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Pokémon Go-ing or staying: Exploring the effect of age and gender on augmented reality game player experiences in public spaces

Ruth Potts and Lachlan Yee

Abstract:

While the benefits of play and discovery in cities have been widely discussed, the impact of augmented reality games such as Pokémon Go, induced urban discovery on different demographics, and their impact on perceptions of public spaces is yet to be studied. This paper examines the perceptions and usage of public spaces by different demographics of augmented reality gamers. The study finds that there are several statistically significant differences between the experiences of men and women, and players of different ages playing *Pokémon Go* in public spaces in Australia, particularly in their mobility, sense of marginalisation, and sense of place.

Keywords: Augmented reality games, *Pokémon Go*, public space, urban design, urban planning,

1.0 Introduction

Despite eulogies in the urban design literature surrounding the ‘death of public spaces’ (Bodnar, 2015; Kayden, 2005; Sorkin, 1992; Zukin, 2009), public spaces remain highly valued and, in many instances, well utilised spaces. In fact, rather than experiencing a death, public spaces world-wide are transforming in their appearance, use, and attractiveness to different demographics. This transformation is in part a result of the increasing pervasiveness and ubiquity of technology in the design and use of public spaces. Technology is increasingly becoming more prevalent and integrated into public spaces, for example phone and device charging stations are now being integrated into solar powered benches in public spaces (Tyrrell, 2017).

Augmented reality games are an emerging and technological lens through which people are experiencing public spaces in novel ways, which may complicate or reinforce existing patterns of exclusion in public spaces. In July 2016, the augmented reality game *Pokémon Go* was launched in 56 countries and made headlines globally as it was downloaded more than 500 million times (Business of Apps, 2016). Internationally, players of *Pokémon Go* began exploring various local streets, parks, public squares, and public spaces in their quest to capture game-generated creatures that could suddenly be found using their mobile devices at city landmarks (Althoff et al., 2016; Sum, 2016). Concerns for safety, antisocial behaviour, cost of maintenance, and appropriateness have also been raised by the media, and cited in several incidents whereby managers of public spaces or buildings have explicitly said that *Pokémon Go* players are unwelcome, such as churches and public parks (Behnke, 2017).

Differences in race, gender, age, class, sexuality, ethnicity, and culture are known to influence people’s experiences of public spaces (McDowell, 1983). The public space literature orients much of the discussion of these differences around the themes of fear and safety, mobility and accessibility, and marginalisation and exclusion (Day, 1999; Gehl, 2011; Madanipour, 2013; Whitzman, 2007). This paper will explore the experiences of different age groups and genders playing *Pokémon Go* in public spaces through these themes. The paper is based on the following research question: Do gender and age affect experiences of public spaces whilst playing augmented reality games? Following the exploration of the issues of race and ethnicity and their effect on *Pokémon Go* and public space use by Salen Tekinbas (2017), this paper aims to explore and compare the perceptions and experiences of public spaces by different age groups and genders of *Pokémon Go* players in order to better understand the dynamics of augmented reality games and public space usage. This paper reports the results of an online survey of 994 Australian *Pokémon Go* players, and compares the experiences and perceptions of public spaces vary across age groups and genders.

2.0 Literature Review

2.1 Technology and public spaces

Internet and technology use has grown rapidly in recent years and affect every facet of daily life. The use of public spaces is no exception to this. In fact, many experiences and perceptions of such spaces are now influenced, personalised, and mediated through a technological lens (De Lange & De Waal, 2013). Mobile technology enables each user of a public space to interact with that space and other users of the space in a totally unique and highly personalised way. Such technologies have been widely criticised for negatively impacting on sense of place in public spaces because they 'reduce the likelihood of serendipitous public encounters (Harris, 2003), contradict common expectations of public behaviour (Ling, 2004), and divert attention away from co-present others (including existing social ties)(Humphries, 2005)' (Hampton & Gupta, 2008). However, this is yet to be studied in the context of augmented reality games being played in public spaces.

Augmented reality games are increasingly shaping people's use and experiences of public spaces. They are games that are played on an internet enabled mobile or tablet device, and encourage players to interact with both digital and real-world physical features as part of game-play (Houghton, 2010; Schrier, 2006). The games use digital layers to 'augment' player's experiences of real world locations by overlaying them with highly interactive story features, fictional characters, and game items in real time (Das et al., 2017). While augmented reality games have been evolving and growing in popularity since the mass production of smartphones in the late 2000s (F. Xu et al., 2016), the release of *Pokémon Go* in July of 2016 marked a significant increase in popularity and awareness of augmented reality games in the general population (Sum, 2016).

Pokémon Go is an augmented reality game that encourages players to catch creatures called Pokémon (meaning pocket monsters in Japanese) that appear randomly in the urban environment (Figure 1). Players are represented on screen as a self-stylized avatar that moves on a digital map based on the player's real-world movements via GPS location technology (Figure 1). Public spaces and landmarks are interactive in the game, and enable players to either collect in-game equipment at 'Pokestops', or battle other player's Pokémon in 'Gyms' (Abbey-Lambertz, 2016). Notably, Pokestops and Gyms can be located at a range of different types of public spaces or landmarks, including historic landmarks, public parks, works of public art, civic buildings, religious landmarks, buildings of architectural significance, and signs (Abbey-Lambertz, 2016). Recent studies have variously examined the physical, and mental health implications of playing *Pokémon Go* (Barkley et al., 2017; Lee, 2016; Nigg et al., 2016; H. Xu et al., 2017), issues of race and accessibility embedded in game-play (Juhász & Hochmair, 2017; Salen Tekinbaş, 2017), the game's relationship with capitalism and commodification of free labour (Jin, 2017), and the game's influence on placemaking and wayfaring (Larissa & Ingrid, 2017; Potts et al., 2017).

INSERT FIGURE 1 HERE

2.2 Experiences in Public Spaces

The perceptions and experiences of different demographics in public spaces have been widely discussed in the urban design and planning literature (Appleyard, 1980; Gehl, 2011; Jacobs, 1958). Differences in race, gender, age, class, sexuality, ethnicity, and culture are known to influence people's experiences and uses of public spaces (McDowell, 1983; Peimani & Kamalipour, 2016). This paper is particularly focussed on the experiences of public spaces by different age groups and genders. These differences are discussed below through the themes of fear and safety, mobility and access, and marginalisation and exclusion drawn from the literature.

2.2.1 Fear and safety

Perceptions of fear in public spaces have been a focal point in much of the urban studies, and feminist geography literature (Day, 2000; Malone & Hasluck, 1998; Sandercock & Forsyth, 1992; Whitzman, 2007; Yon & Nadimpalli, 2017). Public space users can be fearful of a number of experiences in public spaces, including sexual assault, physical violence, antisocial behaviours, and crime. These fears stem from a range of complex social, cultural, and historical structures relating to gender roles, social structure, poverty, and power in cities (Whitzman, 2007). Safety concerns influence which public spaces people choose to spend time in, the time of day that people venture into a public space, the amount of time they spend in a public space, and how they travel to and from a public space. Studies have historically and consistently shown that women experience heightened discomfort and fear in public spaces compared to men (Day, 2000; Malone & Hasluck, 1998;

Sandercock & Forsyth, 1992; Whitzman, 2007; Yon & Nadimpalli, 2017). However, there is an emerging body of literature that suggests that both men and women experience discomfort in public space, but experience discomfort because of different stimuli, and thus have different perceptions of risk and levels of concern in different public spaces (Day et al., 2003; Smith, 2008; Yavuz & Welch, 2010). For example, a study of men's fear in public spaces in Irvine, USA by Day et al. (2003) identified that where women tend to be concerned about sexual assault or harassment by men and thus avoid public spaces or public spaces with low levels of lighting or visibility from neighbouring land uses, men are more likely to fear conflict with other males, particularly groups of males, and thus avoid unfamiliar spaces or spaces that they felt less capable of dealing with conflict. Physical design features of urban environments have also played a role in improving or inhibiting people's sense of security within public spaces. From a physical perspective, perceptions of fear are based on a combination of a public space's environmental (e.g. vegetation, maintenance, landscape design, lighting), and social attributes (e.g. presence or absence of other people, social activities, degree of social control in a neighbourhood)(Foster et al., 2015; Jacobs, 1961; Sreetheran & Van Den Bosch, 2014).

2.2.2 Mobility and access

Public spaces are available in almost all urban areas, however their size, facilities, and locations vary significantly, which affects their appeal and accessibility to different demographics (Floyd et al., 2011). Players of different ages and genders are likely to experience different levels of mobility, and therefore access to public spaces. In recent years, there has been a growing trend for children and adolescents (i.e. those between the ages of 12 and 20) to have declining levels of independent mobility within urban areas (Villanueva et al., 2012). This trend is the direct result of wider social changes, and increased parental concerns for children and adolescent safety (Gill, 2008). Independent mobility, however, increases with age as parental restrictions are loosened, and gender, with male adolescents tending to travel further afield than their female counterparts (Villanueva et al., 2012). Women appear to carry this trend forward into adulthood and their interactions with public spaces, and demonstrate higher levels of risk awareness and lower levels of mobility relative to men in public spaces and cities more broadly (Day et al., 2003; Smith, 2008; Yavuz & Welch, 2010). Fear is identified in the literature as a significant limiting factor women's mobility at certain times of day and in certain public spaces, because they perceive certain locations to be unsafe, unfamiliar, or have certain design features that reduce their perceived security (Prabhu & Pilot, 2014; Sandberg & Rönnblom, 2015). Other factors inhibiting women's mobility to access public spaces include money, carer responsibilities, and time (Day, 1999). Recent research, however, suggests that over time women are increasing the number of trips and distances that they travel, and take more complex trips (i.e. with multiple stops) than their male counterparts (Miralles-Guasch et al., 2016).

2.2.3 Marginalisation and exclusion

Narratives of exclusion and marginalisation in public spaces have been a significant focus in the urban studies literature and have been particularly concentrated on specific age groups (often the young and the elderly), and gender (largely women). Although more than 50% of the world's population consisting of women, the urban environment and public spaces within it have been designed with little consideration of the different 'lifestyles and patterns of movement' of women compared with men (Carmona, 2010, p. 164). These lifestyle and movement factors are largely based on historical divisions of labour and child-rearing responsibilities (Whitzman et al., 2013). This, in tandem with the location of housing in cities relative to public spaces, and provision (or lack thereof) of certain infrastructure and facilities (i.e. public toilets), women feel marginalised in or excluded from using or accessing public spaces (Greed, 2007; Whitzman et al., 2013).

Public spaces are important spaces for adolescents to express their culture, develop a sense of independence, and build social skills, however, adolescents have historically been both victims of marginalisation, and a source of fear for other users in public spaces (Abbott-Chapman & Robertson, 2001; Malone, 2002). Exclusion of adolescents from public spaces is largely based on stereotypes of young people being a source of antisocial behaviour (e.g. theft, noisiness, vandalism) or behaviour that is likely to create conflict with other users of public spaces (e.g. skateboarding, parkour)(Cockcroft et al., 2016). Strategies to reduce adolescents' presence have included increased police presence in public spaces, groups of young people being told to 'move on', exclusionary urban design interventions (e.g. divots on seats to prevent skateboarding, high pitched noises that can only be heard by young people), and limited or segregated provision of 'youth-friendly' infrastructure that are not be appropriate to adolescent's needs or aspirations (e.g. skate parks or park facilities designed for younger children)(Carmona, 2010; Travlou et al., 2008). As a result of these strategies, adolescents likely

perceive many public spaces as hostile, or unwelcoming, and subsequently reduce or avoid spending time in such public spaces.

2.3 Research Question and hypotheses

This paper will explore the experiences of different age groups and genders playing Pokémon Go in public spaces through these themes. The paper is based on the following research question: Do gender and age affect experiences of public spaces whilst playing augmented reality games? The research explores several key themes of gendered and age-related experiences of public spaces based on findings in the public space experience literature. The research began with a number of hypotheses. They include:

1. Female Pokémon Go players experience higher levels of discomfort and feeling unwelcome in some public spaces compared with male players (Day, 2000; Malone & Hasluck, 1998; Sandercock & Forsyth, 1992; Whitzman, 2007; Yon & Nadimpalli, 2017).
2. Male Pokémon Go players have higher levels of mobility than female players (Day et al., 2003; Smith, 2008; Yavuz & Welch, 2010)
3. Older pokémon players (>20 year olds) have higher levels of mobility than younger players (<20 year olds)
4. Younger Pokémon Go players (<20 year olds) experience greater feelings of marginalisation than older players in public spaces

These hypotheses will be explored below.

3.0 Methods

A survey was identified as the most appropriate method of data collection for this research because of its ability to provide insight into mass phenomena, and the incidence of attitudes and perceptions within a specific population (Veal, 2006). Online surveys distributed through social media were considered particularly appropriate because of the high prevalence of augmented reality games that rely on personal mobile devices with internet connectivity. The survey was developed with a focus on gaining an understanding of player experiences and uses of public spaces while playing augmented reality games, and the questions were based on key themes found in the public space literature. The 20 minute survey was formatted in Qualtrics online survey software. Participants were approached through online social networks, including 16 *Pokémon Go* Facebook groups, and the researchers' Twitter and Facebook pages over a period of 30 days between September and October 2016. Facebook groups were identified through the search function of Facebook and Twitter combining the search term '*Pokémon Go*' and the names of Australian capital cities and regional centres. The survey only targeted participants who physically reside in Australia, above the age of 15.

The survey included 12 statements requesting a five-point Likert scale response where 1 was strongly disagree, and 5 was strongly agree. The survey data was compiled in an Excel spreadsheet and analysed statistically. Age groups were banded together to facilitate symmetrical group sizes. This also increased the statistical power for the t-tests and subsequent non-parametric statistical analysis. Two tailed t-tests using a two-sample equal variance (homoscedastic) approach were performed on the responses to Likert scale statements within Excel to determine whether a statistical significance existed between genders. As responses to Likert scale were not assumed to be a Gaussian (or normal) distribution, as well as multiple age bracket groups were being compared, the non-parametric Kruskal-Wallis test based on median scores was considered an appropriate statistical test (Ennos, 2013). It was performed using Prism 7.0c. A post-hoc analysis of the results of the Kruskal-Wallis tests was then undertaken using Dunn's multiple comparisons test. The Dunn-Sidak correction was employed to reduce the likelihood of a Type I error (false-positive) in the multiple comparison analysis of Likert responses (Ennos, 2013). The research had full human ethics clearance in accordance with the Australian National Statement on Ethical Conduct in Human Research.

3.1 Overview of survey respondents

A total of 994 *Pokémon Go* players participated in the survey. The majority of survey participants were female (59.63%), compared with males (39.45%), the balance identified 'other' as their gender (0.91%). Players

identifying as ‘Other’ gender were omitted from tables below due to low representation and statistical power. Participants reported playing a range of different augmented reality games, with the majority playing *Pokémon Go* (79%). These responses are the focus of this paper. The geographical location of participants represents a spread across Australian States: New South Wales (29.09%), Queensland (20.71%), Victoria (17.37%), Australian Capital Territory (11.31%), Tasmania (10.91%), South Australia (5.86%), Western Australia (3.64%) and the Northern Territory (1.11%). Players of all ages were represented, with 21-25 (246) and 26-30 (228) being the most prevalent age groups, and 46-50 the least represented age group (39) (Figure 2).

INSERT FIGURE 2 HERE

Figure 1: Age distribution of survey participants

4.0 Results

The results of this study show that men and women largely share similar experiences and perspectives of public spaces whilst playing *Pokémon Go*. However, some statistically significant differences do exist surrounding the mobility of male and female players, and the experiences of different age groups playing *Pokémon Go* in public spaces.

4.1 Gender, public spaces, and *Pokémon Go*

4.1.1 Fear and safety

Both male and female respondents across all age brackets largely did not feel uncomfortable (Means: 2.70/2.65) or unwelcome (M 2.50/2.34) in public spaces whilst playing *Pokémon Go* (Table 1), and no statistical difference was evident between the genders ($p=0.06$). This is further supported by the descriptions of players’ favourite locations to play *Pokémon Go*. When describing their favourite location to play *Pokémon Go*, both women (5%) and men (2%) indicated that they preferred playing in locations in which they felt safe. This also correlated with similar percentages of women (20%) and men (17%) preferring to play in public spaces where other people were also playing or spending time. A comparison of the different times of day in which players prefer to play *Pokémon Go*, showed no statistically significant difference between the genders and age groups regarding time preferences (Table 2). However, the data shows most players (37.22%) prefer to play *Pokémon Go* during the day, rather than at night (20.90%).

Table 1: Two tailed t-test analysis of male versus female level of agreement with Likert statements surrounding player’s experiences of public spaces whilst playing *Pokémon Go* and a Comparison of mean (and median) scores for combined male and female age groups using the Kruskal-Wallis one-way analysis of variance test

	<i>I have felt unwelcome in some public spaces whilst playing augmented reality games</i>	<i>I have felt uncomfortable playing augmented reality games in some public spaces</i>	<i>I have discovered landmarks, public spaces, pieces of public art, and architecture that I was previously unaware of as a result of playing augmented reality games</i>	<i>I only play augmented reality games in the town I live in</i>	<i>I play augmented reality games in the same public spaces that I spent time in prior to downloading the game/s</i>	<i>I feel responsible for looking after the areas I play augmented reality games in (e.g. picking up litter, reporting damage, reporting bad behaviour, etc.)</i>
Male Mean	2.50	2.70	4.36	2.20	3.24	3.53
Female Mean	2.34	2.65	4.45	2.40	3.16	3.59

p(T<=t) two-tail	0.06	0.59	0.16	0.02*	0.36	0.39
Male and females combined						
<20	2.44(2)	2.71(2)	4.27(4)	2.68(2)	3.39(4)	3.39(4)
21-25	2.46(2)	2.66(2)	4.45(5)	2.45(2)	3.22(4)	3.63(4)
26-30	2.66(2)	2.84(3)	4.32(5)	2.36(2)	3.18(4)	3.59(4)
31-35	2.37(2)	2.66(2)	4.48(5)	2.04(2)	3.12(4)	3.54(4)
35-40	2.46(2)	2.61(2)	4.67(5)	1.96(2)	3.34(4)	3.82(4)
41-45	2.09(2)	2.62(2)	4.38(5)	2.19(2)	3.21(4)	3.63(4)
46-50	2.00(2)	2.63(2)	4.46(5)	2.06(1.5)	2.77(2)	3.66(4)
>50+	2.09(2)	2.10(2)	4.50(5)	2.19(2)	2.79(2.5)	3.17(3)
p value	0.0008***	0.0528	0.0119*	<0.0001****	0.0678	0.0248*
K-W stat	25.02	13.91	18.01	32.97	13.18	16.03

*p>0.05 is not significant, *p<0.05, **p<0.01, ***p<0.001, ****p<0.0001*

Table 2 – Preferred time of day/day of the week for male and female participants to play augmented reality games.

	Male	Female
Mornings	54%	46%
Lunch time	54%	46%
Afternoons	51%	49%
Evenings	51%	49%
All day	55%	45%
Weekdays	49%	51%
Weekends	45%	55%

4.1.2 Mobility and access

The majority of both male and female participants agreed or strongly agreed that *Pokémon Go* had encouraged them to discover and explore both familiar (M: 3.24/3.16) and new public spaces (M: 4.36/4.45) (Table 1). Female players (M:2.20) were also found to be statistically more likely than male players (M:2.40) ($p=0.02$) to play *Pokémon Go* in the town in which they live, however both genders indicated that they did not limit their gameplay to their hometown (Table 1). Both genders also appear equally likely to discover new landmarks whilst playing *Pokémon Go* (M: 4.36/4.45), indicating similar levels of accessibility to public spaces and landmarks (Table 1).

4.1.3 Marginalisation and exclusion

Both male and female *Pokémon Go* Players identified as feeling somewhat responsible for looking after the areas they play the game in. However, there was no significant difference between male (M: 3.53) and female (M: 3.59) players and the degree to which they felt responsible for looking after the public spaces in which they play the game in (Table 1). While the mean response of each gender indicates females experience a slightly higher sense of responsibility for such areas, a T test revealed that this difference (0.39) is not statistically significant ($p=0.39$).

4.2 Age, public spaces, and Pokémon Go

4.2.1 Fear and safety

When comparing the responses of survey participants by age group and gender, no significant differences were found between adolescent participants (<20), and any other age group surveyed in this research regarding feeling uncomfortable or unwelcome in the public spaces in which they play *Pokémon Go* (Table 1). There was a statistically significant difference in how unwelcome 26-30-year-old players (M: 2.69) felt

compared with 41-45 year olds (M:2.09), 46-50-year-old players (M: 2.00), and 50+ year olds (M:2.09) felt while playing *Pokémon Go* in public spaces (Table 1 and 3). All the older age groups (41-45, 46-50, and 50+) identified that they felt more welcome playing *Pokémon Go* in public spaces compared with younger age groups.

Table 3: Significant results from Dunn's multiple comparisons test results of age group level of agreement with Likert statements

Age Group	Mean	Mean rank diff.	Dunn's adjusted p Value
<i>I have felt unwelcome in some public spaces whilst playing 'Augmented Reality' games</i>			
26-30	2.66	117.4	0.0231*
41-45	2.09		
26-30	2.66	154.8	0.0193*
46-50	2.00		
26-30	2.66	129.9	0.0406*
50+	2.09		
<i>I have discovered landmarks, public spaces, pieces of public art, and architecture that I was previously unaware of as a result of playing augmented reality games</i>			
<20	4.27	-123.4	0.0042**
36-40	4.67		
<i>I feel responsible for looking after the areas I play augmented reality games in (e.g. picking up litter, reporting damage, reporting bad behaviour, etc.)</i>			
36-40	3.823	153.9	0.0232*
50+	3.167		
<i>I only play augmented reality games in the town I live in</i>			
<20	2.68	125.3	0.0025**
31-35	2.04		
<20	2.68	145	0.0014**
36-40	1.96		
21-25	2.45	107.5	0.0311*
36-40	1.96		

$p > 0.05$ is not significant, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$

4.2.2 Mobility and access

The degree to which players are willing to travel to play *Pokémon Go* beyond the town in which they live was highly varied across age groups. As Table 3 shows, adolescent and young adult players (<20 and 21-25) were statistically much less likely ($p:0.0025$) to travel away from the town in which they live compared with middle aged demographics (31-35, and 36-40). Adolescent participants of this study appeared to limit or be limited in the distance they travelled to play *Pokémon Go*. The <20 age group also identified as the most likely to play *Pokémon Go* in the same public spaces they spent time in (and likely have the greatest access to) prior to downloading *Pokémon Go* on their mobile devices (M:3.39) compared with any other age group. There was also a statistically significant difference between adolescent (<20) and 36-40-year-old players in the degree to which they discovered new landmarks and public spaces (M: 4.27/4.67). Female players in the 26-30, 41-45, and 46-50 age groups were on average more likely to seek out new public spaces in which to play *Pokémon Go* than male players in the same age groups (Table 3). Adolescent, middle aged and older males (<20, 21-25, 31-35, 36-40, and 50+) were more likely to play in unfamiliar or new public spaces than female participants of the same age.

4.1.3 Marginalisation and exclusion

There was no significant difference between adolescent players (<20) (M: 3.39) and other age brackets in how responsible they felt for looking after the public spaces in which they play *Pokémon Go* (e.g. picking up litter, reporting damage to infrastructure, and reporting antisocial behaviour to authorities) (Table 1 and 3).

However, there was a statistically significant difference between the level of responsibility felt for public spaces between *Pokémon Go* players between the ages of 36-40 (M:3.82) and 50+ (M:3.17). Players in all age groups indicated that they felt somewhat responsible for ensuring the ongoing quality and maintenance of the public spaces in which they play in.

5.0 Discussion

5.1 Gender, public spaces, and *Pokémon Go*

5.1.1 Fear and safety

Despite clear differences in experiences of public spaces between genders found in other studies (Day, 2000; Malone & Hasluck, 1998; Sandercock & Forsyth, 1992; Whitzman, 2007; Yon & Nadimpalli, 2017), our analysis shows that men and women largely share similar experiences and perspectives of public spaces whilst playing *Pokémon Go*. On face value this contradicts strong themes in the literature that suggest that women and men are likely to experience different levels of discomfort or fear in public spaces (Day, 2000; Malone & Hasluck, 1998; Sandercock & Forsyth, 1992; Whitzman, 2007; Yon & Nadimpalli, 2017). However, an alternative explanation is that irrespective of their gender, players may be changing their gameplay to avoid public spaces in which they perceive themselves to be unwelcome or likely to feel uncomfortable. Players may also be restricting their gameplay to highly populated locations, in order to increase the likelihood of interacting with other players, or playing inside their cars proximate to public spaces, increasing their perceptions of safety and comfort regardless of the physical characteristics of the public spaces themselves. These findings accentuate the importance of social attributes (other people, activities within an area, social control of an area) and 'eyes on the street' activating, and reducing perceptions of fear in public spaces (Foster et al., 2015; Sreetheran & Van Den Bosch, 2014). Importantly, it could also indicate that *Pokémon Go* and their players may improve the safety of public spaces by encouraging greater levels of public space use across the entire day.

5.1.2 Mobility and access

The findings of this study suggest that mobility for female *Pokémon Go* players in fact increases with age, which is contrary to arguments in the literature that suggest that women are largely less mobile than men in cities (Day et al., 2003; Sandberg & Rönnblom, 2015; Smith, 2008; Yavuz & Welch, 2010). Moreover, when correlated with how comfortable women of different ages felt in public spaces whilst playing *Pokémon Go*, as women age, they tended to become more, rather than less, comfortable spending time playing *Pokémon Go* in public spaces (i.e. female participants <20 M: 2.79 v. 50+ M: 2.06). One explanation for this is that irrespective of gender, players may prefer playing during the day so as to avoid 'dark, desolate and little-used places, [that are] far away from opportunities to get help if needed' (Sandberg & Rönnblom, 2015, p. 2666). Alternately, it may be that these spaces simply lack interesting features, activities or landmarks for players to interact with digitally or in person, meaning that they fail to meet public space users' needs for passive or active engagement (Carr et al., 1992). While female players are willing to travel and explore new locations, they also play in locations that are highly familiar and potentially perceived as being safer, confirming the findings of Day (1999). This may be related to historical trends of women's mobility as a result of traditional gender roles, caring responsibilities, and time constraints, and does not appear to reinforce the findings of Miralles-Guasch et al. (2016) regarding the overarching trends of increasing mobility of women in western countries.

5.1.3 Marginalisation and exclusion

There is no data to suggest that male or female *Pokémon Go* players feel marginalised or excluded in the public spaces in which they play the game, or that either gender experience a greater sense of marginalisation than the other. However, both genders agreed positively that they feel responsible for the areas in which they play *Pokémon Go*. This could imply that augmented reality games like *Pokémon Go* that encourage players to regularly engage with public spaces have a positive effect on players' sense of place, and inclusion rather than perpetuating or maintaining historical ideas of marginalisation and exclusion in public spaces (Greed, 2007; Whitzman et al., 2013). Moreover, the game dynamics that enable players to achieve in game objectives in any public space, meaning players can choose to play in public spaces that contain certain infrastructure (e.g. public toilets), are proximate to other activities (e.g. between work and home), or privatised public spaces (e.g. shopping centres, and supermarkets). This means that the game can be played around the 'lifestyles and

pattern of movements' of men or women (Carmona, 2010, p. 164)..

5.1 Age, public spaces, and *Pokémon Go*

5.1.1 Fear and safety

This research found surprisingly little evidence to suggest that any age group felt particularly uncomfortable or unwelcome whilst playing *Pokémon Go* in public spaces, contradicting evidence in the literature that suggests that young people may be seen as a source of fear, and thus be unwelcome or made to feel uncomfortable in public spaces. Arguably the in-game objectives of *Pokémon Go* encourage players to move between public spaces, rather than remaining (or being perceived to be 'loitering') in a single location for an extended period. As a result, adolescent players (<20) may be perceived as less threatening or anti-social than they otherwise would by other public space users because they are being dynamic, rather than static in their gameplay and thus their use of a wide variety of public spaces (i.e. not just age/activity specific public spaces like skate parks). This dynamic use of public spaces by players of all age groups, in combination with the broad spread of times of day players spend interacting with *Pokémon Go* in public spaces (Table 2), could improve perceptions of safety in public spaces for all users by encouraging a greater number of 'eyes on the street' at different times of the day (Jacobs, 1961).

While overall participants responded that they had not felt unwelcome or uncomfortable playing *Pokemon Go* in public spaces, there was a statistically significant difference between older and younger players, with older players (41-45, 46-50, and 50+) indicating they felt more welcome and comfortable than younger adult players. Interestingly, there was no statistically significant difference between the level of discomfort or feeling unwelcome between <20 and 21-25 year old players, and older players. This could be explained by the dominance of younger players (<20, 21-25) involved in playing *Pokémon Go* (Figure 1), and the perceptions/or perceived judgement of 26-30 year old players from others about playing a game that is assumed to be intended for younger demographics in a public space. It reflects discussions in the literature that suggest that age-specific public spaces can be the 'territory' of an age group or type of recreational activity user (e.g. skate park, or children's playground)(Cockcroft et al., 2016; Travlou et al., 2008). However, the findings challenge the historical characterisation of young people feeling unwelcome in many public spaces (Adams, 2015; Chipuer & Pretty, 2000).

5.1.2 Mobility and access

The low levels of mobility in younger demographics suggested by the findings of this study reflect the broader trends observed internationally surrounding declining or low child and adolescent active transport and independent mobility in accessing public spaces for recreation activities internationally (Gill, 2008; Villanueva et al., 2012). It was also an unsurprising result, because Australian cities and regions tend to be car-centric, sprawling, have fragmented public spaces, and most adolescents (those <17) are unable to legally hold a driver's licence in Australia (Delbosc & Currie, 2014; Stott et al., 2015). This study indicates that *Pokémon Go* has a limited effect on the mobility of young people. The significant difference between adolescent and 36-40 year old players in the degree to which they discovered new landmarks and public spaces, emphasises issues of mobility between age groups, but also may demonstrate a difference in gameplay priorities. Adolescent players may be less interested in the real-world public space features and landmarks, and more focused on socialising with other game players, and/or achieving in-game objectives. On the other hand, older demographics may be more interested in the dual benefits of achieving in-game objectives, as well as learning or being made more aware of the landmarks and locations that they are interacting with through the game. These findings are consistent with the work of Carr et al. (1992) that suggest that different factors motivate people to spend time in public spaces, and may indicate that older demographics seek out public spaces that meet more passive engagement, relaxation or discovery based needs, rather than active social engagement. The results are also consistent with the work by Gill (2008) on factors of child friendly cities that emphasises that young people seek proximate public spaces in which they can interact with their friends, rather than unfamiliar or new public spaces.

5.1.3 Marginalisation and exclusion

The narratives found in the literature surrounding the marginalisation, and exclusion of young people from public spaces (Abbott-Chapman & Robertson, 2001; Cockcroft et al., 2016; Malone, 2002) (Karsten, 2003; Kusumowidagdo et al., 2015), were largely not reflected in the findings of this study. This could be the result of

both changed perceptions of behaviour due to game dynamics (i.e. loitering vs. moving through spaces), as well as a strengthening of players' sense of place, leading to a potentially increased sense of responsibility and interest in maintaining specific public spaces. The difference in the level of responsibility felt by the 36-40 and 50+ age groups also indicates that the older demographic is less likely to be affected by the placemaking nature of *Pokémon Go*, and thus may have weaker connections than younger demographics to their gameplay locations. Alternately, it may suggest that older players feel uncomfortable playing *Pokémon Go* in public spaces as a result of the game being stereotypically something young people participate in.

The data shows that *Pokémon Go* can improve players' sense of place and connection to the places in which they are playing. Arguably this is a result of players repeatedly visiting and interacting with certain locations (due to the static location of some in-game features in the real world)(Abbey-Lambertz, 2016), and thus having an increased number of positive interactions in specific public spaces (e.g. gaining experience points or items, interacting with other players, etc.). It also demonstrates that rather than creating a 'private cocoon' that reduces mobile technology user interactions (Hampton & Gupta, 2008), *Pokémon Go* could actually incentivise such interactions. Consequently, augmented reality games, including *Pokémon Go* represent a significant opportunity to increase public engagement with underutilised public spaces, increase the physical and mental health benefits of public space use, and encourage greater socialisation within communities.

6.0 Conclusions and recommendations

Augmented reality games such as *Pokémon Go* represent an emerging and significant technological influence on the way in which people choose, use, and interact in public spaces. While the literature shows clear differences in experiences of public spaces between genders and age groups in public spaces (Day, 2000; Malone & Hasluck, 1998; Sandercock & Forsyth, 1992; Whitzman, 2007; Yon & Nadimpalli, 2017), this study shows that there are few statistically significant differences between the experiences of men and women playing *Pokémon Go* in public spaces in Australia. The exception to this is the level to which women and men are willing to travel away from the town in which they live to play *Pokémon Go*, with men showing a greater propensity to travel away from their hometown compared to women. Young adults also have distinctly different experiences and perceptions of public spaces whilst playing *Pokémon Go* compared with their older counterparts. The findings of this study suggest that *Pokémon Go* may refute stereotypes of adolescents, and encourage greater levels of engagement with public spaces across age groups and genders, and could potentially improve the safety of public spaces by encouraging greater levels activity in public spaces throughout the day. This importantly suggests that other augmented reality games could be used to encourage greater levels of not only inclusivity in public spaces (Adams, 2015; Chipuer & Pretty, 2000), but also connectivity between public spaces in Australian cities.

Adolescents' apparent low levels of interest in public space features and landmarks compared with older age groups, indicates a potential emerging opportunity for increased youth engagement with public spaces through augmented reality games. Linking social interactions, in-game objectives and public space features and landmarks will likely improve adolescent and other player interactions with public spaces. Other potential factors that could enhance the inclusivity and use of public spaces by augmented reality game players include:

- ensuring public spaces have various walking routes with good quality footpaths to support the use of augmented reality games that encourage players to walk to achieve in game objectives,
- providing a variety of information signs and interesting landmarks (e.g. public art or historical monuments) to attract and engage players in learning about local areas,
- ensuring public spaces are accessible and spread throughout cities, rather than concentrated in one or two areas within a city; and
- using digital overlays to make public spaces more attractive to different age groups.

The culmination of these strategies could not only improve the connectivity and utility of public spaces within cities, but may also lead to a greater level of use of and engagement in public spaces by augmented reality game players, irrespective of their age or gender.

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