. A Tukey post hoc test revealed that the comparisons between device-agnostic group and the other groups was statistically significant. While previous studies reported that frequent travellers used smartphones more frequently (e.g., Eriksson 2014; Kim et al. 2008; Vallespín et al. 2017), the findings of this study shows that individuals with more international travel experience did not report a strong preference for specific devices. These inconsistencies may be due to this research examining device use only for pre-trip planning.

The findings of this research indicate that there is no difference between device dominant groups based on their domestic travel experience at the $p<0.05$ level (F

(3, 667) = 0.641, p = 0.589). This may be because domestic travel experience is ubiquitous in the sample. Overall, H5 was not supported by the data collected from this sample.

4.3 Comparing device user groups in terms of their personality

One-way ANOVA analyses were conducted to investigate possible relationships between personality traits and device use, and the results are shown in Table 11. The results showed that there were no differences between groups based on agreeableness or openness to experience when using devices for trip planning.

However, based on the analyses, the device-agnostic group had a significantly higher score for extraversion (M = 3.34) compared to the other groups. A Tukey post hoc test revealed that the comparison between the device-agnostic group and laptop and desktop dominant groups and mobile dominant group with the laptop and desktop dominant groups are statistically significant. As the device-agnostic group had no device preferences, they take advantage of the functionality of different devices by switching between them when seeking to achieve their information search goals. Considering extraverts are outgoing and sociable (McElroy et al. 2007), have a greater desire to communicate with others, and are more energetic, it is perhaps not surprising that they use a mix of different devices during their trip planning.

The statistical analyses indicated that the desktop dominant group scored significantly higher on conscientiousness (M = 3.98) (F (3, 674) = 3.252, p = 0.021) and neuroticism (M = 3.45) (F (3, 674) = 3.45, p = 0.015). A Tukey post hoc test revealed that the comparison between the desktop dominant group and mobile dominant group are statistically significant for both conscientiousness and neuroticism. Individuals who score high on conscientiousness often take actions to improve their performance (Costa and McCrae 1992) and are organised and self-disciplined. Individuals with a high score on neuroticism are anxious about forgetting 'active to-dos' (Devaraj et al. 2008) and lose or miss some information during information search and trip planning. Desktop computers are more reliable and stable, and offer users the opportunity to save, organise and retrieve files much more easily (Singh Atwal et al. 2019). Opening several browser windows for comparison purposes is also easier on desktops due to their stability and screen size. Therefore, the functions of desktop computers create an opportunity for individuals with these two personality traits to benefit from the functionality offered by these devices and achieve their personality-related goals.

Table 11 Statistical analysis for significant differences for personality traits

Personality Trait (mean)	Mobile Dominant n = 204	Laptop Dominant n = 203	Desktop Dominant n = 116	Device-Agnostic n = 155	Tests	Sig
Extraversion	3.24	3.00	2.95	3.34	F (3,674) = 8.551	**0.000**
Agreeableness	4.05	3.93	3.87	3.96	F (3,674) = 2.189	0.088
Conscientiousness	3.80	3.82	3.98	3.93	F (3,674) = 3.252	**0.021**
Neuroticism	3.20	3.30	3.45	3.30	F (3, 674) = 3.521	**0.015**
Openness to experience	3.84	3.90	3.92	3.95	F (3, 674) = 1.031	0.378

In summary, the data supported H1 regarding the relationship between information goals and device use, as well as most of the hypothesized relationships for the effects of personal characteristics on device use patterns. The hypotheses regarding the effects of personality traits on specific device use patterns were only confirmed for conscientiousness and neuroticism, while the relationship between extraversion and device use was significant but not in the assumed direction. Table 12 provides an overview of the results.

5 Implications and conclusion

While mobile devices and smartphones have changed the way travellers engage with travel-related information, many individuals still use other devices such as desktops and tablets for their travel information search. The findings confirmed that information goals play a role in device use in the travel information search context. Mobile devices are clearly not perceived as providing the affordances necessary for achieving booking goals during pre-trip planning sessions. In addition, our study demonstrates that travel information searchers' personal characteristics, traits and backgrounds can influence the affordances different devices can provide them. Specifically, age, gender, international travel experience, extraversion, conscientiousness and neuroticism emerged as factors with significant influences on device use. More importantly, this research paints a complex picture of a multi-device world in which travel information searchers perceive different affordances for various aspects of their search. In

Table 12 Summary of the hypotheses and their result

Hypothesis	Result
H1: Mobile-dominant device use patterns are more likely to emerge in the context of "looking", while laptop and desktop dominant device use patterns are more likely for "booking" goals.	Supported
H2: The younger the traveller, the more likely the device use pattern will be dominated by mobile devices.	Supported
H3: Female travellers are more likely to have mobile dominant device use patterns.	Supported
H4: The higher the frequency and level of technology use of a traveller, the more likely they are to exhibit device agnostic use patterns.	Not supported
H5: Greater travel experience leads to more mobile dominant device use patterns.	Not supported
H6a-e: Extraversion and agreeableness are associated with mobile dominant device use patterns, while conscientiousness and agreeableness are linked to desktop dominant use, and openness to experience increases the likelihood of device agnostic use patterns.	Hypotheses regarding conscientiousness and neuroticism supported. Hypotheses regarding agreeableness and openness to experience not supported Hypothesis regarding extraversion was significant but not in the assumed direction.

addition, the increasing multi-functionality of devices leads to device-agnostic multi-device users or sessions in which no single device dominates.

5.1 Theoretical contributions

Taken collectively, the theoretical contributions of this research are two-fold. *First*, the research develops an understanding of device use in the travel information search context by introducing technology affordances to this area of research. Prior research focuses pre-dominantly on technology adoption and acceptance (Wang et al. 2014, 2016). As attested by this research, affordance theory considers device functions, user goals and user characteristics and can therefore better explain the complex and dynamic reality of device use in travel information search. *Second*, this study extends literature on the functions and capabilities of different devices. As much as smartphones are hailed as universally supporting information search and decision-making in travel (Kang et al. 2020), they do not seem to offer the affordances needed to achieve booking goals. This is particularly important from a theory-building standpoint as the results of this study revealed that travellers use multiple devices to overcome technological limitations.

This study also provides insights regarding methodology suitable for affordance-related research. Utilising mixed methods for data collection allowed for methodological triangulation and permitted the exploration of factors that contribute to affordances from multiple perspectives. Using trip planning diaries supported the tracking of travellers' information search goals and device use for each session over the course of long pre-trip planning phases without running into recall problems. Utilising online trip planning diaries can help researchers to capture detailed information in situ.

5.2 Practical contributions

The results of this research provide important practical contributions, particularly for marketing tourism businesses and destinations. First, as attested by this research, some individuals still prefer using their desktop to search for information while most use combinations of devices. This means that mobile devices have not completely replaced other devices due to lack of certain affordances in connection with specific search goals and/or personal characteristics. Designing websites, social media posts, and metaverse offerings to support travel information search thus requires paying attention to responsive designs that can accommodate multi-device use (Gibbs and Gretzel 2015).

Second, since the results of this research affirm that individuals switch between devices during their travel information search, it is extremely important for tourism practitioners to understand that switching between devices needs to be supported better by informational offerings in order to smooth the transition between looking and booking sessions during a search process. For instance, collecting and saving information in a way that makes it easily accessible across devices could be achieved through a linkage with social media accounts as travel information searchers are

unlikely to want to establish elaborate profiles for every travel website they visit during a search.

5.3 Limitations and direction for future research

The empirical results of this study should be considered in the light of some limitations which constitute potential lines of research for the future. The participants in this research were limited to individuals who live in Australia. The functionality and ownership of devices might be different from other countries and different technology infrastructure might influence device preferences; thus, future research needs to consider device use in other national contexts. Second, this research only studied the types of devices travellers used and their relationship with goals and characteristics, assuming that affordances determine device use. Future research needs to probe further into why travellers prefer a particular device for specific elements of the travel information search process.

Moreover, this research divided user information search goals into two broad categories of looking and booking. There is clearly an opportunity for future research to identify more specific information search goals and to explore their impacts on device preferences and use. Moreover, this research used a convergent mixed-methods design which explored travellers' information search goals and travellers' characteristics from two different studies. Future research could use a sequential mixed-method design to explore the relationship between traveller characteristics, their specific information search goals, and their personal device use patterns.

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